The introduction of cyberhunts as a teaching and learning strategy to guide teachers towards the integration of computer technology in schools.

by

André Du Plessis

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Promoter: Prof Paul Webb

Co-promoter: Dr Johann McFarlane

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DECLARATION

I, André du Plessis, declare that this thesis, submitted for the degree of PhD in the Faculty of Education at the Nelson Mandela Metropolitan University (NMMU) in Port Elizabeth South Africa, has not previously been submitted to this or another university. I further declare that it is my own work and that, as far as is known, all materials used have been recognised.

This thesis has also been submitted to online plagiarism detectors namely TurnItIn and Viper.

…………………………………….

André du Plessis

March 2010

PLEASE NOTE: All the data referred to as in the appendix and all appendices are attached to this thesis on a CD containing the portable document format (PDF) files. This can be found at the back.

LANGUAGE DECLARATION

I, **NADINE FELIX**, Language Practitioner, have undertaken the editing/proofreading of the thesis entitled:

The introduction of cyberhunts as a teaching and learning strategy to guide teachers towards the integration of computer technology in schools.

SIGNED AT **PORT ELIZABETH** ON THIS **08 DAY** OF **October 2009**

MS N FELIX MA (Applied Language Studies, NMMU)

ABSTRACT

This study, which is based on a computer literacy teacher development programme that included introducing the teacher participants to the Internet, investigated whether the development of teacher ICT skills through the design of cyberhunts in a learning-as-design context, has the potential to promote the critical and developmental outcomes which form the basis of the South African National Curriculum Statement (NCS) and *Draft White Paper on e-Education*.

The research was conducted within the post-positivist paradigm underpinned by a critical realist position and made use of qualitative and quantitative data[1] gathering methods (mixed research) within an interpretative case study. Several different quantitative and qualitative data collection tools were used. Quantitative data gathering tools that had been used comprised of Likert scale questionnaires, a computer skills questionnaire, as well as certain sections within semi-closed-open-ended questionnaires. The qualitative data gathering tools that had been used were semi-closed-open-ended questionnaires, journal reflection sheets, observation and interviews. Ontologically the research was informed by a critical-realist perspective, epistemologically by a socio-cultural perspective; including situated learning within communities of practice; recognising the cognitive, social and situated learning dimension of teacher learning. Methodologically an interpretive case study approach was used, as the aim was to explore and investigate what the participants experienced, perceived and to understand the participants: what they felt, how they felt and why they felt and responded in certain ways.

Initially the study focused on identifying how ready the participating schools and their participating teachers were in terms of the implementation and integration of Information and Communications Technology (ICT) with reference to first- and second order barriers. The findings suggest that addressing the first- and second order barriers is a vital aspect when assisting schools to move towards ICT integration.

The next phase of the research focused on whether the cyberhunt design approach is capable of developing the critical outcomes of the NCS, whether it promotes motivation and interest, and whether it promotes collaboration. Both the quantitative and qualitative data portrayed positive results regarding the perceptions of the participating teachers in the cyberhunt design approach related to the critical and

[1]PLEASE NOTE: All the data referred to as in the appendix and all appendices are attached to this thesis on a CD containing the portable document format (PDF) files. This can be found at the back.

developmental outcomes with reference to search and research, reading attitude, decision making, planning skills - which include time management and goal setting, knowledge and skills related to composing questions on different cognitive levels, computer skills, reflection and design skills. Positive results were also found related to audience, confidence, mental effort, motivation, interest and collaboration. The probabilities (p values) and practical statistical significance in the form of Cohen's d, were highly significant. The teachers' final cyberhunt products suggest that the majority of the participants had obtained basic cyberhunt design skills. However, in spite of the positive results, it was found that not all teachers are yet ready to implement this approach exactly as it is intended. When interpreted within an activity theory perspective; the positive results might be attributed to the unmediated functioning of the rules, division of labour and community aspects of the theory, while the conditions required by complexity theory for the development of a complex learning community appear to have been met by the implementation of cyberhunts as a strategy. The conditions for enabling the development of a complex learning community; namely internal diversity, redundancy, decentralised control, organised randomness and neighbour interaction; also appear to have interacted with the unmediated aspects of activity theory in developing consensual rules and through the negotiation of the division of labour located within the community.

In a like manner, positive results related to search and research, decision making, questioning, computer skills, reflection, design skills and audience reported can most likely be attributed to the functioning of the mediational tools as described by activity theory such as the computer technology, the Internet, the software that had been used and language. The data thus suggest that the interaction between both the unmediated elements and higher order mediated elements of activity theory, have most likely been the defining factors which created high levels of motivation, interest, collaboration and a positive classroom culture through which the critical and developmental outcomes of the South Africa curriculum can possibly be achieved within a complex learning community.

The study also investigated how the teacher development process regarding ICT implementation should be managed. This study found that the acronym *$CRAR^3FS^2$* holds the key to teacher development and classroom implementation. This acronym represents the verbs or actions that the participating teachers highly valued during implementation and what they have indicated as being important, namely: Care, Relate, Assess, Reflect, Read, Re-Plan, Feedback, Share and Support.

Keywords: *$CRAR^3FS^2$ framework, Teacher development, ICT, e-Education, Cyberhunts, Internet, first- and second order barriers, motivation, interest, complexity theory, activity theory, integration, implementation, critical outcomes, design skills*

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ABBREVIATIONS

ABBREVIATION	MEANING
AC	Assessment Criteria
ACOT	Apple Classrooms of Tomorrow
ANC	African National Congress
ARCS	Attention, Relevance, Confidence & Satisfaction (acronym of the motivational model of Keller)
AVI	AVI video files (Audio Video Interleave, file format)
CAR	Collaborative action research
CBI	Computer Based Instruction
CERTI	Centre for Educational Research, Technology and Innovation (at the Nelson Mandela Metropolitan University)
CO	Critical Outcomes
COP	Community of Practice
C-TAM-TPB	Combined Technology Acceptance Model (TAM) and Theory of Planned Behaviour (TPB)
DOE	Department of Education
HOTS	Higher Order Thinking Skills
HTML	Hypertext mark-up language
ICT	Information & Communication Technology
IDT	Innovation Diffusion Theory
ILPO	Information Literacy Planning Overview

ILS	Integrated Learning Systems
INSET	In-service Education and Training
JPEG	File format for saving images such as photos or pictures. The images file size can be compressed to make the file smaller, but some picture quality is then lost in the process.
LAIS	Learner Attainment Improvement Strategy
LO	Learning Outcomes
LoTi	Levels of Technology Implementation
MPCU	Model of PC Utilisation
NCS	National Curriculum Statement
NETP	National Education Technology Plan
NGO	Non Government Organisation
NRF	National Research Foundation
NTEQ	iNtegrating Technology for inQuiry model
PBL	Project-Based Learning
PC	Personal Computer
PDA	Personal Digital Assistant
PDF	Portable document format
PLC	Professional Learning Community
REALs	Rich Environment for Active Learning
RNCS	Revised National Curriculum Statement
RSS	Really Simple Syndication
RTF	Rich Text Format (Format in which a text file can be saved)
SAIDE	South African Institute for Distance Education
SCT	Social Cognitive Theory

SICTE	Strategy for Information and Communication Technology in Education
SMT	Senior management team
STORCS	Simplicity, Trialability, Observability, Relative advantage and Compatibility
TAM	Technology Acceptance Model
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UTAUT	Unified Theory of Acceptance Use of Technology
wysiwyg	what you see is what you get
ZPD	Zone of Proximal Development

DEDICATION

To my beautiful, encouraging and understanding wife, Marlene, and my two daughters, Elz-Mari and Marli: You have always believed in me – you carried me when I was 'absent' while at home. Without your support, it would have not been possible. May you be blessed.

To all educators: You can make a difference in our country. Our country's children are in your hands. You are the change makers.

> *The mere possibility that thinking skills might be taught dictates that efforts to teach them should be made. If we try, and discover that it cannot be done, the cost is only a bit of wasted effort. If it can be done, but we choose not to try, the cost, in wasted intellectual potential, could be enormous.*
>
> *Nickerson, Perkins and Smith[2] (1985, p. 63)*

[2] Nickerson, R.S., Perkins, D.N., Smith, E.E. (1985). The teaching of thinking. Hillsdale, New Jersey: Lawrence Erlbaum Associates

CHAPTER 1

SETTING THE SCENE

1. INTRODUCTION

A great deal has been written in the South African *White Paper on e-Education* in terms of the type of learning envisioned, the kind of Information and Communications Technology (ICT) levels that need to be developed, and the type of school that is required (Department of Education, 2003, 2004), but there is a paucity of information on how teachers and schools are expected to practically integrate or make use of ICT within the South African context (Hodgkinson-Williams, 2005). Leach and Moon (2000) note that without clear guidelines on how to integrate ICT into the curriculum, chances are slim that new technologies will have a significant influence on systemic improvements. Furthermore, the South African *Draft White Paper on e-Education* (Department of Education, 2003, 2004) informs us that there is a serious backlog related to ICT implementation and integration within the curriculum in our schools, and that the number of learners being exposed to ICT as a teaching and learning tool is small.

Royer (2002), Hinson, LaPrairie and Cundiff (2005), Hinson, LaPrairie and Heroman (2006) and Lawless and Pellegrino (2007) note that 'one-shot sessions' of computer technology development for teachers are not delivering the expected results and have failed to assist teachers to understand the benefits of integrating computer technology in their classrooms. In addition, Ertmer, Johnson and Lane (2001) and Hinson et al. (2005) state that it is important to remember that a 'one size fits all' approach is not the answer, as each teacher is on a different level. They argue that each teacher needs personal assistance wherever possible and has to experience success on a personal level. This is also echoed by Salomon (2002) when he points out that various factors or components have to be taken into consideration for learning, e.g. individual, situational and human factors.[3]

[3] It is important to note that teaching is not synonymous with learning. One can implement various teaching strategies, but this does not imply that all the learners within one's classroom have learned.

This study investigates the effects of a particular approach to ICT integration, i.e. an attempt to accelerate the ICT implementation process in previously disadvantaged schools in Port Elizabeth by using teacher designed Internet based cyberhunts. This is an approach that can be used by teachers in a number of ways and contexts. The study specifically focuses on the obstacles and challenges that may mitigate against teachers successfully implementing the cyberhunt approach, the perceptions and experience of teachers when using the cyberhunt approach and the extent to which the preparation and teacher development process used, satisfied the anticipations and perceptions of the participants. Furthermore, the study investigates whether the critical outcomes of the South African National Curriculum Statement (NCS) are developed as a result of the participation of the teachers. Lastly, this study also focused on the question whether the cyberhunt approach promotes collaboration, motivation and interest.

2. INFORMATION TECHNOLOGY VERSUS INFORMATION AND COMMUNICATION TECHNOLOGY

At this stage it is important to clarify the difference between Information Technology (IT) and Information and Communication Technology (ICT). IT refers to a subject, Information Technology (Fox, 2003; Mohanty & Vohra, 2006). In the South African context, IT has been associated with the subject Computer Studies. Prior to the introduction of the National Curriculum Statement (NCS), learners could either take Computer Studies as one of their six subjects or as an additional subject. In the current NCS, the same applies, the only difference being that there is not six subjects anymore, but seven learning areas.

It is important to note that after the new Outcomes Based Education (OBE) Curriculum was introduced, the South African Department of Education (DoE) defined the term IT in the *Draft White Paper on e-Education* as:

> *… a term used to describe the items of equipment (hardware) and computer programmes (software) that allow us to access, retrieve, store, organise, manipulate and present information by electronic means. Personal computers, scanners and digital cameras fit into the hardware category; while database and multimedia programmes fit into the software category.*
>
> *(Department of Education, 2004, p. 15)*

ICT, an expansion of IT, adds the C to include the communication dimension to IT (Fox, 2003). The Department of Education (2004, p. 15) defines ICT as representing:

> *… the convergence of information technology and communication technology, hence including the communication, networking and searching for information dimensions of the web. ICT is the combination of networks, hardware and software as well as the means of communication, collaboration and engagement that enable the processing, management and exchange of data, information and knowledge.*
>
> *Department of Education, 2004, p. 15)*

The implication is that anything which allows us to either obtain information, communicate or affect the environment digitally (Mohanty & Vohra, 2006), such as computers, digital cameras, cell phones and personal digital assistants (PDA's), can be included, as such equipment would meet the criteria above. The cyberhunt[4] approach used in this study, allows teachers and learners to make use of any or all of the hardware indicated above, depending on whether the cyberhunt designer(s) want to add or extend their cyberhunts with their own visual or own developed digital collected or created media. In addition, software such as Microsoft Word, Microsoft Publisher, Microsoft PowerPoint or Microsoft FrontPage, which are distributed to schools in South Africa as part of the Microsoft Schools Agreement, can be used as design tools to design cyberhunts.

3. CYBERHUNTS: AN ALTERNATIVE KNOWLEDGE-AS-DESIGN CONSTRUCTIVIST TEACHING AND LEARNING STRATEGY/ APPROACH

Perkins (1986, 1991) argues that one of the reasons why children do not engage in thinking on a regular basis, is the fact that teachers do not provide enough opportunities for active thinking through dialogue and product creation. Healy (1991) argues further that the over exposure of learners to visual material contributes to learners who do not think and who read less. As a result, many

[4] The term 'cyberhunt' would probably not be found in a dictionary of the 1990's or in a contemporary one. This could possibly be attributed to the fast development of the Information Society and ICT area. Cyberspace is a term that we can attribute to ICT and the Internet. The term "hunt" refers to finding or searching for something. Therefore a cyberhunt refers to an online activity where learners use the Internet as a tool to find answers to questions (Rechtfertig, 2002) based upon a certain theme or topic that has been composed by someone else. Hyperlinks, related to each question or group of questions, are provided to the learners. By clicking on the hyperlinks or by typing them into the address bar of the Internet Browser, the linked-to website is displayed and the learners can then explore the website to find answers to the questions that have been posed. Teachers and/or learners can be the designers of cyberhunts.

learners "have trouble with the mental organisation and sustained effort demanded by reading" (p. 24). Hence, learners find books hard to read and encounter difficulties with the interpretation of verbal logic, reading and concentration (Healy, 1991).

It is argued in this study that cyberhunts have the potential to address the development of the critical and developmental outcomes that form the basis of the Outcomes Based Education (OBE) indicated in Curriculum 2005 (1997), in the Revised National Curriculum Statement (RNCS) (Department of Education, 2002a), in the *Draft White Paper on e-Education* (Department of Education, 2004) and the current National Curriculum Statement (NCS) in South Africa. In addition, it is argued that cyberhunts could also play a significant role in enhancing motivation and interest towards learning, as well as assisting with collaboration.

However, the implementation of the cyberhunt strategy takes careful planning, as teachers are sceptical about change, an attribute of most people (Rogers, 1983, 1995, 2003). Hence, many people do not readily adopt new innovative ideas (Rogers, 1983, 1995, 2003). Nevertheless, it is suggested that cyberhunts may play a role in bridging the gap between perceptions of what schools should be like, as "Our perceptions about what schooling should look like are a mismatch with the reality of today's children" (Nations, 2001, p. 1).

Hollingsworth and Eastman (1997) add appropriately that "homes have become more high tech than schools" (p. 47) and, as cyberhunts are Internet based, their implementation into the curriculum could also assist to narrow the gap in the digital divide between home and school. However, in the South African context, learners from previously disadvantaged[5] schools do not have the luxury of a computer at home or an Internet connection, as the disadvantages of the apartheid past has had a dramatic impact on their spending power.

[5] In the South African context, disadvantaged schools refer to those schools that have fallen under different ministries based upon race classification prior to the 1994 South African democratic elections. These schools have been discriminated against on various levels for example the money allocated to the schools and their ministries was much less than that allocated to the minority white schools. In many instances the previously undemocratic governments before 1994 made it their mission to have different curricula for the non-white schools, as a means to make them subservient. In many instances the learners in these schools received an inferior education compared to their white counterparts based on resources and the manner in which their teachers were trained. Furthermore, these schools were built in racially segregated areas. These children were, prior the 1990's, not allowed to attend white schools. Although the current African National Congress (ANC) democratically elected government has made huge changes after being elected in 1994, these disadvantaged schools are still lagging far behind many of the previous minority white schools for various reasons.

The cyberhunt approach differs considerably from the dominant model of computer deployment and computer utilisation in schools. Currently the dominant model of computer implementation in schools is the computer room or laboratory, with computers usually arranged in rows on a work surface with one learner allocated to a workstation (Department of Education, 2002b) where "Integration of technology into the classroom [the curriculum] is still the exception rather than the rule" (Department of Education, 2002b, p. 16). The Department of Education's reports recognise that ICT in its current form is 'bolted onto' the school curriculum, something that exists on its own in isolation from what happens in the classroom, with word processing skills as the main focus (Department of Education, 2002b). It is therefore imperative that other alternatives are explored that will change this situation (Department of Education, 2003, 2004).

Using cyberhunts as a teaching and learning strategy, especially when learners become the designers of cyberhunts, is a hundred and eighty degree turn away from the traditional teaching approach dominated by 'teacher talk', passive learners and 'instructionism' (Papert, 1991) to an approach which propagates 'learner talk', active learners and constructivism in a 'knowledge as design' context (Perkins, 1986, 1991, 1992). Eriksen (2001, p. 17) believes that the problem with the transfer approach, or 'instructionism', in our current society; is that we suffer from an information overload. He states:

> *Unlike in other kinds of society, life in the information society is characterised by redundancy and noise: there is far too much information around, and there is certainly enough for everybody, unlike in the industrial and other kinds of society, where people experienced real information shortages (as witnessed in the common metaphors such as 'thirst for knowledge', etc.).*
>
> *(Eriksen, 2001, p. 17)*

Thus we have to realise that we cannot know everything, as there is too much information available; information has become infinite (Nations, 2001; Dochy, 2001). As a result, it is no longer important to emphasise rote learning and factual recall. What is being advocated is the importance of being able to ascertain whether learners (children or adults) understand what they have learned and whether they can assimilate, accommodate or (re)construct their newly acquired knowledge.

Understanding is not enough, however; we need to equip learners with the necessary skills to become life-long learners with the capacity not only to locate information, but also to use information in meaningful ways (Department of Education, 1997, 2003, 2004; Dochy, 2001). It seems, therefore, that there should be a shift from 'how much' knowledge can be conveyed to 'how well' learners (or adults) can use or manage information or internalise knowledge.

Eriksen (2001) refers to this (managing information), as being able to 'filter' information when he states that "… the overarching aim for educated individuals in the world's rich countries must now be to make the filtering of information a main priority" (p. 19). Hence, one needs to protect oneself against too much information or as he states:

> *A crucial skill in [an] information society consists of protecting oneself against the 99.99 per cent of the information offered that one does not want (and, naturally, exploiting the last 0.001 per cent in a merciless way).*
>
> *(Eriksen, 2001, p. 17)*

From the above, it becomes thus evident that enabling learners with the necessary research skills to make meaning of information and to create improved understanding thus becomes important, as information cannot necessarily be equated with knowledge (Eriksen, 2001).

Cyberhunts can be designed either by a teacher, groups of teachers, a learner or groups of learners. In the initial phase when cyberhunts are introduced to learners, the teacher is the designer, but the next phase is to assist learners to become designers of knowledge through the creation of their own cyberhunts. This relates to the idea of knowledge as design (Perkins, 1986; Harel & Papert, 1990; Kafai & Resnick, 1996) where learners become designers or users of knowledge instead of passive consumers of knowledge. The design-of-a-product argument is built upon the belief that knowledge itself results from, and is, a design (Perkins, 1986). Activities that could be related to design include constructing, modelling, composing, writing and investigating (Ehrmann & Balestri, 1992) as well as reflective thought (Rieber, Luke & Smith, 1998). When teachers or learners design cyberhunts, they thus construct, compose, write by typing and investigate. Hence, as designers, learners become producers of knowledge and not mere consumers (Kafai, Ching & Marshall, 1997).

Jonassen, Myers and McKillop (1996) agree that the process is important and not just the final product. They argue further that the only people who significantly benefit from the design process during the design of educational software through the use of design tools are the designers themselves, not the learners. Thus, it is argued in a similar manner as Jonassen et al. (1996) that learners should become designers by using similar design software that an instructional designer can use as a tool, in order that the learners become designers or constructors of knowledge by designing cyberhunts, rather than using the software as a conveyance[6] tool. The value of the design process (see section 4 in this chapter), lies with the fact that it affords learners with opportunities to develop several skills and attitudes, which will be discussed shortly. However, it is important to note that for learners to become designers, their teachers need the design skills required for cyberhunt construction in order that the teachers can empower their learners through a facilitation process to become designers also.

A cyberhunt can become a hypermedia product when it includes not only questions and hyperlinks, but also visual media and/or sound. The design of hypermedia[7] artefacts[8] by learners differs considerably from traditional computer utilisation, as learners 'externalise' their knowledge (Jonassen, Howland, Moore & Marra, 2003, Jonassen, Howland, Moore, Marra & Crismond, 2008), or represent and convey information (Simkins, Cole, Tavalin & Means, 2002) during the design-creation process. The use of computer technology by learners to design hypermedia artefacts (or using

[6] Conveyance is a term coined by Clark (1994b).

[7] Multimedia is the use of two or more media to present information (Green & Brown, 2002). It is also referred to as a message or information conveyance tool which integrates a combination of different digital media objects such as images, text, sound, motion and interactivity (Simkins et al., 2002). Nielsen (1990, p. 5) uses the concepts hypertext and hypermedia interchangeably, yet he prefers the name hypertext. The "media" part in hypermedia refers to its multimedia (multimedia: sound and animation) capabilities (Nielsen, 1990). Hypermedia can be defined as a message or information conveyance tool which integrates a combination of different digital media elements such as text, graphics, sound, animation and video into an interactive computer application (Nielsen, 1990:5; Neo & Neo, 2001). Authoring tools are designer or software 'allowance' and 'performing' tools which provide opportunities for designing (Neo & Neo, 2001, p. 3).

Hypertext is the interactive dynamic links among the nodes or units of information (text) on a system over which users have some 'navigational power' or control over information (Nielsen, 1990). Hypertext can be used in a non-linear manner to present information or text (Green & Brown, 2002) or in a linear manner. A text only website without any graphical/pictorial information, movement or sound can be referred to as a hypertext website. When a website or non-web related application has an interactivity dimension through the use of various media objects (containing multimedia) and hypertext links, the website or application is referred to as a hypermedia application. Hypermedia is the multimedia version of hypertext (Green & Brown, 2002, p. 4). It is the combination of multimedia and hypertext.

[8] An artefact is a realistic constructed product or presentation that represents the understanding of a learner or group of learners. It may take the form of a poster, pamphlet, model, presentation, dramatisation, etc. (Harel & Papert, 1991; Kafai & Resnick, 1996). Hypermedia artefacts in this context refer to the creation of an online or offline educational piece of software that is created by learners to represent their understanding and solution of a problem or scenario which was presented to them. The hypermedia artefact can be designed in software such as Microsoft FrontPage, PowerPoint, Word, Publisher. It must contain hyperlinks to other pages/files as well as pictures/graphics and sound.

hypermedia design as being part of a project in which the computer is used as a tool[9]) in order to develop cognitive skills is not, in itself, a novel idea in education as illustrated by the research of Carver, Lehrer, Connell, & Erickson (1992); Lehrer, (1993), Lehrer, Erickson and Connell (1994); Jonassen, Myers, and McKillop (1996); Jonassen and Reeves (1996), Liu, Jones and Hemstreet (1998), Liu (1998, 2002, 2003), Liu and Hsiao (2002), Du Plessis (2004) and Yildirim (2005). However, learner created or learner designed cyberhunts is a novel idea, as learners not only become the designers, but they also compose questions on different cognitive levels about the topic(s) that they explore. Composing questions on different cognitive levels requires a significant preparation from the teacher's side as he/she has to introduce the learners to the different cognitive levels and to the different verbs which are associated with each level.

4. COMPUTERS AS COGNITIVE TOOLS

The role of technology, and the persons involved, change when computers are used as cognitive or thinking tools. When the computer is used as a cognitive tool, the computer is not the teacher or tutor, rather, it becomes a "mind-extension cognitive tool" (Derry & Lajoie, 1993, p. 5). Cognitive tools not only provide opportunities for learners to visually represent their knowledge construction and understanding, but also promote cognitive and metacognitive thinking (Steketee, 2002). In this context, it is the learner who provides the intelligence (Reeves, 1998), and not the computer. Jonassen (2002) argues that learning becomes active through the construction process, and he adds that beliefs and values related to knowledge are influenced by communities through collaboration.

Research has shown that when hypertext / hypermedia / multimedia authoring systems are used as cognitive design tools (e.g. within a knowledge-as-design context), the major thinking skills that learners need to use as designers of these systems, include project management skills, research skills, organisation and representation skills, presentation skills and reflection skills (Lehrer et al., 1992; Lehrer, 1993; Lehrer et al., 1994; Liu, 2003, Du Plessis, 2004). Each of these skills include

[9] The term "tool" in the concept "the computer as a tool" refers to using the computer as a tool in applications where the computer is an instructional tool, similar to a pencil, typewriter, ruler and/or piano (Taylor, 1980). The learner and/or teacher use the computer as an aid, as it has been programmed to carry out certain useful tasks (Taylor, 1980).

various sub-skills, for example, research skills include reading, note taking, defining or creating keywords, validation of the quality of knowledge, search skills, and so on.

5. CYBERHUNTS, INNOVATION AND BARRIERS TO CHANGE

An innovation can be defined as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers, 2003, p. 12). As a result, one could argue that the introduction of computer technology into schools should be seen as something new or innovative. Yet, the introduction of computers in many schools does not automatically lead to integration or the adoption of new teaching methods; rather, it has often been introduced as an addition to existing and unchanged classroom settings (Bottino, 2004).

In contrast to the above, the cyberhunt approach, which can be hypertext and/or hypermedia based, uses a 'learner-as-designer' approach. It is however, important to note that the teacher is the designer of cyberhunts in the beginning stage(s) when the Internet is introduced to his/her learners. However, when the learners become more computer and/or technological competent, the learners can become the designers of cyberhunts on a given topic, either individually or in groups. It is when the learners become the designers of hypertext or hypermedia based cyberhunts, that the traditional approach and traditional classroom context related to teaching and learning can be transcended. What makes the envisioned 'Learner centred Learning-by-design Extended Cyberhunts' significant and different from other Internet based teaching/learning tools, is the fact that the learners design educational ICT based tools to assist other learners to explore a topic by means of posing questions on different cognitive levels. These learners-as-designers provide the prospective cyberhunt user with hyperlinks, which the user has to explore in order to find appropriate answers to the learner created questions.

Another positive aspect of learner designed cyberhunts, is the fact that another teacher could also benefit from using these learner designed cyberhunts to explore a given topic, especially if the teacher as user is not Internet skilled and/or if a teacher is in need of more information regarding a specific topic. The design of cyberhunts by learners provides an opportunity for teachers to tap into their learners' thinking and their learners' perceptions about topics. When learners become designers, they actually represent what they see or think as being important about the topic that they explored.

One could therefore argue that learner completed designs represent, to a certain extent, the designers' cognitive maps (see Salomon, 1998).

In addition, the usefulness of the completed learner-designed cyberhunts becomes evident when the teacher implements learner designed cyberhunts in the classroom. The advantage of this approach is that other learners could use the completed learner-designed cyberhunts to enrich themselves, to clarify misconceptions that they might have or/and to assist learners who do not have an adequate understanding about a given topic to explore the topic by means of Internet based cyberhunts. Teachers could also ask learners to design cyberhunts on aspects or topics within the curriculum that the teacher will not be able to 'cover' for example as a result of, amongst others, time constraints. Lastly, the fact that the learners have to explore a given topic, or that they have to find the necessary resources on the Internet or that they have to pose questions based on the different cognitive levels of Bloom's taxonomy, is what makes the design of learner created cyberhunts novel (see section 10.4 and Table 2.9A in Chapter 2). However, posing questions on different cognitive levels requires significant input from teachers to empower their learners to be able to compose questions on the different cognitive levels. Therefore, teachers would have to provide examples of the verbs associated with the different cognitive levels to their learners. The Internet could also assist in this regard, as teachers and/or learners will be in a position to search for examples of the different cognitive levels and the different associated verbs of each cognitive level. The above argumentations suggest that 'learner-designed' cyberhunts appears to be a novel approach in the South African educational context, and it can therefore be classified as an innovation.

Prensky (2001b) believes that the slow adoption of technology into schools can be attributed to the differences between teachers' and learners' digital status. He argues that the learners of today are literally born in the technology age. Prensky (2001b) classifies learners as 'digital natives' who think non-linearly as apposed to teachers who, being foreign to technology, can be labelled 'digital immigrants' and who think in linear ways. Teacher beliefs are therefore vital for the adoption of ICT (Ertmer, 1999, 2005). To create a positive attitude in teachers towards computers, it is vital that teachers are equipped with the necessary ICT related skills in order to make them feel confident (Ertmer, 1999, 2005). Yet, not all teachers have the same needs, as some are more ICT competent than others and confidence levels vary (Ertmer, 1999). To assist teachers with the adoption and implementation of ICT learning tools such as cyberhunts, teachers will have to overcome many barriers. These barriers can be classified into first order and second order barriers, which respectively refer to extrinsic and intrinsic barriers (Ertmer, 1999). These barriers receive further attention in sections 15, 16 and 17 in chapter 2.

6. PROBLEM STATEMENT

In some privileged South African schools, learners have been exposed to computers for a number of years, but the overall number of learners being exposed to ICT as a teaching and learning tool is small (Department of Education, 2003, 2004). According to the Department of Education (2003, 2004), the main focus in many schools is computer literacy and basic computer skills rather than using the computer as a learning tool (see also Lawless & Pellegrino, 2007). Watson (2001, p. 182) succinctly summurises her concern with many principals' and educational authorities' perceptions about computer-technology in the schools, when she puts it like this:

> *Most principals and educational authorities are happy to point to the presence of computers in their schools and to the students sitting in front of them. Far less interest is expressed in what students are actually doing on those computers.*
>
> *(Watson, 2001, p. 182)*

Watson's (2001) quote concurs with that of the South African Department of Education's (2003, 2004) concern that was indicated above. It is therefore evident that there is a great need for direction regarding how computer-technology can be integrated within the curriculum in teaching and learning. This implies thus that approaches or strategies about how integration can be achieved have to be presented to teachers.

During meetings of the Nelson Mandela Metropolitan University's Centre for Educational Research Technology and Innovation (CERTI) throughout 2007, teachers and principals who are part of the Science Mathematics Information in Schools (SMIS [10]) project, voiced their concerns and needs related to computers, namely:

[10] The SMIS (Science, Mathematics In Schools) project is an initiative of CERTI of the Nelson Mandela Metropolitan University. This project focuses on the development of teachers and learners in previously disadvantaged schools with special reference to science and

- There is a lack of contact between themselves and the computer facilitator (if the school has one).

- The fact that what happens in the computer room is not directly linked to what happens within the classroom.

- Teachers want to be responsible for their own class's computer integration, but they are unsure what to do as they lack the basic computer and Internet skills.

- There is a need to establish the integration of computers within learning areas and assistance with the implementation of integration.

- There is a need to get personally involved with computer integration and to play an active part in the establishment and implementation of computer integration at schools.

- In many cases, one person is responsible for teaching computer literacy to the whole school.

- The Internet has to be introduced to teachers and learners, but teachers do not have access to the Internet, nor do they know how to introduce the Internet, or how to implement Internet or related strategies in teaching and learning.

It also appears that not much has been done related to e-Education in the Port Elizabeth Education District by the Department of Education. The researcher, who was a Head of Department from 1996 to 2007 at a primary school in Port Elizabeth, is not aware of any ICT related invitations for teacher development from either the Port Elizabeth Education District Office or the Eastern Cape Education Department, despite the current time frames for ICT implementation for schools as suggested in the *Draft White Paper on e-Education* (2003, 2004). An inspection of previously disadvantaged schools in the Missionvale area in Port Elizabeth during 2007, revealed the fact that these schools either have no computers or have old equipment that is in need of replacement. Internet connectivity is also virtually non-existent, as none of the schools have Internet connections (Personal informal interviews with schools in 2007, while working on the SMIS project). The teachers from

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mathematics. Several programs form part of this initiative such as the Key Teacher program, Family Maths, Ripple initiative, etc. Recently, ICT was added to the SMIS initiative, as the DELL Foundation donated computers to six previously disadvantaged schools.

these disadvantaged schools voiced their needs via their principals and other school representatives that they would like to be empowered to become skilled users of computers and the Internet. Empowerment implies training in the various approaches that could be implemented for Internet integration within the curriculum.

Within the context of the SMIS project, it became evident that the problem of the teachers was their inability to use and integrate the Internet as a tool in their teaching and learning strategies, as required by the *Draft White Paper on e-Education* (Department of Education, 2003, 2004).

7. AIMS OF THE STUDY

The main aims of this research project are:

- To develop a strategy (cyberhunts) to introduce the participating teachers to the Internet in an integrative manner.
- To establish what the problems, concerns and barriers are that mitigate against the implementation and integration of the cyberhunts as an ICT learning and teaching strategy and how the identified barriers can be addressed.
- To establish, on a continuous basis, how participants experienced the professional training development process used to prepare them for cyberhunt implementation in order to address teacher needs during the process with a view to make any necessary changes and to assist with future planning and teacher development-training sessions.
- To ascertain whether the cyberhunt approach can address the critical outcomes of the South African National Curriculum Statement.
- To establish to what extent the cyberhunt approach can enhance motivation and interest in teachers.
- To determine in what way the creation of a cyberhunt encourages collaboration.

It was also envisaged that the research findings would make a contribution towards computer technology integration within the curriculum at the participating schools and that the participating teachers would serve to inform the debate and contribute to future teacher development programs related to ICT. These outcomes were sought, as it has been argued that cyberhunts have the potential to address the development of the critical outcomes that form the basis of Outcomes Based Education (OBE) as indicated in Curriculum 2005 (1997), the Revised National Curriculum Statement (Department of Education, 2002b), the Paper on e-Learning (Department of Education, 2004) and the current National Curriculum Statement (NCS) in South Africa. In addition, it is also argued that cyberhunts could also play a significant role to enhance motivation and interest towards learning, as well as assisting with collaboration.

8. RESEARCH QUESTIONS AND DATA GATHERING TOOLS

The following main research question emerged from the problem statement and from the aims of the study:

Can teachers be trained in a collaborative and motivational manner to effectively use a generative ICT strategy based on cyberhunts to address the critical outcomes of the South African National Curriculum Statement?

From this main research question, the following subsidiary questions emerged and have been investigated:

- Question 1: How ready are the teachers and their schools for ICT integration as perceived through the eyes of the participating teachers?
- Question 2: What skills or aspects are developed by 'teachers-as-learners' during their participation in the cyberhunt approach, as perceived by the participating teachers?
- Question 3: Does the creation of a cyberhunt promote motivation and interest?
- Question 4: Does the creation of a cyberhunt promote collaboration?
- Question 5: How should the teacher development process for ICT integration using cyberhunts be managed?

In order to answer these above-mentioned questions, data were collected by means of quantitative data gathering tools such as Likert scale questionnaires and a computer skills questionnaire, as well as by means of qualitative data gathering tools such as semi-closed-open-ended questionnaires, journal reflection sheets, observation and interviews (see Chapter 3 and the Appendix[11] for explanations and examples of the tools used). The reason for using multiple quantitative and qualitative data gathering tools was to assist with convergence (fostering agreement), complimentarity (to supplement) and divergence (to indicate contradiction) (Kelle & Erzberger, 2004; Flick, 2006, 2007); hence using various data gathering tools becomes a 'strengthening mechanism' (Patton, 1990, 2002), a mechanism that also assists with validity.

9. THE RELEVANCE OF THE STUDY

Many teachers feel that research and teachers' actual practices are too far removed from one another (Royer, 2002) and that researchers and their research do not take teachers' needs into consideration (Blumenfeld, Fishman, Krajcik, Marx & Soloway, 2000). This is succinctly summarised by Watson (2001, p. 185) who quotes an in-service teacher's remarks about academics, "There are many of them [academics] out there who have all of the theory and none of the classroom." Research has the possibility to forge new relationships between academics and teachers, especially in a context where not many teachers are really using computer technology in their daily teaching (Royer, 2002). Watson (2001) notes that 'home-grown experts', i.e. teachers who have classroom experience and theoretical understanding, seem to hold the key to assist with the creation of a context for professional information technology teacher development, as they are in the classroom and have the theory (Watson, 2001).

This study aimed at enabling the participating teachers to develop both the theoretical and practical experience to be able to contribute to the idea of becoming 'home-grown experts'. The rationale behind empowering teachers to use technology is to try to start with a small intervention in order to try to close the digital divide within the participating schools. However, providing technology to the participating schools is not enough, as the likelihood that learners will have access to teachers who know how to use the technology well to support learning and teaching in the 21st-century, is slim without professional technology development (Lawless & Pellegrino, 2007). The digital divide can therefore actually increase if a teacher force is not enabled through professional development to

[11] PLEASE NOTE: All the data referred to as in the appendices and all appendices are attached to this thesis on a CD containing the PDF files.

harness technology for effective teaching and learning (Lawless & Pellegrino, 2007). Although this intervention was small (six schools), it was believed that it would contribute to understandings of the process to be followed and the aspects to keep in consideration for teacher- and school development related to ICT implementation and integration.

As noted earlier, it is recognised that 'one-shot sessions' of computer technology development for teachers have proven to be ineffective, and have failed to assist them to understand the benefits of integrating computer technology in their classrooms (Royer, 2002; Hinson et al., 2005; Hinson et al., 2006). In addition, it is noted that a 'one size fits all' approach is not the answer, as each teacher is on a different level, hence each teacher needs assistance and has to experience success on his/her level (Ertmer, Johnson & Lane, 2001; Hinson et al., 2005; Hinson et al., 2006). As such, in this study an intervention was planned to operate on a continuous basis over an entire academic year to examine the barriers and facilitating effects of a longer-term approach.

A study by the South African Institute for Distance Education (SAIDE, 2003) highlighted the need for research-related approaches to computer integration, because computers are being used as an administration tool as opposed to the possibilities that computers could serve as learning and teaching tools. A visit to the website www.nrf.ac.za of the National Research Foundation of South Africa[12] (NRF), confirmed the need for research regarding ICT and teacher development. The NRF states on their website in "Research Theme 4: Human Resource Development Teacher Education and Development", that teachers play a pivotal role as change agents in the teaching and learning process. Furthermore, the NRF (2006) states that there is a definite need for an In-service Education and Training (INSET) strategy that could contribute towards a framework for educator development. Such a strategy could be an endeavour which enables teacher understanding, empowerment and affirmation and assists with the transformation process of teaching and learning.

The need for change is re-affirmed in "Research Theme 5: Curriculum, Pedagogy and Assessment" (NRF, 2006) where it is stated that there is a need for teachers to review their conceptual foundations regarding pedagogy and assessment and that the development of appropriate INSET

[12] Accessed on 2 July 2007

strategies could play a vital role in this regard.[13] This research study therefore resonates with the ideas of SAIDE and the NRF, as well as with the South African Department of Education's (2003, p. 26; 2004, p. 33) call for "evaluation, experimentation and research" to improve practice and for research that is "linked to practice" (Department of Education, 2003, p. 26; 2004, p. 33).

This study might also contribute to Salomon's (2002) notion of addressing misguided research of the past in investigating the effect of ICT on learning, i.e. that of focussing on using X (technology) to teach the content compared to Y (teacher) teaching the content, which has little regard to the role of situational and human factors as part of the process.

Finally, as it is evident that ICT integrated learning provides different learning opportunities, it is also noted that that ICT learning opportunities are difficult to assess with traditional forms of assessment, and that in the process, opportunities are being lost to assess other facets or important life skills such as group work (collaboration), critical thinking, communication, etc. Hence, the findings of this study could contribute to our understanding of these above-mentioned aspects of the learning process.

10. CONTEXT OF THE RESEARCH AND DELIMITATION

Teachers from six SMIS schools comprising of 6 disadvantaged schools (four primary schools and two high schools in the Port Elizabeth Missionvale area) formed the convenience sample used in this study. Each of these six schools received 20 computers each from the Dell Foundation. From each school approximately six teachers participated. Teachers from other schools on the SMIS project, who did not receive computers, were also invited to participate. The project commenced in March 2008 with 38 participants. During the project, some participants decided not to continue and a few new teachers decided to join also. The average attendance per session was 27 participants. The project ended at the end of September 2008.

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[13] The researcher was invited to do a presentation at the LAIS (Learner Attainment Improvement Strategy) summit, hosted be the Eastern Cape Province Department of Education (DoE) from 9 to 10 December 2009. The focus of my topic was teacher development. During group sessions, I was asked to assist to formulate the way ahead for ICT and e-learning. I was able to point out that the *Draft White Paper on e-Education* (Department of Education, 2003, 2004) clearly indicates the way ahead, but that nothing visible related to the ICT development and implementation on grassroots level had been done by the Eastern Cape Province Department of Education in the Port Elizabeth area. Hence, the perception seems to be that the proposed ideas in the *Draft White Paper on e-Education* have been shelved or ignored. During the LAIS summit, the DoE officials again indicated that teacher development related to e-learning (and ICT) is extremely important, but that finance is problematic. It seems thus that this study has the potential to contribute towards ICT teacher development, ICT implementation and integration.

11. METHODOLOGY AND METHODS

The research was conducted within the post-positivist paradigm (Trochim, 2000; Niglas, 2001; Creswell; 2003; Guba & Lincoln, 2005; Mertens, 2005) underpinned by a critical realist position (Sayer 2000; Benton & Craib, 2001; Dobson, 2002; Harvey, 2002; Carlsson, 2003; Mingers, 2004; Wikgren, 2005), and made use of qualitative and quantitative data gathering methods (mixed research) (Kelle & Erzberger, 2004; Flick, 2004, 2006, 2007; Johnson & Christensen, 2008) within an interpretative case study (Stake, 1995; Tellis, 1997; Yin, 1994, 2003a, 2003b; Murray Thomas, 2003; Picciano, 2004; Cohen, Manion & Morrison, 2007; Merriam, 2009). Several different quantitative and qualitative data collection tools were used. Quantitative data gathering tools that had been used; comprised of Likert scale questionnaires, a computer skills questionnaire, as well as certain quantitative sections within the semi-closed-open-ended questionnaires. The qualitative data gathering tools that had been used were semi-closed-open-ended questionnaires, journal reflection sheets, observation and interviews (see Chapter 3 for explanations and the Appendices for the actual data gathering tools, as well as the data collected).

Ontologically (the nature of reality) the research was informed by a critical-realist position or perspective[14] (Sayer 2000; Benton & Craib, 2001; Dobson, 2002; Harvey, 2002; Carlsson, 2003; Mingers, 2004; Wikgren, 2005), epistemologically (how we come to know what we know, the nature of knowledge) by a socio-cultural perspective (Vygotsky, 1978; Engeström & Miettinen; Roth & Lee, 2007; Eggen & Kauchak, 2007); including situated learning within communities of practice (Brown, Collins & Duguid, 1989; Wenger, 1998; Wenger, 2004) recognising the cognitive, social and situated learning dimension of teacher learning (Putnam & Borko, 1997; 2000; Anderson, Greeno, Reder & Simon, 2000). Methodologically an interpretive case study approach was used (Cohen et al., 2000, 2007; Guba & Lincoln, 2005), as the aim was to explore and investigate what the participants experienced, perceived and to understand or "Verstehen" (Held, 1980, p. 308) the participants; what they felt, how they felt and why they felt and responded in certain ways.

The quantitative data gathering tools were used to obtain information with a view to quantify their perceptions, feelings and experiences regarding ICT and certain teacher development related

[14] See the Methodology chapter, chapter 3, for and explanation of the terms within this paragraph.

aspects. The qualitative data gathering tools were used to gather a picture of the participants' inner perspectives with a view "to gather their stories" (Patton, 2002, p. 340) and their experiences; the richness of their feelings and their perceptions which the quantitative data cannot provide.

12. VALIDITY AND TRUSTWORTHINESS

Validity refers to whether we are measuring what we are supposed to be measuring (Silverman, 2000). Hence, it refers to trustworthiness or credibility (see Guba & Lincoln, 1985 and Denscombe, 1998 in section 15 in Chapter 3). This implies to what extent inferences can be made from the data collection tools were implemented in the specific study (McMillan & Schumacher, 2006). Cohen et al. (2000, 2007) caution that issues of validity can be problematic in qualitative research. They add that the case study has been a source of criticism because of its potential investigator subjectivity. However, this can be overcome by (1) using multiple sources of evidence, (2) establishing a chain of evidence and (3) having a draft case study report reviewed by key informants (Yin, 1994, pp. 34-35). To ensure descriptive or contextual validity in this study, a variety of quantitative and qualitative data gathering tools had been used. In addition, the data were also tabulated in tables (see Appendix A) as accurately as possible. Furthermore, the data were also reported as comprehensively and as accurately as possible to ensure a clear picture of the findings. This was also done to not distort or to not omit any aspects. The data have also been attached as an appendix in Appendix A on a compact disc (CD) in portable document format (pdf file).

To ensure interpretative validity, the participants' responses were accurately reported. In addition, the researcher triangulated data, thus various tools and data techniques (qualitative and quantitative) were used to study the same research questions in order to confirm, to show differences and/or to highlight new insights (see Kelle & Eisenberger, 2004 and Flick, 2006, 2007 in Chapter 3). In addition, the guidelines in the form of four questions of Guba and Lincoln (1985) were answered, as well as Denscombe's (1998) seven questions, to assist with the claim of validity (see Chapter 3, Section 15).

13. RELIABILITY

Reliability in quantitative research refers to the consistency of measurement and in qualitative research to the dependability of the data (Punch, 2005). Thus, reliability refers to the consistency of measurement, or whether the results for which the instrument(s) are being used will be similar if the instruments are used in another context or on another occasion (McMillan & Schumacher, 2006). Punch (2005) states that reliability asks the question, namely 'What is the consistency of the data instruments over time?'

Content validity ensures trustworthiness for the quantitative part of this study. As a result, two questions have been asked namely, (i) is the instrument (data gathering tool) really measuring the concept we assume it is measuring? and (ii) are there enough and adequate examples of items that represent the concept or constructs to be investigated (Mertens, 2005)? In addition to the above, the Cronbach alpha ($\propto$) or coefficient alpha was used to determine the internal consistency reliability estimation within this study (Ary, Jacobs & Zazavieh, 2002). Probability (p) values were also determined to indicate statistical significance and Cohen's d scores were calculated to indicate the effect size (Gravetter & Walnau, 2002; Ary et al., 2002) or practical significance on a scale, where 0-0.19 indicates that it is not significant, 0.20-0.49 indicates a small difference, 0.50-0.79 indicates a moderate difference and 0.80+ indicates a large difference.

14. ETHICAL ISSUES AND CONSENT

The district manager of the Department of Education (Port Elizabeth District Office) was contacted to obtain permission for the identified schools to be part of the project (see Appendices D1 to D6 on tha attached CD). The district manager and participating schools' principals received a letter in which the project was explained (see Appendices D1 to D6). Before the project commenced and during the project, participating teachers were assured that the information/data that they would supply by completing the data gathering tools, would be treated confidentially and that no names of the participating teachers would be used in the reporting of the findings in order to protect their identities. As a result, the data are reported by referring to a specific teacher as Teacher 5 or Teacher 18. The specific teacher number was associated with a specific teacher from a specific school. All participants were volunteers.

15. OUTLINE OF THE STUDY

This chapter considered understandings of information technology versus information and communication technology, the thinking behind the use of cyberhunts within a 'learner-as-designer' context and computers as cognitive tools. Furthermore; aspects pertaining to computers, teaching and learning; as well as aspects about innovation and change were explored. In addition, the problem has been clarified, the aims of the study have been made explicit and the research questions have been framed. Furthermore, the relevance of the study has been noted and the context of the research and its limitations has been explored. Issues of methodology, validity and reliability have been touched upon, as have ethical considerations.

The next chapter, Chapter 2, provides the theoretical foundations for the project from the literature. The design, development and implementation of the research project are discussed in Chapter 3. The findings pertaining to the five subsidiary research questions are presented in an integrative manner in Chapter 4, by presenting the quantitative and qualitative data for each subsidiary research question after each question. Where possible, themes or related aspects have been identified to make the data more accessible. As this study used a multitude of data gathering tools, the qualitative and quantitative data were also presented in tabular format to assist with interpretation (see Appendix A on the attached CD). In chapter 5 the findings are discussed with reference to the literature in the literature review. In chapter 6, conclusions are drawn and diagrammatic presentations are made. Furthermore, chapter 6 provides recommendations pertaining to ICT related teacher development with special reference to learning as complexity and to activity theory.

CHAPTER 2

LITERATURE REVIEW

1. INTRODUCTION

In this chapter, the following aspects are described and discussed from the literature:

- What is meant by ICT implementation and integration?
- What examples and types of ICT integration are known to us, as well as what are the stages of ICT integration?
- Why is it important to design artefacts with reference to ICT?
- What models or frameworks available are related to ICT integration?
- What are the theoretical perspectives for designing cyberhunts?
- What do learning theories imply for teacher development?
- What models or frameworks are available for teacher development?
- What are the important aspects related to teacher development, and what are the theoretical perspectives on teacher development and implementation of ICT within this study?
- What are the first and second order barriers that have to be addressed and how can these barriers be ameliorated?,
- What is meant by the diffusion of innovation? And lastly
- What is complexity learning and what is activity theory and how did these two factors influence this project?

These issues and questions are presented in sections, each with sub-sections. The rationale behind this is to portray a picture of aspects that have to be taken into consideration when planning for ICT integration. These issues and aspects were used to inform the teacher development and preparation process, as well as the design of the ICT cyberhunt integration approach. Hence, the literature review provides the overall theoretical framework which underpins this study.

2. WHAT IS MEANT BY COMPUTER IMPLEMENTATION AND INTEGRATION?

There seems to be a problem with the interpretation of the concept "technology integration." An alternative name for "technology integration" is "computer integration." For the purpose of this research, these concepts are used interchangeably. As these concepts are important to understand, they are unpacked below.

According to the online Oxford Dictionary (www.askoxford.com)[15], integrate means to "combine or be combined to form a whole." If one relates this to computers, one could argue that integration could mean that the computer becomes part of the learning process. Shelly, Cashman, Gunter & Gunter's (2002, p. 6.05[16]) definition of integration seems to indicate that integration is not necessarily equated with just new practices, but the focus is to enhance learning. They put it like this:

> *… integration by itself is defined as bringing different parts together to combine into a whole. Therefore, technology integration, also called curriculum integration, is the combination of all technology parts, such as hardware and software, together with each subject-related area of curriculum to enhance learning.*
>
> *(Shelly et al., 2002, p. 6.05)*

Roblyer (2006) concurs as he states that integration is a process that requires thinking about which electronic tools and which methods for implementation of these electronic tools are the most appropriate by reflecting upon the classroom context and the problems one wants to address. Smaldino, Lowther and Russell (2008) add that putting computers and multimedia into the classroom is not equal to integration, but that it is only one part of the task. Hence, integration requires seamless implementation to cover a variety of learning styles and the accommodation of varied teaching strategies in such a manner that teachers and learners are engaged in problem-solving, the cultivation of creativity, collaboration and the realisation of the value of life-long learning (Smaldino et al., 2008). This then implies that learners should be encouraged to use whatever tool they need to assist them with the learning process.

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[15] Accessed 25 June 2009 at www.askoxford.com

[16] This is how they have numbered their pages.

Earle (2002) agrees with Smaldino et al. (2008) as he states that one needs to be cautious of the fact that integration does not entail the mere placement of computer hardware in classrooms, which often leads to focusing on technology first (Shibley, with reference to Wiske, 2001). The problem with the main focus being on technology is that learning takes a 'back seat' (Shibley, 2001). Technology integration does not refer to implementing computers in the classroom in such a manner that it supports the prevailing methods of teaching, rather it should transform the way teachers teach and the way learners learn (Reigeluth & Joseph, 2002). Equally important is that, "Technology integration is meant to be cross-curricular rather than become a separate course or topic in itself" (Flanagan & Jacobsen, 2003, p. 124), Thus, every classroom teacher has an important role to play regarding integration (Flanagan & Jacobsen, 2003).

Morrison, Lowther and de Meulle (1999) state that integration does not imply using the computer merely for the drill-and-practice of basic skills, as this would result in supporting the prevailing non-constructivist methods of teaching, namely traditional behaviouristic informed teaching and learning. Alessi and Trollip (2001), like Morrison et al. (1999), also refer to several methodologies that facilitate learning namely tutorials, drills, simulations, hypermedia and games. One could argue that these above-mentioned methodologies support the prevailing methods which have previously been referred to or the so-called tutor mode (Taylor[17], 1980). However, when learners become designers of tutorials, drills, simulations, games and/or hypermedia, they transcend the prevailing methods and the computer is used in what Taylor (1980) refers to as 'tool mode'. Through the 'design of a product' approach, learners become actively involved in the creation of knowledge (Bruner, 1996). The designing of products or artefacts is an active process of knowledge making (Bruner, 1996; Han & Bhattacharya, 2001) and would thus seem to support the principle of constructivism (Han & Bhattacharya, 2001).

Integration can thus be defined as the process leading from one practice to a new practice where the new practice is characterised by the use of ICT (Information Communication Technology) (Nyvang, 2006) in such a manner that the traditional ways of teaching and learning are transcended. 'Learning by design' or 'designing to learn' (Perkins, 1986, 1991) constitutes a new method or

[17] Taylor (1980) is a seminal work related to computers. He coined the terms tutor, tool, tutee and toy with reference to computer usage.

strategy related to teaching and learning, where learning refers to the design of learner artefacts. The design argument is a pillar of this research, as is ‘teachers as learners’ and ‘teachers as designers’. This was as a result of teachers being the designers of artefacts, and teachers designing and planning computer integration lessons based upon cyberhunts. The emphasis is on empowering teachers so that the participating teachers can empower their learners at their respective schools to become cyberhunt designers. The importance of providing teachers with the necessary methodologies, skills and tools to successfully integrate ICT is a key element (Roos, 2005, cited in Hodgkinson-Williams, 2006).

Several learning approaches are available for ICT integrated learning in which the computer is used as a tool as part of the integration process in non-traditional approaches towards learning. These approaches will now receive attention.

3. EXAMPLES OF INTEGRATED ICT APPROACHES

The information skills frameworks and information literacy models provide the teacher (and learners) with the necessary steps to be followed for each approach or strategy. The following are some examples of information skills frameworks and information literacy models (some authors refer to these as models, rather than frameworks) which can be utilised by teachers and learners when learners have to do assignments, projects or designing artefacts as part of curriculum activities: (1) Plus model (Herring & Tarter, 2004); (2) Information Literacy Planning Overview (ILPO) model (Ryan & Capra, 2001) and (3) Big Six model (Eisenberg & Berkowitz, 2004).

The alternative approaches to those mentioned above, base the searching for information skills on the basic tenets of the above-mentioned information skills frameworks or models. These alternative models or frameworks are (1) the Inquiry Model (NTEQ) (Morrison et al.,1999; Morrison & Lowther, 2002), (2) Project-Based Learning (Blumenfeld, Soloway, Marx, Krajcik, Guzdial & Palincsar, 1991; Krajcik, Blumenfeld, Marx & Soloway, 1994; Thomas, 2000; Grant, 2002; Wong, Quek, Divaharan, Liu, Peer & Williams, 2006; Sherman & Sherman, 2004), (3) Designed Based Learning (Sherman & Sherman, 2004), (4) Problem-Based Learning (Schwartz, Mennin & Webb, 2001; Duch, Groh & Allen, 2001; Jonassen, 2004; Sherman & Sherman, 2004) and (5) Web-based research activities such as cyberhunts and WebQuests (Baedke, 2003). These approaches will receive further attention and explanation in section 8 of this chapter.

It is possible to refer to integration in two ways, (1) the type or kind of integration which is related or associated with computer use and (2) the stages of integration which is related or associated with adoption (Wilson-Strydom, Thomson & Hodgkinson-Williams, 2005). These two possible ways are discussed below.

4. TYPES OF INTEGRATION AT SCHOOL LEVEL

In the following sub-sections, a short overview is given on how computers are being used within schools, namely (1) 'learning about' computers, (2) 'learning from' computers and (3) 'learning with' computers.

4.1 Learning about computers: Implementation without integration (Computer literacy)

In many schools technology is used as an 'add-on', focusing on computer literacy and typing skills (Salomon, 2002), using the computer as a 'typing-tool'. Oppenheimer (1997) reports that a poll conducted among American teachers revealed that they ranked computer skills as being more important and essential than mastering school subjects such as history and science. However, Jonassen (2000) notes that computer literacy no longer seems such a major issue as years ago, as learners are more and more exposed to computers and related technology in modern society and learn quite easily how to use computers and related technology without a great deal of assistance. Focusing on computer literacy or using the computer to learn how to type or to present information that is not curriculum related, would seem to place technology as the focus or centre piece (Salomon, 2002) and not on how one can utilise technology to broaden one's knowledge and to assist with problem solving (Jonassen, 2000). The result of this technocratic view, using computers just for the sake of using them, is that the influence on the curriculum is minimal (Salomon, 2002).

The technocratic view is underpinned by technological determinism, which is a philosophy that implies that technology is a powerful, autonomous and revolutionary force beyond human control that can drive the change by itself (Surry & Farquhar, 1997). On the other side of the spectrum is technological instrumentalism, a philosophy that implies that technology is a tool, not an autonomous force, but rather under human control (can be used for positive or negative purposes) and follows a slow-gradual expansion path through an evolutionary process. Hence, the change process is guided by those person(s) that use computers or computer-related technology, and therefore the change process is people-based or people-orientated (Surry & Farquhar, 1997). To summarise, the view that was discussed in this section, would constitute implementation without integration, where the focus is on basic computer literacy, to which Jonassen (2000) refers as 'learning about' computers.

4.2 Implementation with integration to achieve traditional goals (Using the computer as a tool: 'learning from')

Technology has the power to bring about change (Earle, 2002), yet this is not what we see in the general educational world-wide system, as the system has a tendency to preserve itself and its practices in such a way that technology becomes an 'add-on' to fit traditional teaching and learning practices or goals (Salomon, 2002). Teachers, as part of the system, seem to be part of the preservers of traditional ways of teaching and learning (John & Sutherland, 2004); they are agents that do not want to change.

The result is that when it comes to technology application or integration, teachers implement computer technology in the following ways: (1) fitting technology to their traditional practice, sustaining the current by steering away from change (Salomon, 2002) resulting in 'bolting' technology on top of traditional practice (November, 2001), (2) or to make existing teaching and learning more efficient and effective or (3) to extend existing practice (McCormick & Schrimshaw, 2001). The result is a 'learning from' scenario where technology (the computer) is used as a transmitter of knowledge in tutor mode to learners (Jonassen, Myers, & McKillop, 1996; Jonassen, Peck & Wilson, 1999; Salomon, 2002), or a 'learning with' scenario where learners use the computer in tool mode to represent information or knowledge, which Hokanson & Hooper (2000) refer to as 'representational use' and which is similar to Bialobrzeska and Cohen's (2005) 'functional practice'; using the computer in traditional ways.

The term information is specifically used to indicate that transmitted information is not yet knowledge until it has been linked with existing knowledge structures (see Du Plessis, 2004).

According to Hodgkinson-Williams (2006) the pedagogic assumption in representative tool use is informed by transmission and instruction where teachers are the transmitters and learners are the receivers. Watson (2001) refers to this as mere 're-tooling', it is using computers to achieve traditional goals. Maddux and Johnson (2005) refer to this as Type I applications of technology which refers to technology being used to make the traditional ways of learning faster, easier or more convenient. In this traditional context, learners are still very much reliant on the teacher. The trivialising of technology, for example the computer, to be subservient to the traditional transmission approach causes its impact to be minimal, or in the words of Salomon (2002, p. 72), "Emasculated tools cannot do any harm, but they do not do any good, either." This view would constitute implementation with integration to achieve traditional goals.

4.3 Implementation with full integration to achieve the newly envisaged goals of constructivism (Using the computer as a tool: 'learning with')

In addition to the two views of integration discussed above (see section 4.1 and 4.2), another view of integration emerges, namely that of using the computer as a tool in a 'learning with' scenario or context (Jonassen, Myers, & McKillop, 1996; Jonassen, Peck & Wilson, 1999). The 'learning with' computer-context differs quite substantially from the 'learning from' scenario, as referred to in section 4.2 above. The 'learning with' context refers to an environment or context in which learners construct knowledge by designing and creating their own representations of knowledge through mindful and challenging learning situated in realistic and meaningful contexts, in which deep thinking and reflection play an important role (Jonassen & Reeves, 1996). Hokanson and Hooper (2000) refer to this as the 'generative use' of computers, a learning context in which learners transform knowledge. Maddux and Johnson (2005) refer to this context as Type II applications of technology, meaning using technology applications that make it possible to learn in new and better ways that transcend the traditional ways of learning. However, Krumsvik (2005) states that even in countries like Norway, which are technology rich, ICT implementation is in many instances incremental and therefore often has a limited effect on learning.

Lamb (2003) concurs that generative knowledge creation is important as she argues that extreme and different thinking needs to be cultivated on higher levels within teachers and learners by adding elements of collaboration, generation and interactiveness in learners' projects. Hodgkinson-Williams (2006) argues that in generative mode, ICT can be used in three different tool modes namely, (1) ICTs as cognitive tools, (2) ICTs as mediational tools and (3) ICTs as transformational tools. She also states that each of the above-stated tool modes prescribe to different pedagogical use (Hodgkinson-Williams, 2006). These discussed views constitute implementation with full integration to achieve the newly envisaged goals of constructivism. Cyberhunts can be grouped with the full integration section. Table 2.1 provides a summary of the three types of integration discussed above, namely (1) implementation without integration, (2) implementation with integration to achieve traditional goals and (3) implementation with full integration to achieve the newly envisaged goals of constructivism (Hodgkinson-Williams, 2006; Ertmer, Lane, Ross & Woods, 1999; Johnson & Johnson, 1999, 2004; Hokanson & Hooper, 2000; Harel & Papert; 1991; Bialobrzeska & Cohen, 2005; Hawkridge, Jaworski & McMahon, 1990; McCormick & Scrimshaw, 2001).

Table 2.1

Comparison of integration approaches based upon Hodgkinson-Williams (2006)

Type of implementation	Implementation without integration	Implementation with integration to achieve traditional goals	Implementation with full integration to achieve the newly envisaged goals of constructivism		
CURRICULUM RELATED	Non-curriculum based	Curriculum based	Curriculum based		
REPRESENTATIONAL OR GENERATIVE COMPUTER USE	Representational (representing knowledge)	Representational representing knowledge)	Generative (generating knowledge)		
TYPE OF TOOL	Typing tool	Re-tool	Cognitive tool	Mediational tool	Transformational tool
COMPUTER REQUIREMENT	At least a standalone computer	At least a standalone computer	At least a standalone computer	At least a standalone computer connected to the Internet	At least a standalone computer connected to the Internet
LEARNING ASSUMPTIONS	Behaviourist	Behaviourist	Cognitive /Social Constructivism	Social Constructivism (Sociocultural)	Social Constructivism (Sociocultural)
PEDAGOGICAL ASSUMPTIONS	Teacher Centred Traditionalist Instructivism Transmission	Traditionalist Instructivism Transmission Teacher Centred	Facilitator Listener Questioner Bridge Builder Learner Centred Cooperative learning when required	Cooperative learning Facilitator Learner Centred	Learners as Knowers (teachers as learner from learners) Learner facilitates and teacher co-facilitates Learner Centred
ONTOLOGICAL POSITION	Objectivist	Objectivist	Objectivist	Social constructivist	Development of human qualities and dispositions
EPISTIMOLOGICAL POSITION	Naïve realist	Naïve realist	Naïve realist	Relativist to critical realist	Critical realist
RATIONALE FOR COMPUTER USE	Social & Vocational rationale	Social & Pedagogic rationale Efficiency & Effectiveness Supplement, Reinforcement or Enrichment of Curriculum	Pedagogic & Catalytic rationale Extend learning Transform learning Facilitator for emerging curriculum	Pedagogic & Catalytic rationale Extend learning Transform learning Facilitator for emerging curriculum	Pedagogic & Catalytic rationale Extend learning Transform learning Facilitator for emerging curriculum
COMPUTER INTEGRATION	Functional	Functional	Integrative Transformational	Integrative Transformational	Transformational
TYPE	"Learning about" ICT Typing / Working on Word processor, Spreadsheet, Publishing software, etc.	"Learning from" ICT Tutor mode e.g. Drill-and-Practice, Simulations and Tutorials	"Learning with" ICT Construction or Design e.g. Hypermedia construction; Data gathering & making inferences from data	"Learning with" ICT Communication e.g. Computer conferencing, E-Mail, Discussion lists, Bulletin boards, Internet relay chat	"Learning with" ICT Cognitive Tool, Mediational Tool use or a combination of the two tools in which the learner plays the role of knower who possesses more knowledge on a certain aspect / topic.

5. STAGES OF INTEGRATION AT SCHOOL LEVEL

Having focused on the type of implementation at school level, it is also important to define and explore the stages of integration. Several extant models or frameworks exist. The Apple Classrooms of Tomorrow (ACOT) project (Dwyer, Ringstaff & Sandholtz, 1990, 1991) indicated that teachers evolve through three stages when faced with an innovation, namely survival, mastery and impact, confirming the argument of the seminal work of Hall and Loucks to which Hall and Hord (2001) currently refer to as self, task and impact concerns.

In the survival stage, teachers are being confronted with many new experiences, new questions and new problems, as well as new technology, and hence they find it difficult to cope (Dwyer et al., 1990, 1991). The question that often comes to their minds is: 'Will I/we master it?' (Dwyer et al., 1990, 1991). The reason for this is that they do not possess enough knowledge about computers, and as a result, they cannot anticipate possible problems related to technology and the new classroom context, therefore they react to problems – in many cases with uncertainty (Dwyer et al., 1990; 1991). In the mastery stage, teachers become more accustomed to technology and start to become proficient in anticipating problems and in their planning. This results in a feeling of confidence or mastery, 'I can master the task'. In the impact stage the focus is on the impact of their teaching with computers on student learning and attitudes (Dwyer et al., 1990, 1991).

The ACOT project saw change as an evolutionary process (Dwyer et al., 1990, 1991) and redefined the three to five stages namely (1) entry, (2) adoption, (3) adaptation, (4) appropriation and (5) invention (see Table 2.2). Sherry, Billig, Tavalin and Gibson (2000) found five stages through which teachers move in their adoption and implementation of computer technology (see Table 2.2). These stages are the teacher as learner phase, the teacher as adopter, the teacher as co-learner, the teacher as re-affirmer or rejecter and the teacher as leader (Sherry et al., 2000).

In the South African context, Miller (1997) developed and implemented the 'Evolutionary Model' at Pinelands High School (see Table 2.2). This model is divided into five phases and describes the integration of computer-assisted education (Miller, 1997). The Miller (1997) evolutionary model suggests that different departments of a school can be at different phases of implementation and integration of computer technology. The five phases of the Miller evolutionary model are (1) Introduction, (2) Entry, (3) Intermediate, (4) Penultimate and (5) Creation. Toledo (2005) found that a five-stage developmental model of computer technology integration emerged in a teacher education curriculum in schools, colleges and departments of education, namely (1) pre-integration, (2) transition, (3) development, (4) expansion and (5) system wide integration. Table 2.2 explains each stage and indicates the similarities between the stages/phases.

Table 2.2

Comparison of the adapted version of the ACOT stage model (Dwyer et al., 1991), Effective strategies for the five stages in the revised learning/adoption trajectory model (Sherry et al., 2000), Miller Model (Miller, 1997) and Toledo (2005).

STAGE	ACOT Stage/Phase Model & examples of what teachers do (Dwyer et al., 1990, 1991)	Five Stages in the Revised Learning / Adoption Trajectory Model (Sherry et al., 2000)	Miller's Five Phases: Evolutionary Model (1997)	Toledo Five-Stage Model (2005)
STAGE 1	ENTRY PHASE: Learn the basics of using the new technology. Struggle to establish order in radically transformed physical environments	Teacher as Learner Phase Information-gathering stage Learn the Knowledge & Skills	PHASE 1: INTRODUCTION	PRE-INTEGRATION
STAGE 2	ADOPTION PHASE: Use new technology to support traditional instruction. Use technology to teach in traditional manner	Teacher as Adopter Try out technology in classroom Share experiences with peers	PHASE 2: ENTRY	TRANSITION
STAGE 3	ADAPTATION PHASE: Integrate new technology into traditional classroom practice. Here, they often focus on increased student productivity and engagement by using word processors, spreadsheets, and graphics tools. Traditional teaching methods still in place Consistently supported with computer activities	Teacher as Co-Learner Develop relationship between technology & curriculum	PHASE 3: INTERMEDIATE	DEVELOPMENT
STAGE 4	APPROPRIATION PHASE: Focus on cooperative, project-based, and interdisciplinary work—incorporating the technology as needed and as one of many tools. Change hinges on each teacher's personal mastery More innovative instructional strategies surface. "Team teaching" (Collaboration)	Teacher as Re-affirmer or Rejecter Create new ways to observe & assess impact on student products and performance Disseminate exemplary student work to larger audience	PHASE 4: PENULTIMATE	EXPANSION
STAGE 5	INVENTION PHASE: Discovering new uses for technology tools, for example, developing spreadsheet macros for teaching algebra or designing projects that combine multiple technologies. Experiment and make changes	Teacher as Leader Becomes action researchers, reflect on practice Observe practice, collect data & share improvements in practice with peers Teach peers Skills become portable	PHASE 5: CREATION	SYSTEMWIDE INTEGRATION

The UNESCO (2002) report suggests a four-stage continuum of ICT integration namely (1) emerging, (2) applying, (3) infusing and (4) transforming. In the emerging stage, schools start to obtain computers and software and start to come to terms with ICT by exploring possibilities. The use of ICT is mainly concentrated on the teachers' personal use as he/she comes to terms with ICT. This stage is to a large extent still defined by traditional teacher-centred practice: teachers talk, learners take notes and listen. The school timetable provides discrete times for subjects. Learner access is to technology is through individual teachers (UNESCO, 2002).

The applying stage is characterised by administrators and teachers using ICT for tasks that are already carried out in school management and curriculum. The teacher, at this stage, is still largely dominating the learning environment. Schools try to adapt the curriculum in order that ICT usage can be increased in subject areas. Teachers start to use ICT for professional development and to support their training. ICT is influencing certain changes that begin to emerge in their methodologies as the use of electronic slideshows and computer printed worksheets start to surface. Learner access is through the computer lab or one or more computers in the classroom (UNESCO, 2002).

The infusing stage involves the integration of ICT across the curriculum in schools that employ a range of computer-based technologies in computer laboratories, classrooms and in administrative offices. School organisation becomes more flexible to combine subjects and time periods. Content from multiple sources are being used, including the World Wide Web and from the community. Teachers become more creative, make provision for different learning styles in their planning and start to collaborate with other teachers to solve problems and to share teaching experiences (UNESCO, 2002).

The transforming stage is the beginning of a new way of thinking to rethink and renew school organisation through creative ways. ICT becomes an integral part of their daily lives and practice. Teachers use different methodologies and explore new ways of teaching and learning. There is a definite shift from a teacher-centred approach to a learner-centred and learning-centred approach. Real-world applications become the focus and access to technology becomes unrestricted (UNESCO, 2002).

Recently, Kopcha (2008) has suggested a systems-based mentoring model for integration which highlights the importance of mentoring, modelling, apprenticeship, just-in-time assistance and the forming of communities of practice. In addition, he also indicates the importance of needs analysis, vision and goals and evaluation and revision on a regular basis (see Table 2.3). However, his stages, namely (1) initial setup, (2) teacher preparation, (3) curricular reform and (4) community of practice (Kopcha, 2008) seem to be similar to the stages discussed above and indicated in Table 2.2. Yet, he adds that mentors are needed to assist teachers and that these mentors' focus will have to be different during the different stages, but that some aspects of their focus will overlap with aspects from a previous stage (Kopcha, 2008).

Table 2.3

Stage progression matrix for ICT implementation (Kopcha, 2008)

	Mechanics	**System**	**Culture**	**Curriculum**
Stage One: Initial Setup	Train teachers to troubleshoot problems and resolve existing issues with technology (Bauer & Kenton, 2005; Franklin et al., 2001; Lai et al., 2002)	Develop systems and a physical environment that reduces the time teachers need to manage technology (Easley & Hoffman, 2000; Ertmer, 1999; Hew & Brush, 2007).	Provide reliable access to technology (Clark, 2006; Vanatta & Fordham, 2004). Create a technology committee (Hinson et al., 2005; Whitehead et al., 2003).	Model simple yet effective ways of teaching with technology (Ertmer, 2005; Zhao & Frank, 2003; Zhao et al., 2006).
	Main Focus of the Mentor			
Stage Two: Teacher Preparation	Less time is spent on troubleshooting and getting technology to work properly	Establish a system for training and following the progress of each teacher. Focus on teachers who lack basic skills (Rakes et al., 2006).	Provide support in the form of modelling practices with technology (Ertmer, 2005; Hughes, 2005; Matzen & Edmunds, 2007) and follow-up visits (Atkins & Vasu, 2000; Bradshaw, 2002; Feist, 2003).	Provide leadership needed to integrate technology into curriculum (Lai et al., 2002; Marcovitz, 2000). Present integration as easy and useful, even in student-centered ways (Hu et al., 2007; Rochelle et al., 2001).
		Main Focus of the Mentor		
Stage Three: Curricular Focus	Time will be split (not always equally) between troubleshooting old technology and setting up new technology.	Evaluate, refine, and/or remove systems from earlier stages. Create new systems as technology demands increase.	Create small communities of practice (Clark, 2006; Hughes & Ooms, 2004). Use monthly newsletters and digital libraries to share ideas about technology integration.	Teachers design activities that are student-centered in nature (Hughes, 2004; Koehler & Mishra, 2005). Enlist more administrator support (Cole et al., 2002).
			Main Focus of the Mentor	
Stage Four: Community of Practice	Continue to troubleshoot and update the mechanics that are set in place. Train teacher leaders to troubleshoot problems.	Create a system to sustain community of practice such as reducing the workload of teachers (Snoeyink & Ertmer, 2001-2002).	Form teacher technology leaders who will become the technology mentors for their peers (Glazer et al., 2005).	Continue past strategies to deal with disruptions that the changes in mentorship may cause (Zhao & Frank, 2003).
			Main Focus of the Mentor	

Fluck (2003) also reviewed literature on stages of progression or adoption. He found similar trends, namely that ICT adoption implies that teachers progress through several different adoption stages. An analysis of a table on the stages of progression in Fluck (2003) seems to indicate that integration was not occurring from the start or in the first stage of adoption, but in a later stage, concurring with the stages represented in Table 2.2. This would seem to indicate that the integration of technology is by no means easy, as individuals and schools develop through different stages: some faster and some slower. It would therefore be imperative to develop a suitable method, model and/or framework for teacher preparation and participation to assist with the adoption and integration process. It seems fair to say that the different models that were discussed in this section have many similarities. In many instances it is only the name of a stage that is different, but what the stage implies is also the same as similar stages in another model or framework.

6. WHY IS COMPUTER IMPLEMENTATION AND INTEGRATION IMPORTANT IN SOUTH AFRICA?

In the following section, an overview is provided with respect to the current situation pertaining to ICT in South Africa in comparison to that of the United States of America (USA); and to the question of whether ICT integration is a priority for South Africa. Furthermore, it is argued that the NCS OBE Curriculum of South Africa calls for the use of ICT as a tool to support learning as thinking and that ICT could assist with the curriculum's imperative for reform. Equally important, it is argued that the learners of today are digital natives who demand the use of ICT related tools for teaching and learning, but that our learners still require the teaching of reading and comprehension skills. In addition, it is argued that the different learning theories provide support for ICT integration for teaching and learning.

6.1 The current South African situation is not in line with the rest of the world

Many disparities do exist among schools and provinces in South Africa. This becomes evident from Table 2.4 (Department of Education, 2004, p. 15), which represents the distribution of schools with computers by province in the year 2002. That there is a huge digital divide, becomes evident when the Department of Education (2004) states that only about 6.4% of South Africans have access and usage to the Internet in comparison with 72.4% Americans. However, at school level, the

Internet connectivity in USA schools is virtually 100%, as the National Education Technology Plan (NETP) of 2004 reports that "Over the past 10 years, 99 percent of our schools have been connected to the Internet with a 5:1 student to computer ratio" (NETP, 2004, p. 10). Furthermore, the National Education Technology Plan of the United States of America in 2004 (NETP, 2004) clearly states that computer use and Internet access have to be made even more accessible and that the ratio of student to computer use needs to be narrowed down even more. This creates quite a dilemma for the South African learners and their connectivity as Table 2.4 clearly indicates that the South African situation is critical.

Table 2.4

Schools with computers, by province in 2002 (Department of Education, 2004, p. 12)[18]

Provinces	Schools with computers	Schools with computers for teaching and learning
Eastern Cape	8.8%	4.5%
Free State	25.6%	12.6%
Gauteng	88.5%	45.4%
Kwazulu Natal	16.6%	10.4%
Mpumalanga	22.9%	12.4%
Northern Cape	76.3%	43.3%
Limpopo	13.3%	4.9%
North West	30.5%	22.9%
Western Cape	82.4%	56.8%
National	39.2%	26.5%

In 2003, the Department of Education stated that there has been an increase in the number of schools with computers for teaching and learning from 12.3% in 1999 to 26.5% in 2002. However, the majority of schools are still without computers (Department of Education, 2003, p. 5). It is thus clear that a great digital divide does exist. Despite of the great South African digital divide, the

[18] This is the most recent statistics that I could find.

Department of Education (2003, 2004) has indicated that every South African learner in the GET and DET band will be ICT capable. However, a study by Brandt (2006, cited by Hodgkinson-Williams, 2006) indicated for example that in the Grahamstown area in the Eastern Cape, not much of this promise has yet materialised as schools which do have computers in this area acquired them through donations and fund-raising. School visits by the researcher of this study during 2008, have also shown that the Department of Education has not yet fulfilled its promises regarding ICT. An analysis of Howie, Muller and Paterson (2005) also indicates that a lot of work still needs to be done to get South Africa on par with European and Westernised countries.

6.2 ICT integration is a priority for the South African Department of Education

ICT is of great concern to Government. In a publication dated 22 January 2002 titled "Strategy for Information and Communication Technology in Education" (Department of Education, 2002a, p. 6), the Department of Education stated that:

> *Bringing ICT connectivity to our schools and education institutions will happen and must happen. It is a task that will occur alongside the provision of basic educational infrastructure, which is the responsibility of government.*
>
> *(Department of Education, 2002a, p. 6)*

The South African government through its curriculum statements notes that ICT is of great importance and an urgent matter, as it could assist moving towards a new way of teaching, learning and teacher development. It is envisioned that ICT could trigger the development of new teaching strategies relying on: (1) collaborative work, (2) problem solving and (3) simulation, as the widespread introduction of computers in schools should support Curriculum 2005 (Department of Education, 2003, 2004). It seems that ICT used in a 'learning with' (tool mode) context could assist in defining the role of teachers in the learning and teaching process (Department of Education, 2003, 2004). Thus it is proposed (1) to steer away from IT teaching strategies where learners sit alone at a computer on a one-to-one basis in a 'learning from' (tutor mode) and (2) to integrate technology into the classroom by using ICT in a 'learning with' (tool mode) context (Department of Education, 2002a, 2003). The idea of computers as catalysts of progress and change was already proposed in

1990 by Hawkridge et al. (1990). Hawkridge et al.'s (1990) argument is that the computer could become a powerful tool to achieve radical change in teaching and teaching philosophy.

The publication of the *Draft White Paper on e-Education* (Department of Education, 2003) and the gazetted and Parliament tabled version (Department of Education, 2004) was another attempt to indicate the importance of ICT integration in teaching and learning as part of the curricular reform. According to the Department of Education, ICT should not be used as an educational add-on, but to transform education in terms of teaching and learning. ICT should be used to equip learners with the necessary skills to participate fully in the knowledge society by 2013 (Department of Education, 2003). However, not much has been seen to happen in the Eastern Cape, especially in the PE District.

In the publication titled, *Lifelong Learning for the 21st Century – A User's Guide* (Department of Education, 1997) and the *Draft White Paper on e-Education* (Department of Education, 2003, 2004), the Department of Education advocates a new epistemology and pedagogy which is consistent with the discussion above. The Apple Classrooms of Tomorrow (ACOT) (Dwyer et al., 1990, 1991) project has illustrated that ICT can play a pivotal role to achieve transformation in teaching and learning. This suggests that ICT could indeed assist in achieving the new vision of teaching and learning envisaged by the South African Department of Education. Through the use of ICT, learners should be able to access, analyse, evaluate, integrate, present and communicate information and become knowledge creators by adapting, applying, designing, inventing and authoring information through collaboration among one another (Department of Education, 2003). The Department of Education proposes an exploratory and inquiry learning approach, as well as informed decision-making as part of the learning approach. Equally important, the Department of Education (2003) emphasises the importance Higher Order Thinking Skills (HOTS) and ICT's contribution towards achieving these HOTS, namely: comprehension, reasoning, problem solving, creative thinking and application of knowledge. It seems that through ICT implementation and integration the concept of knowledge as the accumulation of facts and the focus on rote learning could indeed be transcended to become knowledge construction and meaning making. Knowledge construction and meaning making refer to the process whereby learners make use of existing information to create their own understanding by linking new information to existing knowledge.

Taking the importance of the above into account, it is important to state that the introduction and integration of ICT into schools will not necessarily lead towards the immediate development of all these thinking skills envisioned above. Furthermore, it must also be noted that ICT is not the silver bullet or panacea (Earle, 2002) for our educational woes. However, ICT could assist with the process of moving towards the realisation of these skills. One of the keys for this realisation is teacher development, teacher exposure to ICT experiences and access to ongoing ICT support (Vrasidas & Glass, 2005; Mouza, 2005).

6.3 The South African National Curriculum Statement (NCS) requires support for learning as thinking

The South African Department of Education's publication titled *'Lifelong Learning for the 21st Century – A User's Guide'* (Department of Education, 1997) notes that teachers need to develop creative and innovative approaches and competencies to implement the new curriculum. The key features of the new curriculum are active learners (not passive recipients) who can reason, reflect and apply knowledge in a skilful manner (Department of Education, 1997, 2003, 2004). Furthermore, learners should be taught to become critical in a positive sense about their learning and the world, while a strong emphasis is placed on skills development, instead of rote learning (Department of Education, 1997, 2003, 2004). Integration of knowledge and knowledge's connectedness to real-life contexts are of paramount importance, and teamwork is also encouraged. Additionally, the Department of Education (1997) states that learners have to become creators of knowledge which will require a shift in thinking as teachers will have to become facilitators and not mere knowledge conveyers (Department of Education, 1997). In addition, classroom activities should become learner-centred with regular feedback as a cornerstone regarding the progress of learners' learning to affirm their worth (Department of Education, 1997).

Equally important is the critical and developmental outcomes and related issues to the outcomes (Department of Education, 1997, p. 19) of the National Curriculum Statement (NCS) (Department of Education, 2002b) which embody the core competencies to be developed. The Critical Outcomes are as follows: (1) identify and solve problems by means of critical and creative thinking, (2) work together in teams, (3) manage themselves responsibly, (4) collect and analyse information,

(5) communicate effectively, (6) use science and technology effectively, (7) see the world as set of related contexts, (8) employ effective learning strategies, (9) become responsible citizens, (10) be culturally and aesthetically sensitive, (11) explore education and career opportunities and (12) develop entrepreneurial abilities.

The critical outcomes should form an integral part in the new proposed integration model, framework or process. The usefulness of critical thinking, managing oneself responsibly, collecting and analysing information, using technology effectively, employing effective learning strategies; as indicated in the critical outcomes; becomes evident when one examines what is meant by information and communication technology literacy skills. These skills are those Katz (2005) refers to as the previous library skills, so-called because it refer to skills prior to the introduction of the Internet. Information is all around us as we find it in books, journals, on the Internet in online text and in portable disk format (pdf), in spreadsheets, databases, PowerPoint presentations, etc. To be ICT skills literate entails that one is not only able to find relevant online authoritative up to date information, but that one is also very critical about the information found, and that one can use this information to solve the problem(s) at hand (Katz, 2005). What becomes clear is the fact that being technologically competent or savvy does not guarantee that one can skilfully use information (Katz, 2005); hence these skills should form part of the technology integration process when computers are being used. That learners lack these skills, is highlighted by Breivik (2005, p. 22) who argues that "today's undergraduates are generally far less prepared to do research than were students of earlier generations, despite their familiarity with powerful new information-gathering tools."

It becomes clear that the envisaged new approach to teaching and learning, as embedded in the critical outcomes of the Department of Education (1997; 2003), is an approach which is based on meaningful learning. Jonassen et al. (2003, p. 6) define meaningful learning simply as learning "which occurs when students are [actively] making meaning" or when learners are "wilfully engaged in a meaningful task" (Jonassen et al., 2008, p. 1). They go on to explain their conception of meaningful learning as learning that displays the following five attributes (Jonassen et al., 1999, 2003, 2008): (1) active, manipulative, observant, (2) constructive, articulative, reflective, (3) intentional, reflective, regulatory, (4) authentic, complex, contextual and (5) cooperative, collaborative, conversational.

Table 2.5 shows how the Critical Outcomes are related to notions of learning, as viewed by theorists such as Jonassen et al. (1999, 2003 & 2008).

Table 2.5

Linking the Critical Outcomes (Department of Education, 1997) to "What is learning?" as seen be various theorists and "What is meaningful learning?" (Jonassen et al., 1999, 2003 & 2008)

Critical Outcomes	What is learning?	What is meaningful learning?
Identify and solve problems by means of critical and creative thinking	Information processing Remembering and recalling Thinking skills Knowledge construction Conceptual change Contextual change Activity Distributed among the community Chaos	Active, Manipulative, Observant Constructive, Articulative, Reflective Intentional, Reflective, Regulatory Authentic, Complex, Contextual Cooperative, Collaborative, Conversational
Work together in teams	Social negotiation Knowledge construction Activity Distributed among the community	Active, Manipulative, Observant Intentional, Reflective, Regulatory Cooperative, Collaborative, Conversational
Manage themselves responsibly	Conceptual change	Constructive, Articulative, Reflective
Collect and analyse information	Thinking skills	Constructive, Articulative, Reflective
Communicate effectively	Social negotiation Information processing	Cooperative, Collaborative, Conversational
Use science and technology effectively	Knowledge construction	Authentic, Complex, Contextual
See the world as a set of related contexts	Knowledge construction Conceptual change Contextual change	Constructive, Articulative, Reflective

In addition, Jonassen et al. (1999, 2003, 2008) advocate the forming of communities, namely (1) discourse communities, (2) communities of practice, (3) knowledge building communities and (4) learning communities.

The realisation of the envisioned learning and thinking skills of the 21st century, by utilising ICT, is an important worldwide advocated issue (Hawkridge et al., 1990; Punie, 2007; Prensky, 2001a, 2001b, 2007; 2009; Eagleton & Dobler, 2007; Watts-Taffe & Gwinn, 2007). Punie (2007, p. 187) and Prensky (2001a, 2001b, 2007; 2009) stress that 'digital competence' is a 'key competence' that all people require in order to be able to function in the current and future world. These authors make it very clear that ICT usage has to transcend ICT literacy, as the focus of ICT should be higher-order thinking skills (HOTS) in a context where people understand what it means to live in a digital and networked society. ICT learning could therefore assist to empower and emancipate people when they have the ability to locate and access knowledge in a society that has become more and more linked or networked (Punie, 2007). The network principle will also receive attention shortly in the learning theory section, with special reference to connectivism (Siemens, 2006a, 2006b, 2008; Siemens & Tittenberger, 2009).

Hawkridge et al. (1990) have also argued for the implementation of computers in education, based upon four rationales, namely the (1) social, (2) vocational, (3) pedagogic and (4) catalytic. Realising the type of learning as envisaged by the Department of Education of South Africa, could be possible by making use of ICT learning approaches such as project based learning, problem based learning, inquiry based learning and the envisaged cyberhunt approach implemented in this study. These integrative approaches would meet the four rationales of Hawkridge et al. (1990), as when learners are using the computer as a tool, they will be learning more about computers and will hopefully also be relieved from any anxiety related to computers, realising the social rationale. Furthermore, the related learning skills mentioned could also provide learners with valuable skills that could assist them in their adulthood when they either have to work for themselves or someone else, thus realising the vocational rationale. As these integrative approaches require a different way of teaching, different teacher roles from the traditional ones and different classroom management strategies that differ from the traditional transmission approach strategies, these approaches could possibly promote realising the pedagogic rationale of teaching and learning differently. Hence, using ICT integrative approaches that are different from the traditional teaching and learning and the traditional ICT integrative approaches, could prepare schools for change by helping to initiate a catalytic process of change within education. To achieve the envisioned future teaching and learning, ICT could become one of the key enablers and could become a catalyst to create future learning spaces in which learning becomes much more social, and therefore the role of teachers will have to change (Punie, 2007). Yet, teachers will still play a very important role within the changed context (Punie, 2007).

6.4 There is a need for reform

Education is no longer limited to the three R's namely (1) reading, (2) writing and (3) arithmetic, but to 4R's. The added R refers to 'Reform' (Perlman, 1992). The argument is that the current system cannot adequately prepare the young for the future, as education is much more concerned with the past and with tradition than with the future (Perlman, 1992). Egol (cited in Keller & Reigeluth, 2004) argues that the 'new basics' skills that should be focused on are (1) strategic reading, (2) speed reading, effective writing, research, note taking, presentation, listening, dialogue and logic. What becomes evident is that Egol is extending the traditional three R's as reading, writing and arithmetic by stating explicitly and being specific which reading, writing and arithmetic skills are important.

Perlman's sentiment is echoed by Nations (2001) as she asks how long our children have to wait for change regarding pedagogy and technology integration in education and thinking. That change and rethinking of education and its related elements is an urgent situation becomes evident in the article of Dochy (2001) entitled "A new assessment era: different needs, new challenges." Both Nations (2001) and Dochy (2001) have asked and argued for the restructuring of thinking about education and assessment as well as for the reform of schooling. However, Keller and Reigeluth (2004, p. 17) caution us that reforms are typically characterised by repacking old solutions with the hope that "this time things will be differentt" and as a result the *status quo* actually remains in place. Schools are in need of reform, yet, reform is only likely to succeed if "schools are re-visioned and redesigned by the people who will use them" (Keller & Reigeluth, 2004, p. 17), by shifting the predominant belief from that teachers should teach and be in control, to learners who learn (Egol, cited in Keller & Reigeluth, 2004). ICT could be the catalyst for this reform (Hawkridge et al., 1990; Punie, 2007) and could as a result assist the move from the traditional teaching and learning approach to a constructivist approach. Table 2.6 provides a comparison between the traditional classroom and the envisioned classroom of the future based on Brooks and Brooks' (1993, 1999) including complimentary aspects, as suggested by Prawat (1992), Bodner (1986) and McMahon (1997) regarding the differences between the traditional and constructivist classroom.

Table 2.6

*Comparison of the visible differences between traditional and constructivist classrooms**

Traditional classroom	**Constructivist classroom**
Learner primarily works alone	Learners primarily work in groups
Passive learners	Active learners
Knowledge is inert	Knowledge is active, situated in living worlds
Individuals are passive recipients of knowledge	Individuals construct knowledge with the help of others
Learning occurs with programmatic repeated activities	Meaningful learning is useful and retained, building on what the learner already knows
Teacher's role is authoritative, directive	Teacher's role is coach, mediator, strategic, co-learner
Curriculum is presented part to whole, with emphasis on basic skills	Curriculum is presented whole to part, with emphasis on the big concept
Strict adherence to a fixed curriculum is highly valued Curriculum is viewed as a fixed entity	Curriculum is more flexible. Pursuit of learner questions is highly valued. Connectedness
Curricular activities rely heavily on textbooks and workbooks of data and manipulative materials	Curricular activities rely heavily on primary sources.
Learners are viewed as "blank slates" onto which information is etched by the teacher	Learners are viewed as thinkers with emerging theories about the world. (Cognitive apprentices)
Teachers generally behave in a didactic manner, disseminating information to learners. Teacher-talk, learner absorbs	Teachers generally behave in an interactive manner mediating the environment for learners. Less teacher-talk, learner active
Teachers seek the correct answers to validate learner lessons	Teachers seek the learner's point of view in order to understand learner learning for use in subsequent conceptions
Assessment of learner learning is viewed as separate from teaching and occurs almost entirely through testing	Assessment of learner learning is interwoven with teaching and occurs through teacher observation of learners at work and through exhibitions and portfolios

** Du Plessis (2004), based upon Brooks and Brooks (1993, 1999), Prawat (1992), Bodner (1986) and McMahon (1997)*

6.5 Learners of today are digital natives demanding ICT, but they are also in need of reading and comprehension skills

Prensky (2001a, 2001b, 2004, 2005) argues that the children of today at school (learners) are born in technology and surrounded by it, hence, they are digital natives in comparison with many adults who have not been surrounded by ICT since birth. These adults are therefore digital immigrants who do not always connect well with the younger generation's needs (Prensky, 2001a, 2001b, 2004, 2005).

Prensky (2001b) continues by stating that digital media have become a native language to these digital immigrants, something which adults do not seem to understand. Prensky argues that the Internet and digital technologies have become the first line tools of the majority of learners of today. In contrast to Healy (1991, 1998) who argues that the learners of today are the 'Two-Minute Mind' generation that do not seem to be able to concentrate, Prensky (2001a, 2001b, 2004, 2005) argues the exact opposite. He contends that the digital natives or game generation is different and that we as adults have to ask ourselves whether they really cannot concentrate. Prensky's argument is that we just have to take note of how long children can sit in front of digital media (for example the television and computers) without being distracted. Hence, the children of today do concentrate, but we as adults basically bore them to death with our traditional ways of thinking about teaching and learning, as the digital native of today has a craving for interactivity (Prensky, 2001a). Hence, ICT integration could assist teachers to understand the digital natives (learners) of today better and could also probably play an important role to motivate learners to become more positive towards the school context.

Eagleton and Dobler (2007) and Watts-Taffe and Gwinn (2007) contend that ICT integration can serve to develop certain literacy skills while using technology, especially the Internet, but also other ICT's. They argue that the digital information age requires learners to develop comprehension strategies such as setting a purpose for reading, asking and answering questions, examining text, making predictions and inferences, integrating new ideas with prior knowledge, creating visual representations to show understanding, deciding what is important, skimming, scanning, selective reading, summarising and synthesising, dealing with graphical information, navigating text, interpreting and evaluating information and lastly to be able to monitor and repair comprehension (Watts-Taffe & Gwin, 2007). Watts-Taffe and Gwin (2007) state that teachers have to design activities to develop the above-mentioned strategies. However, they warn teachers that these skills are not developed overnight.

Duke and Pearson (2002) propose that a five step approach should be used to develop each of these above-mentioned comprehension reading strategies by (1) sensitising the learners about the strategy: why it is valuable and how it should be used, (2) by teacher and/or student modelling of the strategy, (3) by the implementation of collaborative usage of the strategy and the provision of scaffolding where and when needed, (4) by guided practice and gradual release of responsibility and (5) by independent usage of the strategy by planning individual tasks or assignments in which the learner can show competence in the comprehension and reading skills.

6.6 Learning theories support ICT integration

The South African curriculum is based upon constructivist principles (Moll, 2002), but constructivism does not imply that all rote learning associated with the traditional approaches should be discarded (see Von Glasersfeld, 1995, p. 181). There are certain aspects in the curriculum which might be better suited towards an instructivist approach. Drilling as a remediation tool could have value as a remediation tool, if used with the necessary teacher support. Thus, although constructivism does have great advantages, even constructivist teachers intervene sometimes in direct teaching (DeVries, 2000).

Before continuing, it is important to briefly indicate what is meant by certain terminology. Firstly, a term ending with the suffix '-ism' can refer to a doctrine, theory, religion, political movement, prejudice, condition, action, process, etc. Within this study, it refers to a theory or philosophy. Instructivism is a theory that conceives knowledge as encoded, memorised, and passed from one end to another through the classical teacher or professor model in which the teacher or professor is the source of knowledge (Wittstock & Barrantes, 2006). The emphasis is thus on teaching or instruction. It implies that for better education, better or improved instruction is required and related to computers, it implies that computers will do the instruction or computers will become the teachers (Papert, 1991). Papert (1991) states that teaching does have a place in education, but he strongly advocates that the main emphasis of education should be on learning. Teaching in an instructivist context, refers to a 'talk-and-chalk' approach, underpinned by behaviouristic principles, in which paper based media are normally used. Within this study, the terms instructivism and instructionism are used interchangeably.

Constructivism is a theory that postulates that knowledge is acquired through social interaction with people, interaction with the world and through interaction with things through a non-classical teacher or professor model in which the teacher becomes a facilitator or guide (Wittstock & Barrantes, 2006). Cooperative learning experiences are the main focus in constructivist learning contexts (Wittstock & Barrantes, 2006). The emphasis in the constructivist learning context is thus not on teaching or instruction, but on learning.

A term ending with the suffix '-nism', refers within this study, to a word or term made by the proponents of this theory or philosophy. The term constructionism is an extension of constructivism. Constructionism acknowledges the principles of constructivism, but adds that the best way to acquire or to build knowledge is through constructing, building or creating artefacts or products (Wittstock & Barrantes, 2006; Johnston, 2006). The emphasis is thus not on teaching or instructing, but on building or creating something. Hence, two types of construction are evident, namely constructing in the physical world and constructing knowledge inside the head (Wittstock & Barrantes, 2006). Within this context, not only the product is important, but the process also. Constructionism implies that digital-electronic media are being used whenever possible. Related to computers, this implies that the computer does not become a tutor or teacher, but that the computer becomes a tool with which the learners can do good things (Papert, 1991). Within this study, constructivism implies that constuctionism (product or artefact creation) is sub-assumed.

A term ending with the suffix '-ist', within this study, refers to a person believing or subscribing to a specific theory or philosophy or practicing the theory or philosophy for example instructiv<u>ist</u>, constructiv<u>ist</u> and construction<u>ist</u>.

The argument of Johnson (2005) seems worth noting here, as she suggests that we have to stop taking a 'one is better than the other' stance and that we should rather reconcile the best out of each of these opposite ideas (instructivism-instructionism and constructivism), as a combination may prove to be the most beneficial for learners.

In the following sub-sections the behaviouristic-instructivist tradition and constructivist learning are being explored. The plural form 'traditions', with reference to constructivism, is specifically used as there are many forms of constructivism. These constructivist traditions are trivial constructivism (Dougiamas, 1998) or cognitive constructivism (Bodner, 1986; Hoban, 2002; Slavin, 2003); radical constructivism (Von Glasersfeld, 1995; Dougiamas, 1998); social constructivism (Gergen, 1995; McMahon, 1997; Dougiamas, 1998; Gagnon & Collay, 2001; Slavin, 2003; Marlowe & Page, 2005), which Dalgarno (2001) also refers to as dialectical constructivism; cultural constructivism (Dougiamas, 1998); critical constructivism (Dougiamas, 1998); constructionism (Harel & Papert, 1991; Papert, 1993; Kafai, 1996; Dougiamas, 1998) and lastly, communal constructivism (Holmes, Tangney, FitzGibbon & Savage, 2001; Holmes & Gardner, 2006). In the sections on constructivism, only trivial- or cognitive constructivism, radical constructivism, social constructivism and communal constructivism are explored. The term 'constructionism' has been discussed in section 6.6.

6.6.1 Behavouristic-instructivist tradition

The objectivist worldview or ontological position states that there is an objective reality or world that we can perceive reasonable accurately through our senses (Alessi & Trollip, 2001). Learning within this philosophical view is seen as "the process of correctly interpreting our senses and responding correctly to objects and events in the objective (real) world" (Alessi & Trollip, 2001, p. 31). With reference to the objectivist philosophy or worldview and its influence on curriculum, Van Harmelen (1995, p. 51) argues that:

> *The objectivist model of curriculum, located in behavioural theory, has arguably had the greatest influence on Western curriculum development and therefore in the shaping of school discourse in this century.*
>
> *(Van Harmelen, 1995, p. 51)*

In short, this philosophy is based on instructivism; the transfer of knowledge from a more knowledgeable teacher to a learner. This will shortly be dealt with in more detail in a subsequent paragraph.

Behaviourism implies that learning occurs through conditioning in a stimulus-response manner (Van Harmelen, 1995). Consequences and reinforcement play an important role in behavioural change, as positive consequences strengthen behaviour and negative or unpleasant consequence again, has just the opposite effect (Slavin, 2003). Reinforcement refers to consequences that strengthen the frequency of behaviour (Slavin, 2003). Positive or negative reinforcement can thus be utilised to achieve an intended or 'wanted' response by selecting the correct reinforcement within the context.

Two types of reinforcers can be identified, namely primary and secondary reinforcers. Primary reinforcers refer to things such as food, water, security, warmth, etc., things that are required to fulfill our basic requirements or needs. Secondary reinforcers refer to the value of something associated with either primary or other well-established secondary reinforcers (Slavin, 2003). Slavin (2003) identifies three positive reinforcers namely social, activity and token or symbolic reinforcers. The social reinforcers refer to aspects such as praise, smiles, attention, etc.; activity related reinforcers to access to fun activities, toys, or games and the token-symbolic reinforcers to money, grades, stars, etc. (Slavin, 2003). Thus reward and praise can be seen as positive reinforcement that can strengthen a particular or required behaviour, whereas not paying attention to someone could discourage certain behaviour (Slavin, 2003). Through the conditioning of rewarding and punishing, it is possible to lure or entice people into the participation of less enjoyable activities by making use of enjoyable activities as a reward (Slavin, 2003).

Subscribing to the objectivist behaviouristic tradition implies that the focus is on transfer of knowledge or instructivism, the main focus being on rote-learning and recall governed by reinforcers to achieve favourable behavioural responses. The prime emphasis is on teaching, and not on learning, as learners are instructed in a context dominated by 'teacher talk'. In this context the teacher is active and the learners are passive, as the learners have to listen all the time and at all cost. The rationale behind 'teacher talk' and instructionism (see Papert, 1991) is built upon the notion that the human mind is a blank slate or '*tabula rasa*' (Aspin, 1995), and that the aim of the teacher is to fill these 'empty vessels' or 'empty buckets' by filling the empty minds through the 'pouring of knowledge' (Kruger, 1997). Ozman and Craver (1982) argue that children cannot be seen as 'empty buckets', as they are already highly 'programmed' even before they attend school. This is supported by Nicaise and Craine (1999) who argue that learners come to school with very different levels of motivation, ideas and different goals. Thus, the learners' requirements or needs do not necessarily replicates that of their teachers. Learners have also different aptitudes and attitudes which will make it very difficult for teachers to cater for all the different needs, if teachers subscribe to an intructionist teaching environment. In spite of all the arguments against rote learning and/or memorisation, both Papert (1991) and Von Glaserfeld (1995) state that instructivist principles and memorisation or rote-learning do have a place. However, Von Glaserfeld (1995) succinctly states that these learning modes do not necessarily lead to real enlightment or proper understanding in all instances. Cornbleth (1987, p. 194) is in agreement, as she states that instruction should not focus on the "one right answer" as the main outcome, because the 'right answer' does not necessarily imply that thinking has occurred, as the 'right answer' might be a result of rote learning or memorisation (Cornbleth, 1987, p. 194).

A further problem associated with the '*tabula rassa*' or 'empty bucket' notion, is found in the argumentation of Dochey (2001) and Nations (2001) when they argue that it is not possible to know everything, as there is too much information[19] (knowledge) available: knowledge is not finite (Nations, 2001; Dochy, 2001). The Internet Web Publishing and Book Publishing explosion is evidence of this phenomenon (Dochy, 2001) and as a result it should be our aim to assist learners not to get lost in the 'oceans of data' (Du Plessis, 2004), but to prepare them to access and use information effectively, to filter through information and to distinguish between what is relevant, irrelevant and even factitious information (Eriksen, 2001). In addition, rote learning, associated with instructionism, is thus not the only focus in education, as it is no longer important to emphasise rote learning and factual recall of knowledge as a necessary first step to higher thought (Perkins, 1992). What has become important is to ascertain whether learners [children or adults, using the ideas of Piaget] understand what they have learned and whether they can assimilate, accommodate or (re)construct their newly acquired knowledge (see section 6.6.2 for more about cognitive constructivism and its associated terms namely disequlibrium, assimilation and accommodation).

ICT can support the behavouristic-instructivist tradition, which uses the computer or ICT in a 'learning from' the computer context (Jonassen, 2000) in a traditional teaching context. Taylor (1980) refers to the instructivist computer tradition as tutor mode. In the 'learning from' context,

[19] It is important to note that information cannot necessarily be equated with knowledge. For information to become knowledge, we have to internalize (accommodate or assimilate) information in a comprehensible way (see Du Plessis, 2004).

computers are used as “conveyors of information, communicators of knowledge or tutors of students” (Jonassen, Myers & McKillop, 1996, p. 96) and in many instances the primary use of computers and the software is for Computer-Assisted-Instruction (CAI) (Jonassen, 2000) or Computer-Assisted-Learning (CAL) (Dalgarno, 2001). Traditional drill-and-practice software, for example drilling mathematical times tables using software, is one example. Some of the drill-and-practice software comes in the form of games, which reward the learners with being able to display their name in a hall of fame if they obtain the highest score, moving the learners to the next level or by directing the learner to a game if the learner reaches a certain level or score. Drill-and-practice does have a place in learning, but it focuses on the lower sub-skills and rote learning with the aim for learners to gain automaticity and not to the transfer of the practiced skills to meaningful problems (Jonassen, 2000). However, on this point I want to disagree with Jonassen, as learners could use mathematical sub-skills practiced in drill and practice software, times tables for example, when they have to solve problems where basic computational skills are required and as a result they do not have to make use of electronic calculation tools to do that for them. In a similar manner, Pritchard (2007) argues that drill-and-practice software could accommodate some constructivist principles of learning while they are being used.

Within the behaviouristic-instructivist tradition, the role of the teacher is that of decision maker, as the teacher decides whether learners are going to use drill-and-practice software or tutorial software (off-line or online). The teacher will also have to make the decision of what software to use and where the path of entry will be according to the objectives or learning outcomes that have to be achieved. Furthermore, the teacher will have to monitor the learners’ progress either by observation, by providing them with written teacher-set tests and/or by analysing the results of the learner stored on the drill-and-practice or tutorial software database.

To conclude: Using ICT as a representational tool within the behaviourist tradition presupposes ontologically a naïve-realist conception of the world (mirroring reality); epistemologically it holds an objectivist-empiricist and instrumentalist view of knowledge as being static and unchanging; and pedagogically it assumes a transmitting or instructivist role for ICT (Hodgkinson-Williams, 2006, p. 7).

6.6.2 Cognitive or trivial constructivism

An alternative to the objectivist tradition is trivial or cognitive constructivism. It is important to explore what the tenets of constructivism are. The first essential epistemological tenet of constructivism below provides us with an opportunity to establish the common thread of cognitive or trivial constructivism, namely:

> *Knowledge is not passively received either through the senses or by way of communication, [Rather], the individual actively builds up knowledge.*
>
> *(see Von Glasersfeld, 1995, p. 56)*

In contrast to the objectivist worldview or ontological position of one external reality that we can perceive reasonable accurately through our senses, the cognitive constructivist view of reality or its ontological position, is that "the only reality that matters is our individual interpretation of what we perceive" (Alessi & Trollip, 2001, p. 31). Thus, the change within an individual is *"in the head"* (Hoban, 2002, p. 51) where " … the learner strives to organize his/her own experiences in terms of pre-existing mental structures or schemes" (Bodner, 1986, p. 873). This thus implies that the mind cannot be seen as empty. In constructivism then, knowledge is relativistic, as nothing is absolute (Bodner, 1986). Bodner (1986) argues that constructivism does not necessarily deny the existence of an objective reality, but it does deny the existence of objective knowledge about reality, as there are many ways to structure the world (Bodner, 1986). Bodner (1986) argues that constructivist theory views knowledge as temporary, developmental, non-objective, internally constructed, and socially and culturally mediated.

The Swiss born Jean Piaget, with his science background, can be seen as one of the influential thinkers regarding cognitive constructivism. Piaget proposed that a person progresses through four distinct phases that are age-related and that overlap. These stages are (Pritchard, 2005):

- The sensori-motor (0-2 years);
- Pre-operational (2-7 years),
- Concrete operational (7-11 years), and

- Formal operations (11+ years).

Each of the above-mentioned phases or stages results in the emergence of new abilities and new ways of information processing (Slavin, 2003). Piaget's work emanates from his biological scientific background and has been influenced by Darwin's theory of evolution, as well as by the disciplines of psychiatry and epistemology (Overall, 2007). Observation played an important part in his study and he tried to elicit understanding in three ways, namely (1) observing what the child does when he/she is solving problems by focusing on his/her reasoning, (2) conducting experiments to obtain understanding of how children understood the world and (3) talking to children to obtain clarity about their experience of reality (Overall, 2007).

Piaget views the child as an "active organism" (Slavin, 2003, p. 30) and a 'lone scientist' which portrays a picture of a child who explores and makes conclusions about his/her explorations alone or in solo mode (Pritchard, 2007). Piaget argues that:

> *It is despite adult authority and not because of it, that the child learns [and that the teacher should be] an equal and not a superior, to discuss and examine, rather than to agree and constrain morally.*
>
> *(Piaget cited in Rogoff, 1999, p. 78)*

With reference to Piaget's view, DeVries (2000) states that Piaget's view should not be misunderstood. She points out that mutual respect and cooperation play both an important role when an adult and child are engaged, but she also adds that the Piagetian 'lone scientist' notion has often been misunderstood as if the social context does not play a role. Her argument is that one has to distinguish between Piaget's epistemological and psychological statements. According to her, the former explains how knowledge develops, as well as the development of ideas; and the latter how the child develops; also to with reference to social factors. Palinscar (1998, p. 350) is in agreement with the above, as she also states that social exchanges were indeed valued by Piaget, but she points out that social interaction and exchanges between children in the Piagetian context for cognitive development are preferred rather than exchanges between children and adults.

Cognitive constructivism defines learning as a process of disequilibrium, assimilation, accommodation, equilibrium and adaptation. Children and adults behave and think in terms of schemes that they have built up (Slavin, 2003). When a child or adult is confronted with a new experience (learning opportunity), disequilibrium occurs and the learner has to make sense of the new experience with reference to his/her existing schemes (assimilations). If the learner cannot make sense of the new experience, the learner cannot assimilate the new experience. As a result, the learner has to modify his/her existing schemes to accommodate the new experience (accommodation). Accommodation results in restoring equilibrium. One can say that as a result of the new learning experience, the person makes adaptations to his/her exiting schemes (Slavin, 2003), or as Bodner (1986) puts it, the person or learner makes a modification(s) to existing structures to fit the newly assimilated data or information.

CAI and CAL tutorials are associated with the behaviouristic tradition. However, Dalgarno (2001) argues that there is CAL software which conforms to constructivist approaches, namely hypertext and hypermedia CAL environments, simulations and microworlds. Gobbo and Girardi (2001) add that Logo and microworld software can also be classified as satisfying personal or cognitive constructivist approaches. Hypertext based software makes it possible for a learner to have the freedom to follow an undetermined path set by the teacher. Rather, the learner sets the path or sequence for the exploration of the topic, content or problem at hand that has to be solved. By selecting one's own path, one has also the opportunity to obtain different perspectives of the same topic or issue by following different paths (Borsook, 1997).

A simulation is a model of the real world (Johnston, 2006) with which the user can normally interact, whereas a microworld is a simplified model of a concept space of a real world environment with which the learner can interact and construct knowledge through exploring and designing (Alessi & Trollip, 2001; Thurman, 1993 cited in Dalgarno, 2001; Johnston, 2006). Both simulations and microworlds make active exploration possible within a virtual environment (Dalgarno, 2001, p. 186). Examples of a simulation that fit here is 'Simcity' and microworld related examples are 'The Incredible Machine' and 'Geometer's Sketchpad' (Dalgarno, 2001). Dalgarno (2001) agues that CAL and CAI software applications can be used within the cognitive contexts of endogenous and exogenous constructivism. The endogenous context emphasises the individual nature of knowledge construction and the value of learner directed exploration and discovery (Dalgarno, 2001). The exogenous also emphasises active knowledge construction by learners, but recognises the value of formal instruction in a non-behaviouristic teacher driven type (Dalgarno, 2001, p. 185).

Another learning experience that is not CAL or CAI based, but that could meet the cognitive constructivist principles, is the designing of hypertext or hypermedia artefacts by an individual learner based upon a topic that he/she decides to explore. In this approach, the learner becomes the designer and selects the path and depth of exploration. Within this approach, it is important that the teacher still selects the learning outcomes and topics as these have to be tied to the curriculum requirements. Furthermore, the teacher has to be on the look out to assist learners when they need assistance; when they experience disequilibrium. Here the teacher also has to decide whether the disequilibrium is valuable, whether the learner is be able to endure and for how long or whether immediate assistance is required. Learner construction or design based upon these cognitive principles seems to be in line with the cognitive constructivist principles (Jonassen & Reeves, 1996).

Using computers as cognitive tools in a ‘learning with’ context or manner, where learners are engaged in designing artefacts or products, seems to offer much, but computers cannot do it alone. In the words of Harel and Papert (1991, p. 41), “Computers cannot produce ‘good’ learning, but children can do ‘good’ ‘learning with’ computers.” Bruner’s (1996) third and fourth folk pedagogy that subscribe to constructivist principles can be associated with the cognitive domain; namely (1) seeing children as thinkers and (2) seeing children as knowledgeable (Pritchard, 2007).

In chapter 1 and in the previous paragraph, the term ‘cognitive tool’ was mentioned. It seems appropriate to highlight the value of cognitive tools now, as this section (section 6.6.2) focuses on the cognitive dimension of learning. The rationale for using cognitive tools are succinctly summarised by Jonassen and Reeves (1996, p. 698):

- “Cognitive tools will have their greatest effectiveness when they are applied within constructivist learning environments”

- "Cognitive tools empower learners to design their own representations of knowledge rather than absorbing representations preconceived by others"

- "Cognitive tools can be used to support the deep reflective thinking that is necessary for meaningful learning"

- "Cognitive tools have two kinds of important cognitive effects; those that are *with* the technology in terms of intellectual partnerships; and those that are *of* the technology in terms of the cognitive residue that remains after the tools are used"

- "Cognitive tools enable mindful, challenging learning rather than the effortless learning promised but rarely realized by other instructional innovations"

- "The source of the tasks or problems to which cognitive tools are applied should be learners, guided by teachers and other resources in the learning environment"

- "Ideally, tasks or problems for the application of cognitive tools will be situated in realistic contexts with results that are personally meaningful for learners."

It is also important to unpack the role of the teacher within the cognitive constructivist perspective. Within the cognitive constructivist perspective, the teacher has to take the learners' prior knowledge into account when the teacher designs learning experiences and hence, the teacher should also tailor the design to the individual needs of the learners (Overall, 2007). Equally important, teachers should promote a feeling of community (De Vries, 2000) in the design of the learning experience. Teachers also decide on the goals and/or outcomes that the curriculum requires during their planning and designing of learning experiences and have to consult with their learners about what the learners want to learn (De Vries, 2000). In addition, the teacher's role will shift from instructor to facilitator. Furthermore, the teacher will have to view learning as a process that is not only concerned with the right-answer, but that wrong answers provide learning opportunities that could restructure the thinking behind the wrong assumptions (Overall, 2007). In a cognitive constructivist learning space, learners will be allowed to explore and guide their learning in a more personal way with ICT, as discussed above. However, the teacher has to note that he/she has a great responsibility to clarify any misunderstandings or problem areas which he/she can identify or which the learners may report as problematic.

In summary: Using ICT as a generative cognitive tool presupposes ontologically a naïve-realist conception of the world, epistemologically seeing knowledge as in the head – matching reality outside by manipulating representations inside the head; and pedagogically viewing the teacher as a listener, critical questioner, facilitator and prompter of 'cognitive conflict' (Hodgkinson-Williams, 2006, p. 10).

6.6.3 Radical and social constructivism

In the previous section, trivial or cognitive constructivism, the first tenet or thread of trivial or cognitive constructivism was dealt with. Radical constructivism acknowledges the first tenet named in section 6.6.2, namely:

> *Knowledge is not passively received either through the senses or by way of communication, [Rather], the individual actively builds up knowledge.*
>
> *(see Von Glasersfeld, 1995, p. 56)*

However, in radical constructivism, another two tenets are added, namely:

> *Cognition is an adaptive process that functions to make an individual's behaviour more viable, to present a better fit or viability;*
>
> *Cognition organises and makes sense of one's experiences, it is not a process to render or provide an accurate representation of reality.*
>
> *(see Von Glasersfeld, 1995, p. 56)*

These tenets seem to be very similar to Piaget's view of learning as being a process of restoring equilibrium from disequilibrium through a process of assimilation and accommodation, to which was previously referred to in section 6.6.2. Thus, it can be argued that radical constructivism builds on the ideas of Piaget (Bodner, 1986; Ernest, 1993) and Von Glasersfeld (1995). Learning, within radical constructivism, is based on an individual's particular construction of his/her experiences. It implies that teachers cannot transmit knowledge, but that the learner needs to construct knowledge by himself/herself by trying to link new knowledge to his/her prior experiences and understandings (Du Plessis, 2004). Ernest (1993) argues that radical constructivism is a very 'hard' type of constructivism. He bases his argument on the fact that the radical constructivist views "makes it hard to establish a social basis for interpersonal communication, for shared feelings and concerns, let alone shared values" (Ernest, 1993, p. 4).

To the above-mentioned tenets of constructivism, a fourth tenet can be added. This tenet is based on the ideas of Vygotsky, as articulated in Gergen (1995), Jaramillo (1996), Ernest (1995) and McMahon (1997) and brings the social dimension to constructivism. It can be worded as follows:

> *Knowing and knowledge is a negotiated, shared social experience and a construct mediated through language via meaningful dialogue in a meaningful context through social interaction (Gergen, 1995; Jaramillo, 1996; Ernest, 1995). Learning is thus a socially shared experience rather than an individual experience, mediated by language via social discourse (McMahon, 1997) with the metaphor of 'persons in conversation' (Ernest, 1995).*

Dougiamas (1998:IS[20], with reference to Salomon & Perkins, 1998) refers to the social dimension of social constructivism as follows:

- "Individual learning can be less or more socially-mediated learning.
- Individuals can participate in the learning of a collective, sometimes with what is learned distributed throughout the collective more than in the mind of any one individual.
- Individuals and social aspects of learning in both of these senses, can interact over time to strengthen one another in a 'reciprocal spiral relationship'."

However, I would like to argue that the social dimension of constructivism cannot ignore the important role that the individual plays. What I am arguing for is that in spite of the social dimension, the individual still has to assimilate and adapt newly constructed knowledge, as he/she tries to build his/her reality, even within the social dimension and through social interaction. In the end, it is still the individual who has to make the best 'fit' to his/her world of experience (see Ernest, 1993). In the

[20] The abbreviation IS, refers to 'InternetSource'. Some Internet resources does not have a specific page number, hence when quoting verbatim from such a source, the IS abbreviation was used instead of a page number following the date of publication.

social constructivist approach, the influence of society, culture and language is stressed. However, although society or the group construct knowledge (and this is where the link between the cognitive or trivial, radical and social constructivist approaches comes into play), it is still the individual who has to assimilate and adapt this socially constructed knowledge to 'fit' his/her reality. Hein (1991:IS, p.1) succinctly summarises my reflection when he says:

> *Constructing implies that learners construct knowledge for themselves: individually and socially.*
>
> *(Hein, 1991:IS, p. 1)*

Thus we cannot negate or nullify the role of the individual, as it is the individual who still has to make meaning of the constructed knowledge in the end, even when involved in a social constructivist context.

Having discussed radical and social constructivism, one also has to unpack constructivism's ontology and epistemology. Ontologically, constructivism acknowledges the existence of multiple subjective realities. Hodgkinson-Williams (2006) states that ontologically, social constructivist approaches could be underpinned by relativist to even possibly critical realist orientations. However, Hodgkinson-Williams (2006, p. 11) points out that "there is a separation between assumptions of knowledge and the world it [social constructivism] represents."

Epistemologically, constructivism is a theory of " 'knowing' and a theory about how one 'comes to know' ". Hence, constructivism is a theory about knowledge and learning and not a theory about teaching (Fosnot, 2005, p. ix). Constructivism refers to the active construction of knowledge (not the passive consuming of information) by individuals through a social process in real life contexts (Gagnon & Collay, 2001; Marlowe & Page, 2005). Hence, it is about understanding, applying, thinking and analysing and not about accumulating, memorising and repeating of information (Marlowe & Page, 2005). The focus should be on authentic and meaningful learning through a process of bridge building between what students already know and what they are expected to learn resulting in the creation of artefacts that represent their thinking (Gagnon & Collay, 2006). Therefore, for learning to become meaningful, it has to transcend the focus on mere factual information as "meaning assigned to facts and facts alone are meaningless until they are interpreted and added up into a coherent picture" (Hinchey, 1998, p. 45). Reflection could assist in making learning more meaningful, as Gagnon and Collay (2006) state that the role of reflection cannot be underplayed during and after the design process.

In the following paragraphs, social constructivism is discussed in greater detail, with special reference to Vygotsky. Social constructivism is attributed to Vygotsky (Slavin, 2003). Vygotsky's social cultural theory emphasises the input from other people (Slavin, 2003), as well as the value of prior knowledge (Pritchard, 2005, 2007). Interaction or input from other people, whether peers or any other knowledgeable person, is crucial for learning (Pritchard, 2005, 2007). The historical and cultural contexts and sign systems (for example cultural language, writing, counting system) in which a child grows up, are central to the development of the child (Slavin, 2003). By internalising the cultural signs, the learner is put into a position where he/she can think and solve problems without the assistance of others (Slavin, 2003). Dialogue is vital for interaction with other people as dialogue assists in shaping, sharing and developing ideas. However, is not always required that the interaction has to be with a more knowledgeable person (Pritchard, 2005). Equally important is dialogue in the form of inner private speech, "a mechanism whereby children incorporates the speech of others and then use that speech to help themselves solve problems" (Slavin, 2003, p. 44). This is often noticed in younger children when talking aloud to themselves, yet as they grow up they still continue with this inner speech, but silently (Slavin, 2003). Overall (2007, p. 75) summarises the four ideas that underpin Vygotskian's socio-cultural theory succinctly: (1) children construct their own knowledge, (2) development happens in social settings, (3) learning helps development to happen and (4) language and being able to think cannot be separated.

The Vygotskian theory attributes learning to the Zone of Proximal Development (ZPD). The ZPD can be defined as "the distance between actual developmental level as determined by independent problem solving and the higher level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86; Hedegaard, 1996). Palinscar (1998, p. 52) states that the ZPD refers to a persons' actual and potential level of development. To move from the actual to the potential level, a person requires support or scaffolding (Palinscar, 1998) which can even be via ICT (Pritchard, 2007). DeVries (2000) argues that Vygotsky did not provide clear guidelines on the forms of social assistance to move a person through the ZPD. As shown earlier, at school it will be in many instances the teacher that provides the scaffolding, but this needs not to be so, it can also be any other knowledgeable person, peers included. Pritchard (2007) provides some practical ideas for scaffolding namely, tailored materials for individual needs, timely questions, reminders, apparatus, re-designed tasks, a list of words, a writing frame, etc. Built in support offered by CAI or CBI software could then also be seen as a form of scaffolding. Furthermore, one can also use electronic forms of communication for scaffolding purposes such as "real time" synchronous communication (chat option) or asynchronous communication (email exchanges) (Pritchard, 2007). Pritchard (2005) points out that the social interactive learning that underpins social constructivism does not exclude opportunities for individual and quiet work.

Social constructivism extends the concept of 'meaningfulness' to include learning as a situated approach embedded within authentic contexts. Situatedness refers to learning that is context bound, therefore it is important to note that some contexts might be familiar and unfamiliar to some learners or even unfamiliar to all learners in a teachers' classroom (Pritchard, 2005). Unfamiliar contexts may result in 'unsmooth' learning (Pritchard, 2007). Therefore, it is important to note that a learning context that is beyond the cultural understanding of a learner(s) is likely to be unsuccessful (Pritchard, 2007; see also Lave & Wenger, 1991, Wenger 1998). The rationale for authentic tasks is that authenticity leads to greater engagement and motivation (Pritchard, 2005).

To conclude: It is important to take note that constructivism is not a theory about teaching, it is a theory of knowledge (Jaworski, 1993). However, constructivist principles or theory are not without criticism (see Matthews, 1992; Kozloff, 2002; Kirschner, Sweller & Clark, 2006). Criticism against constructivism and its associated teaching strategies or pedagogies is clearly evident in the words of Smerdon, Burkam & Lee (1999, p. 9) when they state that:

> *… constructivism is a theory of learning, [IT IS NOT]… a prescription for teaching, [AS] methods of constructivist teaching typically are not spelled out precisely and, moreover, are frequently somewhat ambiguous.*
>
> *(Smerdon, Burkam & Lee, 1999, p. 9)*

6.6.4 ICT, social constructivism and communal constructivism

Dialectical constructivism (Dalgarno, 2001, p. 190) seems to fit the social constructivist learning theory as it emphasises the role of social interaction, collaboration and cooperative learning strategies for knowledge construction. Computer Supported Collaborative Learning (CSCL) tools support learners to move through their ZPD by offering software support or alternatively support provided in the form of the teacher and peers (Dalgarno, 2001). Synchronous and asynchronous tools are normally built into the CSCL tools (see previous discussion) as scaffolds.

In the cognitive constructivist section, reference was made to the design of hypertext and hypermedia artefacts by learners individually. The social constructivist perspective can also embed the construction of artefacts or products (Gobbo & Girardi, 2001), such as hypermedia, but would require collaboration among learners. Social constructivism embedded within situated and authentic learning would also meet folk pedagogy three and four of Bruner, as discussed previously (see section 6.6.2).

The development of ICT technologies can be an enabler for teachers to reflect upon and to rethink about their practices (Holmes, Tangney, FitzGibbon & Savage, 2001; Prensky, 2008). But why a new type of constructivism, named communal constructivism? Holmes et al. (2001, p. 1) argue that the theme, or educational philosophy, underlying their approach of teaching and learning is informed by what they call communal constructivism. Communal constructivism can be defined as:

> *… an approach to learning in which students not only construct their own knowledge (constructivism) as a result of interacting with their environment (social constructivism), but are also actively engaged in the process of constructing knowledge for their learning community.*
>
> *(Holmes et al., 2001, p. 1)*

Holmes et al. (2001, p. 2) and Holmes and Gardner (2006, p. 85) state their case for communal constructivism, as follow:

We believe there is a need for an expanded definition of social constructivism that takes into account the synergy between the more recent advances in information technology … In particular we are still at an early stage in trying to construct knowledge as to how to teach, and learn, effectively with ICTs. What we argue for is a communal constructivism where students and teachers are not simply engaged in developing their own information but actively involved in creating knowledge that will benefit other students and teachers. In this model students will not simply pass through a course like water through a pipe but instead, river-like, leave their own imprint in the development of the course, their school or university, and ideally the discipline. This will result in a gain for the institutions or course, but more importantly the students themselves will benefit.

(Holmes et al., 2001, p. 2; Holmes & Gardner, 2006, p. 85)

In a communal constructivist context, peer tutoring, project-based learning, cognitive apprenticeship and the publishing of information are advocated as being important; as well as the use of technology to enable learners to learn from, with and for others (Holmes et al., 2001; Holmes & Gardner, 2006). ICT through e-Learning tools provides opportunities for learners to create new learning opportunities for themselves and enable them to store their new knowledge in ICT formats or through more traditional forms of knowledge presentation formats in a communal knowledge base to which all existing and new members can have access (Homes & Gardner, 2006). Hence, communal constructivism implies establishing a community (Holmes & Gardner, 2006).

6.6.5 The role of the teacher

What is the role of the teacher within a constructivist context? McGhee and Kozma (2001) report that teachers become instructional designers, trainers, collaborators, team coordinators, advisors and monitoring and assessment specialists within collaborative contexts. Furthermore, if one takes note of the Vygotskian socio-cultural theory (see section 6.3.3 in this chapter), it can be argued that the teacher also becomes a mediator, a ZPD guide and a scaffolder with the task to design authentic learning contexts and authentic problems that their learners can solve collaboratively by making use of the various tools, including language, at hand. Within this collaborative social context, the role of the learners also changes and learners become knowledge managers, team members and self-learners (McGhee & Kozma, 2001).

To conclude: Using ICT as a generative mediational tool within a social constructivist context would ontologically presuppose a relativist to critical realist position, epistemologically seeing knowledge as socially constructed and pedagogically based upon collaboration and cooperative learning (Hodgkinson-Williams, 2006, p.11).

6.6.6 Connectivism: A new alternative?

Before the new "theory" of connectivism is discussed, some background is provided in order to portray the developments purported by ICT and related technologies. The reason why the word theory has been placed within inverted commas is because authors like Kerr (2006), Verhagen (2006) and Craig (2008) argue that connectivism is not really a theory, but a philosophy or pedagogy of learning. This will receive further attention shortly.

In the following sub-sections of connectivism, connectivism as a "theory" is explored with reference to the birth of connectivism, the meaning of connectivism and the critique against connectivism. Finally, the concept connectivism and its implications are reflected upon, specifically with reference to the South African context.

6.6.6.1 Connectivism: Born as a result of the changing ways of technology and the web

Elliot (2009) argues that the school master of 1909 would feel just as comfortable in the classroom of the teacher of 2009, as teaching methods have not changed significantly over a century. Many other aspects in life have changed, but teachers still tend to teach in the traditional manner (Elliot, 2009). However, ICT (computers and the Internet) seems to have the possibility to transform the current traditional pedagogy, as the web is not based on 'Web 1.0 Read Only From' usage anymore, but Web 1.0 has been replaced by Web 2.0 based 'Read/Write Contributing' applications (Gillmor, 2004; Anderson, 2007; Solomon & Schrum, 2007; Elliot, 2009). In spite of this development, many of the proponents of the traditional pedagogy still believe that we do not have to modernise pedagogy (Solomon & Schrum, 2007; Elliot, 2009).

Gillmor (2004) argues that the Internet of the 1990's was characterised by consuming material, reading material published by a few. Anderson (2007) refers to the mere consuming or reading of web based material as Web 1.0 usage. This was as a result of the type of software that was available to access and to explore the Internet (Gilmor, 2004). To publish online, a person had to be quite skilful to create and host a website as one had to have knowledge about html (hypertext mark-up language). Html is the syntax or language that web browsers use to interpret how and where to display the information, the columns, colours, pictures, etc. of a webpage.

In the early 2000's, the creation of *wysiwyg* (what you see is what you get) webpage design software has changed this, as users no longer had to have special knowledge to design web pages in html. The newly designed web design or web contribution software works on the same principle as creating a document and encodes the design automatically in the background into html format. Most software today, for example the Microsoft Office 2007 suite, allows one to directly publish content on the web through Word, PowerPoint and/or Publisher.

Anderson (2007) contends that Web 2.0 usage and applications, such as Blog creation (off line) software and Blog online creation sites, Wikis (collaborating online to share, edit, add, create knowledge), Podcasts, RSS (Really Simple Syndication) and newer Web 2.0 services such as online collaboration, social networking (Facebook www.facebook.com, Flock social networking browsing www.flock.com); has changed the traditional Web 1.0 read only usage (see also Gillmor, 2004; Solomon & Schrum, 2007). Thus, the Web 1.0 read only usage of the web has changed as a result of the new developments in the software domain. As a result, users of the Internet are not merely readers and consumers of knowledge anymore, but have also become contributors, co-creators, editors and creators of social networkers on the web. Hence, the web as tool to create online content-material by a privilege few, has been expanded to become the web as tool for creating, publishing and editing by all who have access to the web (see Anderson, 2007; Solomon & Schrum, 2007).

Anderson (2007, p. 14) argues that Web 2.0 usage is underpinned by "six big ideas" namely, (1) individual production and user generated content, (2) harnessing the power of the crowd, (3) data available on an epic scale, (4) a new architecture of participation, (5) network effects and (6) openness. This implies (Anderson, 2007; Elliot, 2009) the following:

- Individual production and user generated content: Users become creators instead of consumers by using uncomplicated online services such as Facebook, YouTube, Blogger and Twitter.

- Harness the power of the crowd: Users connect with one another to create collective intelligence by discussing, blogging, decision making, etc. on a large scale in which titles or positions are not necessarily important, but one's knowledge on something (reputation) for example Wikipedia, Wikis and Blogs as collective intelligence tools is.

- Data on an epic scale: The web enables us to search for data all over the world, to save data, to find specific information through RSS, and to use various different services and applications for example in Google, Amazon and Ebay.

- Architecture of participation: Facebook and Wikis illustrate that more and more people participate and contribute, edit, share, create and comment on issues and ideas. The BitTorrent downloading service for example, is an example of a network that provides bandwidth and data to Internet users based on the principle that the more people participate, the greater number of resources are available to others.

- Network effects: There is an exponential increase in value of a service as more people participate, for example search engines (the more pages archived, the more effective searches will be) and social networking sites (the more members, the more useful the service).

- Openness: People become willing or open to share data, ideas, philosophies, information, etc. (for example in Wikis, Blogs, Facebook and YouTube).

The above developments suggest that people are using the web in new ways; however, our educational practices have not yet been transformed on a great scale to embrace the new technologies, and yet our learners and the way they learn have changed (Barnes, Marateo & Ferris, 2007; Prensky, 2001a, 2001b, 2004, 2005, 2008, 2009; Solomon & Schrum, 2007; Elliot, 2009). Elliot (2009, p. 4) points out that a common set of characteristics emerges from the literature with respect to learners' learning styles, which include (1) active learning rather than the passive receiving of knowledge, (2) authentic learning experiences rather than contrived tasks, (3) construction rather than instruction, (4) just in time learning, (5) searching for information instead of memorising information, (6) knowing where to find answers to solve problems, (7) Googling (for information) on the Internet instead of visiting traditional libraries and (8) collaborating and not competing. However, in spite of all these new developments, the educational communities have not yet embraced these new developments to their fullest extent (Barnes, Marateo & Ferris, 2007; Prensky, 2001a, 2001b, 2004, 2005, 2008, 2009; Elliot, 2009).

6.6.6.2 What is connectivism?

Siemens (2005:IS[21]) states that "Connectivism is the integration of principles explored by chaos, network, and complexity and self-organisation theories. Learning is a process that occurs within nebulous environments of shifting core elements – not entirely under the control of the individual. Learning (defined as actionable knowledge) can reside outside of ourselves (within an organisation or a database), is focused on connecting specialised information sets, and the connections that enable us to learn more are more important than our current state of knowing."

Siemens (2005) argues that decision making is a very important skill as people have to make decisions based on rapidly altering foundations, as information is growing on a continuous basis. It is therefore important to draw distinctions between important and unimportant information, similar to what Erickson (2001) has referred to as 'filtering' through the information to determine what information is required. Furthermore, it is important to have the skill to be able to recognise when new information alters the current trends (Siemens, 2005). Siemens (2005) thus argues that we need to empower ourselves with the necessary information gathering, filtering and decision making skills, as these skills are more important for a person merely than the person's current knowledge. This principle could therefore also embrace the notion of 'life-long learning' or being a 'life-long learner', as advocated by the critical outcomes of the South African NCS.

Connectivism is based upon networking principles, the key being simplicity. Simplicity within the network context implies that two elements are required to create a simple network: nodes and connections (Siemens, 2005). Thus, for a network to be established, at least two nodes have to be

[21] The abbreviation IS indicates that this is an Internet Source and that a direct quote has been used, however, the source does not provide a page number, as the whole source is one continuous web page or web resource.

connected or linked. When a connection or connections have been established or created, information can start to flow from one node or domain to another in any direction (Siemens, 2005). Learning can thus be defined as "the process that occurs when knowledge is transformed into something of meaning (and will then generally result in something that can be acted upon). During this process, learning is the act of encoding and organising nodes to facilitate data, information, and knowledge flow" (Siemens, 2005:IS).

Siemens (2005:IS) differentiates between data, information, knowledge and meaning in the following ways:

- "Data – a raw element or small meaning neutral element
- Information – data with intelligence applied
- Knowledge – information in context and internalised
- Meaning – comprehension of the nuances, value, and implications of knowledge"

The following principles or elements are embraced by connectivism (Siemens, 2005, 2006b):

- Learning and knowledge rests in diversity of opinions,
- Learning is a process of connecting specialised nodes or information sources,
- Learning may reside in non-human appliances,
- Capacity to know is more important than what is currently known,
- Maintaining connections is needed to facilitate learning on a continuous basis,
- Ability to see connections between fields, ideas, aspects, elements and concepts is a core or vital skill,
- Currency (accurate, up-to-date knowledge) is key, and
- Decision-making is itself a learning process.

Connectivism is thus the view that "knowledge and cognition are distributed across networks of people and technology and learning is the process of connecting, growing, and navigating those networks" (Siemens & Tittenberger, 2009, p. 11). The implication or meaning of seeing learning as networking, is that learning can be described as a network on three separate levels namely, the neural, conceptual and external level (Siemens & Tittenberger, 2009).

Knowledge within connectivism is not seen as static, rather; knowledge is co-creation, dissemination, communication of key ideas through networking, personalisation through the experience of internalisation, and dialogue and reflection (Siemens, 2006b). The principle of connectivism also acknowledges that knowledge is not the filling of the mind through a 'jug-and-mug' approach (see behaviourism), but knowledge is the opening up of the mind (Siemens, 2006b). Rather, learning is seen as something chaotic, diverse, messy, ongoing, co-creation or co-construction, continual, complex (one aspect changes another or changes/alters the larger network), connected specialisation and continual suspended certainty (Siemens, 2006b). The term networking implies diversity, autonomy, interactivity and openness (Siemens, 2006b). The network principle suggests that our mind is an evolving and adapting network, adapting and evolving as a result of our interaction with the environment and with different networks. However, we do not necessarily learn the moment when we connect to the network, as learning is a process. The above thus implies that it is not only important what you know, but it is equally important who you know. Hence, it is very important with whom a person is connected or networked, as that could influence a person's learning.

6.6.6.3 Critique of connectivism and the rebuttal of Siemens

Connectivism is not seen as a theory by some scholars. Several scholars such as Kerr (2006), Verhagen (2006) and Craig (2008) have been opposing and critiquing connectivism. Kerr (2006) states that networks are important. However, he adds that connectivism has not changed how learning occurs in a manner that we can throw away the established learning theories. He continues by stating that firstly, connectivism fails to contribute to a new theory, as it uses language and slogans that are sometimes correct, but that in most instances, it seems to be too generalised to guide new practice. Secondly, he continues, "connectivism does contribute to a general world outlook but we already have theories and manifestos for that view (systems theory, chaos theory, network theory, clue train manifesto), so we don't need a new -ism in this respect.” Thirdly and lastly, he adds that “connectivism misrepresents the current state of established alternative learning theories such as constructivism, behaviourism and cognitivism, so this basis for a new theory is also dubious.”

Verhagen (2006) argues in a similar manner that connectivism is nothing new, but that the principles advocated by connectivism are present in other learning theories too. He also asks whether learning can reside in non-human application. Lastly, he argues that connectivism refers rather to a type of pedagogy than to a learning theory.

Craig (2008) seems to be the least critical of the three as he states that although connectivism may not be able to explain or answer how people do learn or will learn in the future, connectivism does establish a good point of departure for discussion of the undergoing changes by learning and teaching. Elliot (2009) is in agreement with Craig (2008), as he is more positive, suggesting that new pedagogies might built upon connectivist principles. Kop and Hill (2008) are in agreement with Elliot, as they also argue that it does hold promise, but that is does not warrant the name of being a new theory.

Siemens (2006a, 2008) responded to the critique above by citing Ertmer’s and Newby’s five definitive questions to distinguish a learning theory. Siemens’ response to the critique is indicated in Table 2.7A.

Table 2.7A

*How different theories or learning relate (Siemens, 2006a, p. 36, 2008, p. 11)**

Questions	Behaviorism	Cognitivism	Constructivism	Connectivism
How does learning occur?	Black box - observable behavior main focus	Structured, computational	Social, meaning created by each learner (personal)	Distributed within a network, social, technologically enhanced, recognising and interpreting patterns
What factors influence learning?	Nature of reward, punishment, stimuli	Existing schema, previous experiences	Engagement, participation, social, cultural	Diversity of network
What is the role of memory?	Memory is hardwiring of repeated experiences - where reward and punishment are most influential	Encoding, storage, retrieval	Prior knowledge remixed to current context	Adaptive patterns, representative of current state, existing in networks
How does transfer occur?	Stimulus, response	Duplicating knowledge constructs of "knower"	Socialisation	Connecting to (adding nodes)
What types of learning are best explained by this theory?	Task-based learning	Reasoning, clear objectives, problem solving	Social, vague ("ill defined")	Complex learning, rapid changing core, diverse knowledge sources

**Note the spelling of behaviour here and in the table, as behaviour, as it is directly taken from the source.*

From Table 2.7A it becomes evident that Siemens's (2006a) argument related to connectivism as a learning theory does have substance, as connectivism fulfils Ertmer's and Newby's five definitive questions to qualify as a learning theory. Hence, Siemens might have a point.

6.6.6.4 Reflection on connectivism

The need to rethink what constitutes learning and epistemology, becomes evident from the above and also from the words of Dede (2008, pp. 80-81), as he indicates also how the web has changed the concepts of learning and epistemology, as well as who the authorities of knowledge today are. Dede (2008) argues that authorities of knowledge are not just well qualified people anymore. Dede (2008, pp. 80-81) puts it like this:

In this Classical perspective, experts with substantial credentials in academic fields and disciplines seek new knowledge through formal, evidence-based argumentation, using elaborate methodologies to generate findings and interpretations. Premier reference sources, such as the Encyclopedia Britannica, and curricular materials, such as textbooks, embody "authenticated" knowledge as compiled by experts and transmitted to learners. Epistemologically, a single-right-answer is believed to underlie each phenomenon, even though experts may not yet have developed a full understanding of the systemic causes that provide an accurate interpretation of some situations. In contrast, the Web 2.0 definition of "knowledge" is collective agreement about a description that may combine facts with other dimensions of human experience, such as opinions, values, and spiritual beliefs. The epistemology that leads to validity of knowledge in Web 2.0 media such as Wikipedia is peer-review from people seen, by the community of contributors, as having unbiased perspectives. Expertise involves understanding disputes in detail and proposing syntheses that are widely accepted by the community. Possible warrants for expertise are wide-ranging and may draw on education, experience, rhetorical fluency, reputation, or perceived spiritual authority in articulating beliefs, values, and precepts.

(Dede, 2008, pp 80-81)

Thus, Dede (2008) argues that a higher qualification does not necessarily indicate authority, as a person that has learned through experience, reading and extensive networking could also be very knowledgeable. Dede (2008) argues further that the Internet has assisted in bringing many people to the fore who are not necessarily highly qualified, but who have high levels of knowledge and skills. Thus, the Internet has not only changed the manner how people communicate and how they use the Internet (see section 6.6.6.1 with reference to Gillmor, 2004; Anderson, 2007; Solomon & Schrum, 2007; Elliot, 2009), but it is also changing our concept of knowledge.

The above has led to the following question: If connectivism evolves to become a new pedagogy or even a theory, will schools be able to embrace it if they are not connected to the web? It seems that one cannot embrace the connectivism pedagogy, if one is not connected to the web. One could be connected through clusters or groups at a local level, but that would be a limited network. Hence, within the South African context, it seems that it will still take a long time before we can think about propagating connectivism in its broadest sense. Therefore, within this study, the terms constructivist and constructionism have been the focus, as the teachers and their respective schools are not yet connected to the web and, because the theory underpinned by the Outcomes Based National Curriculum Statement seems to suggest constructivism (Moll, 2002), as previously indicated. However, note has been taken about connectivism as a new development.

7. DESIGNING ARTEFACTS

Perkins (1986), Harel and Papert (1991) and Kafai and Resnick (1996) contend that treating knowledge as design could move teacher beliefs away from 'knowledge as information' and the 'knowledge-as-transmission-model'. The reasoning behind this claim is that the design act promotes active and creative use of knowledge by the learners. Furthermore, when learners design, learners are required to make use of their diverse intelligences such as artistic, logical, linguistic, musical as well as other talents, to accomplish the design task (Ivers & Baron, 2006). All learners have all the intelligences according to Gardner (1985), but some may be more strongly developed than others (Ivers & Baron, 2006). An interpretation of the intelligences related to roles in hypermedia design, follows in Table 2.7B, based upon (Ivers & Baron, 2006, pp. 6-7).

Table 2.7B

Roles of multiple intelligences in the creation of multimedia projects (Ivers & Baron, 2006)

Intelligence	Observed student behaviours	Roles in multimedia projects
Linguistic	Loves to read books, write, and tell stories; good memory for names, dates, and trivia; communicates well	Gathers and develop text for project; provide narration; keep journal of group progress
Logical-Mathematical	Excels in math; has strong problem-solving skills; enjoys playing strategy games and working on logic puzzles	Designs flowchart; write scripting and programming code; develop navigation routes
Spatial	Needs a mental or physical picture to best understand things; draws figures that are advanced for age; doodles a lot	Creates graphics, animation, and other visual media for project; design layout
Bodily-Kinesthetic	Excels in one or more sports; good fine motor skills; tendency to move around, touch things, gesture	Keyboard information; manipulates objects with mouse; operates multimedia equipment
Musical	Remembers melodies; recognizes when music is off-key; has a good singing voice; plays an instrument; hums a lot	Identifies works for content integration; creates musical score for project; input audio/sound effects
Interpersonal	Enjoys socializing with peers: has leadership skills; has a good sense of empathy and concern for others	Coordinates group efforts; helps setting group goals; helps solving group disputes
Intrapersonal	Has strong sense of self; is confident; prefers working alone; has high self-esteem; displays independence	Conducts independent research to share with team-mates; pilot tests multimedia projects; leads multimedia project presentations

Jonassen (2000, p. 206) adds to the abovementioned 'knowledge as design' argument as he states that:

> *…the people who are learning the most from instructional material are the designers, not the learners for whom they are designed. So let students become designers rather than learners and knowledge constructors rather than knowledge users. They learn more in the process.*
>
> *(Jonassen, 2000, p. 206)*

Du Plessis and Webb (2008) argue that the design skills framework of Carver et al. (1992) and the hyper-composition-design-framework of Lehrer (1993) provide opportunities for teachers to realise the critical outcomes of the South African curriculum, while Prensky (2009) contends that the learners of today have to develop several Essential 21st Century Skills (see Appendix C1) through using technology in such a manner, that "the basic direction is away from the 'old' pedagogy of teachers 'telling' (or talking, or lecturing, or being the 'Sage on the Stage') (see Johnson, Johnson & Smith, 1991, p. 81) to the 'new' pedagogy of children [learners] teaching or learning by themselves with the teacher's guidance (Prensky, 2008).

In addition, Prensky (2008, p. 1) argues that this proposed pedagogy is not new at all, yet many teachers are "somewhere on a continuum between the old and the new paradigms. Our herculean task is [thus] to move all of them [teachers], around the world, to the new pedagogy as quickly as possible." It is argued that technology (ICT) integration could assist to achieve the Essential 21st Century Skills. It seems thus that the proposed cyberhunt approach - which is the vehicle in this study - could be a strategy that could be useful to address the critical outcomes of the NCS, as well as the 21st century skills and issues advocated by Prensky. The Essential 21st Century Skills, which are advocated by Prensky (2009, p. 1), are:

- Knowing the right thing to do (behaving ethically, thinking critically, setting goals, having good judgment, making good decisions).
- Getting it done (planning, solving problems, self-directing, self-assessing, iterating).
- Doing it with others (taking leadership, communicating/interacting with individuals and groups (especially using technology), communicating/ interacting with machines (programming), communicating/interacting with a world audience, communicating/interacting across cultures).
- Doing it creatively (adapting, thinking creatively, tinkering and designing, playing, finding your voice).
- Constantly doing it better (reflecting, being proactive, taking prudent risks, thinking long-term, continually improving through learning).

The above argumentation of Prensky opens up the importance and value of planning for learning and the value of planning during learning, as well as during the design process. It is important to note that not all learners plan and design in similar ways. Lehrer et al. (1994) argue that planning is a very important skill, but at the same time they caution that not all learners have good design skills. Therefore, they contend that it is important for teachers to assist learners in this regard. At the same time, it is also important to take cognisance of the fact that not all learners do engage with planning in the same way (Turkle & Papert, 1991; Papert, 1993; Kafai, 1996). Turkle and Papert (1991) define two kinds of planners, namely 'hard-thinking planners' and 'soft-thinking *bricoleurs*'. According to Turkle and Papert (1991, pp. 168-169) 'planners' can be defined as persons who value hierarchy, abstraction and premeditated control. Kafai (1996:77) refers to 'planners' as persons, who, before they start with their design, carefully lay out what they want to do. '*Bricoleurs*' on the other hand, would develop their designs as they proceed or when they see that there is a need for planning (Kafai, 1996, p. 77). '*Bricoleurs*' prefer the negotiation and the rearrangement of their material or media at regular intervals after contemplation or reflection (Turkle & Papert, 1991) instead of the hierarchy and abstraction of the 'planners' or 'hard-thinkers'. Kafai (1996, p. 93) states that we should be aware that 'hard-thinking planners' and '*bricoleurs*' can coexist in one person. According to Segall, what Turkle and Papert are advocating is the acceptance of "e*pistemological pluralism*" (Segall, 1991, p. 239); i.e. there is different or multiple ways in which we can come to know, as each individual is different. According to Segall (1991), Turkle and Papert (1991), encourage the importance of creating a learning environment that provides equal opportunity of access to the tools that learners need to build their own representational worlds (Segall, 1991, pp. 239-240). The idea of different learning styles and that each learner is unique in the ways that they prefer to learn, is also advocated by Mellon (1999). He states that each person or learner is different, as everyone does not necessarily have the same learning style and might not want to use the same tool, for example a technology tool such as the computer, to engage in learning and/or to solve problems.

With reference to artefact design, research reports have been very positive about artefact design in general and hypermedia construction in particular. These reports indicated that the design of artefacts by students/learners, appear to provide:

- Better retention and comprehension of content materials (Lehrer, 1993 and Beichner, 1994; Chen, 1999; Yildirim, 2005)

- Greater higher order thinking skills (Chen, 1999; Liu, 2003)
- Increased self-esteem and confidence (McGrath et al., 1997)
- Ownership (Lehrer, 1993; Du Plessis, 2004)
- Greater awareness of audience (Liu, 2003; Du Plessis, 2004; Beichner, 1994)
- Commitment and enthusiasm (Beichner, 1994)
- Improved motivation, interest and cooperation (Turner & Dipinto, 1992; Lehrer, 1993; Turner & Dipinto, 1997; Liu, 1998; Du Plessis, 2004)
- Internalisation of design skills (Liu & Hsiao, 2002; Liu, 2003; Du Plessis, 2004).
- Increase in knowledge organisation and elaboration as well as the depth of knowledge (Chen, 1999)
- New perspectives on organising and presenting (communication) of information as well as new insights into writing (Turner & Dipinto, 1992)
- Seeing knowledge in a fundamentally different way and developing critical standards for knowledge (Lehrer, et al., 1994)
- Different ways of designing approaches and opportunities for valuable reflection (Kafai, 1996)

From the above, it becomes evident that hypermedia construction or hypermedia design by learners could offer opportunities for enriched learner and learning experiences. Hence, as the cyberhunt approach requires similar skills to hypermedia design, it is proposed that this strategy could be implemented to achieve similar results, as indicated by the above research.

In conclusion, the design of artefacts in a knowledge-as-design framework or process does not only focus on the final product, but also on the process of how to arrive at the final artefact or product. The value of process as a learning principle is highlighted by Thayer (cited in Letseka, 1995, p. 304) when he states that "it is not [just] what one knows that is important, but how one comes to know what one knows."

8. MODELS OR FRAMEWORKS OF COMPUTER INTEGRATION

Herring and Tarter (2004) refer to debates around the terms information literacy and information skills, and note that information literacy is seen as a more inclusive term than information skills. Herring (1996, cited in Herring & Tarter, 2004) defines information skills as "… the skills which pupils use to identify the purpose of, locate, process and communicate information concepts and ideas and then reflect upon the effective application of these skills." Clarke (2006, p. 9) draws on the Chartered Institute of Library and Information Professionals' definition for information literacy by stating that "Information literacy is knowing when and why you need information, where to find it, and how to evaluate, use and communicate it in an ethical manner." Ryan and Capra (2001, p. 2) define information literacy in greater detail as:

> *The ability to process and synthesize information using the skills found in the steps of defining, locating, critically analyzing, and synthesizing information in order to create an original response to a problem or task. The ability of individuals to use an information process model in their daily lives can enable them to participate effectively and confidently in the community in which they live and the world at large.*
>
> *(Ryan & Capra, 2001, p. 2)*

A number of models or frameworks for computer integration encompass both information skills and information literacy. Some of these models or frameworks will be described briefly in the two sections to follow.

8.1 Information skills models

In the section below, an overview follows on the information skills models, namely the PLUS model, Information Literacy Planning Overview (ILPO) model and the Big Six model.

8.1.1 The PLUS model

The plus model is based upon the view that learners need guidance to structure their learning and their ability to produce good quality assignments, including the research aspect (Herring & Tarter, 2004). Herring and Tarter (2004) define four interlinked steps, namely (1) Purpose, (2) Location, (3) Use and (4) Self-evaluation. These steps are not necessarily linear, but can be circular and/or repetitive (Herring & Tarter, 2004). The elements of the plus model and the related skills and thinking associated with the model are (Herring & Tarter, 2004):

- Purpose — Identify the topic; use existing knowledge; brainstorming and/or concept mapping; identify possible print or electronic sources.

- Location — Find information in libraries; books, CD-ROMS and the Internet (world wide web); selection skills / relevance / quality of information; ICT skills to locate/find resources.

- Use — Reading skills; skim and scan electronic information for relevant information; comprehend what is read, viewed or listened to; ability to relate new information to existing knowledge; select appropriate/ relevant information: reject irrelevant information; evaluate appropriateness, authority and reliability of information; note taking (recording); synthesizing in a coherent framework; writing & representational skills in a logical manner.

- Self-evaluation — Reflect on the process and identify areas for improvement.

8.1.2 Information Literacy Planning Overview (ILPO) model

Ryan and Capra (2001, p. 3) developed the Information Literacy Planning Overview (ILPO) model which has been widely used. The ILPO model consists of the following steps: (1) Defining, (2) Locating, (3) Selecting/Analysing, (4) Organising/Synthesising, (5) Creating/Presenting and, (6) Evaluation (Ryan & Capra, 2001). The steps of the ILPO model related to skills and the associated thinking (Ryan & Capra, 2001) are:

- Defining — Formulate questions; analyse and clarify requirements of task/problem.

• Locating	Identify potential sources of information; locate and access a variety of resources (utilising different formats).
• Selecting/analysing	Analyse, selects and rejects information linked to the problem/topic/project.
• Organising/ synthesising	Organise gathered information; link information to prior knowledge (synthesise); develop original solutions.
• Creating/presenting	Implement communication skills (various formats and options); develop communication skills: teachers provide opportunities for learning these skills.
• Evaluation	Critically evaluates effectiveness of his/her abilities to complete task/solve problems; identify future learning needs (reflection).

Ryan and Capra (2001, pp. 3-4) argue that their model can enhance the development of critical, creative and original thinking with a view to producing solutions to problems. Herring and Tarter (2004) argue that not only content, but also the process to be followed, as well as reflection, are being shared in both the PLUS and ILPO model.

8.1.3 Big Six model

Eisenberg and Berkowitz (2004) developed a model which comprises of the following stages: (1) task definition, (2) information seeking, (3) location and access, (4) use of information, (5) synthesis and (6) evaluation. The elements of the big six model and the related skills and thinking associated are (based upon Eisenberg & Berkowitz, 2004):

• Task definition	Define the information problem; identify information needed.
• Information seeking	Determine all possible sources; select the best sources.

• Location and access	Locate sources (intellectually and physically); find information within sources.
• Use of information	Engage (for example, read, hear, view, touch); extract relevant information.
• Synthesis	Organise from multiple sources; present the information.
• Evaluation	Judge the product (effectiveness); judge the process (efficiency).

8.2 Information literacy models or frameworks

In the following sub-sections, examples of information literacy models/frameworks are discussed; namely WebQuests and project-based. Table 2.7C presents a comparison to indicate the similarities and differences among WebQuests, project-based learning, basic cyberhunt and the envisioned Learner centred Learning-by-design Extended Cyberhunt.

8.2.1 WebQuests

A WebQuest is "an inquiry based activity in which all or most of the resources are Internet-based" (Dodge, 1997, p. 1). Two types can be defined, namely short term and long term WebQuests. A short term WebQuest is normally designed to be completed in one to three class periods where a long term WebQuest's duration may vary from one week to a month (Dodge, 1997). Baedke (2003, p. 7) states that a WebQuest is "more involved and detailed than a cyberhunt and is usually introduced to students who are more comfortable when using the Internet and assessing web-based information." To be classified as a WebQuest, the following parts are a prerequisite (Dodge, 1997; Schweizer & Kossow, 2007):

- Introductory section,
- Do-able task section,
- Information resources section,
- Description of the process to be followed section,

- Guidance section, Evaluation or assessment section, and
- Conclusion section.

Some teachers may group some of these above-mentioned sections together, for example resources and processes (Schweizer & Kossow, 2007), where teachers could extend it even further. The following descriptions of each part are based upon the summary of Schweizer and Kossow (2007). In the introduction, the learners are introduced to the quest or project in an interesting manner to gather their attention and to motivate them. The 'Doable Task' refers to a product that the learners have to produce that will indicate their success. The 'Information Resources' refer to web documents, web links, books, email addresses of experts, online databases, etc. which can be explored to assist them to complete the task. In the 'Process Section' the learners are being provided with a clear step-by-step process to be embarked upon to complete the task at hand. The 'Guidance Section' provides ideas on how the learners have to organise the gathered required information. In the 'Evaluation Section' the learners have access to the tools that will be used for assessment purposes. The 'Conclusion Section' provides opportunities for further learning, the extension of learner experiences and/or reflection opportunities (Dodge, 1997; Schweizer & Kossow, 2007).[22]

8.2.2 Project-Based Learning (PBL)

Wong et al. (2006, p. 450) state that "PBL draws on the latest research on effective teaching pedagogies and learning approaches in the 21st century." Both WebQuests and PBL are project orientated, but PBL extends WebQuests, as learners are not restricted to only use the Internet

[22] A cyberhunt can eventually become a webquest, if it contains al the prerequisite parts associated with a webquest, as indicated in section 8.2.1 above. In addition, a cyberhunt may also transcend a webquest when it becomes a website or hypermedia site which guides the user(s) in exploring a topic. The criteria for determining whether it is different would be determined by comparing the different elements or parts of the newly designed cyberhunt with the elements or parts associatwd with webquests. It is important to note again that either the teacher or the learner(s) could become the designers of cyberhunts, webquests or other forms of learning tools that transcend cyberhunts or webquests. The final cyberhunt framework, indicated and discussed in the final chapter (see Chapter 6, section 3.7 and Figure 6.7), suggests that learners would initially start with simple teacher-designed cyberhunts as a means to introduce the Internet to them, but that they would eventually move beyond the mere completion of 'teacher-designed' cyberhunts and the design of their own simple cyberhunts to designing cyberhunts that would be very similar to webquests AND/OR to cyberhunts that contains different parts that are not identifiable in webquests. For example, the do-able task could be the design of a hypermedia or web based artifact that could be used by learners in order to explore a topic or as an artifact with a re-learning focus. The rationale that other learners may use the learner-designed web based tool or hypermedia tool could be to enrich learners' knowledge, to assist learner(s) who struggle in order that they could have a better understanding of a topic and/or concepts, to assist learners to learn and discover at their own pace, etc. (see also section 1.3). The cyberhunt approach envisioned to transcend webquests, places a very high premium on formulating questions or do-able tasks that focus on the different cognitive levels, as indicated in this chapter in section 10.4 and in Table 2.9A. Hence, the posing of questions for investigation would require questions on as many different cognitive levels as possible. In order to enable learners to pose questions on the different cognitive levels when learners become cyberhunt designers, the learners would require teacher assistance, for example the teacher will have to provide the learners with the verb-keywords or phrases associated with the different cognitive levels. This might not be easy for learners in the beginning, but it could become easier the more they are exposed to the verbs (keywords) associated with the different cognitive levels.

information resources supplied by the teacher as designer (Baedke, 2003). PBL thus makes provision for student directed resources (Baedke, 2003). Sherman and Sherman (2004, p. 318) summarise PBL succinctly when they state that PBL can be of the following nature: (1) answering a driving question in a scientific manner by building knowledge and understanding (problem based), (2) designing a product as a solution to a problem or (3) a combination of both.

Sherman and Sherman (2004, pp. 321-325) state that important aspects of PBL are (1) developing a driving question, (2) developing sub problems for investigation, (3) planning the project to align it with topic in the curriculum, (4) selecting an authenticity theme, (5) take prior knowledge into consideration, (6) developing and stating project goals, (7) selecting instructional design goals, deciding upon assessment tools, (8) specifying teacher and learner roles, (9) developing class rules, (10) creating a project timeline and (11) searching for resources.

In a PBL context, where the design of a product is important, another dimension comes to the fore, namely the design loop. The design loop consists of the following (Sherman & Sherman, 2004, p. 351):

- Becoming familiar with the problem,
- Creating a design brief to guide the work,
- Researching and investigating the topic/problem,
- Exploring ideas,
- Generating possible solutions,
- Selecting the best solution,
- Developing and draw,
- Making a model or prototype,
- Testing the model, prototype or solution, and
- Making the necessary changes required.

Project-based multimedia learning can be defined as a “method of teaching in which students acquire new knowledge and skills in the course of designing, planning and producing a multimedia (hypermedia) product” (Simkins et al., 2002, p. 3). The two components that drive projects or PBL (Blumenfeld et al., 1991, p. 371; Simkins et al., 2002) are: the connection to a real-life question or to a problem that needs to be solved and the activities which result in the creation of a product or artefact that culminates in a final product that addresses the driving question or problem. Learners play an integral part through participation and are thus active and not passive during learning (Blumenfeld et al., 1991; Simkins et al., 2002). Baedke (2003, p. 8) summurises the four defining elements of PBL as such:

- Content: Real-world question that ‘hooks’ the student,
- Conditions: Expected behaviours of students such as teamwork and task-and-time management,
- Activities: Investigative and engaging using real-life resources and technologies, and
- Results: Real-world outcomes that are presented using multi-media presentations, models or reports.

In an article titled, *"Wondering, wiggling, and weaving: A new model for project- and community-based learning on the web",* Lamb, Smith and Johnson (1997) provide an interesting model that comprises of eight steps that teachers can use within a Project-Based Learning context or learning space. These eight steps are (Lamb, Smith & Johnson, 1997):

- Watching (identifying potential projects to explore in their community),
- Wondering (brainstorming possible ideas to investigate),
- Webbing (locate or searching for information),
- Wiggling (evaluate the appropriateness and quality of the information found),
- Weaving (synthesising information),

- Wrapping (packaging ideas),
- Waving (sharing and publicising their ideas), and
- Wishing (reflecting on the project and the process)

The value of PBL is that it can be used in a context where learners create multimedia artefacts. Within a hypermedia based ‘learners-as-designers’ context, PBL can be defined as “a method of teaching in which students [learners] acquire new knowledge and skills in the course of designing, planning, and producing a multimedia product” (Simkins et al., 2002, p. 3). In a PBL context, learners engage in an investigation of authentic ‘nontrivial’ problems, requiring a comprehensive approach to classroom teaching and learning with a view to moving beyond current understanding (Blumenfeld et al., 1991; Solomon, 2003). Project-based problems are relatively long-term (yet it could also focus on the short-term in the beginning for novice teachers), problem-focused and meaningful, as PBL can integrate concepts (and ideas) from a number of disciplines (Blumenfeld et al., 1991), or learning areas as they are called in the current South African nomenclature.

PBL is a learner-centred approach in which learners have greater autonomy over what they learn (Grant, 2002; Wong et al., 2006). The teacher or learners can decide upon the question or problem to be researched or undertaken. Learner involvement makes the project more sustainable and enhances motivation (Blumenfeld et al., 1991). The creation of a product or products (artefacts) is of great importance, as generation is a process of knowledge construction and hence represents the learner’s thinking (Blumenfeld et al., 1991; Wong et al., 2006). However, PBL is not easy to implement and therefore teachers need a great deal of support or guidance with implementation including creating a culture of collaboration, adjusting to changing roles as teacher, scaffolding techniques (Ertmer & Simons, 2006) and complex class management issues (Mergendoller & Thomas, 2005). These management issues are related to promoting thoughtful work, establishing a different from the traditional classroom culture, holding to timelines and on the spot troubleshooting (Mergendoller & Thomas, 2005).

9. THEORETICAL PERSPECTIVES FOR CYBERHUNTS

In the previous section, models or frameworks of computer integration were discussed. In this section, the theoretical perspectives for cyberhunts are discussed in order to lay the foundation for the following section, cyberhunts. However, before the theoretical aspects are discussed, it is important to indicate how cyberhunts and hypermedia relate. A cyberhunt refers to an online activity where learners are using the Internet as a tool to find answers to questions (Rechtfertig, 2002) based upon a certain theme or topic that has been composed by someone else. Cyberhunts can be linked to hypertext and hypermedia, as in a cyberhunt, a hyperlink(s) is provided on which the user have to click so that the hyperlink to which the hyperlink points, can open and be displayed on the computer screen. Cyberhunts contain questions, and hyperlinks are provided which the user explores in order to answer the questions. A cyberhunt may include links to text based resources on the web, or to different digital media objects such as images, text, sound, motion and interactivity. Thus, a cyberhunt could contain some elements of hypermedia, e.g. hypertext links, and/or several additional digital media objects. However, the main focus of the cyberhunt is the answering of created questions on different cognitive levels by exploring the hyperlinks and the websites or media to which the hyperlink(s) points. Teachers and/or learners can be the designers of cyberhunts.

The following theoretical perspectives are important in the cyberhunt design approach, namely (1) design or construction, (2) motivation and interest, (3) collaboration and (4) constructivism. These theoretical concepts are similar to Wisnudel's (1994) rationale for the design and construction of hypermedia products, namely (1) constructivism and conceptual understanding, (2) programming and design and (3) motivation. Likewise, the theoretical perspectives mentioned at the beginning of the paragraph, are also in agreement with McGrath, Cumaranatunge, Chen, Broce and Wright's (1997) research concerning the construction of multimedia science projects embedded by (1) constructivism, (2) learning as design and (3) multiple intelligences.

Hypermedia construction "facilitate the weaving of the learners' cognitive webs" and "subsequent ways of organising information in their [learners'] cognitive webs" (Salomon, 1998, p. 5). Therefore, one can argue that hypermedia designed products represent the learners' thinking and knowledge construction. However, Garthwait (2001, p. 243) cautions that hypermedia presentations do not necessarily convey the complete picture of the child's knowledge, as there could be "invisible learning." During the design process that consists of planning, translating and transforming, evaluation and revising (Lehrer, 1993) learners have opportunities to develop complex mental skills, as indicated below (Carver et al., 1992; Lehrer, 1993):

- Project management skills: Creating a timeline for the completion of the project; allocating resources and time to different parts of the project; assigning roles to team members.
- Research skills: Determining the nature of the problem and how research should be organised; posing thoughtful questions about structure, models, cases, values, and roles; searching for information using text, electronic, and pictorial information sources; developing new information with interviews, questionnaires and other survey methods; analysing and interpreting all the information collected to identify and interpret patterns.
- Organisation and representation skills: Deciding how to segment and sequence information to make it understandable; deciding how information will be represented (text, pictures, movies, audio, etc.); deciding how the information will be organised (hierarchy, sequence) and how it will be linked.
- Presentation skills: Mapping the design onto the presentation and implementing the ideas in multimedia; attracting and maintaining the interests of the intended audiences.
- Reflection skills: Evaluating the programme and the process used to create it; revising the design of the program using feedback.

Motivation plays an important part during authentic hypermedia construction (Wisnudel, 1994). Webster, Trevino and Ryan (1993) argue that work that is associated with playfulness could assist learners to become more interested and motivated to do certain tasks. The motivational theory in the seminal works of Keller (1983) and Malone and Lepper (1987) also contain important factors that can enhance motivation, factors that can be related to the design process. Du Plessis (2004) grouped Keller and Malone and Lepper's motivational factors together in the following manner to indicate how the factors can fit together in order to assist teachers to plan for these factors: (1) curiosity, fun and attention, (2) challenges, competence and relevance, (3) control, choice and voice, (4) fantasy and novelty and (5) collaboration and connectedness to others through recognition.

Borsook (1997) proposes that the following theories support hypermedia as an effective learning technology, namely (1) cognitive flexibility theory, (2) information processing, (3) case based reasoning, (4) generative learning, (5) schema/semantic network theory and (6) dual coding theory.

Theories which can be related to hypermedia construction are (1) constructivism and constructionism (Harel & Papert, 1991; Papert, 1993; Kafai, 1996), (2) knowledge as design (Perkins, 1986; Perkins, 1992), (3) situated cognition (Brown et al, 1989) and (4) multiple intelligences (Gardner, 1985; Ivers & Baron, 2006).

Collaboration plays an important role within social constructivist learning and has a significant impact during designing, as it offers possibilities to enhance cognitive and social skills (Wisnudel, 1994, Chen, 1999; Vygotsky, 1978; McMahon, 1997). A constructivist learning environment can be defined as (Wilson, 1996, p. 5) "a place where learners [and teachers] may work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem-solving activities." Regarding design-oriented classrooms, Penuel and Means (1999) suggest these classrooms should be characterised by (1) learners engaging in longer-term, more complex assignments, (2) teachers acting as coaches and facilitators of learner learning, (3) learners engaging in more small-group collaborative activities and (4) greater involvement with external resources, including heightened attention to external audiences for learner work.

The establishment of Rich Environments for Active Learning (REALs) is an important aspect for establishing a constructivist environment (Lebow, 1993; Dunlap & Grabinger, 1996). Constructivist REALs provides opportunities for meaningful learning (Dunlap & Grabinger, 1996) which is based upon (1) collaboration, (2) personal autonomy, (3) generativity, (4) reflectivity, (5) active engagement, (6) personal relevance and (7) pluralism (Lebow, 1993, p. 5). Honebein (1996) adds to this by referring to the ideas of Cunningham, Duffy and Knuth (cited in Honebein, 1996, pp. 11-12) that constructivist learning environments live by seven pedagogical goals, namely (1) provide experience with the knowledge construction process, (2) provide experience in and appreciation for multiple perspectives, (3) embed learning in realistic and relevant contexts, (4) encourage ownership and personal 'voice' in the learning process, (5) embed learning in social experience, (6) encourage the use of multiple modes of representation and (7) encourage self-awareness of the knowledge construction process.

10. CYBERHUNTS

In the following sub-sections, the following aspects pertaining to cyberhunts are discussed namely: what a cyberhunt is, its advantages, how learner-designed cyberhunts is different from WebQuests and project-based web activities, what is meant by horizontal and vertical cyberhunts, Bloom's taxonomy as well as the taxonomy of Anderson and Krathwhol, cyberhunts and the level of innovation, hypermedia design frameworks and the integration of the cognitive and knowledge dimensions.

10.1 What is a cyberhunt?

The term 'cyberhunt' would probably not be found in a dictionary of the 1990's or even in a contemporary one. This could possibly be attributed to the quick development of the Information Society and ICT area. Cyberspace is a term that we can attribute to ICT and the Internet. The term 'hunt' refers to finding or searching for something. Therefore a cyberhunt refers to an online activity where learners are using the Internet as a tool to find answers to questions (Rechtfertig, 2002) based upon a certain theme or topic that has been composed by the teacher or learners. Teachers may use cyberhunts as an introduction to a theme in a pre-activity, as a review for an upcoming test or as another form of authentic assessment (Slayden, 2000). Cyberhunts can also be used as a knowledge generation tool when learners become cyberhunt designers. The completed cyberhunt artefacts could be used to extend the curriculum topics or to assist learners who struggle with a specific topic. Thus, cyberhunts could be used to move learners who struggle with certain aspects within the curriculum, through the Zone of Proximal Development.

An example of a simple cyberhunt that was created in Microsoft Word is presented in Figure 2.1A. This cyberhunt provides the learner/user with the options of either completing it on paper or typing on the computer is a software application, and then to save and print the answers. It is important to note that the level of each question (related to the Taxonomy of Bloom) has been indicated in front of each question within brackets (see Figure 2.1A). The value of indicating the level adjacent each question within brackets is that it assists the novel cyberhunt designer to ascertain whether he/she has composed questions on each of the different cognitive levels.

Figure 2.1A: Example of a simple cyberhunt created in Microsoft Word

A VISIT TO ADDO ELEPHANT PARK

Answer the questions on your printed worksheets. Click on the blue links to go to a website which has the information you need to answer the questions listed below it.

What to see and do in Addo
http://www.nature-reserve.co.za/cape-eastern-addo-elephant-park.html

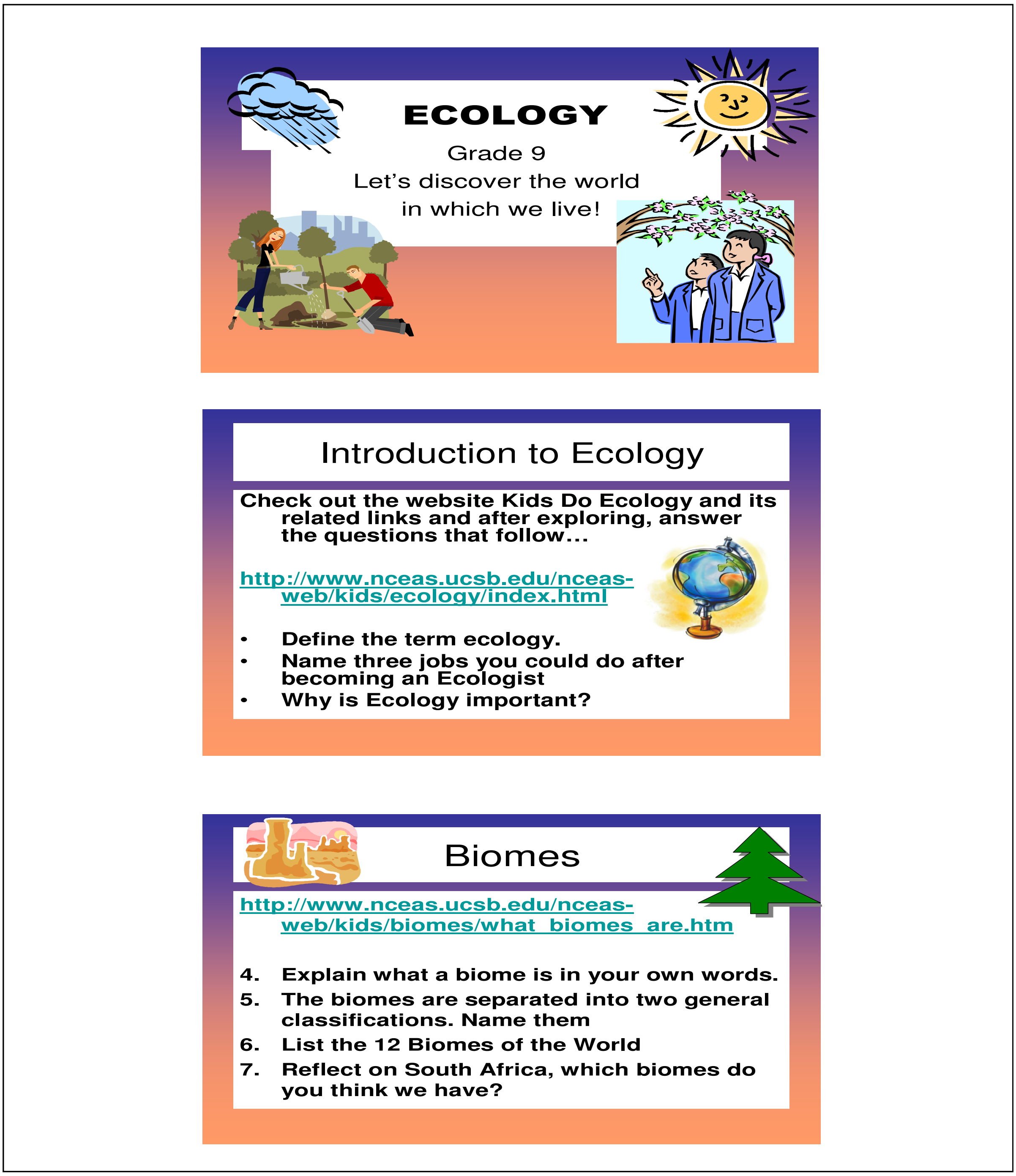
1. (Know) How many elephants are there in the Addo Elephant Park?
2. (Know) How far away from Port Elizabeth is the Addo Elephant Park?
3. (Know) Name three other kinds of large animals you could expect to see in Addo.
4. (Comp) What is another name for a suricate? Describe one in a sentence.
5. (Comp) What do you think is the main thing visitors to Addo, do?
6. (Comp) What other activities are there? (Name at least 3).

Accommodation at Addo http://www.sanparks.org/parks/addo/

7. (Know) What are the main types of different accommodation at Addo? Name at least five types.
8. (Appl) How many safari tents are available for the night of 1 September 2006?
9. (Know) How many people can sleep in each tent?
10. (Comp) Describe a safari tent in your own words (Hint: find some pictures).
11. (Appl) How much would it cost for a family of 2 adults and 2 children to share a Forest Cabin on the night of 1 September 2008?
12. (Comp) Which number would you phone to book your reservation?

Another positive aspect of cyberhunt design, is that the designer is not limited to the use of only a word processor such as Microsoft Word or a web authoring software tool such as FrontPage, but that virtually any software can be used, even presentation software, for example Microsoft PowerPoint. The only prerequisite is that the software should have a hyperlink option. In Figure 2.1B an example can be seen that was created by a student at the Nelson Mandela Metropolitan University in PowerPoint on the topic of Ecology for Grade 9 learners.

Figure 2.1B: Example of a simple cyberhunt created in Microsoft PowerPoint



This specific cyberhunt presented in Figure 2.1B (see above), requires that the learner/user can either complete it on paper, type the answers in a software application (e.g. Microsoft Word or even PowerPoint), print the answers or save the answers. The manner in which the learners complete the cyberhunt will be determined either by the teacher, or through agreement between the teacher and the learners.

It is argued that cyberhunts subscribe to the principles of constructivism and constructionism as a learning theory, as the cyberhunt design process relies on collaboration and social dialogue, learners being active and hands-on and on the creation of a physical product or artefact. Learner designed cyberhunts would therefore be in line the South African OBE based National Curriculum Statement as the South African curriculum is underpinned by constructivist principles (Moll, 2002).

10.2 Advantages of cyberhunts

The advantage for teachers being cyberhunt designers, are fourfold: (1) they learn valuable ICT skills while designing cyberhunts, (2) they start to use ICT in an integrative manner (Rechtfertig, 2002) within their learning area, (3) the design process provides the teacher with control over the websites to be visited by the learners and (4) it is a time saver, as the learners are presented with web links, hence the learners do not have to search for websites containing relevant information (Baedke, 2003). The valuable skills developed as a result of cyberhunt design, include ICT skills, questioning skills and management skills. These ICT skills include how to search by making use of search engines and the evaluation of the level and appropriateness of the information on the websites found. The questioning skills refer to empowering oneself to compose questions on the different cognitive levels (see section 10.4) and the management skills refer to providing opportunities for teachers to extend their teaching repertoire within the ICT context (see Starr, 1999; Slayden, 2000 & Rechtfertig, 2002).

Learners can also benefit from using pre-designed cyberhunts (Rechtfertig, 2002; Baedke, 2003), as they (1) learn the basics of web navigation, (2) are introduced to online reading for information gathering for meaning, (3) learn how respond to comprehension questions either by typing the answers online or by writing it in pencil and (4) and are prepared for more complex online Internet based activities for the future such as designing their own cyberhunts.

Learners are enabled to open bookmarked or referenced website hyperlinks that need to be explored to find the answers to questions. The learners type the answers on their computers and save or print them in order that the teacher or peers may assess them (see Appendix C2 for an example). Alternatively, the questions are provided on paper with hyperlinks below each one (see Appendix C3 for an example). Learners type these hyperlinks in the address bar of their web browser or click on the provided hyperlinks which would then open the website that needs to be explored to find the answers to the composed questions. The learners then write the answers on paper, type them in a word processor or create a PowerPoint presentation. Should the learners use a word processor, they either print their final answers or save them in order that they or their teacher may have access to them for further use or/and assessment.

Other examples of cyberhunts are ones which have one hyperlink and several questions that refer to the website which is opened after the learner has clicked on the hyperlink. Learners can then complete the questions either on screen or on paper (see Appendix C3 and C4 for examples).

Another positive aspect of cyberhunt design, is the fact that the designer is not limited to what kind of software he/she has to use, as the designer could use a word processor such as Microsoft Word, web authoring software such as FrontPage or even presentation software, for example Microsoft PowerPoint.

It is important to note that learners can also become designers of cyberhunts. When learners become the designers of cyberhunts and not mere users of pre-designed cyberhunts, it is possible for the 'learners-as-designers' to acquire Internet related skills, e.g. searching the Internet by making use of search engines, the identification and evaluation of the level and appropriateness of websites to be included for their cyberhunts and even enabling them to compose questions on different cognitive levels (see Starr, 1999; Slayden, 2000; Rechtfertig, 2002).

To conclude this section, the framework of Lamb, Smith and Johnson (1997) that was discussed in section 8.2.2 in this chapter, has been slightly adapted to indicate that 'learner-designed cyberhunts' can also be linked to the eights W's used in the PBL framework or model. The rationale was not to show that cyberhunt design follows exactly the same design steps as PBL, but that the cyberhunt design process does address similar aspects. However, the main difference between cyberhunt design and PBL is the fact that learners compose questions on different cognitive levels, they provide the hyperlink and they also compile a memorandum. However, it is also important to note that the learner-designed cyberhunts are designed by learners for other learners to be used. The adapted eight w's related to cyberhunts based upon Lamb, Smith and Johnson (1997) are:

- Watching: Looking for or identifying a potential topic that could be useful to explore. The rationale for selecting this specific topic could be to assist learners who are struggling with a topic or to select a section in the curriculum that the teacher cannot cover as a result of time constraints. Another possibility could be to select a topic or aspects that can be probed in a much deeper level for enrichment or deeper learning purposes. This also implies decision-making.

- Wondering: Brainstorming possible ideas or topics to explore, thinking about possible sub-themes or sub-sections to explore, thinking and defining keywords for their searches, thinking about possible questions that could be asked on the topic.

- Webbing: Searching for information on the Internet and bookmarking of possible relevant websites. This also implies the making of notes, if required.

- Wiggling: Evaluating the quality of the information found and the appropriateness of the reading level. It also implies categorising, connecting, linking information and posing questions to address or to develop the different cognitive levels. This is also the most cognitive challenging aspect in the design process.

- Weaving: Designing and structuring cyberhunts in a coherent whole, inserting any extra aspects, constructing the memorandum and adding or rephrasing any questions, if necessary.

- Wrapping: Making their design or layout attractive to their users, writing the necessary instructions, testing whether all the hyperlinks are working, ascertaining whether different levels of questions have been appropriately addressed, re-checking the memorandum and making any necessary revisions to any aspect where necessary.

- Waving: Inviting other learners to use their completed ‘learner-designed’ cyberhunts.

- Wishing: Reflecting on the design process with a view to articulate in their journals what to do differently when another learner-designed cyberhunt has to be created or designed in future.

The bulleted points above suggest that cyberhunts do contain certain elements associated with a WebQuest, but that they also contain a distinguishing characteristic, namely the formulation of questions on different cognitive levels by the designers, designers which can either be the teacher or the learners.

10.3 Learner designed cyberhunts, WebQuests and problem based learning: What is the difference??

WebQuests and project based learning were discussed in section 8.2. In this section I will present how ‘Learner centred Learning-by-design Extended Cyberhunts’, i.e. cyberhunts designed by learners, are different from WebQuests and project based learning by using a table. Table 2.7C illustrates that the envisioned ‘Learner centred Learning-by-design Extended Cyberhunt’ learning tool, contains aspects from initial cyberhunts, WebQuests as well as from PBL.

The main difference among the different web based activities indicated in Table 2.7C, is the fact that in the learner-designed cyberhunt, the learners have to compose questions on different cognitive levels that their peers (or even other teachers) have to answer by exploring the provided hyperlinks. The teacher-designed cyberhunt or learner-designed cyberhunt could thus become a learning tool for learners and even other teachers, as learners and teachers may utilise the learner-designed cyberhunts to explore a topic. Learners may therefore use the learner-designed cyberhunts to enrich their knowledge, to ameliorate understanding of a topic(s) with which they struggle and/or even to learn and discover at their own pace.

It is important to note that the composition of questions and memoranda by learners is not a key element in WebQuests and project-based learning web based activities. Hokanson and Hooper (2000, p. 547) have argued that the use of ICT should have as its prime aim “ … to generate thought.” It is therefore argued that the generation of thinking is precisely what could happen when learners answer the composed questions in a cyberhunt or when learners themselves compose questions when they design their own cyberhunts.

Table 2.7C

Comparison of Cyberhunts, WebQuests, Project-Based or Problem-Based Learning (adapted from Baedke, 2003) and the envisioned 'Learner centred Learning-by-design Extended Cyberhunts'

Web Based Activity	Rationale for activity	Student Outcomes	Designer	Duration	Resources	Final Product
CyberHunt	Introductory Internet lessons Introducing ICT & Internet skills to learners Linked to a topic(s) or aspects related to the curriculum	Navigating a web site Scanning for details (fact finding activity) Applying the read facts or ideas to the questions being posed Teaching beginning Internet research skills Typing results in computer based software package: Learn basic typing and computer skills (if required)	Teacher initially (Learner or learners may also become designers when they have the necessary ICT skills) Learners completing the teacher-designed cyberhunt OR completing the learner designed cyberhunt(s)	One period to several periods	Teacher-selected web sites (learners do not have to search for web sites) to conserve time and to make the initial Internet exploration less daunting	Graphic organizer (worksheet, puzzle, word search, etc.)
WebQuest	Task to be completed might be whimsical or imaginary (not necessarily real-life authentic project, but it could also be) Extending ICT & Internet skills (Usually after some form of introduction to ICT & Internet skills, but not always the case) Could be linked to a topic(s) or aspects related to the curriculum	Comparing web sites Evaluating information Applying information Designing a finished product Typing results in computer based software package: Learn basic typing and computer skills (if required)	Teacher initially (Learner or learners may also become designers when they have the necessary ICT skills, but this is not the main outcome) Learners completing the teacher-designed WebQuest Each team following the step-by-step teacher sections e.g. introductory section, do-able task section, information resources section, description of the process to be followed section, guidance section, evaluation or assessment section and conclusion section	Several weeks to several months	Teacher-selected web sites [Web based research] Learners are limited to these resources	Visual presentation (report, poster, play, slide show, etc.) Normally determined by the teacher (learners may have input)
Project-Based or Problem-Based Learning plus Multimedia	Applying ICT resources to an authentic & real-world project Linked to a topic(s) or aspects related to the curriculum	Assessing multiple resources Applying facts to problems Synthesizing information Evaluating process and project Typing results in computer based software package: Learn basic typing and computer skills (if required) [Could contain some of the skills of the 'Learner centred Learning-by-design Extended Cyberhunts'	Teacher initially (Learner or learners may also become designers when they have the necessary ICT skills) Each team planning their own strategies, exploring sources of information and formulating their own end results	Several class periods to several weeks	Teacher and/or student-selected web sites AND teacher or student-selected outside resources (field trips, surveys, interviews, reports, experiments, etc.) if required: Broader resource based than WebQuest [Web based and traditional research based]	Multimedia presentation (PowerPoint presentation, HyperStudio, movie, Slide show, etc.), reports or models Learners present and defend their own unique solutions to their peers and teacher

Type of Web Based Activity	Rationale for activity	Student Outcomes	Designer	Duration	Resources	Final Product
Learner centred Learning-by-design Extended Cyberhunts ***[Contain aspects from cyberhunts, WebQuests and project-based learning]***	Using technology as a learning tool AND Catering for a specific audience: Designing a finished product to be used by class peers or other class groups or to teachers AND/OR Introducing a topic to class peers or other class groups or to teachers AND/OR Assisting learners who struggle with a topic or aspect in the curriculum or assisting teachers who struggle with a topic AND/OR Serving as enrichment on a topic for learners or teachers AND/OR Serving as resources for learners from same school or for learners from another school Exposing learners to the different levels of questioning and thinking, including the verbs associated to each level Reciprocal teaching (Can be for learners and teachers from the same or from different schools or different grades)	Developing ICT skills Planning & designing of a product Goal setting Project management Time management Keyword generation Searching for appropriate information and Internet navigation Bookmarking of sites Comprehension Comparing website information, Evaluating information (decision making) Summarising ideas Inserting appropriate visual and/or audio links to enhance understanding Sorting or grouping questions that belong together Reflecting on process through journal writing Creating questions on different cognitive levels which learners/ users have to explore and answer Creating a memo Inserting appropriate complementary visual material Writing instructions Typing results in computer based software package: Learn basic typing and computer skills Testing finished product and revise Knowledge presentation and generation Collaboration	Learners are the designers (individually, two-two or in bigger groups) Each team plans their own strategies, explores sources of information and formulates their own questions to be explored (teacher may provide some direction)	Several class periods (even extending over a school term if required) Level of difficulty of topic or topics will determine the learner design duration (time required) Can be completed during school time OR after regular school time in the afternoons or even on weekends	Teacher or student-selected web sites	Simple basic cyberhunts created in Word, PowerPoint, Publisher, FrontPage, Hyperstudio, etc. OR Extended cyberhunts created in Word, PowerPoint, Publisher, FrontPage, Hyperstudio, etc. [Web-based OR even off-line based, depending on the learners' skills, as learners could copy and paste information and design an off-line workable cyberhunt] [May contain aspects from cyberhunts, WebQuests and project-based learning]

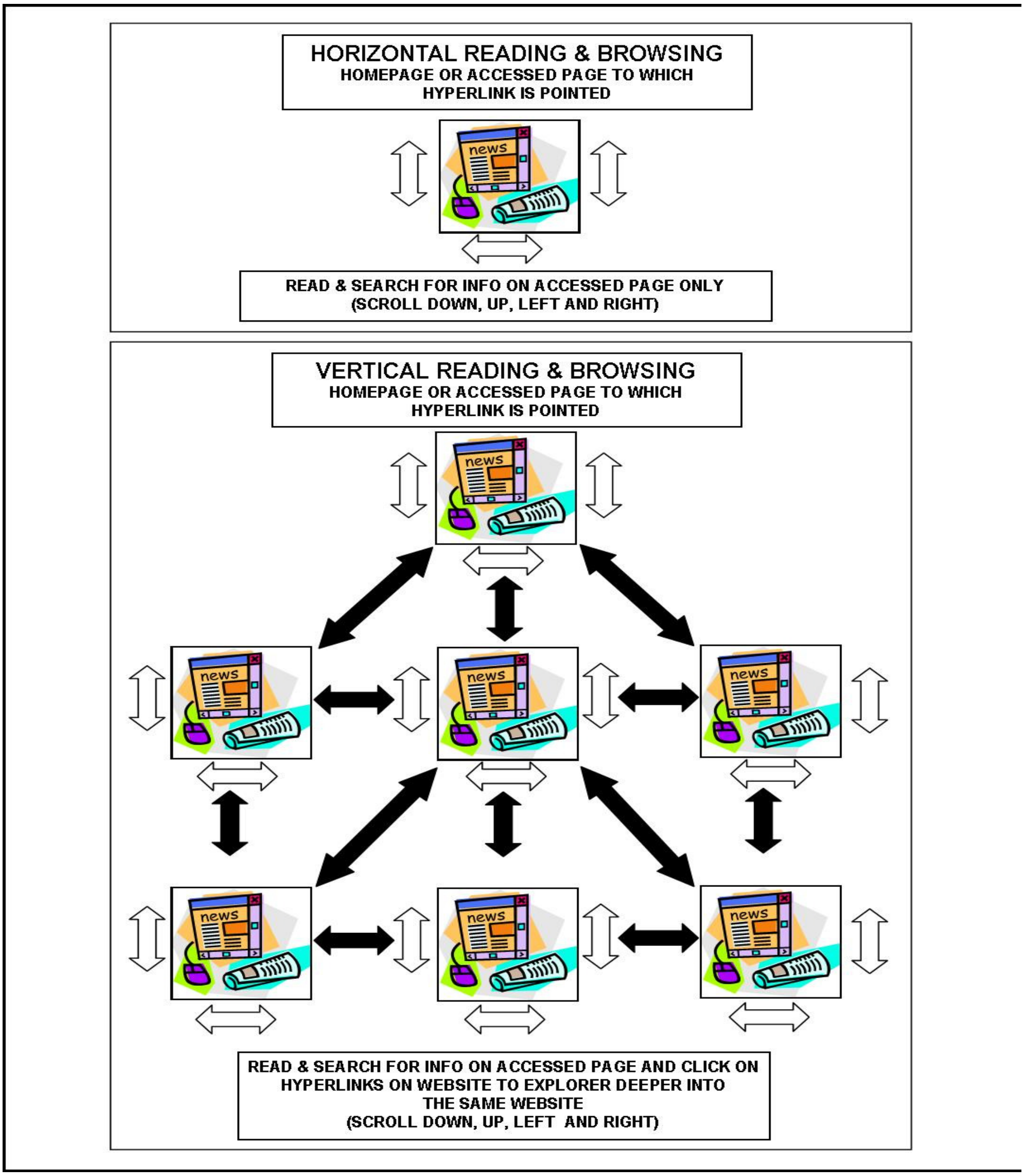
In addition, it is also important to note that the main focus of the 'Learner centred Learning-by-design Extended Cyberhunt' is on the design skills (see also Lehrer et al., 1992; Lehrer, 1993; Lehrer et al., 1994; Liu, 2003, Du Plessis, 2004), as indicated in Table 2.7C under 'Student Outcomes'. Furthermore, it is the learner (or groups of learners) that is (are) primarily responsible for the design of the 'Learner centred Learning-by-design Extended Cyberhunts' and not the teacher. Equally important, during the 'Learner centred Learning-by-design Extended Cyberhunt', it is the learner or the groups of learners that can decide how to proceed with the design process, as Turkle and Papert (1991), Papert (1993), and Kafai (1996) have argued that not all learners follow the same design process. Hence, it is argued that the 'Learner centred Learning-by-design Extended Cyberhunt' learning tool affords the learners with more opportunities and greater flexibility related to the design of their final product.

10.4 Horizontal and vertical cyberhunts

During my involvement with cyberhunts, I started to notice that two types of cyberhunts can be distinguished in what I have labelled as 'horizontal' and 'vertical' cyberhunts. The horizontal and vertical cyberhunts refer to the type of cyberhunt or the kind of questioning and exploration that is required when the website is visited. A cyberhunt can be defined as horizontal if it complies with the following: The whole cyberhunt (all the questions) is based upon one web page that has been accessed and the learner will be able to find all the answers on that specific web page. The reading thus takes place on one level. The learner is not required to explore the web site deeper by clicking on other hyperlinks within the website. Questions within a cyberhunt can also be horizontal if a learner does not have to explore the visited or accessed website deeper, thus, he/she stays on the same level that has been accessed from the beginning.

Horizontal cyberhunts could be the starting point for learners as first time users of the web or when learners are introduced to cyberhunts. Equally important and useful, horizontal cyberhunts could also serve as the starting point for novice teachers starting with ICT integration. These simple and low level horizontal cyberhunts assist teachers and learners to feel secure in the initial stages and enable them to build the necessary ICT confidence in both parties. During this stage, learners can start to answer the questions on paper. However, the teacher may decide to move from learners who write their answers on paper to learners that open the teacher created cyberhunt file from the network or web and then type their answers either in a blank word processor page or under the composed questions in the spaces provided.

Figure 2.1C: Horizontal & vertical reading & browsing



A cyberhunt becomes vertical the moment a learner has to, on his/her own, explore a website deeper to find the answer to the composed question. In practice this entails that a learner is provided with a question and a hyperlink that opens a web page when the hyperlink is selected. However, the learner will not be able to find the answer to the question on that accessed page, but will have to explore the website further or deeper by ascertaining whether some of the hyperlinks that can be seen on the accessed web page could provide possible clues embedded or hidden in the hyperlinks' names that may indicate that it is a link that can be followed. Alternatively, a learner will have to embark on a step-by-step exploration process of the website to find the answers or by collaborating with a few peers to assist him/her to explore the website in order to find the appropriate answer(s). Figure 2.1C tries to visually portray the difference between horizontal and vertical cyberhunts. The transparent arrows indicate how the learner/user scrolls up and down, left to right and right to left while reading. The black arrows indicate the movement of learners among the different screens in a website by clicking on the various links or by making use of the forward and back keys in a browser to access/move among previously accessed or visited screens.

Table 2.8 represents the different levels of cyberhunts. These higher level cyberhunts bring Internet exploration or surfing to a new and higher level, requiring more ICT skills and experience related to Internet browsing (surfing). Normally learners will type the answers on their computer and save them and make a print-out.

Table 2.8

Different levels of cyberhunts

LEVEL	PROVIDER OR DESIGNER	ANSWERS	DEPTH	WHERE ARE THE QUESTIONS FOR THE CYBERHUNT	ROLE OF LEARNER	LEVELS OF POSSIBLE QUESTIONING
LEVEL 1	**TEACHER**	Answers to be found on accessed page only.	Horizontal	Questions with hyperlinks underneath on PC screen.	Click on hyperlinks.	
				OR	OR	
				Questions with hyperlinks underneath on paper (not on PC screen).	Learner needs to type hyperlink in search engine's address bar.	
LEVEL 2	**TEACHER**	Answers NOT to be found on accessed page. Learners need to explore the website further by vertical browsing without any assistance. Hyperlinks on page provide hints as hyperlink names are suggestive.	Vertical	Questions with hyperlinks underneath on PC screen.	Click on hyperlinks.	
				OR	OR	
				Questions with hyperlinks underneath on paper (not on PC screen).	Learner needs to type hyperlink in search engine's address bar.	
LEVEL 3	**TEACHER**	Answers NOT to be found on accessed page. Learners need to explore the website further by vertical browsing without any assistance. Hyperlinks on page do not provide any hints.	Vertical	Questions with hyperlinks underneath on PC screen.	Click on hyperlinks.	
				OR	OR	Remembering
				Questions with hyperlinks underneath on paper (not on PC screen).	Learner needs to type hyperlink in search engine's address bar.	Understanding
LEVEL 4	**TEACHER**	Topic, Theme or Problem introduced. Keywords are provided.	Horizontal and/or Vertical	Questions without hyperlinks on PC screen.	Learner needs to type provided keywords in search engine's search box. Select and explore the results.	Applying Analysing Evaluating Creating
				OR	OR	
				Questions without hyperlinks on paper.	Learner needs to type provided keywords in search engine's search box. Select and explore the results.	These levels can be utilised by starting with the REMEMBERING level and gradually moving to the higher levels
LEVEL 5	**TEACHER**	Topic, Theme or Problem introduced. Keywords are NOT provided. Possible keywords that may match the topic, theme or problem need to be generated by learners.	Horizontal and/or Vertical	Questions without hyperlinks on PC screen.	Learner needs to type own generated keywords in search engine's search box. Select and explore the results.	
				OR	OR	
				Questions without hyperlinks on paper.	Learner needs to type own generated keywords in search engine's search box. Select and explore the results.	
LEVEL 6	**LEARNER, PAIR OR GROUP OF LEARNERS**	Generate or Design Cyberhunts on any of the levels OR a combination of the levels.	Horizontal and/or Vertical	Learners design questions with OR without hyperlinks on PC screen.	Click on hyperlinks OR Learner needs to type hyperlink in search engine's address bar OR Learner needs to type provided keywords or own generated keywords in search engine's search box. Select and explore the results.	
				OR	OR	
				Learners design questions with OR without hyperlinks on paper.	Learner needs to type hyperlink in search engine's address bar OR Learner needs to type provided keywords or own generated keywords in search engine's search box. Select and explore the results.	

10.5 Cyberhunts, Bloom and Anderson and Krathwohl

Bloom (1956, cited in Wilson, 2005) has provided us with his taxonomy to assist us to compose questions on different levels of thinking. The taxonomy of Bloom ranges from lower to higher levels of cognitive thinking and the different levels of the taxonomy have been defined as (1) knowledge, (2) comprehension, (3) application, (4) analysis, (5) synthesis and (5) evaluation as being the highest level. In 2000, Anderson and Krathwohl redefined Bloom's taxonomy by making certain changes, for example rewording Bloom's nouns to verbs, rewording certain categories and the repositioning of the last two categories (Wilson, 2005). In addition, Anderson and Krathwohl indicate "how the taxonomy intersects and acts upon different types and levels of knowledge - factual, conceptual, procedural and metacognitive" (Wilson, 2005, p. 2). A detailed description of how Bloom and Anderson and Krathwohl correlate and differentiate can be found in Table 2.9A (see also Appendix C5) (Wilson, 2005).

Cyberhunt designers (teachers or learners), especially if they are new to the web and/or computers, should start to design horizontal cyberhunts. Initially, teachers-as-designers should focus on the first three levels of the taxonomy of Bloom or the first three levels of Anderson and Krathwohl when they compose questions to be be included in their cyberhunts. As they (teachers or learners as users or designers) feel more comfortable, they can start to design on a higher level by including various websites and composing questions on higher levels of the taxonomy. However, more experienced web and computer users may start designing on higher levels, keeping in mind their learners' or peers' level of computer skills and cognitive capabilities. Table 2.8 (see previous page) provides a detailed summary of the different levels of cyberhunts, ranging from Level 1 being the lowest, and Level 6 being the ultimate goal: learners who design their own cyberhunts for their peers in their own class or for peers in other classes, by making use of the different levels of questioning when they compose questions.

Table 2.9A

Taxonomies of the cognitive domain: Bloom vs Anderson & Krathwohl (Wilson, 2005).

Bloom's Taxonomy 1956	**Anderson and Krathwohl's Taxonomy 2000**
1. Knowledge: Remembering or retrieving previously learned material. Examples of verbs that relate to this function are: know, define, record identify, recall, name relate, memorize, recognize list, repeat, acquire	**1. Remembering: Retrieving, recalling, or recognizing** knowledge from memory. Remembering is when memory is used to produce definitions, facts, or lists, or recite or retrieve material.
2. Comprehension: The ability to grasp or construct meaning from material. Examples of verbs that relate to this function are: restate, identify, illustrate locate, discuss, interpret report, describe, draw recognize, discuss, represent explain, review, differentiate express, infer, conclude	**2. Understanding:** Constructing meaning from different types of functions be they written or graphic messages activities like i**nterpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.**
3. Application: The ability to use learned material, or to implement material in new and concrete situations. Examples of verbs that relate to this function are: apply, organize, practice relate, employ, calculate develop, restructure, show translate, interpret, exhibit use, demonstrate, dramatize operate, illustrate	**3. Applying:** Carrying out or using a procedure through **executing, or implementing**. Applying refers to situations where learned material is used through products like models, presentations, interviews or simulations.
4. Analysis: The ability to break down or distinguish the parts of material into its components so that its organizational structure may be better understood. Examples of verbs that relate to this function are: analyze, differentiate, experiment compare, contrast, scrutinize probe, investigate, discover inquire, detect, inspect examine, survey, dissect contrast, classify, discriminate categorize, deduce, separate	**4. Analyzing:** Breaking material or concepts into parts, determining how the parts relate or interrelate to one another or to an overall structure or purpose. Mental actions included in this function are **differentiating, organizing, and attributing**, as well as **being able to distinguish between** the components or parts. When one is analyzing he/she can illustrate this mental function by creating spreadsheets, surveys, charts, or diagrams, or graphic representations.
5. Synthesis: The ability to put parts together to form a coherent or unique new whole. Examples of verbs that relate to this function are: compose, plan, propose produce, invent, develop design, formulate, arrange assemble, collect, construct create, set up, organize prepare, generalize, originate predict, document, derive modify, combine, write tell, relate, propose	**5. Evaluating:** Making judgments based on criteria and standards through **checking and critiquing**. Critiques, recommendations, and reports are some of the products that can be created to demonstrate the processes of evaluation. In the newer taxonomy evaluation comes before creating as it is often a necessary part of the precursory behavior before creating something. **Remember this one has now changed places with the last one on the other side.**
6. Evaluation: The ability to judge, check, and even critique the value of material for a given purpose. Examples of verbs that relate to this function are: judge, argue, validate assess, decide, consider compare, choose, appraise evaluate, rate, value conclude, select, criticize measure, estimate, infer deduce	**6. Creating:** Putting elements together to form a coherent or functional whole; **reorganizing** elements into a new pattern or structure through **generating, planning, or producing**. Creating requires users to put parts together in a new way or synthesize parts into something new and different a new form or product. This process is the most difficult mental function in the new taxonomy. **This one used to be #5 in Bloom's known as synthesis.**

10.6 Cyberhunts as an innovation: What to keep in mind?

Innovation can be defined as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers, 1995, p. 11; 2003, p. 12). Diffusion on the other hand, is "the process by which an innovation is communicated through certain channels over time among members of a social system (Rogers, 1995, p. 10; 2003, p. 11). Diffusion then could be defined in simple terms with spreading the word or communicating the innovation with a view to gaining acceptance from society. Communication is a central aspect and would imply that diffusion have a social dimension. The innovation-decision process is:

> *The process through which an individual (or other decision-making unit) passes from first knowledge of an innovation to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision.*
>
> *(Rogers, 2003, p. 20)*

However, Rogers (1995, 2003) warns that technical superiority of a new product or innovation does not guarantee rapid adoption and cites the superior Betamax video format and Dvorak keyboard that respectively succumbed to VHS standard and the QWERTY monopoly as examples. Hence, the same could apply to the cyberhunt strategy.

When designing a new strategy or innovation, Rogers (1983, 1995, 2003) argues that the following should be kept in mind when one design something with a view that people might try-out the innovation or even embrace it in totality, the so-called perceived attributes theory:

- Simplicity (or conversely, complexity): Is the innovation easy or difficult to understand, to maintain, and to use? [The easier the innovation is to apply and understand, the more the likelihood of adoption].

- Trialability: Is it possible to test the innovation, to experiment with it on a limited basis? [Provides less uncertainty].

- Observability: Is the innovation visible to others? Are the results of the innovation visible to others? [This stimulates discussion].

- Relative advantage: Is the innovation perceived or seen as better than the one(s) it supersedes (replaces)? Is it more economical (faster cheaper), more convenient, more socially prestigious, more satisfying? [Perceived relative advantage is more important than objective advantage – perceived advantage leads to a more rapid rate of adoption].

- Compatibility: Does the innovation fit with the existing values, past experiences and needs of potential adopters? [Find it easier to align with own beliefs].

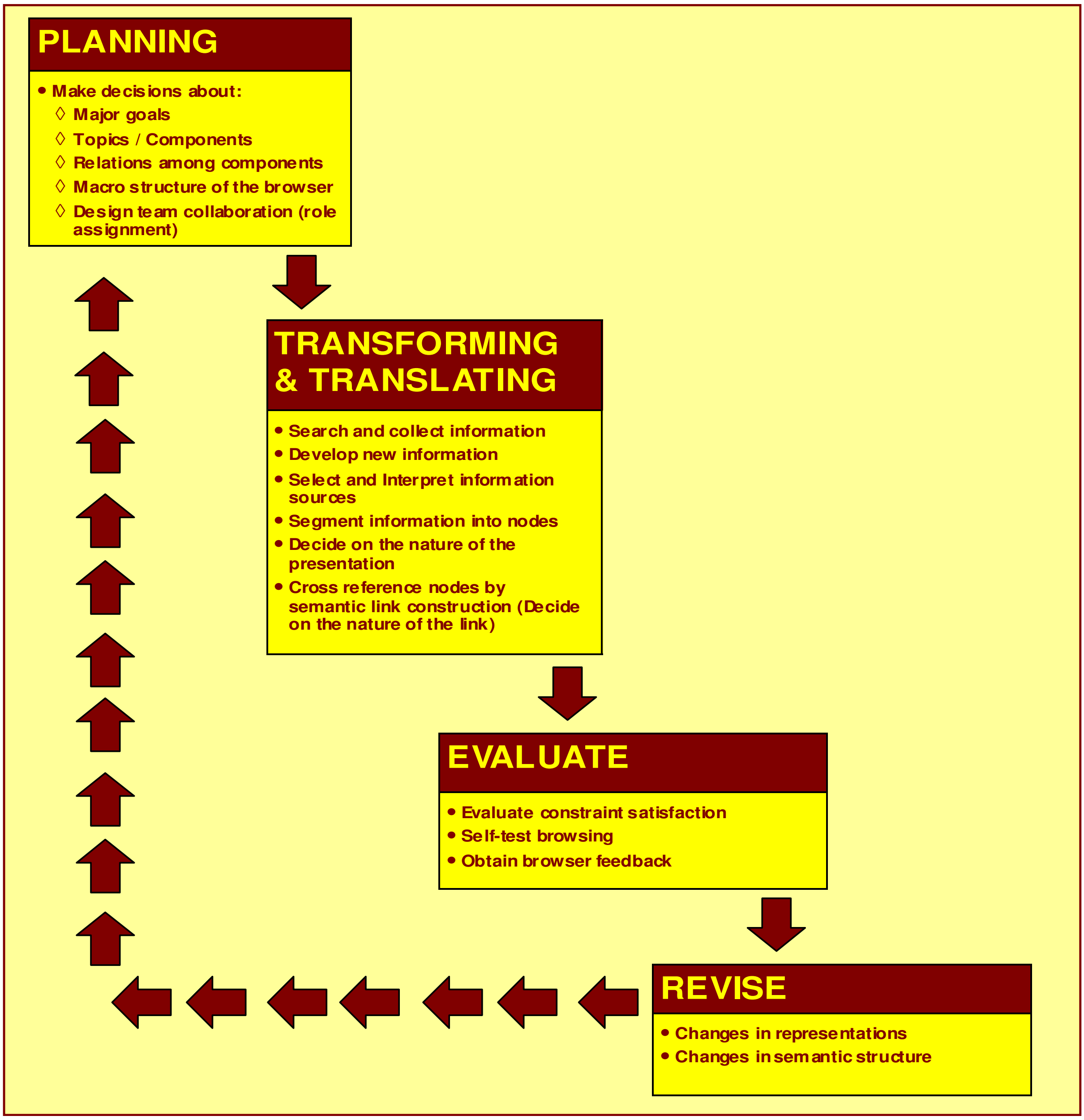
Wilson, Sherry, Dobrovolny, Batty, and Ryder (2001) add a sixth characteristic to that of Rogers (1983; 1995; 2003), namely, support. The question that has to be asked is whether there is enough support available to assist the user, enough time, energy, money and resources to ensure that the project is successful. Furthermore, it is also important to ask whether there will be administrative and political support present for the project. In addition, I want to add two additional characteristics, namely communication and reinvention. Although Wilson et al. (2001) do not mention communication; it could be argued that communication is subsumed under support. Support in this context, would refer to peer communication and persuasion of the innovation. Reinvention refers to the possibility that users can change the strategy or innovation by using it in a new way or manner not thought of before to achieve new outcomes that were not originally intended. Reinvention could thus accelerate the adoption process. However, reinvention could also have a negative side as it could refer to quicker adoption of the innovation (or technology) to achieve traditional or 'old fashioned' goals. Thus, the traditional sense refers to using technology for instance in an undesirable way, not like the innovators intended the technology to be used.

Another aspect that could also be added is that of sustainability. It could be argued that sustainability is embedded within the support aspect above, but I would argue that this needs to stand on its own. Sustainability, I would define, refers to the question whether adopters will be able to use the new adopted innovation over a long period of time, as not every human being tends to respond quickly to change. Thus the 'sustainability-life' *[my term]* could also influence adoption. It seems thus that although Rogers has provided us with perceived attributes, we cannot limit the adoption process to these alone.

10.7 Hypermedia design strategies-frameworks

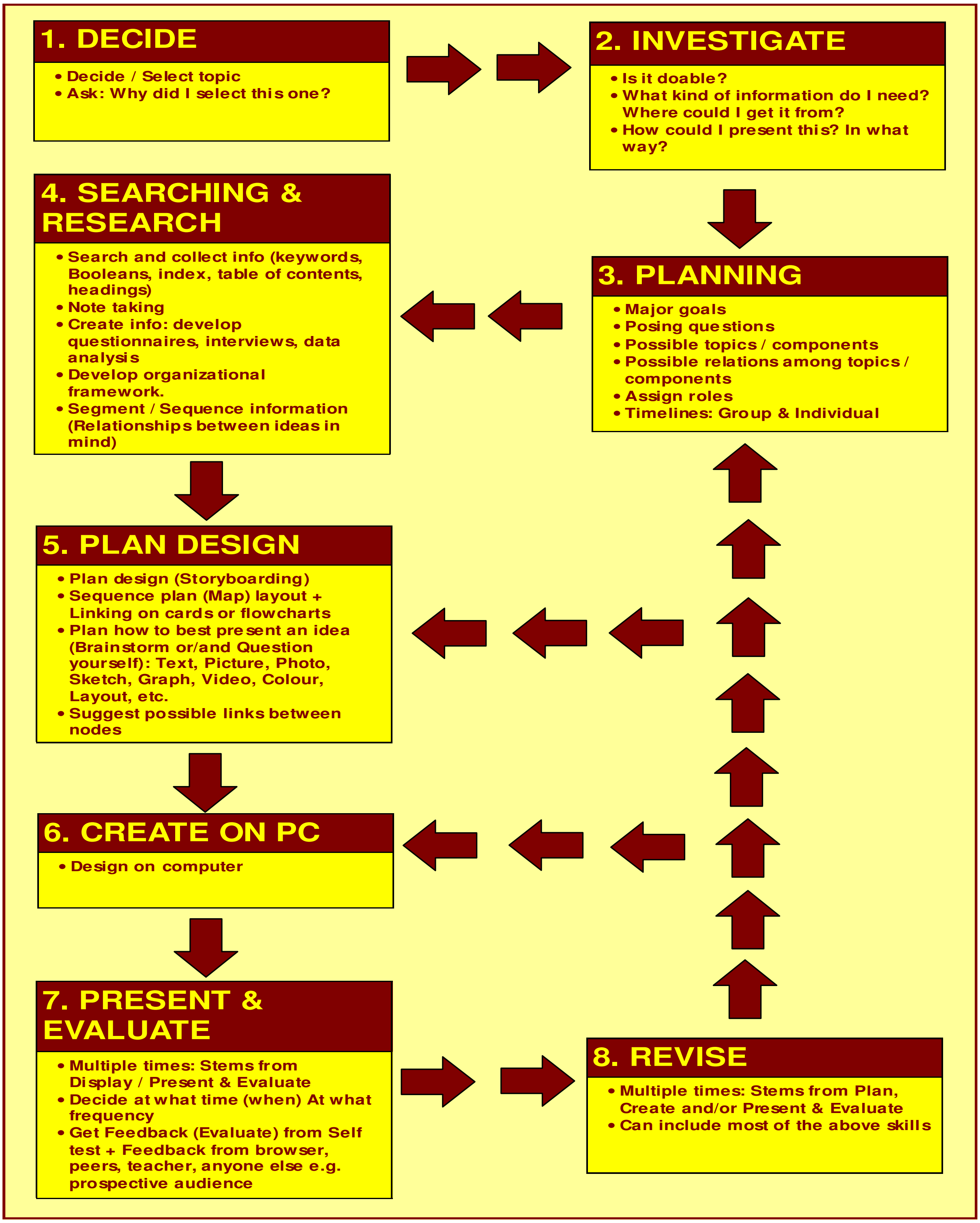
The design process/framework and the skills linked to design (Carver et al., 1992, pp. 388-389) have been mentioned previously (see section 9). According to Lehrer (1993), there are four phases in the hypermedia design process, namely planning, transforming and translating, evaluating and revising. A schematic presentation of the design process/framework can be seen in Figure 2.2. The rationale for presenting the design process/framework of hypermedia design, is that aspects of the hypermedia design process/framework were used to inform the initial cyberhunt design framework or model indicated in Figure 2.4B.

Figure 2.2: A framework for hyper-composition-based design (Lehrer, 1993, p. 202)



The design procedure for the creation of hypermedia artefacts of Lehrer (1993) was extended by Du Plessis (2004) and consists of the following aspects as indicated in Figure 2.3. The altered design framework (Du Plessis, 2004) consists of the following phases: (1) Decide, (2) Investigate, (3) Plan, (4) Search and Research, (5) Present and Evaluate and (6) Revise.

Figure 2.3: Altered design framework based on the design framework of Lehrer (Du Plessis, 2004, p. 158)



This altered design framework corresponds to the frameworks which multimedia designers use (Liu, 2003; Allessi & Trollip, 2002) and to the proposed DDDE model or framework for classroom development and design of multimedia projects (Ivers & Baron, 2006). The DDDE framework refers to 'Decide, Design, Develop and Evaluate' (Ivers & Baron, 2006). However, the altered design framework also highlights two stages that precede planning, as indicated in Figure 2.3, *viz.* decide and investigate. The argument is that decision making and investigating extend the possibilities and scope of the project as they precede planning with a view to make it less complex. Although these aspects are subsumed by the other models or frameworks, Du Plessis (2004) added these as distinct features to show their importance of added searching and research as distinct to planning. The arrows were inserted to indicate the flow among the phases, but also to illustrate the cyclical nature of the process. A comparison of the proposed procedure (Du Plessis, 2004) and other proposed multimedia design procedures follows in Table 2.9B. It is important to note that the Du Plessis framework (2003) places a high premium on journal writing as a means of reflection throughout the design process.

Table 2.9B

Comparison of the stages / phases of the design of hypermedia products

Du Plessis (2004)	**Liu (2003)**	**Ivers & Baron (2006)**	**Alessi & Trollip (2002)**	**Lehrer (1993)**
Decide Investigate Planning Search and research	Planning	Decide	Planning	Planning
Plan design on paper and in groups	Design	Design	Design	Transforming & translating
Create on computer	Production	Develop	Development (evaluation and revising is sub-assumed)	Transforming & translating
Present and evaluate	Evaluation and revising	Evaluate	Development (evaluation and revising is sub-assumed)	Evaluating
Revise	Evaluation and revising	Evaluate	Development (evaluation and revising is sub-assumed)	Revise

Allessi and Trollip (2002) state that real designers in a real-world context follow a procedure of (1) Planning, (2) Design and (3) Development of the design on computer which also includes evaluation of the product. Liu (2003) also has a similar procedure which begins with (1) Planning and then leads to (2) Design, (3) Production and (4) Evaluation and Revising. Thus Liu (2003) has separated the evaluation and revising stage from the production phase, which is sub-assumed in the Allessi and Trollip framework under the Development stage/phase.

After some reflection on the critical outcomes and the designs stages/phases, it became evident that it is possible to link the critical outcomes and the design stages/phases. These links are indicated below in Table 2.9C.

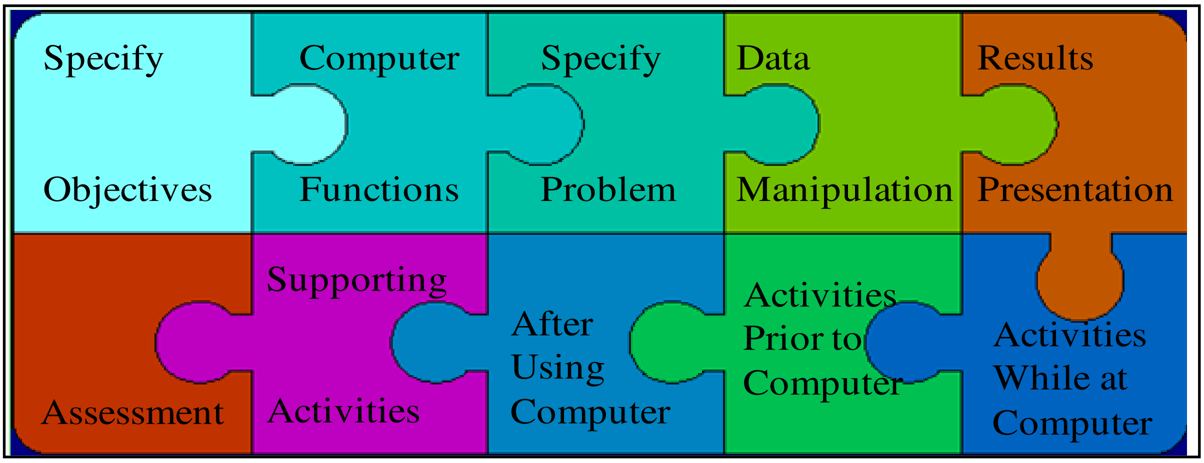
Table 2.9C

Critical outcomes in relation to design skills

Critical outcomes and related issues	**Design skills:** **Ask: What actions must be evident in the skills to indicate that the critical outcome has been addressed?**
Identify and solve problems in which responses display that responsible decisions using critical and creative thinking have been made.	Research Skills Project management and Time management Reflection Skills Design Skills
Work effectively with others as a member of a team, group, organisation, community	Decision Making Skills Research Skills Project management and Time management Design Skills Reflection Skills
Organise and manage oneself and one's activities responsibly and effectively	Project management and Time management Design Skills Reflection Skills
Collect, analyse, organise and critically evaluate information	Decision Making Skills Research Skills Design Skills Reflection Skills
Communicate effectively using visual, mathematical and/or language skills in the modes of oral and/or written presentation	Design Skills Reflection Skills
Use science and technology effectively;	Research Skills Design Skills
Employ effective learning strategies;	Decision Making Skills Research Skills
Become responsible citizens;	Time management
Be culturally and aesthetically sensitive;	Project management

The iNtegrating Technology for inQuiry model (NTEQ) (Morrison & Lowther, 2002) was also examined in order to assist with the development of the cyberhunt implementation framework and process. The NTEQ (Morrison & Lowther, 2002) is an approach based on a ten step process (see Figure 2.4A) in which learners work collaboratively in groups to solve a problem or problems. This approach requires that learners search for information, analyse the information, manipulate information, discuss issues pertaining to the project and have to produce a stipulated product or artefact that would represent their solution of the posed problem. The emphasis is on inquiry, hence the name iNtegrating Technology for inquiry. Figure 2.4A indicates the various parts of the NTEQ model for integration.

Figure 2.4A: NTEQ Model for Inquiry (Morrison et al., 1999; Morrison & Lowther, 2002)



The NTEQ model requires a different approach to teaching, as the role of the teacher and learner changes as does the instruction. In the NTEQ model, the teacher is not using the computer to achieve traditional goals; rather, the teacher uses the computer in tool mode in an integrative manner. In tool mode the computer supports learning when learners calculate, determine, identify, summarise, find information and/or organise information in a learner-centred learning environment. Learners' presentations or artefacts serve as evidence, their solution to the problem(s). As a result, the teacher needs to be more technology competent and becomes a designer of problem-solving contexts, a facilitator and a manager (Morrison et al., 1999; Morrison & Lowther, 2002). By using the ideas of Ivers and Baron (2006); Lehrer (1992), Du Plessis (2004) and (Morrison et al., 1999; Morrison & Lowther, 2002, the framework in Figure 2.4B (also indicated in Appendix C6) was designed for cyberhunt implementation in this study. In the cyberhunt model/framework, a high premium is placed on journal writing and reflection throughout the design process, as it is argued that reflection by means of journal writing, enables the designer to articulate his/her thinking, his/her needs and the learning that occurs.

Figure 2.4B: The initial cyberhunt planning and implementation model of 2008

10.8 Integration of cognitive and knowledge process dimensions

Ainley, Banks and Fleming (2002) argue that computers can be used as (1) information resource tools, (2) knowledge reinforcement tools, (3) authoring tools and (4) knowledge construction tools. Knowledge reinforcement would thus refer to using, for example, drill and practice software where the main focus is on testing remembering or recall. To be confident, creative and productive users of technology, Ainley et al. (2002) contend that that knowledge reinforcement is not the answer, but that one should rather use technology as information resource tools, authoring tools and knowledge construction tools, as mentioned above. The rationale behind this is that one should develop activities that contain aspects related to the cognitive processing dimension and knowledge dimension.

The knowledge dimension refers to (1) factual knowledge, (2) conceptual knowledge, (3) procedural knowledge and (4) metacognitive knowledge. According to Ainley et al. (2002) (1) factual knowledge refers to basic information, (2) conceptual knowledge to the way in which basic information connects to other more complex information – theories and classifications for example, (3) procedural knowledge to methods or ways on how to do something, as well as knowledge of the criteria used for this and (4) metacognitive knowledge as self-awareness about one's learning, which I would refer to as 'thinking about ones own thinking or doing.'

The cognitive dimension again, refers to (1) remembering, (2) understanding, (3) applying, (4) analysing, (5) evaluating and (6) creating (Ainley et al., 2002, see also Bloom as well as Anderson and Krathwohl, referred to earlier in this chapter). According to Ainley et al. (2002) (1) remembering refers to recognition and recall, (2) understanding to constructing meaning, for example by providing a summary, comparing or classifying something, (3) applying as carrying out or using a procedure, (4) analysing to investigate something, (5) evaluating to assessing a product, process or something else based on criteria and (6) creating to producing a product, planning or designing a product or procedure or even the creation of a hypothesis (Ainley et al., 2002).

It was previously stated (see section 10.6) that journal writing and reflection have been viewed as important learning opportunities during the design process. Based on all of the above, a table can be constructed to help establish whether the cyberhunt strategy contains the above-mentioned aspects, with special reference to cyberhunts created by learners themselves, either individually or in a group (see Table 2.10). The table suggests that cyberhunt design addresses the cognitive process and types of knowledge at the same time.

Table 2.10

Knowledge and cognitive dimensions of learner created cyberhunts when incorporating journals

Cognitive process	**Types of knowledge**			
	Factual (Basic information)	**Conceptual (How basic information connects)**	**Procedural (Ways on how to do something as well as knowledge of the criteria used)**	**Metacognitive (Thinking about one's own thinking or progress)**
Remembering (Recall)	Learners provide answers on lower level questions in the cyberhunt			
Understanding (Providing a summary, comparing or classifying something)		Learners provide answers on understanding level questions in the cyberhunt		
Applying (Applying or carrying out a procedure)	Learners using other learners' created cyberhunts		Learners provide answers on applying level questions in the cyberhunt	
Analysing (Investigate something)		Learners provide answers on analysing level questions in the cyberhunt		Reflection: Completing journals to reflect on what they have learned (skills, knowledge, procedures, etc.)
Evaluating (Assessing a product, process or something else based on criteria)	Learners assess other learners' answers or presentations	Learners assess other learners' answers or presentations	Learners assess quality of the learned designed cyberhunt based upon a checklist or rubric Learners assess other learners' answers or presentations	Reflection: Completing journals to reflect on their own progress based upon evaluation issues such as e.g. which goals have you reached? Which goals were not reached? Explain.
Creating (Producing a product, planning or designing a product or procedure)		Learners create their own cyberhunts in a group or as individuals		Learners reflect in their journals on how well they have designed it and what changes they should make next time

11. LEARNING THEORIES AND TEACHER DEVELOPMENT

Hoban (2002) provides insightful ideas for teacher development by drawing on learning theories. The following perspectives on learning will be discussed: (1) the behaviouristic perspective, (2) the cognitive constructivist perspective and (3) the situated perspective. It is important to note that all people are learners and therefore teachers are included under this umbrella term.

11.1 Behaviourist perspective on learning

The objectivist perspective sees teacher development as a craft with the workshop model as emphasis (see Hoban, 2002). This view is underpinned by the belief that teachers can be filled with new knowledge related to the teaching profession in a similar way as their learners. Hence, the teacher developer is active and the teachers are the passive receivers or listeners, who receive what they should do when they return to their schools from the workshop presenter. Hoban (2002) argues that this approach views teachers as mirrors of reality: workshop training will lead to class implementation (Hoban, 2002). Yet, in spite of workshops, teachers still do not necessarily adopt and implement what they have been told and trained to do in their classrooms, which Flemming and Lynch (2005, p. 93) attribute to teachers' perseverance with their current approaches which teachers see as working. Hence, teachers see in many instances that their traditional way of teaching is the truth. Flemming & Lynch (2005) argue that the root of the problem is the great resistance to the unlearning of what is seen as truthful and hence this influences teachers' practice.

11.2 Cognitive constructivist perspective on learning

In contrast to the objectivist-positivist tradition in which learners (or teachers during development) are passive receivers, the cognitive perspective exemplifies an active role for learners (teachers) in the learning process during teacher development. In addition, the cognitive perspective acknowledges prior knowledge as also being important (Hoban, 2002). Cognitive learning assumes that learning is in the mind of an individual, a process through which cognitive schemes are modified through social interaction (Hoban, 2002). Where the objectivist behaviourist perspective argues that the mind is an 'empty black box' (Bodner, 1986), the cognitive perspective does not contend that the mind is empty (Hoban, 2002). Piaget's cognitive constructivism is testimony to this as it defines learning as a process of accommodation, assimilation and equilibration (Slavin, 2003; see also section 6 in this chapter), which implies that new knowledge is linked to prior knowledge structures when people are learning.

11.3 Social and situated perspective on learning

Where the cognitive perspective focuses mainly on the individual (Hoban 2002; Pritchard, 2005, 2007; Overall, 2007), a socio-cultural and socio-historical perspectives highlight the importance of the situation and/or context, as well as social interaction (Hoban, 2002; Slavin, 2003; Pritchard, 2005, 2007; Overall, 2007) through discourse, as depicted in situated cognition (Brown et al, 1989) and situated learning (Lave & Wenger, 1991).

Epistemologically, constructivism views knowledge acquiring or learning as an active process through which a learner (child or adult) builds or constructs knowledge by adapting new knowledge to existing schemes to achieve the best possible 'fit' (Von Glasersfeld, 1995, p. 56), as a result of what the person experiences or has been exposed to. Dialogue or community discourse, as well a reflective thinking, are the driving forces of learning in a constructivist perspective (Fosnot & Perry, 2005). Therefore, "learning is not the result of development; rather, learning *is* development" as it requires invention and self-organisation from the learner's side (Fosnot & Perry, 2005, p. 33). Learning within this perspective is thus viewed as an active, ongoing and social process.

11.4 The situated perspective, authentic learning and cognitive apprenticeship

The seminal works of Brown et al. (1989) regarding the situated cognition theory on learning, state that "activity and the context in which learning takes place are not merely regarded as ancillary to learning, nor is it neutral, rather it is an integral part of what is learned" (Brown et al., 1989, p. 1). Learning and cognition are fundamentally situated, as "situations might be said to co-produce knowledge through activity" (Brown et al., 1989, p. 1). Hoban (2002, pp. 53-54) succinctly summarises Brown et al.'s (1989, p. 1) perspective when he states that a situated perspective assumes that "the thinking of an individual cannot be separated from its context" and as a result it "emphasizes the importance of the situation or context for learning" (Hoban, 2002, p. 53-54).

Learning must therefore be related to a context or situation that is meaningful or authentic to become meaningful (Lave & Wenger, 1991; Wenger, 1998). Brown et al. (1989, p. 11) state, "Cognitive apprenticeship methods try to enculturate students into authentic practices through activity and social interaction in a way similar to that evident - and evidently successful - in craft apprenticeship."

Cognitive apprenticeship can be linked to the situated perspective. It can be defined as the development of concepts through continuing authentic activity, or as Brown et al. (1989, pp. 6-17) continues, cognitive apprenticeship is:

> *The development of concepts out of and through continuing authentic activity is the approach of cognitive apprenticeship --- a term closely allied to our image of knowledge as a tool. Cognitive apprenticeship supports learning in a domain by enabling students to acquire, develop, and use cognitive tools in authentic domain activity. Similarly, craft apprenticeship enables apprentices to acquire and develop the tools and skills of their craft through authentic work at and membership in their trade. Through this process, apprentices enter the culture of practice. So the term apprenticeship helps to emphasize the centrality of activity in learning and knowledge and highlights the inherently context-dependent, situated, and enculturating nature of learning.*
>
> *(Brown et al. 1989, p. 16-17)*

11.5 Social perspective on learning and communities of practice[23]

Many people assume that learning is an individual thing that individuals do, it "has a beginning and an end; that it is best separated from the rest of our activities; and that it is the result of [our] teaching" (Wenger 1998, p. 3). However, this is not the case according the situative perspective. Lave and Wenger (1991) argue that learning involves the participation in a community of practice, and Clancey (1995, p. 3) adds that "learning occurs in all human activity, all the time."

An individual is not a community, but may become part of a community. One can thus say that a community consists out of more than one person (Lave & Wenger, 1991). Lave and Wenger

[23] I do acknowledge that connectivism (see Section 6.6.6) as learning a possible 'learning theory' of the future might have an impact on teacher development, as being connected with who could influence and determine what, how and why one could approach teacher development. The forming of online communities by using for example Facebook, could become a tool to be used for teacher development as teacher could share their needs with one another.

(1991) and Wenger (1998) argue that communities of practice are of different sizes and can be found virtually everywhere: at school, church, work, etc. They continue that the positions in the communities of practice may be different at various times as some members would be at the periphery or outside during some stages, and in other stages the same members may be at the centre. Within a community of practice, all people learn from one another. Hence, it is not only the novices that learn, but the experts can also learn from novices (Wenger, 2004) even if it is e.g. to identify some kind of assistance. This is based upon the premise of life-long learning for everyone.

But what is a community of practice and what characteristics define it? "Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (Wenger, 2004). However, not all communities are communities of practice (Wenger, 2004). Wenger (2004) uses the analogy of a neighbourhood or suburb; something which is often referred to as a community. This neighbourhood community does not necessarily share a concern or passion, nor necessarily interact regularly. Thus, community of practice implies sharing common goals, sharing practices and working together to reach the defined goals and to improve practice.

Polman and Pea's (2001) 'transformative communication' could be useful to explain how totally new meanings or 'a new way of thinking' are created within and among members of a community related to inquiry in education and learning practices (Polman & Pea, 2001). Members bring along different, creative and unique voices; different understandings or different practices. Thus, as a result of mutual appropriation through social interaction, new meanings and practices are created that neither participants have thought of (Polman & Pea, 2001). Often these new meanings result in a 'new way(s) of thinking' and hence to new transformed practice(s). It becomes evident that knowledge, learning and tools are conceptualised differently within a situated perspective. Clancey (1995, p. 6) states:

- "Learning is becoming a member of a community of practice" [through activity]
- "Knowledge is the ability to participate in a community of practice", "seeing roles", "seeing ways of interacting"

- "Tools facilitate interaction in a community of practice" [language, text books, computers, humans, etc.]

The term 'legitimate peripheral participation' (Lave & Wenger, 1991; Wenger 1998) can be used to indicate how newcomers become part of the Community of Practice. This term indicates that the learner can become part of a social group or community and learns through social participation (Wenger, 1998). In the beginning the learner is a newcomer at the periphery, a person that requires the granting of legitimacy, as he/she is "likely to come short of what the community regards as competent engagement" (Wenger, 1999, p. 101), but as social interaction increases and the learner becomes more confident and competent, the learner moves to the centre becoming an expert or old-timer (Lave & Wenger, 1991; Wenger 1998).

Learning is thus more than just doing, one could contend that it is the generation of new knowledge through interaction in a community "an evolving, continuously renewed set of relations" (Lave and Wenger, 1991, p. 50). This becomes evident in the words of Wenger (1998, 1999) as he states that learning communities are important, as they provide space for meaning making through negotiation, learning communities become creators of new knowledge, spreaders or diffusers or new knowledge and a place with which the members can identify.

The teacher development approach for the implementation of cyberhunts was firmly rooted in the COP model. The researcher ascertained the participants' level of ICT use and the perceived barriers related to ICT. This was done to build on their existing or prior knowledge and experiences. Furthermore, social interaction and collaboration were encouraged as a strategy to learn more about the cyberhunt approach. This resulted in drawing from both a cognitive and social-authentic-situated learning perspective for teacher development with a view to establish a learning community.

12. MODELS OF TEACHERS DEVELOPMENT

In this section, models pertaining to teacher development are discussed. It will also be shown that it is possible to classify each of the teacher development models or frameworks as either being open- or a closed system. It is also argued that teacher development should embrace an open systems approach, as open systems are more vibrant and creative than closed systems (Letsaka, 1995).

According to Letsaka (1995), open systems are multi-dimensional whereas closed systems are one-dimensional. The open systems perspective implies that communication is a vital aspect for any system to grow or to develop, therefore, communication in a teacher development context cannot be a ‘one-way’ event. This implies that the person in charge of the teacher development (and the presenter or facilitator) should establish open communication spaces, for example, providing opportunities for (1) the sharing of information, (2) debating issues, (3) contesting issues, (4) voicing constructive criticism, (5) providing opportunities of inquiry and lastly, (6) creating space for interaction among the participants and the presenter/facilitator (Letsaka, 1995).

Before the different models for teacher development are addressed, it is important to unpack the following in more detail, namely (1) what is meant by a closed- and an open system and (2) how do teachers view or perceive teaching?

12.1 Closed and Open Systems

Letsaka (1995, p. 294) states that a system is “a set of interrelated elements which functions as a whole or in unity to achieve a common goal or purpose.” Two types of systems can be defined, namely closed systems and open systems (Prigogine & Stengers, 1984; Letsaka, 1995; Badenhorst, 1998).

In the seminal work of Prigogine and Stengers (1984), ‘*Order Out of Chaos: Man’s New Dialogue with Nature*’, these authors argue that a closed system is very much mechanical, exchanging energy only with self-preservation or stability as its focus. Closed systems, it seems, do not want to change, rather, they want to preserve themselves by staying the same, not willing to change or not willing to adapt, thus maintaining equilibrium or *status quo*. Doll (1989), in his seminal article, ‘*Foundations for a post-modem curriculum*’, adds that a closed system is very tightly controlled with so-called efficiency as its aim. Errors, perturbations, anomalies and fluxes within a closed system are minimised wherever possible, as these aspects are a closed system's enemies (Prigogine & Stengers, 1984; Doll, 1989). The reason for this being is firstly that errors, perturbations, anomalies and fluxes may lead to chaos within the system; and secondly, that these elements have the possibility to take the closed system to a bifurcation point (Prigogine & Stengers, 1984; Doll, 1989) which could result in new possibilities or changes within the system. As a result, any risk(s) need to be minimised, as risk(s) could result in negative feedback which again could influence efficiency. Another important aspect within a closed system is that information exchange is limited (Bleecher and Badenhorst, as cited in Letsaka, 1995).

An open system's functioning is in direct contrast with that of a closed system, as an open system exchange energy and matter, resulting in rejuvenation (Prigogine & Stengers, 1984). Bleecher and Badenhorst (cited in Letsaka, 1995) argue that an open system is in a continual state of changing or becoming. One could argue then that an open system is in a continual state of evolving and exchanging information, and as a result, open systems are thus alive while "closed systems run off and die" (Badenhorst, 1998, p. 248).

Exchanging ideas and information is paramount for systems to evolve (Letsaka, 1995; Badenhorst, 1998). Within a school context, the creation of opportunities among teachers to voice concerns and to share ideas could result that teachers become professionally more receptive and open to examine their practice(s) and then probably also to become more open to change. However, a climate or culture to promote the rethinking of current or traditional practice and personal critical reflection is not easy to create, as there are many barriers that discourage teachers, namely the '*culture of silence, individualism and secrecy'* (Brookfield, 1995). These engrained cultures represents in many instances a closed systems view. Therefore, it is argued that for a teacher development model to be successful, it has to provide opportunities for participants to transcend these above-mentioned engrained cultures and it has to be able to transcend a climate or attitude of '*keeping everything to myself'* through establishing an open system. Within an open system, it is important to provide platforms or opportunities for participants to voice their opinions, concerns, successes, etc.

12.2 Teachers' conceptions of teaching and how it relates to systems

It is also important to unpack teachers' conception(s) of teaching. According to Hoban (with reference to Wise, Darling-Hammond, McLaughlin & Bernstein, 1984 in Hoban, 2002), teachers hold one of four conceptions of teaching, namely teaching as a craft, teaching as labour, teaching as profession and teaching as an art. As a craft, teaching can be viewed as something that can be mastered, a repertoire of skills or competencies that can be accumulated over a period of time (Hoban, 2002, with reference to Wise et al., 1984). This often results in a perception that 'the more experience a teacher has and the longer he/she is teaching, the greater the mastery'. Hence, experience (the number of years teaching) is linked to expertise or to be classified as being an 'expert'. As labour, teaching is viewed as a set of goals, lesson plans and skills that has been designed by others to be implemented by the teacher(s) (Hoban, 2002). Both of these views subscribe to a closed view of teaching, as teaching is perceived as a repertoire and as the accumulation of skills that have worked well in the past and that thus will result in the same achievements of the past in the future, the so-called '*it has proven itself for years'* argument. This way of thinking assists in establishing an orderly system that does not need or want to change.

However, when one conceives teaching as a profession or an art, teaching is more than just the development of a repertoire of skills, competencies and techniques that can be accumulated over a period of time, as it also "includes personal judgments about when and how these techniques should be applied" (Hoban, 2002, p.11). Teaching as a craft or as labour would thus subscribe to a mechanistic (Hoban, 2002) or closed systems view and teaching as a profession and art to an open systems view.

12.3 The different models of continuing professional teacher development (CPD)

Several models of continuing professional teacher development (CPD) exist and will receive attention. The following models have been identified (Kennedy, 2005), namely the (1) training model, (2) award-bearing model, (3) deficit model, (4) cascade model, (5) standards-based model, (6) coaching/mentoring model, (7) community of practice model, (8) action research model and the (9) transformative model. Picciano (2006) states that staff development programs with respect to technology should be (1) hands-on, (2) ongoing, (3) providing staff with the technology equipment, (4) incentive driven and (5) should be reviewed regularly.

Picciano (2006) argues that shorter one-on-one coaching sessions and/or train-the-trainer approaches should be used as these approaches seem to be effective. Dana and Yendol-Hoppey (2008, p. ix) are in agreement that teacher development is very important, but they state that the problem is that teachers see teacher development as "torture" and not as "treasure." Lawless and Pellegrino (2007, p. 597) add that professional development should have as its focus to assist teachers to change their pedagogies with a view to improve teaching and learning, hence they argue, the question professional developers have to ask is, "What do teachers do differently in their classrooms as a product of professional development?" Therefore, one should ask oneself when deciding on a specific teacher development model, whether this model will result in teachers changing their pedagogies.

In the following sub-sections, the different teacher training models are discussed, as well as whether each one constitutes a closed or open systems perspective.

12.3.1 Training model

The training model is a skills and knowledge based model in a context where an expert transmits or pours 'new' information to passive teachers with a view to update teachers' skills, offering a narrow technocratic view of teaching (Kennedy, 2005). This model ignores the context of practical teaching (Kennedy, 2005) resulting in a 'theory-practice gap'. Hoban (2002) argues that this approach is often seen as a fast and convenient way to introduce new knowledge to teachers, but also indicates that this model does not necessarily lead to change in practice, as the training is often de-contextualised.

Little (1993, p. 29) states that the training model's focus is first and foremost on "expanding an individual repertoire of well-defined and skilful classroom practice." She argues that this model is not serving the needs for the present requirements. Little (1993) contends that professional development has to be planned in such a manner that discussions and debates can provide the way for possible action, as teachers should be the "shapers, promoters and well-informed critics of reforms" (Little 1993, p. 130). Kennedy (2005) argues that the training model has a too high degree of control, either by government or the organisation being involved in the training. This results in ignoring the teacher as the important stakeholder, as the teachers who attend these training sessions have no input towards the training agenda (Kennedy, 2005) in most instances.

From a systemic perspective, the training model constitutes a closed systems view, as there is too much control from the trainers. This approach results thus in single-loop learning, which leads to continuing with traditional practices and not leading the way to new ways of doing (see Poole, 1998).

12.3.2 Award-bearing model

In the award-bearing model, the focus is on the completion of an award bearing programme or study, which is usually validated by universities (Kennedy, 2005) and results in receiving recognition through obtaining a diploma or degree. Kennedy (2005) argues that the reason for external validation is to seek quality control, but that it could also be a measure of control by the validating or funding bodies.

From a systemic perspective, this model may constitute a closed or open systems view. If the content of an award-bearing programme is prescribed by government to the university to maintain traditional technocratic views of teaching, then it constitutes a closed system. However, if there is some prescription with a view to transform traditional thinking and practice, then it may constitute an open systems view.

12.3.3 Deficit model

Another manner to assist with teacher development is to identify perceived weaknesses or deficits within individual teachers. A specifically professional development program is then designed to assist to remedy these weaknesses (Kennedy, 2005). In the South African context, the Integrated Quality Management System (IQMS) and the Whole School Evaluation Programme, a form of school inspections, could be used to identify deficits within schools and individuals, with a view to design professional development programmes to remedy these deficits. Rhodes and Beneicke (cited in Kennedy, 2005) caution us that poor teacher performance is not necessarily related to individual teachers, but that the root causes lie within management, leadership and organisational practices.

However, the possibility that the system itself could be the hurdle for poor individual teacher performance cannot be underplayed (Kennedy, 2005). In addition, Kennedy (2005) argues that this model seems to underplay collective responsibility.

This approach often results in the "blaming game" on groups of teachers, ignoring the possibility that the system itself (for example, government intervention-control) and/or leadership-management could be the attributers to deficits. Thus, this approach seems to suggest that this view constitutes a closed systems perspective.

12.3.4 Cascade model or Train-the-Trainer model

The cascade model is often used in situations where resources are limited and involves that teachers attend training sessions or workshops with a view to disseminating the newly acquired skills and information obtained at school level to their colleagues who have not attended the training (Kennedy, 2005). Nieto (2003, cited in Kennedy, 2005) argues that this model focuses too much on the 'what' [knowledge] and 'how' [skills] questions and neglects the 'why' [value and attitudes]. The assumption is that knowledge is the most important part of the dissemination process and not the context. This does not mean that knowledge is not important during training, but that new knowledge in provided in a de-contextualised context by not taking the context of practical teaching into consideration. The result of this approach can be seen as a technicist/technocratic approach to teaching within a closed systems perspective, resulting in single-loop learning in many instances.

12.3.5 Standards-based model

The standards-based model emphasises professional actions which demonstrate that [pre-scribed] standards have been met. Kennedy (2005) argues that this approach is concerned with the 'scientific' basis of standards and relies heavily on the behavioural perspectives on learning, neglecting collaboration among teachers (Kennedy, 2005). Hence, this approach encourages uniformity at the expense of collaborative and collegial approaches to learning (Kennedy, 2005). As a result of uniformity at the expense of collaboration, the standards-based model seems to constitute a closed systems perspective on learning.

12.3.6 Coaching / mentoring model

The coaching/mentoring model is a one-to-one or two-way relationship between two teachers in a trustworthy-confidential context where guiding, supporting and consulting are key elements (O'Connor & Ertmer, 2003). MacLennan (1995, cited in O'Connor & Ertmer, 2003) states that mentoring refers to a 'learning from' context and coaching to a 'learning with' context. In addition, MacLennan argues that a person can unknowingly be a mentor, but cannot unknowingly be a coach. Coaching seems to be more skills based (Kennedy, 2005) whereas mentoring seems to include elements of "counselling and professional friendship" (Rhodes & Beneicke, 2002, p. 301, cited in Kennedy, 2005).

In a mentor context, a more experienced teacher normally takes the leading role by acting as a temporary scaffold, to assist a novice teacher who is new to the profession (Kennedy, 2005). Kennedy (2005) argues that this approach normally uses a transmission view where the older-experienced teacher uses [or miss-uses] this situation to introduce the social and cultural norms of the school as institution to the novice teacher, in many cases to preserve the *status quo*. It seems that the experienced teacher has a greater say and stronger power in this relationship.

However, in a coaching context, it is suggested that there is a distribution of power in a less hierarchical fashion, a more equitable and less threatening relationship, characterised by dialogue and discussion of possibilities, beliefs and hopes (Kennedy, 2005). This is in opposition to the mentoring context and its transmission view, as the coaching context offers the possibility of a transformative view of professional development (Kennedy, 2005) in which inter-personal skills, collaboration, creativity, open mindedness, self-reflection and support (O'Connor & Ertmer, 2003) are key elements.

The result of this professional development model could be twofold: Firstly, it may result in a technicist/technocratic view of teaching that constitutes a closed systems perspective resulting in single-loop learning with the focus on transmission to preserve the *status quo*. Secondly and alternatively, it may result in a transforming view of teaching that constitutes an open systems perspective, resulting in the possibility of double-loop learning, if the focus is to build a supportive and challenging framework to interrogate practice with a view to seeking transformed practice.

12.3.7 Community of practice (COP) model

Little (1993) argues that teacher collaboration and networking are viable alternatives for the training model. Communities of practice's membership consist of more than two members (see Wenger, 1998, 1999, 2004). In communities of practice a major focus is on sharing and learning from one another, thus a trustworthy-confidential context, to which has been previously referred to by O'Connor and Ertmer, (2003); has to be considered.

In communities of practice there is mutual engagement towards developing a shared repertoire of practice with learning being the result of being part of the community through participation and interaction among members of the community (Kennedy, 2005; Wenger, 1998; 2004). Little (1993) highlights the importance of moving away from a focus of teacher consumption of subject matter teaching knowledge to teacher involvement in the construction of subject matter teaching knowledge.

As the coaching/mentoring model had two possible outcomes, to which previously have been referred, a community of practice may also have similar results related to professional development. Kennedy (2005) states that learning within a community is determined by the roles that the different members play within a community. She argues that learning within the community could be both positive and proactive, or a passive experience depending on the roles of the dominant members of the community. As a result, the community itself could serve to either perpetuate dominant discourses in an uncritical fashion or could act through collective participation as powerful sites of transformation (Kennedy, 2005). Krumsvik (2005, p. 8) argues that joining communities of practice is not always easy, as newly established communities of practice require teachers to think and work differently than before, which often results in the re-examining and breaking down of institutionalised boundaries and "preserving structures" and hence challenge the existing practices, which could be uncomfortable for staff members. Communities of practice could thus become a catalyst for change (Krumsvik, 2005).

Kennedy (2005) and Wenger (1998, 2004) caution that one has to be aware of the power of the dominant members to shape the thinking and understandings related to the roles of members and what the community stands for or what the community wants to achieve. Equally important, they continue, is that power struggles should be avoided within a community, as power struggles could have a negative impact within and among members. A possible way to deal with the power issues, is to provide an opportunity for the members of the community to have a say in the agenda, the principles of the community and the way forward for the community, as this could lead to mutual accountability and fewer power issues (see Little, 1993).

Communities of practice could therefore be either closed or open systems. When dominant members determine discourse and/or when discourse is dealt with in an uncritical fashion, it would constitute a closed view of community. However, if members have a say in the agenda(s) of the community, their participation is valued and their contributions are appreciated, it would constitute an open system, as it has the possibilities within to lead towards transformative practice.

12.3.8 Action research model

Burbank and Kauchak (2002) argue that collaborative action research (CAR) is an effective alternative model for professional development to address the needs of teachers in present-day classrooms. They state that CAR should be informed by groups of teachers who design, implement and evaluate areas for teacher generated research (Burbank & Kauchak, 2002). Action research is a participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes, grounded in participation through a process of action and reflection in which theory and practice plays an important role (Reason & Bradbury, 2001). This process starts when teachers become critical about existing practice (Kennedy, 2005). The focus in action research is on the process and not on the product alone, as the process has the ability to lead us to new and sometimes even serendipitous, discoveries (Kennedy, 2005).

Action research could become very useful when it is conducted within communities of practice (Kennedy, 2005), as the sharing of ideas and experiences could lead to some members within the community applying some of these newly developed ideas in their practice. This ‘try-out’ or deliberate action could be the start and development of new and evolving practices.

It was indicated in Chapter 1 that teachers stated that research is too far removed from them and thus that research and its findings often does not take the teachers’ needs into consideration

(Royer, 2002; Blumenfeld et al., 2000; Watson, 2001). However, Kennedy (2005) suggests that action research within a community of practice might assist in alleviating this perception and providing the 'relevant factor'. Stringer (2004, p. 5) states that action research in an educational context should focus on (1) change, (2) reflection, (3) participation, (4) inclusion, (5) sharing, (6) understanding, (7) repetition, (8) practice and (9) community. Stringer (2004) concurs with Kennedy (2005) and Dana and Yendol-Hoppey (2008) that action research has a community of practice at heart, as his reference to community, participation, inclusion and sharing might imply this. The action research model constitutes an open system, which could liberate teachers from their traditional beliefs and practice.

12.3.9 Transformative model

The transformative model is not a model in itself; rather it makes use of aspects taken from other models (eclectic), as it "recognizes the range of different conditions required for transformative practice" (Kennedy, 2005, p. 246). Hoban's (2002) model suggests that we need to include aspects of both cognitive and situated perspective-models on learning, including the linear transmission model, in order to create a more encompassing model. Kennedy (2005) concurs with this viewpoint.

Communities of practice could be the vehicle to assist with transformative practice. However, we have to take note that enquiry and debate related to new and transformative agendas of practice might be filled with tension. Although dialogue should be the focus, debates will arise at many occasions as a result of conflicting agendas and philosophies. These debates and tensions could be the key for the transformative model (Kennedy, 2005). The transformative eclectic approach constitutes an open systems view, as its aim is to transform current traditional ways of doing and thinking about practice.

In conclusion, it is important to take note of Bredeson's (2003) argument that changing the traditional perceptions about teacher development [and developing and implementing different models] will not be an easy task. He argues that we are in need of new ways of professional teacher development and that this will require a new vision for teacher development. He continues by arguing that we are aware that the change is required, but that this change will not be without pain, as it requires a paradigm shift which will require a new way of thinking, restructuring and the reculturing of professional development.

It has also been indicated and argued in the sections above that each model of continuing professional development constitutes a closed or open systems perspective. The models can also be grouped to indicate whether their purpose is transmission-orientated, transitional or transformative (Kennedy, 2005). If a model falls into the transmission category, it will assist with the transmission or dissemination of new information and this could result in incremental change(s). However, if a model falls into the transformative category, it does not imply dissemination, but knowledge- and *"practice creation"* [my term] with a view to achieve [possible] deep change(s); namely transformation or discontinuous change. When a model falls within the transitional category, it implies that it could be used either in a transmission or transformative manner, depending on the desired or intended outcomes (see Table 2.11).

Table 2.11

*A spectrum of continuing professional development (CPD) models**

MODEL OF CONTINUING PROFESSIONAL DEVELOPMENT (CPD)	CLOSED OR OPEN VIEW ON DEVELOPMENT	PURPOSE OF THE MODEL		
Training model **Award-Bearing model** **Deficit model** **Cascade model**	More closed than open	Transmission: Incremental change		**INCREASE IN CAPACITY FOR PROFESSIONAL AUTONOMY**
Standards-based model **Coaching/Mentoring model** **Community of Practice model**	Closed or open depending on the role(s) of the facilitator / coach / mentor	Transitional: Incremental or discontinuous change	Could support agendas for TRANSMISSION or TRANSFORMATIVE purposes	
Action Research model **Transformative model**	Open view	Transformative: Discontinious change		

** adapted from Kennedy (2005)*

It is important to take note of double loop learning and discontinuous change (Poole, 1998; Brooke-Smith, 2003), as well from single loop learning or incremental change (Poole, 1998). The focus [and also buzzwords or key concepts] in single-loop learning is "correction, refinement, selection from existing alternatives, efficiency, production, implementation, execution, standardization and the reinforcement of traditional or basic assumptions" (Poole, 1998, p. 2). In single-loop learning, the actions that are taken are thus not to change to something totally new, but to improve or to refine the current or traditional ways of doing. Single-loop or incremental learning can occur in two ways, namely (1) when the results and the intentions match or (2) when a mismatch between results and intentions is noticed and corrected. In both of these examples, the values and assumptions are not questioned or altered.

On the other hand, double-loop or discontinuous learning occurs when mismatches are noticed, examined and altered (Poole, 1998). As a result, values and assumptions are questioned and altered. The focus [and also buzzwords or key concepts] in double-loop learning is "risk taking, experimentation, searching, play, flexibility, discovery, invention and the examination of basic assumptions" (Poole, 1998, p. 2). The result of double-loop learning is that the traditional action does not stay intact, but it undergoes change(s).

It can thus be argued that single-loop or incremental learning leads to the confirmation of existing practices, actions, habits, assumptions, perspectives, routines, etc. on a deeper level or seeing teaching as a craft, as previously mentioned in section 12.2. Change within single-loop learning or incremental learning would therefore not result in reorientation. Rather, changes within a single-loop context; result in adaptation, refinement or continuous improvement of existing action or practice. In direct opposition to this view of change, double-loop learning requires that existing practices, actions, habits, assumptions, perspectives, routines, etc. need to be abandoned, unlearned or 'e*rased*' as they have to be replaced with new ones (Poole, 1998).

The question whether an organisation, for example a school, should adopt incremental learning or discontinuous learning, does not provide a clear cut answer of one as being the winner and the other as the loser. However, Poole (1998) provides us with a very appropriate summary why both types of learning need to be employed. The argument is that organisations that are entrapped in incremental learning may be in a stable state, but as a result may sacrifice optimal performance (Poole, 1998). Entrapment in stability makes it difficult to pursue real change(s). On the other hand, entrapment in discontinuous learning may lead to greater freedom and experimentation, the result being too many undeveloped ideas (Poole, 1998). Hence, balance seems to be the answer.

For double-loop learning to occur, we need to take cognisance of the following aspects/parameters, which are not easy to manage (Brooke-Smith, 2003; Poole, 1998):

- The rate of information flow to participants
- Connectivity between teachers
- Variety and diversity in the composition of participants
- Power differentials and influence
- Containing anxiety levels

The importance of connectivity between teachers and the interplay of variety and diversity within participants could be a contributing factor towards double loop learning (Brooke-Smith, 2003). The cyberhunt teacher development process has to take these aspects into consideration. Equally important, the implementation of cyberhunts could be crucial to start with the interrogation of existing beliefs and the communication that emanates through discussions during support sessions, could assist to establish a more open systems view. It is hoped that this cyberhunt teacher development project may assist with transformation and double-loop learning within participating teachers' practice or to what Poole (1998, p. 1) refers to as leading to "changes in the theory of action."

With reference to this research project, it is important to take cognisance of the fact that the research project has been informed by the Community of Practice (COP) model and has drawn on any other elements in an eclectic manner where necessary and when considered appropriate, for example drawing on the reflection element from the Action Research Model (see section 12.8). During the teacher development process pertaining to cyberhunts, participants received regular opportunities for reflection through the completion of journal sheets at the beginning and end of the various cyberhunt development sessions.

13. ICT AND TEACHER DEVELOPMENT

Sandholtz, Ringstaff & Dwyer (1997) report on teacher development related to the Apple Classrooms of Tomorrow (ACOT) teaching-with-technology project and they propose that constructivist learning environments (situated in real classroom contexts with real students), time for exploration, reflection on classroom observations of fellow teachers, and peer collaboration are important aspects that should form part of the teacher development process.

Williams, Coles, Wilson, Richardson and Tuson (2000) provide evidence that appropriateness or usefulness within classroom context, a hands-on approach, on the spot support and the sharing of ideas are important issues for teachers that should receive attention during planning and implementation, which seems to be in line with the advice from Rogers (2003). In addition, Williams et al. (2000) highlight the importance of familiarity with a wide range of ICT resources. Furthermore, Williams et al. (2000) contend that there should be a strong focus on whether the ICT resources that are available at school for teachers to utilise are appropriate, it should be acknowledged that teachers are at different levels and stages related to ICT literacy and integration, and there should be a strong emphasis on reflection during teacher development. The importance of poor tutoring, a too quick pace and information overload are other factors that also deserve careful attention (Williams et al., 2000), as these factors could likewise contribute to non-implementation.

Hawley and Valli (1999, pp. 139-144) argue that teacher development should focus on the following aspects:

- Goal setting related to learner performance.
- Including teacher involvement in the planning process: Teachers should be encouraged to identify their needs where possible, what assistance they require.
- Being school-based in authentic settings, yet not denying access to non-school based teacher development experiences.
- Including opportunities for collaborative problem solving which could lead to the sharing of expertise and the clarification of issues or problems, the development of new practices and assist to arrive at possible solutions

for identified concerns or problematic areas by making use of practical research and interaction.

- Ongoing: Based upon continuous external [and internal] support.
- Evaluating the process and its influence on learner outcomes and teacher development.
- Developing theoretical understanding: Teachers should see how the new skills and knowledge that they acquired through the developmental process have benefited themselves as well as their learners.
- Integrated with a comprehensive change process: Starting small with multi-faceted plans.

Hawley and Valli (1999, pp. 132-133), with reference to Alexander and Murphy (1998), assert that teacher development should include the following learner centered principles:

- Taking note of the teachers' knowledge base (prior knowledge),
- Providing opportunities for reflection,
- Promoting teachers' motivation,
- Recognising the developmental aspect or process and
- The importance of the sharing of knowledge within context.

Vrasidas and Glass (2005) also highlight the importance of exposing teachers to contextual experience in everyday practice (situatedness in meaningful and authentic contexts) so that teachers are enabled to try-out new approaches in their own classroom context. Burns (2002) argues that teacher development is vital to achieve realistic and fruitful ICT integration within the classroom. She states that the focus should be on the teachers, and not on how much they can be taught, thus focusing on how the teachers learn. In addition, it is important to instil within teachers a feeling that no harm is done if their learners know more about ICT than themselves as learning is a reciprocal process (Burns, 2002). The following issues are important for a teacher development process related to ICT (Burns, 2002), namely:

- The forming teams for collaboration,
- Ongoing and continuous support at school level,
- The sharing of experiences,
- The discussion of the use of specific instructional approaches or/and software within the classroom,
- The developmental or training process is embedded in real-life content,
- The fact that the training should follow a hands-on approach,
- The fact that the development process is experienced as enjoyable,
- The principle of allowing for participants to make mistakes, and
- The importance of providing opportunities for reflection.

Richardson (2003) highlights the importance of the following for professional development, namely:

- School wide and long term based,
- Ongoing support and follow-up,
- Collegiality,
- Agreement upon goals and vision (achieve buy-in),
- Access to funds for materials, access to obtain knowledge and access to training for substitute teachers,
- Acknowledgement of the existing beliefs and practices of participants and
- The use of an outside source as facilitator or as staff developer.

Birman, Desimone, Porter and Garet (2000) and Garet, Porter, Desimone, Birman and Yoon (2001, pp. 919-920) attribute six key features to effective teacher professional development. The first three refer to structural features and the next three to core features. The structural features are (Birman et al., 2000, p. 21) & Garet et al., 2001, pp. 919-920):

- The form of the activities: Reform type activities for example networking, study groups, mentoring and coaching which are in contrast to the traditional workshops.

- Duration: Providing more time for training of new aspects, discussions of content, student misconceptions, pedagogical strategies, etc. and the providing of support over a period of time to assist with implementation (including support during the school day or when needed).

- Collective participation among teachers of the same grade or learning area, department or same school. This includes sharing, discussions, reflection of problems and the generation of solutions.

The core features are (Birman et al., 2000, p. 21; Garet et al., 2001, pp. 919-920):

- Content Focus: Focusing on increasing, deepening and improving participants' content knowledge of the subject area [learning area] and general pedagogy or teaching practices which include lesson planning, classroom management, grouping methods, lesson planning and ways in which learners learn.

- Active learning: Reflecting, discussing and exploring of the new aspects for example by receiving feedback on actual teaching. Furthermore it may include observing the teaching of other teachers or experts, to plan new teaching methods, to design new curriculum materials together, reviewing of student work and to participate and lead discussions.

- Coherence: Encouraging continuous professional communication among teachers, consistent with teacher goals and aligned with state standards and assessments. This includes being aware of teachers' prior knowledge and skills and thus building on their prior learning.

Garet et al. (2001) provide evidence that duration, collective participation, content, active learning and coherence are more important than the form or type of activities for teacher professional development. Vrasidas and Glass (2005) also point out the importance of sharing knowledge, constructing knowledge together, as well as providing opportunities for teachers to observe, study and to reflect on model presented lessons by teachers or facilitators. However, Vrasidas and Glass (2005) state that the irony is that although many teachers follow student-centered constructivist approaches, the majority of teachers continue to assess with traditional standardised tests instead of using alternative modes of assessments, for example portfolios, where appropriate.

Fishman, Best, Foster and Marx (2000) and Fishman, Best and Marx (2001) highlight the importance of content, strategies, sites and media as design elements that should be taken into consideration when planning for teacher development. These design elements entail the following (Fishman et al., 2000, pp. 5-6; Fishman et al., 2001, pp. 6-7):

- Content refers to what the teachers have to learn and understand in order to prepare, plan and implement classroom instruction. The above refers to subject matter knowledge, instructional knowledge and pedagogical knowledge.

- Pedagogical strategies refer to those strategies that the professional developers have to utilise for and during teacher development.

- Sites refer to the place or context where the professional development will happen.

- Media refers to the training strategies that could be utilised for professional development. These media could be used in various combinations if required, depending on how the developer has planned for the media's usage.

The CERA acronym of Fishman et al. (2000, p. 6) and Fishman et al. (2001, p. 6) assists to conceptualise key aspects of professional development, namely the importance of: "Collaborative construction of understanding, (2) Enactment of new practices in classrooms, Reflection on practice and Adaptation of materials and practices." Table 2.12 provides an overview of the design elements of professional development (Fishman et al., 2000; Fishman et al., 2001).

Table 2.12

Design elements of professional development (based upon Fishman et al., 2000 and Fishman et al., 2001)

Professional development design elements	**Explanations**	
Content for professional development	**Strategies for planning**	New forms of assessment Content knowledge (Subject matter knowledge)
	Classroom instruction issues	Pedagogical content knowledge (teaching strategies) Meaning making for students Creating opportunities contextualisation Fostering collaboration Facilitating scientific processes Use of tools, technologies, representations & modelling Content of the curriculum Basic pedagogical knowledge e.g. classroom management
Pedagogical strategies		Planning assistance Tutoring Team teaching Modelling Examine student work Examine teacher practice Examine models of teaching Professional learning goals Curriculum review Software review Teacher enactment of curriculum: constructivist principles Identification of barriers Discussions Sharing Reflection
Sites for professional development		Saturday workshops Holiday schools After school sessions In-class support Visiting other classrooms: same school or different schools On-line support materials On-line groups Graduation courses
Media		Print Video ICT Face to face discussions Audio

Tiene and Luft (2001, 2002) suggest that for professional development related to ICT integration and implementation to succeed, it is vital to have manageable size groups, ongoing support and regular meetings. They further add that when teachers return to their schools, at least 3 levels of technical support are required namely, (1) an administrative facilitator to schedule meetings and serve as a liaison between the participating schools and the professional developers, (2) a staff member that can assist in realising the curricular suggestions made by the teachers involved during their training and (3) a staff member responsible for technical support who works directly with the teachers and the learners to assist with the implementation (Tiene & Luft, 2001).

Royer (2002) and Hinson et al. (2005) concur with the above and add that 'one-shot-sessions' or a 'one-size-fits-all' workshop approach has to be rethought, as these approaches do not lead to adoption at classroom level. They suggest in a similar manner that professional development should be characterised by ongoing support, but also add that professional development has to take into consideration that not all teachers and their respective contexts are similar (Royer, 2002; Hinson et al., 2005). Sherry and Gibson (2005) are in agreement, as they also state that teacher development should move away from the transmission model (see also Hoban, 2002; Kennedy, 2005) to a responsive dissemination approach, which values ongoing feedback, ongoing development and continuous improvement, similar to the suggestions of Ertmer (2001).

Glazer, Hannafin, and Song (2005) propose a collaborative apprenticeship framework for teacher professional development, as they state that their collaborative apprenticeship framework is designed in such a manner that it renders support to teachers' learning during the school day. They are thus in agreement with Royer (2002), Hinson et al. (2005) and Hinson et al., (2006) that teacher professional development has to transcend the intensive seminar approach and should become situated within the teachers' working contexts. Glazer et al. (2005) state that their collaborative apprenticeship framework features several similarities with cognitive apprenticeship, but that it also contains several distinctions. Cognitive apprenticeship emphasises modelling, coaching and fading (see Brown et al., 1989) in which one apprentice can be assigned to one mentor, several apprentices can be assigned to one mentor or several apprentices can be assigned to several mentors in a rotational manner. The traditional cognitive apprenticeship model does not imply a collaborative community of practice in which teachers learn from one another and respond to each other's needs, rather, it implies a transfer approach from the mentor to the apprentice (Glazer et al., 2005). In contrast to cognitive apprenticeship, collaborative apprenticeship requires support in an ongoing and distributed manner from the mentor to the apprentice(s) (Glazer et al., 2005). Glaser et al. (2005) continue by stating that training and support has to be on-site, ongoing and requires therefore 'in-time' training or support on demand.

A unique feature of collaborative apprenticeship is that the focus is to empower the novices who join the collaborative community in order that they can also become experts or leaders in the technology field within their schools. Hence, it is not only the expert and the novice who benefit from the learning from one another, but the rationale is that the novices who become experts will have an impact within their respective schools or teaching communities, and that the novices who become experts can again establish collaborative apprenticeship communities. However, the transition from novice to expert (teacher-as-leader) is not something that happens in a fortnight, but is a carefully designed process that comprises four phases, namely an (1) introduction phase, (2) developmental phase, (3) proficiency phase and (4) mastery phase (Glazer et al., 2005). Table 2.13 provides an overview of the phases as indicated by Glazer et al.'s (2005).

Table 2.13

Overview of the phases and roles to promote collaborative apprenticeships for technology integration in teaching communities (Glazer et al., 2005, p. 60)

Technology Integration Phase	**Teacher-Leader Roles**	**Peer-Teacher Roles**	**Collaborative partnerships**
Introduction	Promotes and models use of technology in workshop or classroom environments	Observes and participates in learning applications of technology	Discusses and reflects on learning and design experiences
Developmental	Provides scaffolding, coaching and fading to design, development, and implement learning activities	Acquires software and design skills in context of participation	Collaboratively designs, develops, and implements technology-enhanced learning activities
Proficiency	Identifies areas for improvement and exploration	Articulates understanding by autonomously designing activities	Shares experiences and ideas with peer community
Mastery	Observes and participates in learning applications of technology	Promotes and models use of technology in workshop or classroom environments	Peer-Teacher becomes Teacher-Leader for design and development of learning applications.

Havelock and Zlotolow's (1995) CREATER model is also useful for planning professional teacher development, as it provides clear guidelines in a step-by-step manner for facilitators related to teacher development and change. It highlights to the facilitator the importance of having and practically showing a caring attitude towards the group involved and relating to the group. Furthermore, the CREATOR model highlights the importance of examining the context, acquiring resources, trying out the designed process, extending what has been learnt and renewing areas in need of redressing. Hayes (2005) adds and warns that whatever development is planned, these plans will be fruitless and hence it will not lead to harnessing, adopting and changing new ideas or practices if adequate ongoing support to develop new approaches to teaching and greater access to reliable technology is not provided. Furthermore, ICT leadership among teachers and their principals, as well as technical support are crucial (Hayes, 2005), as is access to the Internet (Castro & Alves, 2006; Hinson, LaPrairie & Heroman, 2006). In Section 14, the barriers mentioned above, as well as several other barriers that ameliorate ICT integration, are explored in greater detail.

14. THEORETICAL PERSPECTIVES ON TEACHER DEVELOPMENT AND THE IMPLEMENTATION OF ICT WITHIN THIS STUDY

This study has been informed by a community of practice model embedded by cognitive apprenticeship (Brown et al., 1989). It is acknowledged that teachers' prior beliefs and knowledge related to classroom practice influence their interpretation of new pedagogical ideas (Putman & Borko, 1997; Pritchard, 2007) and new practices. However, teachers also learn a great deal from their social interaction(s) in discourse communities when they share experiences from the classroom contexts in which they experiment with new or alternative practices (Putman & Borko, 1997; Dana & Yendol-Hoppy, 2008).

Ertmer (2001) proposes a responsive instructional design model for teacher development, as she argues that the teaching staff at most schools comprises of teachers with low ICT skills and low ICT confidence and of teachers with medium ICT skills and medium ICT confidence. The former refers to teachers who are reluctant and/or resistant to change in their classrooms and the latter to teachers who have some ICT skills, but they have not yet had the desire to use ICT as a tool within their classroom (Ertmer, 2001). Ertmer (2001) argues further that it is pointless to try and convince the teachers with low confidence and low skills to adopt ICT related teaching and learning practices if they do not have the necessary skills and confidence. Thus, personal mastery of ICT skills could create confidence towards ICT implementation and furthermore, if these teachers with initial low confidence and low skills can be practically shown the fruitfulness and relevance of ICT, these teachers may reconsider and to use ICT for teaching and learning (Ertmer, 2001). This seems to be in line with Rogers' (1995, 2003) argument that relative advantage is an important element in the adoption of an innovation or something new.

For teachers with medium skills and medium confidence, social persuasion and vicarious experiences (observing how others do it) could serve as a lever to initiate change through trialability (Ertmer, 2001). This is also in line with Rogers (1995, 2003) who highlights the importance of trialability as an element that might assist towards adoption of something new.

Ertmer's (2001) responsive instructional design model comprises of the following stages, (1) creating an opportunity for teachers to reveal their current practices and beliefs related to the classroom and ICT, (2) proposing possible strategies for teachers to assist with implementation of ICT by analysing their needs, (3) creating opportunities and contexts for implementation and structure these in such a manner that teachers experience success in order to raise their self-efficacy, (4) assisting the teachers with reflection related to the implementation – what worked well and what did not and (5) creating opportunities for discussion among teachers in order that they can discus how to refine their ICT lessons and then re-try their lesson-approach through re-implementation.

Ertmer (2001, 2005) suggests that for technology-professional-development-design to be able to initiate and support teachers' technology uses, ongoing conversation is required in which all stakeholders share and discuss the pedagogical beliefs that underpin technology uses and share and discuss how technology can support those beliefs. She adds that to achieve the above, small communities of practice have to be created in which teachers can explore new teaching methods, ICT tools and their beliefs. The rationale is that these communities of practice can become a supporting structure, through which teachers can assist one another by being scaffolds for one another. Hence, these communities have to be exposed to observing classroom practice in which the pedagogical beliefs are being modelled (Ertmer, 2001, 2005).

Furthermore, technology tools should be introduced to the communities over a period of time, starting with technology that supports the teachers' current practices (Ertmer, 2005). However, one should take heed of the possibility that technology could become a barrier towards renewal, if it is introduced to support traditional behaviouristic approaches such as drill-and-practice, which could then negatively influence the movement towards alternative constructivist applications of technology implementation. This does not imply that ICT related drill-and-practice has no value, but that the focus of ICT implementation is to change traditional practice to constructivist practices. Ertmer (2005) also highlights the importance of ongoing technical and pedagogical support to teachers as this could assist in creating confidence towards using new approaches in which technology is used.

Herrington and Oliver's (1997, 2000) and Herrington and Kervin's (2007) suggestions for situated learning environments (which seems to be in line with Wenger's communities of practice and Ertmer's small communities of practice) are also useful to keep in mind when planning for teacher development sessions related to technology implementation. Herrington and Oliver's (1997, 2000) and Herrington and Kervin's (2007) ideas were reflected upon and slightly adapted which resulted in the following recommendations for teacher technology development, namely providing and promoting (1) authentic contexts that reflect the way that knowledge will be used in real life, (2) authentic activities, (3) access to expert performances and the modelling of processes, (4) multiple roles and perspectives, (5) collaborative construction of knowledge, (6) opportunities for reflection, (7) discussion and feedback sessions to enable tacit knowledge to be made explicit, (7) safety nets through coaching and scaffolding by community members at critical times and (8) professional learning (keeping in line with technology and new pedagogies) through communities of practice. Modelling, explanation, coaching, scaffolding, fading, reflection, articulation of experiences through reflection are equally important strategies that the expert or project facilitator should bring into action in the cognitive apprenticeship learning context (Dennen, 2004).

Putnam and Borko (1997, 2000) propose seven conditions that are important for teacher learning. Their approach is more unified as it encompasses insights from both perspectives as indicated in Table 2.14. In addition to their seven conditions, another one is added, indicated by an asterisk * in the table.

Table 2.14

Seven conditions for teacher learning using an eclectic approach based upon the ideas of Putnam and Borko (1997, 2000)

Conditions related to teacher learning	Relation to the perspectives of cognition	Leads to …	Result
Teachers are active learners: treat accordingly	Personal nature	→	A MORE UNIFIED APPROACH
Teachers construct knowledge individually	Personal nature		
*** Teachers construct knowledge socially**	Social nature		↓
Empower teachers: treat them as professionals	Social nature		
Situate teacher education in classroom practice	Situated nature		
Project leaders (facilitators, teacher educators)are expected to treat teachers as they expect teachers to treat their students/learners	Social nature		ENCOMPASSING: Personal nature Social nature Situated nature Distributed nature
Teachers need to consider what ideas or content is essential for and in their learning	Distributed nature		
Teachers need to gain different expertise	Personal nature, Social or/and Situated nature		
Teachers need to use a range of tools to keep up or to stay abreast of the vast and often different information available related to learning and practice.	Distributed nature		

** The asterisk in the table above, indicates another condition that was not mentioned explixitly by Putnam and Borko*

Hoban (2002) and Turbill (2002) state that reflection and communities of practice are two important keys to assist with teacher development. Zhao, Pugh, Sheldon and Byers (2002) concur that teacher reflection related to teachers' own beliefs regarding teaching and technology, during teacher development programs, is one of the key elements which could lead to technology integration within classrooms. Equally important is action or learning by doing, conceptual input and feedback (Hoban, 2002) when new approaches are 'sold' to teachers.

By making use of the above-mentioned suggestions, the theoretical model of organisational knowledge creation of Nonaka and Takeuchi (1995) was used as a theoretical basis in order to assist with the issue of how knowledge can be constructed within a teacher development project. The knowledge creation model makes use of two kinds of knowledge that play an important role in knowledge creation, namely (1) tacit and (2) explicit knowledge. The four modes of knowledge creation are represented as indicated by Nonaka and Takeuchi (1995) and additions are added from Sallis and Jones (2002, p. 22):

- From tacit to tacit: Sharing of ideas (socialisation).
- From explicit to explicit: Combining knowledge to test ideas (combination).
- From tacit to explicit: Emergence of new ideas (externalisation).
- From explicit to tacit: Developing new ideas and learning by doing (internalisation).

Nonaka's (1994) model suggests that the tacit dimension points to the personal cognitive nature and the explicit dimension to the social and distributed nature. By taking the cognitive and situated perspectives regarding learning into consideration (see sections 11.2 to 11.5 in chapter 2), it becomes possible to take note of and embed these perspectives within a teacher development program. Table 2.15 provides a concise, but thorough summary of these perspectives, as well as their relation to cognition and to enablers.

Table 2.15

Cognitive enablers for professional teacher development based upon the ideas of Putnam & Borko (1997, 2000) and Hoban (2002)

Cognitive enablers related to teachers	**Relation to the perspectives of cognition**	**Enablers within a community of practice**	**Related to critical outcomes: tasks while member within community**
***Teachers do not want to listen all the time to what has to be done and how, but there is a place for this. However, teacher listening and project leader talk should be limited.**	Behaviouristic nature	Action (Practical Experience)	
Teachers are active learners: treat accordingly	Personal nature	Cognitive Apprenticeship: Observe & Internalise (Learn) Practice & Feedback Externalisation	
Teachers construct knowledge individually	Personal nature	Action (Practical Experience) Self-Reflection Internalisation	Identify and solve problems by means of critical and creative thinking
Teachers prior knowledge & beliefs (experience) influence learning	Personal nature	Individual or Group Articulation Teachers set Agendas Articulation of concerns & successes	Work together in teams
Teachers need to be motivated	Personal nature	Relevance Challenge Competence Collaboration and Connectedness to others through Recognition Control, Choice and Voice	Manage themselves responsibly Collect and analyze information Communicate effectively
Teachers construct knowledge socially	Social nature	Communities of Practice: Collaboration Articulation Socialisation & Reflection Externalisation Combination Networking	Use science and technology effectively See the world as set of related contexts
Empower teachers: treat them as professionals	Social nature	Grow Leadership Assist with Barriers	Employ effective learning strategies
Situate teacher education in classroom practice	Situated nature	Authentic Modelling Coaching Support Personal Action (Practice) Plan, Act, Reflect, Make Changes, Re-Plan, Act, Reflect Cycle	Become responsible citizens Be culturally and aesthetically sensitive Explore education and career opportunities
Project leaders (facilitators, teacher educators)are expected to treat teachers as they expect teachers to treat their students/learners	Social nature	Share Successes Feedback & Praise Provide Time	
Teachers need to consider what ideas or content is essential for and in their learning	Distributed nature	Self-Reflection: Identify Barriers Group Discussions Action (Practical Experience)	
Teachers need to gain different expertise (Teachers learn all the time)	Distributed nature	Conceptual input Networks	
Teachers need to use a range of tools to keep up or/and to stay abreast of the vast and often different information available related to learning and practice.	Distributed nature	Lesson Templates Lesson Unfolding Procedure Academic Journals Electronic Help User Group Communities of Practice Internet Search Capabilities	

**My insertion*

By making use of the cognitive, distributed, situated, personal and behaviouristic perspectives, it becomes possible to link the cognitive enablers related to teachers for teacher development to the 'Enablers within a community of practice' column (see Table 2.15). Hence, these perspectives assist one to ask: 'What elements should be included in teacher development?', including for the design of cyberhunts as being the focus of this research project.

Equally important, the project leader(s) or project manager(s) should also determine concerns, problematic issues and anxieties within and among teachers before the project commences, during the course of the project as well as in the evaluation phase towards the close of the project. Determining concerns, problematic issues and anxieties could be useful for planning and providing support accordingly. These aspects are further discussed in section 15 and 16 in this chapter.

Teacher learning within this study relies on knowledge creation through socialisation, combination, externalisation and internalisation. Furthermore, the following aspects (enablers) have been utilised as enablers for this research project's teacher development training process (see Table 2.15 also) namely (1) collaboration within a community of practice, (2) sharing of ideas, beliefs, practice, (3) ongoing support: meetings & electronic user group, (4) self-reflection and group reflection, (5) ongoing dialogue, (6) observation of authentic activities for cyberhunt learning, (7) actual authentic practice within own classroom context, (8) planning the learning process and (9) feedback.

The planning for the teacher development process has been informed by drawing on the design elements defined as content, strategies, media and sites (see Table 2.11). Furthermore, besides the aspects mentioned in Table 2.15 above, additional aspects related to first- and second order barriers, are discussed in sections 15 and 16 to follow. These barriers have also been taken into account in order to address them with a view that they may become enablers and contributors towards successful implementation.

15. BARRIERS TO THE TEACHER DEVELOPMENT PROCESS

Using a computer for administration purposes has been adopted by a great number of teachers, however, many of these teachers have not embraced computer integration and/or computer supported learning (Kopcha, 2008). To achieve successful implementation and integration is by no means easy, as teachers experience first-order and second-order barriers (Ertmer, 1999). First-order barriers are extrinsic to teachers and include aspects such as (1) lack of access to appropriate software and hardware, (2) lack of time, (3) lack of support and (4) lack of training (Ertmer, 1999). Second-order barriers are intrinsic to teachers and refer to the following aspects, namely (1) attitudes, (2) beliefs of teaching, (3) beliefs related to learning, (4) practice and (5) resistance of teachers (Ertmer, 1999).

The seminal work of Ely (1999) indicates that several conditions facilitate the implementation of educational technology innovations. If a condition is not met, then the condition becomes a barrier. Expertise, time and resources create first-order barriers, for example, access to the knowledge and skills required by the user of the innovation, as are the availability of resources; things needed to make it work such as funding, hardware, software, publications, audio-visual media, technical support, and infrastructure. Availability of time may also become a first-order barrier, i.e. improper time prioritisation (company time and personal time); the time required to acquire knowledge and skills, plan for use, adapt, integrate, and time for reflection.

Second-order barriers are more closely related to emotions, for example dissatisfaction with the *status quo*, i.e., noting that something is wrong, that others progress while the individual or organisation does not. Second-order barriers are also related to rewards or incentives, including satisfaction in the working environment. Similarly, opportunities to participate may be a barrier, such as the lack of shared decision-making; lack of collaborative communication and good representation of interests, as well as firm and visible evidence of continuing endorsement and support to technological innovations, as are the lack of competent and supportive leaders of projects (Ely, 1999).

Ely's findings are supported by the findings of Wilson and Peterson (1995) in an educational context. Leggett and Persichitte (1998), Mumtaz (2000) and Vrasidas and Glass (2005) state that successful project implementation requires enthusiastic teachers, it is teachers who have the expertise, access to technology, the will to be successful and teachers who are prepared to sacrifice time. Bai and Ertmer (2004) argue that second-order barriers are more difficult to overcome as teachers' pedagogical beliefs do not change quickly, as teachers teach as they have been taught (Pajares, 1992; Kagan 1992). The argument is that beliefs about teaching and learning are ingrained and of a personal nature and affect whether there will be (1) meaningful technology integration, (2) integration to achieve traditional teaching and learning or (3) no integration at all (Bai & Ertmer, 2004).

To achieve the envisaged teaching and learning through using ICT as advocated by the South African Department of Education (1997, 2003), it is important to address the first- and second-order barriers. Therefore, any implementation program or project would have to take these barriers into consideration. However, it is important to understand that if it was possible to remove every first-order barrier, it would still not guarantee that teachers would automatically start to use technology in their classrooms to achieve meaningful outcomes (Ertmer, 1999), as they would have to see its usefulness such as making lessons more fun, interesting, enjoyable and interesting (Mumtaz, 2000; Rogers, 1995, 2003). Hermans, Tondeur, Van Braak and Valcke (2008) report that what seems promising is the fact that teachers who subscribe to constructivist teaching beliefs, are more likely to use computers in their classrooms than teachers subscribing to traditional teaching approaches. Hence, it is suggested that strategies which subscribe to or which are underpinned by constructivist principles, have to be disseminated to the teaching community and teachers have to be made more aware of the philosophy which underpins constructivism. This could possible play a role in ameliorating barriers intrinsic to teachers.

16. APPROACHES TO AMELIORATE FIRST-ORDER BARRIERS

First order barriers are related to issues that are extrinsic to teachers. Yet, issues such as lack of time, support and training also have implications for teacher development and require individuals to become part of the development and planning processes to deal with these barriers accordingly. It is suggested that the following aspects could assist in overcoming the first order barriers.

16.1 Vision in the planning process

A starting point for dealing with first order barriers is the creation of a shared vision about the implementation of technology and its integration in teaching and learning (Wilmore, 2000; Davis, 2002; Gibson, 2002; Schiller, 2002; Fullan and Smith, 1999; Creighton, 2003; Flanagan and Jacobson, 2003; Scrimshaw, 2004; Fullan, 2006). The creation of a technology plan is important (Cradler, 1996; Creighton, 2003; Fishman and Zhang, 2003; Scrimshaw, 2004). However, Fishman and Zhang (2003) caution against the main focus of technology being seen as hardware and software as the main emphasis in the technology plan. They argue that the focus should be on "planning for technology" which "emphasises the pedagogical and educational over the technological" (Fishman & Zhang, 2003:17). In addition, Fishman and Zhang (2003) argue that reference to learning theory should be part of the technology plan.

It is also important to note that one needs to be aware that the vision should not be a blue print cast in stone, but that vision evolves, as does the technology plan (Fullan and Smith, 1999; Surry, Porter, Jackson and Hall, 2004) and that one should accept and learn from failures (Surry et al., 2004). Equally important is the fact that the vision should focus on how to improve learning and not on teaching (Schiller, 2002; Harris & Muijs, 2005), as the implementation and integration of ICT has at its heart the improvement of teaching and learning through the use of ICT (Schiller, 2002; Creighton, 2003).

Law, Wong and Yuen (2003) concur with Schiller (2002) and with Harris and Muijs (2005) as they state that it is not only important to rethink the nature of education when one introduces technology, but that it is imperative to think how the implementation of ICT could impact on the school as organisation. This is by no means an easy task, as it is quite a challenge to articulate or to embrace visions that are new and in contrast with one's existing beliefs regarding teaching and learning (Hughes & Zachariah, 2001). Therefore, rethinking the nature of education requires a great deal of understanding of technology's potential and its use as an instructional tool in the various learning areas (Hughes & Zachariah, 2001). Hence, when schools introduce technology, the focus should not be on technology *per se*, but how technology could assist in improving learning (Creighton, 2003). It is thus evident that technology integration within schools has the possibility to play a vital role in curriculum innovation and reform, if teachers are prepared to relinquish their traditional roles and are willing to embrace new roles for themselves and their learners (Law et al., 2003).

16.2 Plan collectively: The voice of teachers and learners

From initial planning to actual implementation, it is imperative to keep the whole picture in mind. Hence all stakeholders (principal, staff, governing body, parents and community) should be part of the planning process (Fullan & Smith, 1999; Hinson, LaPrairie & Heroman, 2006). The planning process entails the establishment of goals and objectives, as well as the creation of a framework and timeline regarding implementation (Fullan & Smith, 1999; Hinson, LaPrairie & Heroman, 2006). The planning process is critical, as it will affect the school's vision and hopefully ultimately affect the school culture (Fullan & Smith, 1999; Hinson, LaPrairie & Heroman, 2006). Joseph (2006) states that we cannot underestimate the value of learner input in the planning process, as the learners' voice and suggestions could assist to plan for their needs.

16.3 Focus on what you want to achieve with technology

Another important aspect is that schools should not accept materials (software & hardware) just for the sake of having the software and/or hardware, as material should assist the school to achieve its curricular- and technology plan (Cradler, 1996), thus to assist to achieve the vision and goals. The curriculum should therefore drive technology application and not technology, or as Earle (2002) puts it, the technology tail should not wag the curriculum dog (Earle, 2002). Trilling and Hood (1999, p. 5) also caution against obtaining technology first and then setting a vision and goals, as they argue that it should not be the case of "We're Wired, Webbed, and Windowed, Now What?" Thus, schools need first to determine what they want to do and then start to focus on the technology necessary to achieve their goals as "schools may be overwired and children undertaught" (Bronner, 1997, p. 4, quoted in Earle, 2002, p. 6). Equally important, adequate resources do no necessarily lead to natural integration (Earle, 2002; Salomon, 2002). Hence, ongoing assessment of where the school is at, by means of a SWOT analysis (Analysing the strengths, weaknesses, opportunities and threats), could assist the school in remaining focused and to plan the way forward on a continuous basis (Creighton, 2003).

16.4 Provide the infrastructure required and technical support to support and sustain the innovation

Fullan and Smith (1999) argue that each school is different. They continue by stating that it is a misconception to think that an innovation which is implemented and deemed as being successfully implemented will continue to last. Therefore it is imperative to have the necessary infrastructure and support to sustain the innovation (Fullan & Smith, 1999; Surry et al., 2004; Mueller, Wood, Willoughby, Ross & Specht, 2008). Thus, if a school cannot provide the necessary infrastructure and support, one could argue why should the school try to implement a new innovation that may not only cost a lot in terms of convincing people to adopt the new innovation and in terms of money, but that could also lead to its abandonment because of the fact that the innovation cannot be sustained.

Administrative support is critical, especially the role of the principal (Wilmore, 2000; Creighton, 2003), as the principal should become a technology leader; a head learner that supports his/her staff (Wilmore, 2000; Gibson, 2002). The rationale behind the principal becoming a head learner, is that he/she has to be the initiator and not the manager or responder in terms of change facilitation (Wilmore, 2000 & Schiller, 2002, 2003). Wilmore (2000, p. 6) states that "the principal who does not see the school as a learning community does so at their [the school's and principal's] peril." Tiene and Luft (2001), Scrimshaw (2004) and Castro and Alves (2006) acknowledge that administrative support is important, but add that technical support from the administration is just as vital. Administration has to provide support in the form of an ICT dedicated professional person for the computer laboratory if they want ICT implementation to succeed, as this person has to be responsible for the maintenance of the computer hardware and software, the planning of the time table or schedule for the laboratory and, to assist the subject teacher with any routine problems in the laboratory (Castro & Alves, 2006). The technical support person not only provides teacher support, but in many instances also assists the learners and hence becomes a ‘second’ teacher in addition to the subject teacher being in the classroom too (Tiene & Luft, 2001).

16.5 The importance of staff development and discussion groups

Teacher training (staff development) is of the utmost importance, it is not a “once-off-thing”, it is continuous (ongoing) (Harris & Muijs, 2005), which implies follow-up sessions (Lim & Barnes, 2002). Creighton (2003) states that technical training for teachers is important, but at the same time cautions that the ultimate focus of staff development should be on how to integrate technology in the classroom and not on technical training *per se* (Creighton, 2003).

Cradler (1996) and Harris and Muisj (2005) suggest that discussion groups should be created and that these groups should meet on a regular basis to share successes and to voice their problems. Castro and Alves (2006) concur as they state that that the sharing of successes and errors, discussing new paths to explore and discussing how to restart after the encountering of setbacks, are vital. At the same time Ertmer (2001) advises that it is important to take note of the composition of the discussion groups, in order for less capable staff not to feel threatened, as teacher success leads to greater self-efficacy within teachers (Bandura, 1997).

Collegial mentorship could provide an opportunity to enhance self-efficacy. Collegial mentorship can be defined as a process which provides opportunities for teachers to build technical skills and teaching competence to solve problems encountered through collegial sharing, with a view to provide scaffolding that could lead to independence (Coupal, 2004). The importance of emotional, technical and informational support is crucial during staff development (Coupal, 2004).

16.6 The importance of establishing professional learning communities (PLC’s)

A professional learning community can be defined as groups of professionals that connect and network with one another on a regular basis in a structured manner by using protocols to ensure focused, deliberate conversation and dialogue with the aim to ‘learn’ from practice and from one another (Dana & Yendol-Hoppey, 2008, p. 7). The importance of the establishment of schools as learning organisations and communities of learners and teachers inside and among schools (where schools learn together collectively), is also critical for the Department of Education (Department of Education, 2003). In order to provoke, sensitise and expand teachers' perspectives on the benefits of ICT, it would imply research, critical dialogue and analysis of practice among teachers by using a collective and collaborative approach among teachers from the same school and from different schools, to achieve this (Department of Education, 2003). This is in agreement with what Jonassen et al. (2003) advocate, namely the forming of communities to assist with learning. These communities are not limited to learners at school level or students at university level, but should also include inservice teachers. These communities are (1) discourse communities, (2) communities of practice, (3) knowledge building communities and (4) learning communities (Jonassen et al., 2003). Dana and Yendol-Hoppey (2008) suggest that action research and reflection should be implemented by PLC's, as these actions contribute to the learning process.

Kagan (1992) argues that teachers base most of their ideas on their personal experience. Pajares (1992, p. 326) states that "there is a strong relationship between [teachers'] educational beliefs and their planning, instructional decisions, and classroom practices." Ertmer (2006) cautions that the concepts of 'teacher belief' and 'teacher knowledge', are not synonymous. Knowledge refers to factual understandings and propositions, whereas beliefs refer to commitments, suppositions and ideologies (Ertmer, 2006). The sharing of beliefs and knowledge could become possible through the establishment of 'discourse communities', in which knowledge and expertise about practice are shared (Putnam & Borko, 2000; John & Sutherland, 2004).

The argument is that personal experience could be influenced and changed by participating in a PLC, as PLCs are characterised by a great deal of talk. These discourse communities should focus on dialogue and not on discussion or debating only, as discussion-debating is orientated towards judging, evaluating ideas and making decisions (Poole, 1998). Debating has overtones of controversy and strife, implying that debating is an attacking mode that wants to establish a position of rightness (Watson, Correia, Lee & Schwen, 2004, p. 54).

Dialogue, in contrast to discussion, is orientated towards data gathering, exploration and learning (Poole, 1998). Dialogue's focus is thus consensus building through collective communication based upon shared values and beliefs (Watson et al., 2004 with reference to Banathy). Dialogue assumes that other people may have some pieces of the puzzle, as they may offer a useful answer and as a result emphasise listening (not mere hearing) as a collaborative activity (Watson et al., 2004).

Cuban (2001, pp. 45, 170,180) argues that both the dominant school culture and teacher beliefs are chief impediments, as they have engraved the way in which schools are organised, as well as engraved beliefs about teaching, learning and classroom organisation which results in computers being oversold and under used. Russell, Bebell and O'Dwyer (2005) argue that the problems, as stated by Cuban (2001), rest on two central aspects, namely (1) teachers' lack of understanding of how ICT can be integrated into their classrooms and (2) the school systems' failure to fully support ICT integration. This can be attributed to the fact that schools try to keep the *status quo* in the schools' systems structure (Cuban, 2001). The common belief that new teachers who join the teaching profession and who have been part of the technological revolution by being exposed to technology during their pre-service teacher training will use technology more regularly than in-service teachers, also seems to be correct to some extent (Russell et al., 2005). Matzen and Edmunds (2007) concur, as they have found that teachers would teach in learner-centred ways if they had been taught in a similar manner, which seems to be in agreement with Kagan (1992), Pajares (1992) and Bai and Ertmer (2004) who have argued that teachers tend to teach the way they have been taught (see Section 16.6).

Russell et al., (2005) contend that ICT skills are in fact utilised more outside the classroom than inside the classroom by teachers, as teacher training models focus on technical skills and not on how to teach with technology. It thus seems that the dominant traditional culture and beliefs still hinder technological innovation to play a key role in educational reform (Vrasidas & Glass, 2005). The problem is not the learning of new skills related to teaching and learning, but the real problem is the unlearning of old habits (Flemming, & Lynch 2005; Vrasidas & Glass, 2005). Hill, Reeves, Grant, Han and Wang (2005, p. 8) add that "Fundamental change in pedagogy takes far longer than most people imagine." Thus, there is a great need to establish learning communities that are supportive and that could provide leadership (Hord, 2004).

Flemming (2004) adds that the principal plays a vital role in the creation of PLC's. She adds that the principal's role is (1) developing collegial relationships with their staff, (2) focusing his/her staff on student success, (3) creating opportunities for teachers to learn, (4) creating opportunities for the principal to learn, (5) inviting teachers into decision-making and implementation related to or pertinent to them and (6) nurturing new ways of operating. Drago-Severson (2004) suggests that principals [or other leaders/trainers] should focus on the growth and development of school leadership through transformational learning. In order to develop teachers, the focus should be based on (1) teaming with inside and outside partners, (2) providing leadership roles for all, (3) engaging in collective enquiry and (4) mentoring (Drago-Severson, 2004).

Bielaczync and Collins (1999) suggest that the following principles are important to consider when learning communities are established, namely (1) knowledge and skill growth, (2) establishing goals on a continuous basis, (3) articulating the goals in order to gauge success, (4) provisioning of opportunities for metacognition (reflecting on one's current knowledge, knowledge required and knowledge acquired), (5) the transending of current boundaries and beliefs by soliciting diverse opinions and views, (6) cultivating respect for others, (7) accepting failures as learning opportunities, (8) collaborating and depending on one another for assistance and valuing one another, (9) realising the importance of depth and not just breath, (9) sharing expertise and developing diverse expertise as a result, (10) providing different roles for participants, (11) sharing, (12) developing negotiation and non-personal critiques skills and lastly (13) developing quality products-strategies by assessing these products against pre-determined criteria (see also Dana & Yendol-Hoppey, 2008).

Although the principles mentioned above refer to learning communities in classrooms, it is argued that these principles could be just as valid and important when teachers design or establish learning communities at their schools or engage in and become members of learning communities outside their schools. Dana and Yendol-Hoppey (2008) suggest that the principal should establish professional learning communities at school, which assist members to create a 'wondering' mindset. This implies that community members of professional learning communities start to ask 'What will happen if …' or 'How can I change/improve/influence, etc. …' questions as these types of questions requires action on the part of the teachers. By taking action, the foundation is being laid for action research (Dana & Yendol-Hoppey, 2008).

Taking a socio-cultural view to ICT integration, Hung and Koh (2004) argue that (1) school structures, (2) classroom dynamics, (3) teacher beliefs and (4) student (learner) behaviours are inter-related enablers, which impact on efforts of computer technology integration within the curriculum. Hung and Koh (2004) argue that consistent changes are needed in all the four dimensions over time to achieve successful integration and that any incremental changes in one of the four dimensions would result in minimal change, whereas consistent changes in all four dimensions would result in maximal change(s). They also suggest that communities of practice could assist in discussing, addressing and having an influence towards these enablers, as the enablers have to be acknowledged and considered in the planning of computer integration (Hung & Koh, 2004).

Fullan and Smith (1999) and Fullan (2005a, 2006) concur as they also suggest that schools have to become learning organisations that network with one another. The idea is that communities of practice within one school can engage with communities within other schools that share similar points of interest. They further suggest that the 'reculturing' of schools is important for change and innovation and that the establishment of learning communities can play a key role here (Fullan & Smith, Fullan, 2005a, 2006). However, Fullan (2005b) argues that the impact of learning communities will be minimal if the system does not improve as a whole. Hence, he argues that improvement and capacity building on all the three levels, namely the school/community level, district level and national/state level are vital to achieve what he labels the "Tri-Level Solution" (Fullan, 2005b, pp. 209-210).

16.7 Allowing time for reflection

Reflection is a learning activity (Gagnon & Collay, 2006), an enquiry process to search for knowledge through critical analysis into one's own and/or other colleagues practice (Harris, 2002; Jonson, 2008; Dana & Yendol-Hoppey, 2008). Reflection is thus a learning opportunity which assists teachers to think about their practice (Day, 2003). Harris and Lambert (2003, p. 115) amplify Day (2003) when they state that the main aim of reflection is "improving practice rather than collecting knowledge." However, one could argue that to improve practice, one does need knowledge and skills and that it is through active participation and by the sharing of ideas (knowledge and skills) within a community of practice that practice is being informed and improved.

Reflection is more than just talking about problems, it is about taking action and solving the problems that have been identified, hence, reflection is "a path from insight to action" (Weinbaum et al., 2004, p. 149). For action to be taken, feedback-loops are important. Feedback plays an important role in reflection, as it is a way to examine practice in a critical manner (Harris, 2002; Harris & Lambert, 2003). Feedback-loops can be obtained from learners, peers, project leaders and members of a community of practice through dialogue, reflection journals, diaries, discussions, etc. (Adey, 2004).

Ertmer (2001) notes that reflection has the power to influence beliefs related to teaching and learning. Therefore, teachers need to be encouraged to become reflective and reflexive practitioners (Jonson, 2008; Dana & Yendol-Hoppey, 2008). Adey (2004) argues that guided reflection does not only have the potential to influence conceptual thinking, but also has the power to change it. When conceptual thinking changes, it restructures one's intuitive knowledge upon which one's teaching or practices are based (Adey, 2004).

Several types of reflection have been identified, namely reflection-in-action, reflection-on-action and reflection-for-action (James & Connolly, 2000; Day, 2003). Reflection-in-action refers to identifying immediate problems and the creation of solutions on the spot (Day, 1999). Reflection-on-action offers the ability for further dialogue among members of the education fraternity, as it is a deliberate process to review, analyse, reconstruct and reframe actions in practice from outside the setting with a view to plan further teaching and learning (Day, 1999; Day, 2003). Reflection-about-action involves becoming responsible and accountable for one's decisions taken, as one's actions in practice influence personal, social, economic and political contexts (Day, 2003).

To conclude, reflection is a critical endeavour which refers to the thinking, rethinking and articulation of people's thoughts related to their practice, or as Jonson (2008, p. 112) states, reflection becomes "stepping stones to improvement, opportunities for growth." Reflection without action does not necessarily result in possible change or improvement in practice. For reflection to become a valuable tool for teachers, reflection needs to become a reflexive activity: words into action (see Dana & Yendol-Hoppey, 2008).

17. APPROACHES TO AMELIORATE SECOND-ORDER BARRIERS

As noted earlier, Bai and Ertmer (2004) argue that second-order barriers are more difficult to overcome, as teachers' pedagogical beliefs do not change quickly, because many teachers teach as they have been taught (see also Kagan, 1992; Pajares, 1992; Bai & Ertmer, 2004). Some of the approaches that could be adopted in order to overcome second-order barriers are noted below. It is important to note that 'teacher leadership' and 'seeing development as a process' are both barriers that could also be categorised under first order barriers, as both of them refer to aspects that are intrinsic and extrinsic to teachers. The following aspects have to be addressed in order to assist with the amelioration of second order barriers.

17.1 Teacher leadership

Leadership seems to be a key aspect when attempting to overcome second order barriers. It is imperative for leaders to be conscious of the important role that relationships play and the manner in which the leaders interact with people during the innovation process, a process that implies change (Fullan, 2001). Dexter, Anderson and Becker (1999), Hargreaves and Goodson (2003) and Prensky (2008) state that teachers are the key agents of change in the current knowledge society. Fullan and Smith (1999), Mumtaz (2000), Kirkman (2000) and Mouza (2005) also emphasise the importance of teachers and their role in the implementation and integration of technology in education. With special reference to the role of technology in education, the value of teachers is further emphasised by Fullan and Smith (1999, p. 2) when they say "the more powerful technology becomes, the more indispensable good teachers are." Teachers are thus still very important when ICT is implemented (Lim & Barnes, 2002), as ICT is not replacing the teacher.

It becomes evident from the literature that teachers are the champions in the change process (Havelock & Zlotolow, 1995; Fullan & Smith, 1999; Ertmer, 2001, 2005; Fullan, 2005a, 2006); they are the drivers who drive the change process, who facilitate steps for improvement in learning (Hargreaves & Goodson, 2003; Prensky, 2008). Therefore, teachers have to become leaders in and of their practice (Lingard, Hayes, Mills & Christie, 2003). The role of the principal is key, as the principal cannot promote technology usage and integration if he/she does not use computer technology (Hinson, LaPrairie & Heroman, 2006). Thus, one can argue that the principal's ICT competence is a leading factor that could influence his/her staff's attitude towards ICT technology.

Lingard et al. (2003) argue that educational leadership's main focus should be classroom practice and furthermore, that educational leadership should not be limited to the principals, deputy principals and heads of departments, but that educational leadership should also be exercised by teachers, students, parents and all other persons or parties who could add value and leadership (Lingard et al., 2003). Educational leadership is not an occasional activity; it is a continuous day-to-day leadership on all levels by all stakeholders (Surry et al., 2004), as all involved in education have and educational leadership role to fulfil. This would imply that principals, deputies, heads of departments and fellow colleagues could become followers of educational leadership portrayed by any person in teaching and learning, the only prerogative for following being that it leads to improving teaching and learning.

Two types or kinds of leadership have been identified by Lingard et al. (2003) that could assist with what they refer to as 'leading learning', namely (1) leadership as pedagogy and (2) pedagogy as leadership. However, I want to substitute the 'as' with the preposition 'in' and rephrase what Lingard et al. (2003) state to become (1) leadership in pedagogy [in computer technology] and (2) pedagogy in leadership [in computer technology]. 'Leadership in pedagogy' illuminates the idea that all persons involved in for instance an institution of learning, for example a school, need to become leaders that show the ways of 'how to' effectively teach, assess and integrate the curriculum in novel ways that would lead to improvement in teaching and learning. 'Pedagogy in leadership' is not in contrast with 'Leadership in Pedagogy', but a necessity, as the one cannot exist without the other. 'Pedagogy in leadership' refers to innovative ways by which all involved in the education system (from principals to classroom teachers) can lead and assist one another to become leaders in pedagogy or to what Lingard et al. (2003, p. 20) refer to as schools becoming "leader-full" with teachers sharing responsibility for the teaching and learning of their students.

An analysis of the literature clearly indicates that teachers do not change their practice easily (Dexter, Anderson & Becker, 1999; Cuban, 2001), as practice is explicitly or implicitly rooted in some theoretical framework (Gamache, 2002). For change to occur within teachers, re-culturing is needed, it is challenging one's current beliefs (Fullan, 1999, 2003, Fullan & Smith, 1999). Factors such as (1) becoming conversant with educational teaching and learning theory, (2) experiencing the fruitfulness of new practice (Mumtaz, 2000) and (3) being convinced that new practice will address issues with which teachers are dissatisfied, could assist in this regard (Prawat, 1992; Rogers, 1995, 2003). The formation of learning communities, which has been discussed in section 16.6 in this chapter, could assist in changing beliefs and practice (Fullan & Smith, 1999; Fullan, 2005a, 2006). Chambers (2002) suggests that universities can play a key role in assisting with the change process, as universities develop future teachers, and because of the key role that teachers play in the change process, these new teachers could have an influence in their schools in initiating change.

17.2 Seeing development as a process

It is important to view teacher development as a process (Evans, 2002; Surry et al., 2004; Fullan, 2005a, 2006). The task of convincing teachers to implement technology in their instructional practice in their classrooms, is by no means easy, thus the aim or objective of technology leadership should be to influence teachers to implement technology as part of their daily repertoire in their classrooms. For this to happen, a great deal of support is needed (Mumtaz, 2000; Valli & Hawley, 2002; Creighton, 2003; Flanagan & Jacobson, 2003). Teachers need to be convinced to change their fundamental beliefs by providing them with "opportunities to engage in developing a theoretical understanding of the knowledge and skills to be learned" (Vali & Hawley, 2002, p. 91).

Individual teacher development is affected by attitudinal development and functional development (Evans, 2002). The attitudinal development can be modified by focusing on intellectual and motivational aspects; and the functional development by focusing on productive and procedural aspects (Evans, 2002). In addition, successful teacher development should have an influence on the professional role and professional culture, as these elements need to be redefined and/or modified for teacher development to be effective and successful (Evans, 2002). Hinson et al. (2006, p. 156) state that it is important during teacher development to steer teachers away from the attitude that "technology is a luxury, not a necessity."

Schiller (2003, p. 3) found that the following suggested interventions were helpful for high levels of ICT integration:

- "Regular discussion about ICT and frequent, brief workshops during staff meetings,
- One-on-one practice sessions during lunch breaks or after school,
- Peer tutoring,
- Team teaching with, and shadowing of, more experienced colleagues,
- Encouragement to attend computer courses offered within the system and by other providers, such as technical colleges and private training companies,
- Assistance from friends and colleagues who were more computer literate,
- Use of "train the trainer" approaches, and
- Clear identification/appointment of a technology leader or leaders in the school."

Flanagan and Jacobson (2003) are in agreement with Schiller (2003), but add that equity of access to technology and the readily availability of digital resources are further important elements that can support effective technology integration. Creighton (2003) highlights the importance of conducting a SWOT analysis, which was referred to in section 16.3, and that it should be the point of departure for ICT integration. However, this SWOT analysis should not by once-off, but a regular event.

Coupal (2004, p. 591) highlights the importance of teacher development and illuminates three waves of ICT professional development, namely (1) literacy uses (a technology-centred pedagogy), (2) adaptive uses (teacher-centred, direct instruction pedagogy) and (3) transforming uses (a student-centred, constructivist pedagogy). Coupal (2004) argues that the focus in teacher development of teachers, should not be on the instruction of technical skills to learners, but on how teachers can use their ICT skills in meaningful ways to benefit their learners. Hence, if we want transformed educational use of ICT in a context where learners are actively engaged in identifying and solving real-life problems by comparing, contrasting, arguing and synthesising, the focus of teacher professional development should be on the third wave, as suggested by Coupal (2004).

Ertmer (2001, 2004) argues that teachers' beliefs about their ability to use computers in instruction are a crucial factor for technology integration. Self-efficacy refers to a person's personal belief regarding his/her ability to learn or perform actions at certain levels (Bandura, 1997). Thus, self-efficacy is based upon a person's skill level and his/her judgement or belief about what he/she can achieve with the current skills (Bandura, 1997). To perform, one needs skills, but without the belief that one can perform, the task may not be attempted (Ertmer, 2001). The efficacy level for teaching with technology (high or low) would thus determine how eagerly a teacher would participate in technology related tasks, the effort spent on technology related tasks, as well as his/her persistence related to technology tasks (Ertmer, 2001).

17.3 Developing self-efficacy

If self-efficacy holds a possible key to computer implementation and integration, as argued in section 17.2, then one needs to ask: 'How can a person's judgments on self-efficacy be boosted?' It seems that the answer lies in equipping users with skills and information regarding the innovation, in this context, ICT. Bandura (1997) and Schunk (2004) provide four sources of information that could be used to promote self-efficacy, namely:

- Successful Performance Accomplishments or Personal Mastery (Experiencing success in completing a task).
- Vicarious Experience (Observing how people model/implement something in practice).
- Verbal or Social Persuasion ('I/We know you can do this').
- Emotional Arousal (Helping people to believe that things causing anxiety or fears do not affect them internally).

The development of a model for computer integration should therefore include motivators such as personal mastery, observation of how to practically implement the integrative practice, positive feedback, persuasion and addressing participants' fears or anxieties. The aim should be to increase confidence, skill and self-belief, as these aspects could be beneficial to raise self-efficacy, and greater self-efficacy could assist with the creation of positive attitudes related to ICT adoption and ICT integration (Ertmer, 2001). Mueller et al. (2008) concur as they highlight the importance of teachers feeling comfortable with ICT and teachers being enabled not only to see the positive outcomes and successful practice of computer integration, but also to experience the positive events for themselves (see also Bandura, 1997; Schunk, 2004).

17.4 Promoting motivation

In this section, the following aspects related to motivation receive attention, namely (1) what is motivation?, (2) types of motivation, (3) a motivational framework for cultural responsive teaching, (4) additional motivational theoretical aspects to take note of and (5) super motivation, optimal flow and playfulness.

17.4.1 What is motivation?

The importance of motivation cannot be underestimated to raise the confidence of teachers. Weiner (1996) notes that motivation is a causal factor that influences thought and action. Ormrod (2004, p. 425) views motivation as “an internal state that arouses us to action, pushes us in particular directions, and keeps us engaged in certain activities.” Motivation can thus be seen as something that is caused by an internal and/or external ‘force’ or ‘trigger’ that directs action, thought and behaviour.

17.4.2 Types of motivation

In the literature, two types of motivation have been identified, namely intrinsic and extrinsic motivation. Intrinsic motivation comes from the inside and does not require rewards or incentives, but at the same time it is necessary to note the role that rewards and incentives could play. Alderman (1999, p. 211) defines intrinsic motivation as the engagement of learners in “actions for their own sake and without coercion such as pleasure, learning, satisfaction, interest and challenge” and extrinsic motivation as to "engage in activities to attain rewards, such as praise, grades, special privileges and certificates or material rewards.” However, Alderman (1999, p. 228) cautions against the belief that intrinsic and extrinsic motivation are always polar opposites, as she argues that in some instances extrinsic motivation could undermine or reduce intrinsic motivation, but in some contexts it could also benefit or enhance intrinsic motivation.

Wlodkowski (1999) argues that intrinsic motivation is to a large extent governed or regulated by emotions, as emotions influence our task engagement, hence one could argue that satisfaction and achievement seem to be the motivators. He argues that emotions are socialised through culture, thus persons with different cultural beliefs could experience tasks or engagements differently (Wlodkowski, 1999), even though motivators have been built in. Therefore, it is important to take note of the motivational framework of cultural responsive teaching (Wlodkowski & Ginsberg, 1995; Wlodkowski, 1999), which is respectful of the different cultures in our classroom and society, and hence is capable of creating a common culture that all learners can accept or identify with.

17.4.3 Motivational framework for cultural responsive teaching

The motivational framework for cultural responsive teaching is a "holistic and systemic representation of four intersecting motivational conditions that teachers and learners can create or enhance" namely (1) establishing inclusion, (2) developing attitude, (3) enhancing meaning and (4) engendering competence (Wlodkowski, 1999, p. 81).

Establishing inclusion refers to the creation of a learning atmosphere in which both teachers and learners feel respected and connected to one another (Wlodkowski, 1999). Developing attitude refers to creating a favourable disposition or inclination towards the learning experience through personal relevance and choice (Wlodkowski, 1999). Enhancing meaning refers to the creation of challenging and thoughtful learning experiences which includes the learners' perspectives and values (Wlodkowski, 1999). Lastly, engendering competence refers to the creation of an understanding that learners are effective in learning something they value (Wlodkowski, 1999).

Wlodkowski (1999, p. 85) suggests that establishing inclusion can be addressed by making use of collaborative learning strategies; sharing with one another where one comes from, sharing expertise or involvement with subject matter; indicating intentions to help or assist; providing reason or purpose for what has to be learned, linking this to personal lives, thus usefulness; assessing previous experiences and/or knowledge, expectations and needs; introducing guidelines; providing rationales for giving assignments; use their [the 'their' refers to the learners' or to the people with which one are engaged] language; think through their perspectives and understand their attitudes; introduce comfort zones and acknowledge different levels and skills as well as different ways of knowing and knowledge with a view to establish a safe learning environment (Wlodkowski & Ginsberg, 1995; Wlodkowski, 1999). Thus, one has to create a climate of respect (Wlodkowski, 1997; 1999), trust and care, as well as establishing inclusion or belonging (see Havelock & Zlotolow, 1995).

Positive attitudes can be developed by assisting learners to pose relevant learning goals or/and by creating and designing learning experiences of such a nature that someone wants to learn, hence, making learning irresistible. Relevance is the key here. As a result, positive attitudes are essential towards the instructor or facilitator, towards the subject or learning area, towards adults and learners themselves, and towards the learners' expectancy for success. Thus, one has to try to eliminate any negative conditions where possible (see George & Camarata, 1996); one has to strive to ensure successful mastery in learning; one needs to positively confront negative attitudes and erroneous beliefs; scaffold by modelling, think out loud, anticipate difficulties, provide prompts and cues, use reciprocal teaching and self-assessment checklists; encourage effort; use goal setting and announce the amount of time needed for success. In addition, one has to try to make the activity safe, interesting, personally relevant and self-determined (Wlodkowski, 1997, 1999).

Enhancing meaning can be developed by using critical questioning in a challenging and reflective learning environment. Novelty, surprise and complexity may also be useful, as well as personal interest. In addition one could also provide opportunities for frequent responses by all on an equitable basis, thus valuing each person's viewpoint or input. Furthermore, the use of various presentation styles, the type of examples used, analogies, stories and humour could play a positive role, as does the statement or demonstrations of the benefits that the learning activity could provide (Wlodkowski, 1997, 1999).

Engendering competence can be addressed through self-assessment and effective feedback. Effective feedback refers to feedback that is informative, specific, constructive, prompt, frequent, positive and personal. Furthermore, it is important to avoid cultural bias or stereotyping. In summary, this refers to the promotion of competence through experiencing success.

In a similar manner as Wlodkowsi (1999), Alderman (1999) argues that cognitive and emotional aspects have a great influence on learners' achievement. He adds that the three functions of motivation are (1) “energizing or activating the behaviour, (2) directing behaviour and (3) regulating persistence of behaviour” (Alderman, 1999, p. 14).

17.4.4 Additional motivational theoretical aspects to take note of

Alessi and Trollip (2001) state that there are two motivational theories that are frequently used in multimedia design: The Malone and Lepper (1987) motivational theory for design and Keller’s (1983) ARCS acronym or model for motivational design. The Malone Lepper model suggest four important factors for motivation and interest, namely (1) challenge, (2) curiosity, (3) control and (4) fantasy. The Keller ARCS model (1983) refers to factors such as (1) attention, (2) relevance, (3) confidence and (4) satisfaction. Thus, one can argue that if one wants to have a motivated learner, then one would have to design activities or one has to provide contexts or learning environments in which these elements or factors are apparent.

17.4.5 Super motivation, optimal flow and playfulness

Another approach to motivation is that of Spitzer (1995) and his ‘Super Motivation Approach’. Spitzer (1996) argues that the more motivators one build into the context of an activity, the more motivating it will be. Hence, any activity can become motivational; one just has to add the motivators (Spitzer, 1996). Spitzer’s motivational approach highlights the importance of the context in which the task or activity takes place. Webster, Trevino and Ryan (1993) attribute the element of “playfulness” as another important factor that can enhance motivation and interest towards computer activities, based on the theory of “Optimal Flow” of Csikszentmihalyi (1990, p. 4). Optimal flow is “ … the state in which people are so involved in an activity that nothing else seems to matter; the experience is so enjoyable that people will do it even at great cost, for the sheer sake of doing it” (Csikszentmihalyi, 1990, p. 4).

The ‘playfulness’ concept is also supported by Resnick (1998), who advocates a ‘kindergarten approach’ to learning where learners manipulate objects through play, as well as by Rieber, Luke & Smith (1998), who contend that children explore their environments through play. Play is an active activity or process which often includes physical engagement (Rieber, 1996). Hence ‘play’ as a life-long learning process should be promoted in learning, not only for young children [learners], but for everyone (Rieber, Luke & Smith, 1998).

17.5 Developing collaboration

According to McMahon (1997), the majority of social constructivist models emphasise the importance of collaboration among learners. This is built upon the Vygotskian notion that learning is "a social construct which is mediated by language *via* social discourse" (McMahon, 1997:IS)[24].

Learning as a social construct through collaboration would thus imply more "learner-talk" than "teacher talk" during the learning process in the classroom. However, collaboration is not necessarily confined to between learners only, as the teacher could also become a co-learner. Collaboration as an interactive engagement activity between learners could be used to assist learners to move through their Zone of Proximal Development (ZPD) (Vygotsky, 1978).

During the collaboration process, social discourse among learners (peers) and learners (peers), or among learners and teacher(s), plays an important role, as when thinking and understanding becomes audible, it becomes possible for peers or the teacher to provide possible scaffolding or assistance to aid learners to bridge their misconceptions or problems that they might experience. Learning in the ZPD then is learning that assists with learner development that focuses on the process, rather than the final product (Chen, 1999).

The definition given by Johnson and Johnson (2004) is used with slight modifications to indicate how collaboration was viewed during this study when participants were busy to design cyberhunts:

> *Cooperation is working together to accomplish shared [and individual] goals. Within cooperative activities individuals seek outcomes that are beneficial to themselves and beneficial to all other group members. Cooperative learning is the instructional use of small groups so that learners [peers] work together to maximize their own [goals] and each other's learning [shared goals].*
>
> *(Johnson & Johnson, 2004, p. 786)*

It is important to note that the placement of learners into groups does not necessarily create a cooperative relationship (Johnson & Johnson, 1994). In order for an activity to be cooperative

[24] This quote is from an Internet source that does not have page numbers. It is in the section with the heading, Social Constructivism, the last sentence of the third paragraph.

(collaborative), five basic elements are essential and need to be included (Johnson, Johnson & Smith, 1991, pp. 16-24; Johnson & Johnson, 1999, p. 5), namely (1) Positive interdependence, (2) Individual accountability, (3) Face-to-face promotive interaction, (4) Social skills and (5) Group processing.

1. "Positive interdependence: Positive interdependence is the perception that we are linked with others in such a way that we cannot succeed unless they do. Their work benefits us and our work benefits them.

2. Individual accountability: Individual accountability exists when the performance of each individual student is assessed and the results are given back to the group and the individual. The purpose of cooperative learning groups is to make each member a stronger individual. Students learn together so that they can subsequently perform at a higher level as individuals. To ensure that each member is strengthened, students are held individually accountable for their share of the work.

3. Face-to-face promotive interaction: Individuals promote each other's success by helping, assisting, supporting, encouraging, and praising each other's efforts to achieve.

4. Social skills: Contributing to the success of a cooperative effort requires interpersonal and small group skills. Placing socially unskilled individuals in a group and telling them to cooperate does not guarantee that they will be able to do so effectively. Persons must be taught the leadership, decision-making, trust-building, communication, and conflict-management skills just as purposefully and precisely as academic skills.

5. Group processing: Group processing exists when group members discuss how well they are achieving their goals and maintaining effective working relationships. Groups need to describe what member actions are helpful and unhelpful and make decisions about what behaviors to continue or change."

Johnson and Johnson (2004, p. 788) state that there are four types of cooperative learning that may be used in combination with instructional technology, namely formal cooperative learning, informal cooperative learning, cooperative based groups and academic controversy. Within this study, stable cooperative based groups were used to ensure stable membership (Johnson & Johnson, 2004) with a view to enable the members to build relationships within their groups and within the learning community of practice as a whole. The rationale was that the various stable groups would provide support, help and encouragement to their members (Johnson & Johnson, 2004).

17.6 Creating a climate of trust

During the process of knowledge creation, it is important to create a climate of trust between the facilitator and the participants (Havelock & Zlotolow, 1995). Trust is an important ingredient during the change process (Harris, 2002; Dana & Yendol-Hoppey, 2008). As coach and co-participant in this project, my aim as researcher and participator was that the other participants [participating teachers] will 'learn with' me (MacLennan as cited in O'Connor, & Ertmer, 2003). As someone with prior experience, I also had the role of mentor.

17.7 Containing anxiety

People normally respond to anxiety in two ways, namely (1) by seeking comfort in isolation and in the process, show their disapproval or (2) by seeking comfort in groups which provide support as they experience similar anxieties (George & Camarata, 1996). Thus, it is imperative that cyber anxiety towards computer technology needs to be limited if instructors seek to be successful in teacher development programmes. The following perceptions and implementation issues could lead to active resistance towards technology (ICT) (George & Camarata, 1996), namely (1) perceiving oneself as an incompetent person, (2) reasoning with oneself that adaptation and adoption is not necessary, (3) feeling incompetent, (4) instructors that shows frustration, (5) hints of inefficient communication between administrators and instructors and (6) indications of improper planning towards implementation.

The key to less or lower levels of cyber anxiety lies with raising the self-efficacy level (see Bandura, 1977, 1997; Ertmer, 2001; Schunk, 2004), as previously discussed, as an increase in self-efficacy through success in the utilisation of computer technology implementation in the classroom, could lead to higher motivational levels (George & Camarata, 1996). Improved self-efficacy and higher motivational levels could lead to teachers being more positive, and hence it could be easier to encourage these positive teachers to learn more about ICT, how to use ICT and what other benefits ICT implementation and integration might render (George & Camarata, 1996).

Just as teachers have to take their learners' "*Perezhivanie*" or *"lived emotional experience"* (Vygotsky cited in Mahn & John-Steiner, 2002, pp. 4-5) into consideration during learning within a constructivist context, project facilitators or teacher developers should take the teachers' "*Perezhivanie*" into consideration when they train teachers during teacher development sessions. Thus, project facilitators or teacher developers have to take note of how their learners (the teachers during this study or any other related teacher development sessions) perceive, experience and process the emotional aspects of social interaction.

According to Mahn and John-Steiner (2002, p. 1), for learning to be successful in the ZPD, teachers [and learners] should build on their fellow learners' [peers that can be learners or teachers] prior experience, as this supports the development of confidence and competence in the social context. Furthermore, a caring nature and effective support could also enhance the learning process, as affective factors play just as important a role in the learning process as cognitive factors. Hence, emotional scaffolding is just as important as cognitive scaffolding and teachers (and project facilitators or teacher developers) should create the necessary "safety zone" or "safety nets" for their learners by getting to know their learners, engendering trust and lending support (Mahn & John-Steiner, 2002, p. 10; see also Herrington & Oliver's, 1997, 2000; Herrington & Kervin, 2007).

17.8 Taking cognizance of aspects that influence adoption

The innovation-decision process is the process through which an individual (or other decision-making unit) passes from first obtaining knowledge of an innovation to finally confirming adoption or the reverse; dumping the innovation. Rogers (1983, 1995, 2003) argues that people do not readily adopt new innovations, even if the innovation is an improvement on existing practice. Baron and Bruillard (2007) concur as they argue that in spite of traditional practices being institutionalised within teachers, many of these institutionalised practices do not necessarily contribute to useful knowledge or useful learning and even if new approaches or practices are labelled as 'good' or 'best', teachers do not easily embrace them.

Rogers (1983, 1995, 2003) contends that in spite of people's tendency not to adopt new approaches, the following aspects could play a vital role in the rate of how people adopt innovations: (1) the relative advantage over a previous idea, (2) compatibility with existing ways of doing, (3) simplicity of the innovation, (4) trialability and (5) observablity of the results of the innovation (see also Mumtaz, 2000).

Hinson et al. (2006) concur with Rogers (1983, 1995, 2003), as they posit that teachers tend to rely on proven strategies that have worked for them. Hence, unreliability of technology (ICT), for example computers that malfunction or the Internet that goes down, could result in teachers not seeing the relative advantage of technology (ICT) and/or not seeing technology (ICT) as being simple, but as too complex (Hinson et al. , 2006). However, Baron and Bruillard (2007, p. 80) state that in spite of new strategies or examples of 'good' or 'best' educational practices being available to teachers, these so-called new approaches have seldom been "infectious by their own virtue." Hence, if innovative practices have not been fully adopted, even when they have been plausible in the past, one may then ask about the probability that this will change in future (Baron & Bruillard, 2007).

Knowledge plays a vital role during the decision process, hence how the innovation is communicated, is of great importance (Rogers, 1983, 1995, 2003). According to Rogers (1983, 1995, 2003) there are five main steps in an innovation-decision process. Firstly, exposure to an innovation leads to knowledge about the innovation. Secondly, the knowledge acquired could lead to persuasion. Thirdly, persuasion leads to a positive or negative image about the innovation. Based upon the knowledge accumulated, a person decides to accept or reject the innovation. Fourthly, if the innovation is accepted, the person moves to the next stage, namely implementation of the innovation or even reinvention. Lastly and finally, the fifth stage is the one in which the adopter either confirms of rejects the innovation.

18. THE DIFFUSION OF INNOVATIONS AND ACCEPTANCE THEORIES

In sections 15 to 17, aspects pertaining to barriers to ICT teacher development have been discussed. In this section, aspects pertaining to innovation, diffusion, acceptance and change are discussed. It is stressed that these aspects were not the focus of the thesis, but that they have been added to add extra value.[25]

In the following sub-section, Stockdill and Morehouse's (1992) critical factors for successful adoption and Burkman's (1987) User Orientated Instructional Development process are discussed. A specific attempt has also been made to address the key elements in the diffusion of innovation process, the role of opinion leaders, perceived attributes theory, the adopter categories and the rate of adoption theory. In all of the above-mentioned aspects, Rogers (1983, 1995, 2003) has been the main voice. A schematic summary of the diffusion of innovation is also provided. The Concerns-Based Adoption Model (CBAM) (Hall & Hord, 1987, 2001) is also discussed. The Concerns-Based Adoption Model describes the levels or stages of concern which teachers could experience when they adopt new practices. The levels of use and decision points related to adoption or rejection are also probed, as well as the Levels of technology Implementation (LoTi) framework of Moersch (1995, 1996). Several acceptance theories are also briefly mentioned, each with their own constructs, with special reference to Venkatesh, Morris, Davis and Davis (2003). A local adoption model (Govender, 2006) in the South African context is also briefly discussed. This section concludes with an overview of the different levels of ICT use in the South African context.

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[25] I am aware that several models, frameworks or theories exist regarding the adoption, acceptance and implementation of innovations. However, it was decided not to use these within the analysis of the data in this study, as one of the aims of this study was to identify the barriers (first- and second order with reference to Ertmer, 1999) related to ICT implementation and adoption within the South African context. I am also aware of aspects pertaining to change, with special reference to Fullan and Stiegelbauer (1991), Ellsworth (2000) and James and Connoly (2000).

Ellsworth (2000) is another author who provides a detailed overview of how to survive change and innovation. He reports about the 'Conditions of Change' of Ely (1999); the 'Diffusion of innovation' of Rogers (1983, 1995); the 'Meaning of Educational Change' (Fullan, & Stiegelbauer (1991); the 'Change Agent's Guide' of Havelock & Zlotolow (1995); the 'Concerns-Based Adoption Model' (CBAM) of Hall & Hord (1987); the 'Strategies for Planned Change' of Zaltman & Duncan (1977) and the 'Systemic Change in Education' with reference to the authors Banathy, Reigeluth, Garfinkle, Carr-Chellman & Jenlink.

Wilson, Sherry, Dobrovolny, Batty and Ryder (2001) provide an insightful overview of the adoption of learning technologies.

Banathy et al. (2001) refer to the eight conditions that facilitate the implementation of educational technology; the STORCS acronym (simplicity, trialability, observability, relative advantage, compatibility and support with reference to Rogers (1995), to which Rogers (1995, 2003) refers as the Perceived Attributes Theory. Some of these above-mentioned aspects will be presented shortly in the literature review chapter.

18.1 Adoption: Stockdill and Morehouse's Critical Factors and the User Orientated Instructional Development (UOID) process of Burkman

Stockdill and Morehouse's (1992) present critical factors that have to be addressed for successful adoption of technology. These critical factors are:

- Educational need,
- User characteristics,
- Content characteristics,
- Technological considerations, and
- Organizational capacity.

Burkman (1987) also investigated innovativeness. His User Orientated Instructional Development (UOID) (Burkman, 1987) process provides steps to be followed by facilitators who want to introduce new practices or innovations to possible future adopters. The UOID consists of the following five steps:

- Identify the potential adopter,
- Measure relevant potential adopter perceptions,
- Design and develop a user-friendly product,
- Inform the potential adopter, and
- Provide post-adoption support. This also includes the feed-in of user feedback and suggestions into the development of the product.

All the above-mentioned perspectives provide valuable insights for departmental educational officials or any other persons involved with innovation and adoption-related aspects.

18.2 Innovation and diffusion: The Rogers perspective

In section 10.5 in this chapter, the terms 'innovation' and 'diffusion' had been addressed. To refresh our memory, the definitions are provided again:

An innovation can be defined as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers, 1995, p. 11) whereas diffusion is "the process by which an innovation is communicated through certain channels over time among members of a social system (Rogers, 1995, p. 10).

In the following section, models, frameworks or theories regarding the adoption and implementation of innovations, including technological ICT-based ideas, are touched upon. However, I decided not to explore them in too great detail, as the findings of this study have not been linked to these theories and frameworks *per se*.

Rogers (1983, 1995, 2003) differentiates between both diffusion and adoption as a process. The diffusion process filters through as a result of societal and group influences, whereas the adoption process refers specifically to the individual person. Hence, the diffusion process is a social process.

In the following sub sections, aspects related to adoption and diffusion are discussed with special reference to Rogers (1983, 1995, 2003).

18.2.1 The key elements in the diffusion of innovation process

There are four key elements that form an integral part in the diffusion of innovation process, namely (1) the innovation, (2) communication channels, (3) time and (4) a social system (Rogers, 1983, 1995, 2003). I innovation refers to the idea, object, practice(s), etc. that are being viewed as new. Communication channels refer to how the innovation is communicated from individuals to individuals, from an individual to a group or from a group to another group. The time element implies that it takes time to adopt an innovation and that that adoption is embraced by everyone at the same time. The social system refers to the role that societal created systems or groups can play in accomplishing the adoption of an innovation (Rogers, 1983, 1995, 2003).

18.2.2 The role of opinion leaders

Opinion leaders can play a vital role during the diffusion and adoption process of an innovation. Opinion leadership refers to "the degree to which an individual is able to influence other individual's attitudes or overt behaviour informally in a desired way with relative frequency" (Rogers, 2003, p. 27). A person's technical competence or social accessibility for example, could determine whether the person is perceived as an opinion leader (Rogers, 1983, 1995, 2003).

It is important to note that there are positive and negative forms of opinion leadership. Openness towards change or innovation within a social system leads to innovative opinion leaders, but opposition or closeness towards change leads to conformity, i.e. opinion leaders that reflect the norm (Rogers, 1983, 1995, 2003). Hence, opinion leaders can be classified as either being innovative opinion leaders or resistance opinion leaders; being promoters or resistors (Rogers, 1983, 1995, 2003). According to Rogers (1983, 1995) a striking characteristic of opinion leaders is their unique and influential position in their social system's communication structure or network, as they are at the centre of interpersonal communication. Thus, they are interconnected individuals (Rogers, 1983, 1995, 2003). These interpersonal networks allow interconnected opinion leaders to fulfil a societal role. Therefore, the opinion leader's innovative behaviour is imitated by many others in their contexts (Rogers, 1983, 1995, 2003).

18.2.3 Perceived attributes theory

Rogers argues that the perceived attributes of an innovation, the type of innovative decision process (optional, collective or authoritative), the means of communication, the nature of society (connectedness for example) and the extent to which change agents promote the innovation (including opinion leaders) are determining factors or variables that play a role in the rate of adoption. Having said this, it is important to take note of Rogers' (1983, 1995, 2003) 'perceived attributes theory'. The perceived attributes theory (STORCS) states that a potential adopter of an innovation judges the adoption of an innovation on (This was also addressed in section 10.5):

- Simplicity (or conversely, complexity): Is the innovation easy or difficult to understand, to maintain, and to use? [The easier the innovation is to apply and understand, the more the likelihood of adoption].

- Trialability: Is it possible to test the innovation, to experiment with it on a limited basis? [Provides less uncertainty].

- Observability: Is the innovation visible to others? Are the results of the innovation visible to others? [This stimulates discussion].

- Relative advantage: Is the innovation perceived or seen as better than the one(s) it supersedes (replaces)? Is it more economical (faster cheaper), more convenient, more socially prestigious, more satisfying? [Perceived relative advantage is more important than objective advantage – perceived advantage leads to a more rapid rate of adoption].

- Compatibility: Does the innovation fit in with the existing values, past experiences and needs of potential adopters? [Find it easier to align with own beliefs].

The type of innovative decisions, i.e. optional, collective or authoritative, implies that there is a decision-making process that is influenced by one of these types or by a combination of them. The optional, collective or authoritative innovation-decisions are briefly elaborated on below:

- Optional innovation-decisions: The choice to adopt or reject the innovation is made by the individual himself and is independent of the decisions of the other members of the social system.

- Collective innovation-decisions: The choice(s) to adopt or reject the innovation is made collectively by reaching consensus among the members of the social system.

- Authority innovation-decisions: The choice(s) to adopt or reject the innovation is made by a minority who possesses power, status and technical expertise; a top-down decision approach.

In the next section, an overview is provided of the innovation-decision process theory.

18.2.4 Innovation-decision process theory

Another important theory related to innovation, is the 'innovation-decision process theory'. The innovation-decision process theory states that the innovation decision-making is the process through which an individual (or other decision-making unit) passes from first knowledge of an innovation to finally confirming adoption or the reverse; dumping the innovation (Rogers, 1983, 1995, 2003). Knowledge plays a vital role during the decision process, hence how the innovation is communicated, is of great importance. According to Rogers (1983, 1995), 2003) the subjective experience and feedback from near-peers have a greater impact on an individual's decision to evaluate an innovation than scientific studies have. This does not imply that scientific findings do not play a part in the decision process, but that it is not playing the main part. If communication plays an important part in the innovation decision process, then the influence and role that early adopters might have, could become an important factor in capacity and knowledge building of the innovation.

Rogers' innovation-decision process (adoption process) follows a series of five linear stages in which the information (that leads to the creation of knowledge) component plays a vital role. The reason for this is that knowledge assists to reduce uncertainty. These so-called five distinct steps or stages are actually intertwined and not separate. These five stages are (Rogers, 1983, 1995, 2003):

- Knowledge: A person (or group) is exposed to the existence of the innovation and begins to learn how it functions. This could lead to increased knowledge and skill.
- Persuasion: A person forms a positive or negative image about the innovation. This can be as a result of discussions and interactions with other people such as peers for example.
- Decision: Based on the knowledge accumulated, a person decides to accept or reject the innovation. If it is accepted, the person moves to the next stage, namely implementation of the innovation.
- Implementation (and/or Reinvention): The person uses the innovation. Should the person (or group) need more information (knowledge) about the innovation during implementation or more information (knowledge) regarding issues during implementation, capable persons should be available who can be consulted. Although I have also referred to the aspect of re-invention as a possible element of the perceived attributes theory, it could also fit here. Thus, another important aspect during implementation is the possibility of reinvention of the innovation and the processes associated with the innovation and the implementation process. It could be argued that reinvention could refer to two opposite strands: the one being reinventing the innovation (such as technology) by using it in a new way or manner not thought of before and the other being using the innovation to achieve traditional or "old fashioned" goals (domesticating it). Thus, the traditional sense refers to for example, using technology in an undesirable way, not in line with the innovator's intention.

- Confirmation or Rejection: The ‘temporary adopter’ decides whether to continue to use the innovation by looking at the benefits of the innovation. I specifically use the term “temporary adopter” as negative results might lead to the rejection of the innovation. An improved version of an innovation could also lead to rejection of the current innovation and towards adoption of the improved model. However, a so-called improved innovation would not necessary lead to the abandonment of an existing innovation and the implementation of the latest version. This has been mentioned previously with reference to Betamax and the Dvorak keyboard.

In addition, it is important to note that it becomes possible to link the perceived attributes or ‘push factors’ to the five steps or stages within the innovation decision process, as indicated in Table 2.16.

Table 2.16

Linking the innovation decision stages to elements of perceived attributes

Innovation-decision process		**Perceived attributes having an influence on the innovation-decision process**
Knowledge: Gain knowledge by means of …	→	Observability Trialability Simplicity
Persuasion: Can be persuaded by …	→	Relative advantage: Peer influence and peer communication Trialability Simplicity
Decision: May lead to a decision to adopt the innovation initially or reject it before it has even been tried as a result of …	→	Compatibility Relative advantage Trialability Simplicity
Implementation (and/or Reinvention) by means of …	→	Trialability
Confirmation (Adoption) or Rejection as a result of …	→	Trialability Relative advantage

Table 2.16 thus serves as a guide for project facilitators about the attributes that could be used in each stage of the innovation-decision process.

18.2.5 Consequences of the innovations and the diffusion process on the individual

The consequences that the adoption of an innovation may have on an individual (or group), may range from desirable to undesirable, direct versus indirect and anticipated versus unanticipated These ranges are explained below (Rogers, 1983, 1995, 2003):

- Desirable versus undesirable consequences: This refers to the functionality effects of the consequences, positively affecting the individual or social system making it more functional.
- Direct versus indirect consequences: Direct consequences refer to the changes that occur to the individual or social system as an immediate response to the innovation. Direct consequences can be positive or negative. Indirect consequences can also be positive or negative.
- Anticipated versus unanticipated consequences: Anticipated consequences are those consequences that were intended by the innovation. Unanticipated consequences may also refer to undesirable consequences, i.e. they may have effects that are not desirable or it could also refer to positive unanticipated consequences.

Change makers should take cognisance of the above-mentioned consequences, as these consequences could be useful to inform their planning in order to try to achieve the intended outcomes of the intended training or teacher development for innovation.

18.2.6 Adopter categories and the rate of adoption theory

The adopter categories of Rogers (1983, 1995, 2003), are the innovators, early adopters, members of early majority, members of late majority and the 'laggards'. Rogers describes them as follows (1983, 1995, 2003):

- Innovators: The first one to adopt something new, the small minority, risk takers or the few pioneers. They are not always respected by the members of the social system as they advocate change.

- Early adopters: They have a great deal of opinion leadership within the social system. Potential adopters look to the early adopters for advice and information about the innovation, thus their credibility and leadership are of essence. Often they are far ahead of the average individual; hence they serve as role models for prospective adopters.

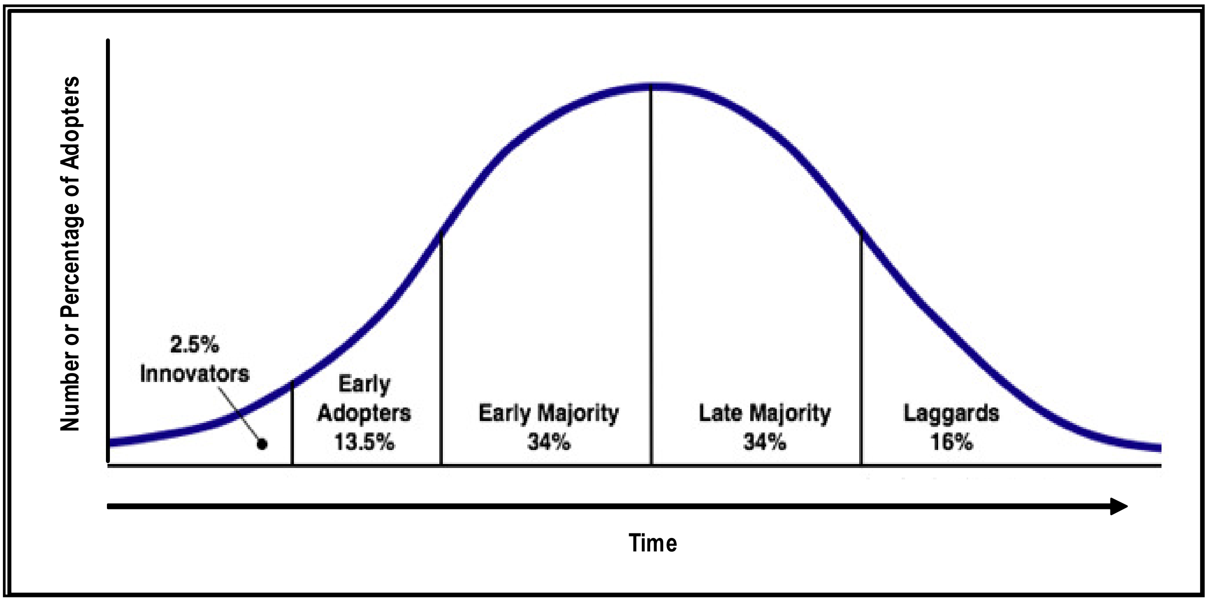
- Members of Early Majority: They adopt the innovation just before the average member or the late majority, making them an important link in the diffusion process. They can be described as deliberators. Interaction with peers takes place on a regular basis, but they do not often hold leadership positions and thus seldom lead.

- Members of Late Majority: They are very sceptical and can be characterised as 'gate keepers'. Adoption follows mostly after everyone else have done so.

- Laggards: In many instances, they are near isolates within the social system and cling to the past as the past holds certainty, a 'rear view mirror' (Rogers, 1983, p. 250). Their resistance to change is as a result of fear. Their thinking is tied to a belief that the innovation need to prove itself before adoption might follow.

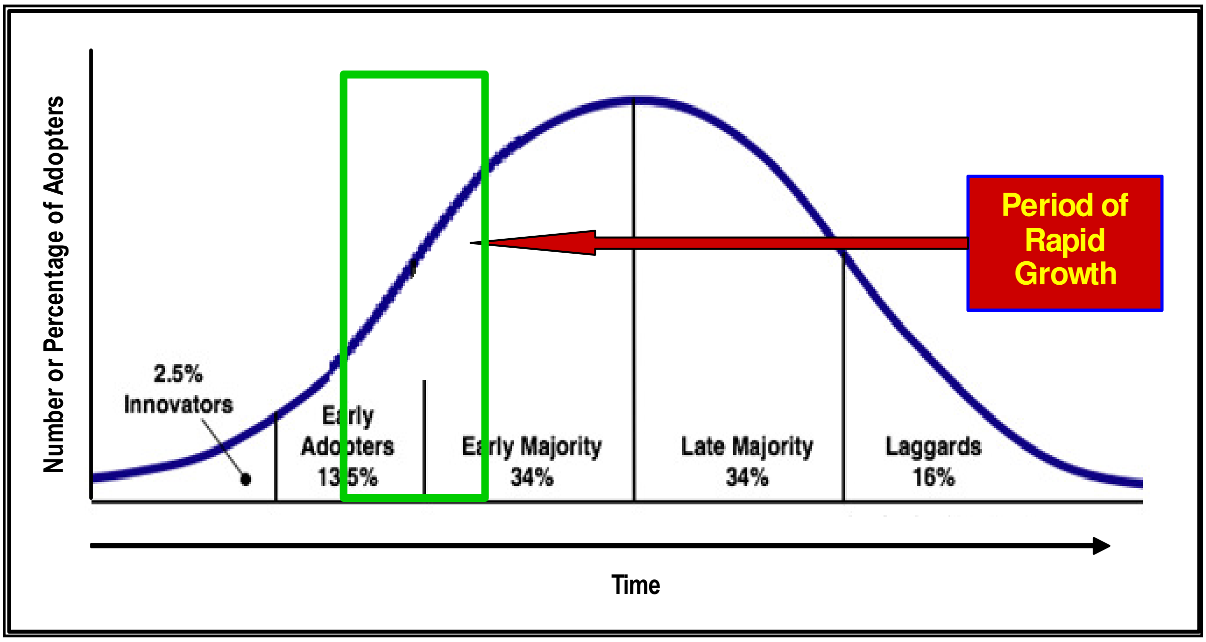
Figure 2.5 represents a diagram of the different categories and the number or percentage of people associated with each:

Figure 2.5: Categories of individual innovativeness (Rogers, 1983, 1995, 2003).



It is important to unpack what is meant by the rate of adoption and what the curve in Figure 2.5 and Figure 2.6 suggests regarding the rate of adoption. The rate of adoption refers to the period of growth in relation to time. In the beginning, the innovation goes through a very slow and gradual growth (see period preceding the rectangular green box as indicated in Figure 2.6), but then there is a period of dramatic or rapid growth, indicated by the s-curve in Figure 2.6. The period that follows the period of rapid growth (see period that to the right of the rectangular green box in Figure 2.6), indicates that there is a gradual stabilisation which eventually leads to a sharp decline.

Figure 2.6: Period of rapid growth on the s-curve (half of the bell shaped curve), indicated by the green box (Rogers, 1983, 1995, 2003).



Geoghegan (1994) makes an interesting comparison between early adopters and the early majority (see Table 2.17). His comparison enables persons in charge of implementing, managing and/or planning for change/innovation to try and plan ahead by taking the traits in Table 2.17 into consideration. Thus, his comparison provides a possible ‘trait map’ which signals to those in charge of what to take note of in dealing with persons associated with each of the categories.

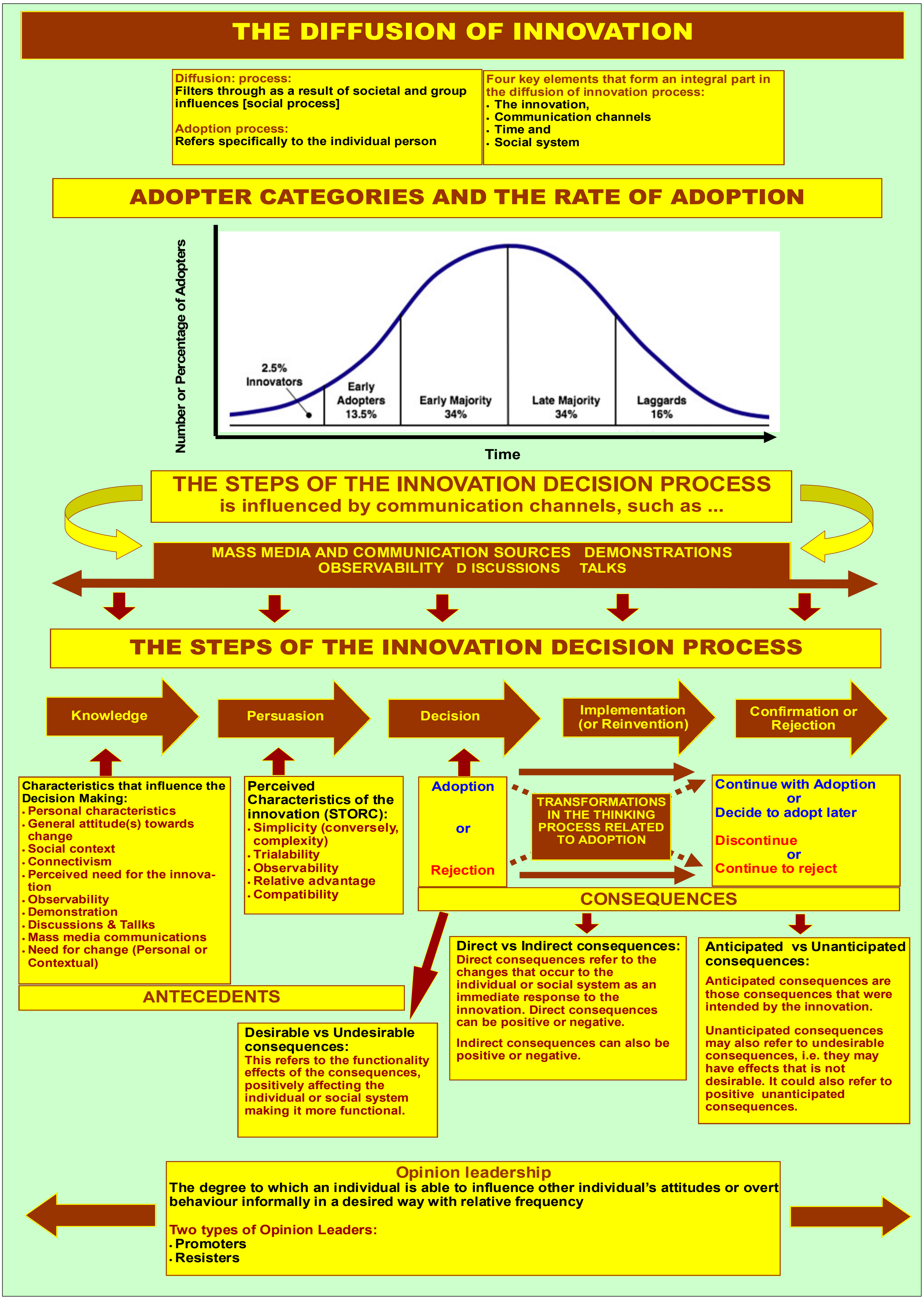
Table 2.17

Comparison between early adopters and early majority (Geoghegan, 1994)

Early Adopters	Early Majority
Favour revolutionary change	Favour evolutionary change
Visionary	Pragmatic
Project oriented	Process oriented
Risk takers	Risk averters
Willing to experiment	Wanting proven applications
Generally self-sufficient	May need significant support
Horizontally connected	Vertically connected

The review in sections 18.1 and 18.2, including their sub sections, enables one to make a summary of Rogers' diffusion of innovations in a schematic diagram, which is presented in Figure 2.7.

Figure 2.7: Overview of the diffusion of innovation or Innovation Diffusion Theory (IDT) (Based on Rogers, 1995, 2003)



Rogers is not alone in the quest to explain aspects pertaining to innovation. Recently, Venkatesh et al. (2003) have formulated theories of acceptance. These theories are briefly discussed in section 18.4.

18.3 Concerns Based Adoption Model (CBAM)

In adopting a new approach towards practice(s) [praxis], methodology or technology integration; various concerns related to adopters have to be addressed. In the next sub section, the Concerns-Based Adoption Model (CBAM) of Hall and Hord (1987, 2001) is explored, as well as the Levels of Use.

18.3.1 Why ICT is not readily adopted: CBAM as an indicator

The Concerns-Based Adoption Model (CBAM) (Hall & Hord, 1987, 2001) describes seven levels or stages of concern and their categories that teacher-practitioners could experience as they adopt a new practice. The stages of concern can also be related to categories of concern, namely self-orientated, task orientated and impact related. These stages of concern and how the stages relate to the categories of concern, are indicated in Table 2.18. The aspects indicated in Table 2.18 highlight the questions that possible adopters may ask and provide an explanation of how the possible adopters think.

To embrace ICT for example, it becomes evident from Table 2.18 that change-makers, facilitators and officials should take cognisance of the categories of concern as well as the stages of concern in order to obtain an overview of their adopters' concerns, the questions that they ask and to form a picture of the prospective adopters' thinking.

Table 2.18

Relation between stages of concern and categories of concern in the CBAM concerns-based adoption model (Hall & Hord, 1987, 2001)

CATEGORIES OF CONCERN	STAGES OF CONCERN	QUESTION	EXPLANATION OF TEACHER THINKING
"Haze" *MY INSERTION	**Awareness**	What is this innovation?	Little concern or involvement with the innovation.
Self	**Informational**	How does it work?	General interest present towards the innovation. Would like to know more about it.
	Personal & [*Attitudinal] *My insertion	How would this impact me? Am I going to try to implement it?	Want to learn about the personal ramifications of the innovation. Raise questions regarding the effects of the innovation on them.
Task	**Management**	How can I master the skills? Would I be able to master it? Would I be able to incorporate this in my current situation?	Learn the processes and tasks of the innovation. Focus on information and resources.
Impact	**Consequence**	Is it working? What are the results and are they worthwhile?	Focus on the impact of the innovation on the learners
	Collaboration	How do peers (other teachers) implement and use it?	Cooperate with peers [other teachers] during the implementation of the innovation.
	Refocusing	Are there any alternative(s) that could prove to be better or that could enhance the current innovation and related methodology / implementation?	Reflect and consider the benefits of the innovation. Think of additional alternatives that could be more beneficial or might work even better.

In the next section, the Levels of Use of Loucks, Newlove and Hall (1975) and Hall and Hord (1987, 2001) are indicated, as well as how Moersch (1995, 1996) has adapted these levels for technology implementation.

18.3.2 Levels of Use

The level of use, e.g. Level 0 or Level 1, indicates the behaviour of the individual(s) within that level. In the table below, each level is explained. Furthermore, a definition has been provided to explain what each level is about. In addition, a decision point is linked to each of the different Levels of Use (see Table 2.19).

Table 2.19

Levels of Use and the respective decision points (Loucks, Newlove & Hall, 1975; Hall & Hord, 1987, 2001)

Levels of Use	**Definition**
Level 0 - Non-use	Having little or no knowledge of innovation.
Decision Point "Fuzzy" or "Hazy": No action and/or no knowledge of innovation. No guarantee(s) that action might be taken in the future towards innovation.	
Level I - Orientation	Acquiring some information of innovation.
Decision Point A: Takes action or initiative to learn more about innovation.	
Level II - Preparation	Preparing for first use of innovation: User has definite plans.
Decision Point B: Makes a decision to use innovation.	
Level III - Mechanical Use	Focusing on immediate needs of user to master tasks of innovation: Making changes to organisational structure(s).
Decision Point C: Begins first use of innovation.	
Level IVA- Routine	Making no changes or a few changes in ongoing use of innovation.
Decision Point D-1: Establishes routine use of the innovation.	
Level IVB - Refinement	Varying use of the innovation to make impact on learners to achieve and/or increase outcomes.
Decision Point D-2: Changes in use are based on formal or informal evaluation.	
Level V - Integration	Combining efforts of self, colleagues/peers to achieve collective impact on learners through coordination.
Decision Point E: Initiates changes based on collaboration with colleagues for benefit of learners.	
Level VI - Renewal	Re-evaluating own use, seeking major modifications, and exploring new developments to established use of innovation.
Decision Point F1: Begins to explore alternatives.	
Decision Point F2: Reflect, Decide to be or not to be Reflexive: Cyclical Process : [My insertion]	

Moersch's (1995, 1996) Levels of Technology Implementation (LoTi) framework consists likewise of seven levels (Level 0 to Level 6), namely:

- Non-use,
- Awareness,
- Exploration,
- Infusion,
- Integration,
- Expansion, and
- Refinement.

These Levels of Use (Loucks, Newlove & Hall, 1975; Hall & Hord, 1987, 2001) are also the levels on which Moersch (1995, 1996) based his LoTi framework.[26]

18.4 Theories of Acceptance

Venkatesh et al. (2003) provide a detailed overview of various user acceptance theories by citing various authors. In their overview, they provide each model's core constructs. The core constructs of these models, namely the Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Theory of Planned Behaviour (TPB) and the Combined TAM and TPB (C-TAM-TPB) are indicated in Table 2.20. An analysis of Table SA4 indicates that the first three theories have been combined in the Combined TAM and TPB (C-TAM-TPB) Model, which is indicated in column four of Table 2.20.

[26] The Technology Acceptance Model (TAM) (Venkatesh, Morris, Davis & Davis, 2003) and Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) are also acknowledged, but are not reported in detail. Venkatesh et al. (2003) provide an overview of the Theory of Reasone Action (TRA), Technology Acceptance Model (TAM), Motivational Model (MM), Theory of Planned Behaviour (TPB), Combined Tam and TPB (C-TAM-TPB), Model of PC Utilisation (MPCU), Innovasion Diffusion Theory (IDT) and Social Cognitive Theory (SCT).

Table 2.20

The core constructs of the Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Theory of Planned Behaviour (TPB) and the Combined TAM and TPB (C-TAM-TPB) (Venkatesh et al., 2003)

Theory of Reasoned Action (TRA)	**Technology Acceptance Model (TAM)**	**Theory of Planned Behaviour (TPB)**	**Combined TAM and TPB (C-TAM-TPB)**
Attitude Toward Behaviour		Attitude Toward Behaviour	Attitude Toward Behaviour
Subjective Norm	Subjective Norm	Subjective Norm	Subjective Norm
	Perceived Usefulness		Perceived Usefulness
	Perceived Ease of Use		Perceived Ease of Use
		Perceived Behavioural Control	Perceived Behavioural Control

Venkatesh et al. (2003) also refer to the Model of PC Utilization (MPCU), which consists of the following core constructs, namely:

- Job-fit
- Complexity
- Long-term Consequences
- Affect Towards Use
- Social Factors
- Facilitating Conditions

In addition Venkatesh et al. (2003) also touch on the Social Cognitive Theory (SCT) of acceptance. This theory consists of the following constructs which are acknowledged as aspects that influences acceptance, namely:

- Outcome Expectations related to Performance
- Outcome Expectations related to the Personal dimension
- Self-efficacy
- Affect
- Anxiety

The Unified Theory of Acceptance Use of Technology (UTAUT) is a deliberate attempt by Venkatesh et al. (2003) to combine aspects or elements as indicated in Table 2.21 in a coherent whole. Rogers' (1983, 1995) IDT has also influenced their thinking. The UTAUT has four predictors that play a significant role as direct determinants of user acceptance (Venkatesh et al., 2003). These determiners or predictors are as follow (Venkatesh et al., 2003, pp. 447-453):

- Performance expectancy: "… the degree to which an individual believes that using the system will help him or her to attain gains in job performance."
- Effort expectancy: "… the degree of ease associated with use of the system."
- Social influence: "… the degree to which an individual perceives that important others believe he or she should use the new system."
- Facilitating conditions: "… the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system."

Table SA6 provides an overview of each of the sub-items or constructs associated with the determiners or predictors referred to above (Venkatesh et al., 2003).

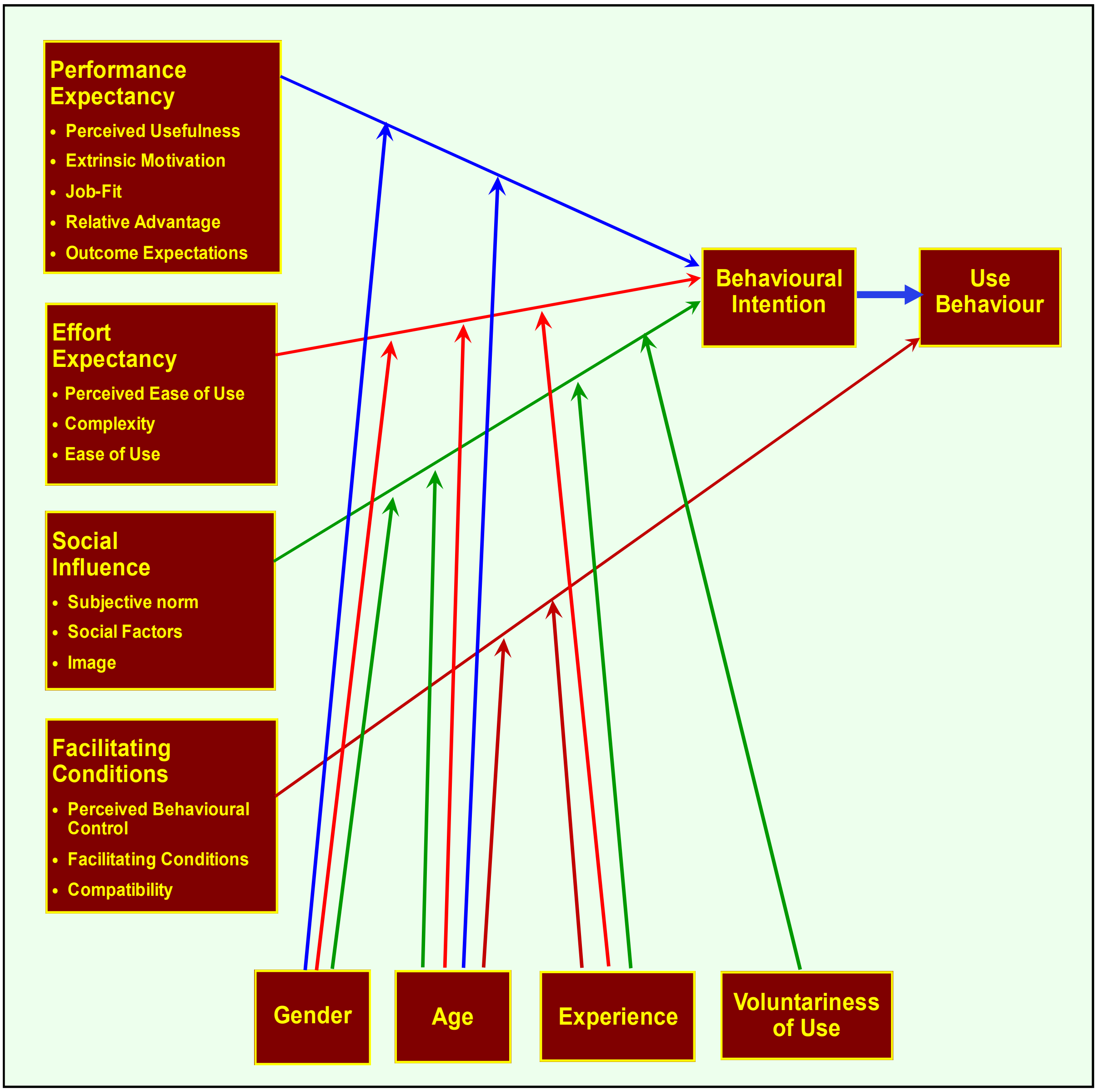
Table 2.21

The determiners or predictors and their constructs that encompass the Unified Theory of Acceptance Use of Technology (UTAUT) (Venkatesh et al., 2003)

Performance expectancy	**Effort expectancy**	**Social influence**	**Facilitating conditions**
Perceived Usefulness	Perceived Ease of Use	Subjective norm	Perceived Behavioural Control
Extrinsic Motivation	Complexity	Social factors	Facilitating Conditions
Job-fit	Ease of Use	Image	Compatibility
Relative advantage			
Outcome			
Expectations			

Figure 2.8 provides a diagramatic overview of the Unified Theory of Acceptance Use of Technology (UTAUT) by highlighting each of the determents as indicated in Table 2.21.

Figure 2.8: The Unified Theory of Acceptance Use of Technology (UTAUT) (Adapted from Venkatesh et al., 2003, p. 447)



In the section above, a summary has been provided related to acceptance theoretical constructs. In the next section, the local adoption model of Govender (2006) is discussed, as well as the different levels of ICT adoption in the South African context.

18.5 Educator Technology Adoption Model in the South African context: Govender

A recent study in the South African context, Govender (2006, p 132) has drawn from acceptance theories and adoption and innovation related theories with a view to providing a research model for educator technology adoption. Govender (2006) argues that extrinsic motivation, perceived usefulness, complexity, perceived behavioural control and relative advantage seem to hold the key as all these aspects influence attitude / behavioural intention to use technology. He adds that influence attitude / behavioural intention to use technology plays a central part in the actual use of technology.

Govender (2006, p187) also proposes an insightful process to be followed for educator professional development. This entails the following (Govender, 2006, pp. 184-187):

- Selection of in-service educators
- General ICT training on a university campus: Training in basic computer and ICT related skills
- Didactic phase: The participants attend lectures, participate in laboratory sessions, discussions and team projects. The didactic phase focuses ICT-supported didactic approaches and should be delivered or presented by knowleadgeable academic and specialised educators with ICT experience.
- Apprenticeship in Schools: The participants visit selected schools in a specific area and then train school educators. During this phase, which could last for up to 4 weeks, the trainers ares supervised by their course tutors. The use of small groups of mixed specialities is advocated, as the rationale is hands-on experience for both the trainer and trainee
- Feedback end of semester on campus
- Practice work in schools: General ICT training in schools and subject specialist training in schools.
- Further training phase: This depends on the needs of the educators and their respective schools. If the trainers require more assistance, they could then start with a new didactic phase.

Govender's (2006) framework seems to be workable, however, more details could have been provided in order to provide a 'blue print' for the Department of Education to follow. Thus, it is suggested that different scenarios should be planned for in detail in order to be easily followed by the Department of Education. Another aspect that could be useful in this framework or model is to indicate how the facilitators and trainers would address the human psychological and emotional factors, e.g. establishing a caring context in which positive relationships are forged, and how to limit anxiety. It is also important to indicate who the initial or selected teachers will be, in other words, on what basis they will be selected.

This framework could be very valuable to address the backlog regarding ICT implementation, if the buy-in of the Department of Education is obtained, if the necessary professional and skilled trainers and mentors are appointed and if the trainees are identified by making use of appropriate pre-determined criteria, e.g. identifying participants who can be identified as innovators or early adopters of innovative aspects related to education. One main barrier however, is the provision of ICT resources to schools, as without the necessary resources, innovation cannot succeed.

18.6 The adoption of ICT in the South African context

A study of the South African Institute for Distance Education (SAIDE, 2003) highlighted the basic issues with respect to the adoption of ICT in the SA context. One of these is the fact that there are schools which do not use computers at all or at a very low level. The study also highlighted the fact that adoption levels are still very low; probably as a result of the apartheid past, the lack of finances from government and the lack of expertise in the Department of Education and within schools related to ICT. The SAIDE study found that those schools that do have computers can function on one or a combination of the levels as indicated below. The SAIDE (2003, p. 184-187) study provided the following levels of computer use that they found evident in the South African context, namely:

- Level 1 — Only school administration use computers
- Level 2 — Teachers use computers for heir administration
- Level 3 — Teachers use computers to prepare worksheets and tests for their pupils
- Level 4 — Teachers access on line resources to support teaching and learning in their subject
- Level 5 — Learners use computers to develop IT skills and knowledge. No formal attempts are made to integrate this work with subject-based learning – but some incidental

use is made informally by learners for this purpose (such as using a CD in their own time, or having access to the Internet.)

- Level 6 — Learners apply basic IT skills to work across the curriculum in their IT lessons, and informally outside formal teaching time
- Level 7 — Learners use computers to do work on non-IT subjects from time to time, in a loose way and arrangement are made by their teachers as needs demand it and when resources are available [This section is not well written or explained by SAIDE]
- Level 8 — Learners use computers to do subject related work in non-IT subjects lessons in a sustained and well-integrated way

It seems fair to argue that the majority of the South African schools and their respective teachers are functioning on a wide, but different range of these levels. In many instances, there are no computers at all in the vast majority of South African schools (see Table 2.4 in section 6.1 in Chapter 2: Literature Review). Equally important, it seems that the vast majority of South African teachers do not have their own computers at home.

19. LEARNING AS A COMPLEX ACTIVITY

Complexity theory is based upon the idea that order emerges through the interactions of organisms, agents [or participants] (Davis & Simmt, 2003; Sinclair, 2004) in the system or in the activity. Davis and Simmt (2003) and Sinclair (2004) argue that the necessary, but not sufficient, conditions for a complex system to be able to learn, are (1) internal diversity, (2) redundancy, (3) decentralised control, (4) organised randomness and (5) neighbour interactions. These aspects are discussed below.

19.1 Internal diversity

Internal diversity refers to the idea that the members of a system have different capabilities or skills (Sinclair, 2004, Davis & Simmt, 2003, Davis & Sumara, 2008). The existence of internal diversity in a system or community could thus provide novel and creative responses when necessary, depending on the level of diversity within the system [or community] (Sinclair, 2004, Davis & Simmt, 2003, Davis & Sumara, 2008). The higher the diversity within a system or community, the greater the chances for new developments (Sinclair, 2004, Davis & Simmt, 2003), or the greater the possibilities for novel responses (Beswick, Watsom & de Geest, 2007). Diversity can therefore be seen as having a positive impact during learning, learning being viewed as a developmental and ongoing process.

Davis and Sumara (2008) state that diversity among members or agents can become a useful source from which various responses could be drawn when emerging circumstances dictate the need to obtain different responses in order to maintain the learning process. They continue that diversity is vital, as it is not always possible to specify in advance what sorts of variation are required for appropriate intelligent action (Davis & Sumara, 2008). However, Davis and Sumara (2008) caution that diversity could be suppressed and that this suppression could then lead to the minimisation of opportunities for innovative collective action in response to when dictating circumstances require action or a response. Another point of caution is the fact that a reduction in internal diversity could lessen a system's or learning community's capacity to respond in a quick and appropriate manner when a need arises, due to the fact that the system or community lacks a sufficient range of diverse responses (Davis & Sumara, 2008).

Within the educational context, Davis and Sumara (2008) argue that diversity cannot be assigned or legislated; rather, it must be assumed that diversity is present. Therefore, the argument is that the so-called cooperative learning contexts, in which different roles are designed to different group members, is in fact a context in which diversity has been pre-imposed. Hence, this type of cooperative learning context is a form of top-down artificially imposed diversity (Davis & Simmt, 2003; Davis & Sumara, 2008).

19.2 Redundancy

Redundancy refers to the fact that many people can do the same thing, which allows for interactions leading to common understanding, hence assisting to compensate or to assist other agents or participants when they require assistance (Sinclair, 2004, Davis & Simmt, 2003). Redundancy supports continuity, as it ensures that key skills are distributed among many agents or many participants (Sinclair, 2004). In the words of Davis and Simmt (2003, p. 150), redundancy “enables interactions among agents ... when necessary, it makes it possible for agents to compensate for others' failings.” Within this context, redundancy becomes a source of ‘stability’ (Davis & Sumara, 2008). Redundancy refers thus to the duplication and the excesses of aspects (Davis & Sumara, 2008).

It is argued that redundancy as ‘deep sameness’, is a key element in a complex learning system, as the capacity to maintain coherence within a complex learning system is dependent on the commonalities of its agents or participants (Davis & Sumara, 2008). Redundancy can therefore become a coping mechanism to assist with the maintenance of stability within a system/context when agents or participants have to compensate for other agents' or other participants' short comings or failings. Davis and Sumara (2008) highlight the possibility of the existence of ‘minimal redundancy,’ i.e. high specialisation of only a few agents or a few participants within a system or learning context. Minimal redundancy could be acceptable within a stable orderly context, but at the same time it poses a risk when the system or learning context becomes volatile, as minimal redundancy within a volatile system or learning context could lead to poor adaptability to the challenges at hand (Davis & Sumara, 2008). Maximal redundancy again, i.e. low specialisation but highly interchangeable agents, seems to be more appropriate within more volatile situations or contexts, as there are more agents or participants available to respond to the needs of other agents or participants, the fact being that less specialisation is required (Davis & Sumara, 2008). Redundancy can thus be seen as complementing internal diversity, but at the same time, it is important to note that there is within human beings more redundancy (sameness) than diversity (Davis & Sumara, 2008).

19.3 Organised randomness

Organised randomness or enabling constraints refers to the fact that although there are boundaries to work within, these boundaries still allow one to respond and to react with varying degrees of freedom, hence tasks becomes postscriptive rather than prescriptive (Sinclair, 2004). Prescriptive refers to ‘what you must do’ whereas postscriptive refers to ‘what you can't do’ (Sinclair, 2004, p. 65). Sinclair (2004) argues that postscriptive tasks allow for a greater degree of a variety of possible responsive options than prescriptive tasks. This does not imply that the agents or participants can do whatever they like, but that participants are given a greater degree of choice on how they want to explore. Davis and Simmt (2003) state eloquently that there are rules within complex systems [communities], but that "those rules determine only the boundaries of activity, not the limits of possibility" (2003, p. 154). They continue by stating that the structures or rules within a system [or community] are there to:

> *… maintain a delicate balance between sufficient organization to orient the participants' actions and sufficient randomness to allow for flexible and varies response. Such situations are matters of neither "everyone does the same thing" nor "everyone does their own thing" but of everyone participating in a joint project.*
>
> *Davis & Simmt, 2003, p. 155)*

This would thus also link with decentralised control, as organised randomness refers to being able to explore within certain boundaries, but not being constrained by these boundaries (Davis & Simmt, 2003; Sinclair, 2004; Davis & Sumara, 2008). Hence, the notion of centralised control by one person calling all the 'shots' is relinquished in favour of collective control through consensus. At the same time, Davis and Simmt (2003) argue that the facilitator or teacher is the one that will have to decide when to relax certain conditions or constraints, when to be more rigid and when to abandon them.

19.4 Neighbour interactions

Neighbours within a learning community do not work in isolation, rather, the neighbours should communicate with each other and should be able to influence or affect one another's activities (Davis & Sumara, 2008). The concept 'neighbour' within learning communities is not necessarily referring to the person(s) or social groupings only, but refers to the ideas, hunches, queries, representations, etc. that interact with one another while being neighbours (Davis & Sumara, 2008). Thus, mere interaction with one another does not necessarily imply that learning is taking place. For learning to emerge, it is required then that there should be interaction with one another's ideas, hunches, queries, representations, etc. through discussion for example. It thus becomes evident that the concept of knowledge as mere information, changes within a complex learning community as being the potential(s) to action. This implies knowledge that is dynamic, even volatile (Davis & Sumara, 2008, p. 40). It can thus be argued that knowledge is not something that is static, but fluid; as knowledge is subject to continuous revisions as a result of new experiences through interactions within the system or community (Davis & Sumara, 2008, p. 40).

The value of neighbour interactions is that it allows one in the classroom context to ‘bump up’ ideas against one another by means of peer-peer interactions, teacher-student interactions and also interactions between the student (learner/peer) and the task (Sinclair, 2004, Davis & Simmt, 2003). The neighbour interactions thus refer to the impact and effect of one agent or participant on another, the effect of the interaction(s) on development and the effect of the interactions on the agents’ or participants’ behaviour (Sinclair, 2004, Davis & Simmt, 2003). This implies that mechanisms should be planned for and put into place to ensure that participants will be able to voice their ideas and as a result, that these ideas will trigger further discussion and the blending of new and existing ideas (Davis & Sumara, 2008). The Web 2.0 applications (see section 6.6.6.2) seem to provide a platform for voicing, presenting and the ‘bumping off’ of ideas in an online context on the Internet.

19.5 Decentralised control

In a complex learning community context, there is no central figure which sends out commands to every working part. Thus, neither the teacher, nor the individual is the focus; the collective is (Davis & Simmt, 2003; Sinclair, 2004,). The above also has an influence on how learning is perceived. Learning within a complex community is not an individual activity, but a collective endeavour, as learning emerges from shared understandings (Sinclair, 2004, Davis & Simmt, 2003). Another implication of decentralised control is the fact that outcomes cannot be predicted, as outcomes emerge as a result of the collective activities and interactions between and among agents or participants (Beswick et al., 2007). Consensus plays a vital part, as the community would decide what is acceptable and what is not, as Davis and Simmt (2004, p. 153) put it, “… action can only be conditioned by external authorities, not imposed. The system [community] itself “decides” what is and is not acceptable.”

When one is part of a community, it is important to note that the traditional notion of centralised control is relinquished in neighbour interactions. That is not to say that there is no control at all, or that ‘anything goes’, but that the concept control within this context refers to the creation of a context or milieu that assists with the creation of new or emerging possibilities (Davis & Sumara, 2008). Participants would thus create their own boundaries and work within these constraints. To conclude, within learning as complexity context, the focus is not on a “knowledge-producing system”, but on “knowledge produced by the system [community]” (Davis & Sumara, 2008, p. 41) without one person being the sole authority.

19.6 Conclusion and final words on learning as complexity

It becomes evident that learning as complexity within a community/neighbourhood of learners/practice, should be a participatory process characterised by providing opportunities for expression and engagement, establishing support structures, creating learning spaces for creating and sharing experiences, creating opportunities for mentoring, developing self-worth and appreciation of contributions and creating opportunities for social connection with one another (see Davis & Sumara, 2008). This can probably be attributed to the notion that learning being a complex activity/process, emerges as a result of the collective and that knowledge within a complexity learning context does not reside within an individual, but within the collective (Davis & Simmt, 2003). Thus, knowledge and learning are determined by the collective and not by the individual. However, this does not imply that individual learning does not exist, as individuals can also be classified or described as “complex systems nested within others” (Beswick et al., 2007, p. 114).

In conclusion, the ideas of Davis and Simmt (2003), Sinclair (2004) and Davis and Sumara (2008) about the concepts (1) internal diversity, (2) redundancy, (3) decentralised control, (4) organised randomness and (5) neighbour interactions can be summarised in the following manner: Internal diversity is useful as it allows the system or learning community to develop new and creative responses to challenges. Redundancy again, supports continuity as it ensures the distribution of vital or key skills among the participants or agents. Decentralised control assists with the notion that control does not reside with one authority, but that control is shared. Organised randomness contributes a balance between redundancy (stability) and diversity (creativity). It also refers to task constraints, but seeing constraints not as being what one must do, but rather to what one cannot do, thereby creating more openness and a wider learning space which is less limiting or inhibiting. Lastly, the concept neighbour interactions refers not to just being around in a social context, but to interaction among one another's ideas, hunches, queries and representations. Therefore there are exchanges between peers, the peers and the facilitator and between the peers and their tasks.

As a result of the above, the training and teacher development approach for this research project has also drawn from the complexity literature, as opportunities have been created for neighbour interaction among participants, peer-facilitators and the project facilitator to raise their concerns and to 'bump off' ideas on what to do, how to do it and why to do it, from one another. Furthermore, the internal diversity issue had been planned for by identifying capable peers during the training in order that these peers may assist other participants in the learning community who require assistance. Boundaries were established in the form of certain ground rules, but these rules were not cast in stone, but allowed the participants the necessary learning space to explore, hence there was some form of decentralised control.

20. ACTIVITY THEORY

What is activity theory and what does it entail? The following sub-sections try to provide an overview of activity theory.

20.1 What is activity theory?

Engeström and Miettinen (1999, p. 9) state that activity theory is an object orientated, collective, and culturally mediated human activity." Lim & Chai, 2004 (with reference to Engeström, 1987) state that activity theory takes a collective-orientated activity as its prime unit of analysis (see Figure 2.5). This allows one to observe the actual learning process in context, the context being the activity system (Lim & Chai, 2004). Hence, one could state that activity theory is not a learning theory; rather it is a philosophy of learning. Hardman (2005a, p. 380) argues that:

> *If we think of computers as cultural tools, then we need to be able to ask and answer questions related to how these tools facilitate learning and, how teachers and students change the computer and are transformed by it over time. Activity theory can be used in order to understand this process of transformation within a system (such as a classroom/university laboratory) as well as illustrating how different systems interact with, and transform each other over time.*
>
> *(Hardman, 2005a, p. 380)*

She continues that “the strength of activity theory is that it enables one to understand learning as the complex result of tool mediated interactions, rather than as something opaque which happens in a student's mind” (Hardman, 2005a, p. 380). Hardman (2005a) states that within an activity system, learning is not viewed as transmission, but as transformation, and Roth and Lee (2007) add that learning within an activity system is not seen as something with a specific beginning and end, but that it should be seen as an evolving and complex process mediated by tools and social interaction. Hence, learning happens at two planes, namely the social level and psychological (individual) level (Lim & Hang, 2003; Lim & Chai, 2004).

Hardman (2007) draws from various sources to succinctly summarise activity theory principles. She states (2007, p. 2) that within an activity theory framework, the following is assumed:

- Human activity is collective
- Behaviour originates within the social realm
- The mind is social as it grows through joint activity
- Tools carry our socio-historical meanings and it is these tools that mediate our psychology
- Activity theory is concerned about development and change
- Activity theory assumes that people are active cognitive agents
- Activity theory assumes that people have to act or participate in sites or contexts that they did not choose or do not prefer

- Activity theory favours an emergent nature of the mind in activity, rejecting at the same time cause and effect explanations

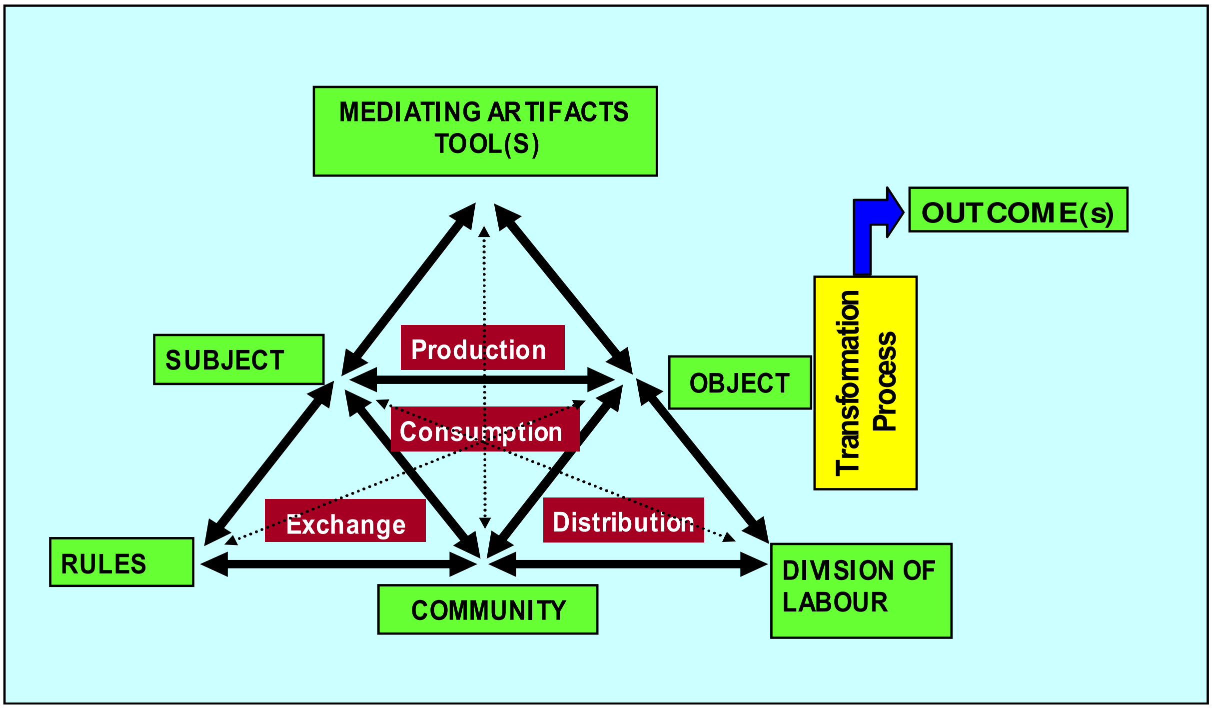
- Activity systems are constantly subject to change and these changes are driven by contradictions

According to Hardman (2007), activity theory serves as a heuristic device that guides the researcher to try and answer questions pertaining to human activity; it is not a theory that has predicative power.

20.2 The mediational structure of an activity system

In an activity system, the subject, object, tools, community, rules (also named 'praxis' by some, see Turner & Turner, 2001) and division of labour are the different components or nodes (see Figure 2.9) in the activity system (Engeström, 1999; Roth & Lee, 2007).

Figure 2.9: Mediational structure of an activity system (Adapted from Engeström, 1999; Roth & Lee, 2007)



The mediational triangle above in Figure 2.9 represents the basic structure of human cognition that results from tool mediation (Engeström, 1999). Subjects refer to the participants in an activity who are motivated towards attaining the purpose of the object. The object can refer to either

(1) the goal of an activity, (2) the subject's motives for participating in an activity, and/or (3) the material products that subjects gain or create through an activity (Yamagata-Lynch & Haudenschild, 2009, p. 2). Murphy and Rodriguez-Manzanares (2008) state that the object precedes and motivates activity. They continue by stating that tools are socially shared cognitive and/or material resources that subjects can use to attain the object. Within the activity system, informal or formal rules regulate the subject's participation while engaging in an activity. The community is the group or the organisation to which subjects belong (Yamagata-Lynch & Haudenschild, 2009, p. 2). The division of labour refers to the shared responsibilities in the activity determined by the community (Yamagata-Lynch & Haudenschild, 2009, p. 2). The outcome is the consequences that the subject faces as a result of his/her (subject's) actions driven by the object (Yamagata-Lynch & Haudenschild, 2009, p. 2).

20.3 Levels of an activity or activity structure

Activities within an activity system are longer-term formations, as objects cannot be transformed into outcomes at once, because transformation is a process that consists of several steps or phases (Kuutti, 1995). An activity consists of an action or actions and the actions consist of operations. Each activity has a motive or motives, each action or actions are goal directed and each operation is underpinned by certain conditions (Kuutti, 1995). Take the cyberhunt project for example:

- The activity is the development of teachers during training to design cyberhunts and to achieve certain outcomes linked to problem statement, the aims of the study, the research questions and the relevance of the study.
- The motive is to enable the participants to be able to design and implement cyberhunts at their respective schools.
- The action refers to the participation of the participants in the cyberhunt design project.
- The goal or need refers to the participants who want to develop their ICT skills and to develop professionally.

- The operation(s) entails practical involvement in cyberhunt design, expressing feelings and experiences through journal reflection sheets, etc.

- The conditions refer to using the necessary training context, an ICT laboratory or classroom, support materials, support by means of the facilitator and their peers, regular weekly training sessions, opportunities for cyberhunt design, etc.

Jonassen (2002, p. 50) summarises the interaction of the above as follows: Activities are driven by the motives of the activity system with the view to the object being achieved or affected. The actions are determined by the previously established goals and the operations are automated performances that are performed to execute the actions (Jonassen, 2002, p. 50).

20.4 Subsystems: Production, consumption, distribution and exchange

Four subsystems (see Figure 2.5) exist within an activity system, namely the production, consumption, distribution and exchange subsystems (Smørdal, 1997:IS; Davydov, 1999; Jonassen, 2002; Roth & Lee, 2007). These four subsystems are discussed below.

The production process involves the subject, object, tools, actions and operations (Jonassen, 2002). Furthermore, it is also important to note that the production subsystem is the primary focus of the activity, as the goal of the activity is to assist the subject (participant) to produce a new physical object or mental process in order to achieve the planned outcomes (Jonassen, 2002). At the same time, while the subject/participant is busy with the production/creation of a new object or with new mental processes, the subject/participant is also producing or constructing knowledge about the activity, the activity's components and the activity's assumptions and identifying contradictions (Jonassen, 2002; see also Davydov, 1999 and Roth & Lee, 2007). It is thus envisaged that the subject is also transformed (not only the object), as a result of the functioning of the mediated tools at the apex of the triangle and through the influences of the unmediated functioning of the rules, community and division of labour at the base of the activity triangle. In summary, production denotes the relationship between subject (a human) and object (Smørdal, 1997:IS[27]). Within the cyberhunt project, the relationship between the subject (being the participants) and object (being the participant designed

[27] The abbreviation IS refers to an Internet source. This source does not have clear page numbers, as it was in pure hypertext markup language (html). Hence, direct quotes from this source are just indicated by inverted commas.

cyberhunts) is mediated through the computer, Internet, journals, discussions and language as tools (see also Smørdal, 1997:IS).

The consumption subsystem involves the subject, object and community. The consumption subsystem describes how the subject and community work together to act on the object (Jonassen, 2002), or as also Smørdal (1997:IS) states, it covers the use of products and/or services of the activity by the subjects or participants involved. The community supports the production process, as the subject operates (functions) and/or learns within a community by means of the interactions among the different members (Jonassen, 2002). Smørdal (1997:IS) puts it like this:

> *The individual is not isolated but is a part of a community, and the activity is affected by the individual's participation within this community.*
>
> *Smørdal (1997:IS)*

These interactions among subjects or participants assist the subject/participant to consume or to internalise what has been discussed, queried, etc. with a view to assist the subject/participant with the production process' contradictions (Jonassen, 2002; see also Davydov, 1999 and Roth & Lee, 2007). Within the cyberhunt teacher development project, the participants support one another within a community during the design process, as the cyberhunt teacher development process has been informed by a community of practice (COP) framework (see section 12.7).

The distribution subsystem links the object of activity to the community through the division of labour (Smørdal, 1997:IS; Jonassen, 2002). Thus, the division of labour comprises of the so-called social laws and/or expectations (Jonassen, 2002). With reference to the cyberhunt teacher development project, distribution was achieved as a result of each participant being aware of what he/she was responsible for and what the rules and time frames associated with the cyberhunt project were.

Lastly, exchange denotes the relationship between the subject and the community (Smørdal, 1997:IS). The exchange subsystem links the subject and the community through rules of social behaviour and communication (Smørdal, 1997:IS; Jonassen, 2002). The nature of the activity would thus have an impact on the rules. These rules regulate performance (Jonassen, 2002) or state what is expected from the subjects/participants. Within the cyberhunt project, the participants exchange ideas through communication with one another, with the peer-facilitators and with the project facilitator.

20.5 Contradictions

Russel and Schneiderheinze (2005) argue that the different components or nodes of an activity system in many cases (e.g. the rules and division of labour) represent the viewpoints, beliefs, voices, layers and historicity of certain individuals, subjects or even certain cultural organised contexts. As a result of individuals or groups coming from different contexts, this often causes contradictions within teachers (or the participants in the activity system). They argue that teachers' (or participants') viewpoints, beliefs, voices, layers and historicity are in most instances different from the new tool or new strategy that a new approach brings and therefore create tension and contradictions. Contradictions refer to change(s) within or between (among) activity systems (Turner & Turner, 2001; Barab, Evans & Baek, 2004; Yamagata-Lynch and Haudenschild, 2009). Change is thus driven by contradictions (Hardman, 2005b). Russel and Schneiderheinze (2005, p. 39) explain what is meant by contradictions when they say that it occurs:

> *When teachers attempt to implement a technology innovation in the classroom, they naturally face the complex challenge of fitting together new ideas with deep-rooted pedagogical beliefs and practices. … The ways they respond to these tensions affects how effectively they implement the intended reform [change/innovation/strategy].*
>
> *(Russel & Schneiderheinze, 2005, p. 39)*

It is important to note that in this study related to teacher development to implement cyberhunts, in which the participating teachers used technology (computers) and the Internet as tools for cyberhunt design, that the participating teachers had to reconsider their current teaching practice(s) in terms of the rules and the division of labour required by cyberhunt design. This resulted in the identification of contradictions. Contradictions within the cyberhunt context can be defined in many areas, e.g. the context is different from the traditional one as the computer as tool is used, and the rules of how the classroom should be managed and the type of learning that the learners are engaged with are different from the traditional non-computer context.

Hardman (2005b) argues that it is important to uncover contradictions, as these contradictions could inform us of potential shifts in pedagogical practice. She continues by stating that it is important for teachers to confront, deal with and overcome the contradictions, as dealing with the contradictions will determine how well teachers appropriate new tools within their schools (Hardman, 2005b).

Four levels of contradictions can be identified (based upon Engeström) according to Turner and Turner (2001), Barab, Evans and Baek (2004), Yamagata-Lynch and Haudenschild (2009), namely; primary contradictions, secondary contradictions, tertiary contradictions and quaternary contradictions. Table 2.22 provides an overview of each of these contradictions.

Table 2.22

Engeström's four levels of inner contradictions in activity systems

Contradictions	**Turner & Turner (2001, p. 2-3)**	**Barab, Evans & Baek (2004, p. 203-204)**	**Yamagata-Lynch and Haudenschild (2009, p. 4)**
Primary contradictions	Contradictions within a single node (e.g. within the Rules or within the Division of labour). Implies that breakdowns exist between actions or sets of actions within the node.	Arise within each node of the central activity under investigation; this contradiction emerges from tension between USE VALUE and EXCHANGE VALUE.	When activity participants encounter more than one value system attached to an element within an activity that brings about conflict.
Secondary contradictions	Contradictions which occur between nodes (e.g. between the Subject and the Rules of the activity).	Arise between constituent nodes (e.g. between the Subject and the Tool) of the central activity system.	When activity participants encounter a new element of an activity, and the process for assimilating the new element into the activity brings about conflict.
Tertiary contradictions	Contradictions occur between an existing activity and what is described as a more advanced form of that activity. Takes place when an existing activity is remodelled to take into account new motives or new ways of working (e.g. culturally more advanced activity).	Arise between the object/motive of the central activity and the object/motive of a culturally more advanced form of the central activity.	Tertiary contradictions occur when activity participants face conflicting situations by adopting what is believed to be a newly advanced method for achieving the object.
Quaternary contradictions	Contradictions occur between different co-existing or/and concurrent activities.	Arise between the central activity and adjacent activities, for example, instrument (tool)-producing, subject-producing and rule-producing activities.	Quaternary contradictions occur when activity participants encounter changes to an activity that result in creating conflicts with adjacent activities.

20.6 Unmediated functioning, mediated functioning and the cyberhunt project

According to the Vygotskian notion of higher and elementary mental functioning, "unmediated (elementary) functioning occurs along the base of the triangle; while mediated (higher) functioning are interactions between the subject (individual) and object (task) mediated by tools, at the vertex of the triangle" (Lim & Chai, 2004, pp. 220-221).

In the ICT classroom, the subject is the learner[28], and the object the lesson outcomes (or higher order thinking skills, motivation and interest, greater interaction or collaboration, etc.) that the learner needs to achieve. The mediating tools are the lesson design, the media used, the software, the information on the Internet, etc. The learner works within the social community of the class, and is subject to the rules of the teacher and the school. The division of labour is negotiated between the teacher and the learner (Lim & Chai, 2004).

With reference to this study (based upon Hardman, 2005a), taking the ICT based cyberhunt teacher training development sessions as an activity system, the facilitator acts on the participating teachers' (learners as subjects) through the use of tools, in order that the subjects are empowered to design cyberhunts (the object). Through tool mediation and the unmediated functioning of the community and the division of labour, the envisioned outcomes as a result of the creation of their own cyberhunts as artefacts, are the development of computer knowledge/skills and cyberhunt knowledge/skills, increased collaboration and the enhancement of motivation and interest. Thus, the envisioned object is the creation of a cyberhunt artefact and the envisioned outcomes are teachers who are enabled to design cyberhunts in a collaborative or individual manner in a context that promotes motivation, interest and the critical outcomes (outcomes) [see Table 2.9C or Appendix C7 regarding the critical outcomes' relation to design skills].

The rationale for the design of cyberhunts embedded by 'learning as design', is based on the belief that the learning as design approach is an active knowledge creation process, which focuses on the process and the product during the learning process (see Perkins, 1986). In this study the personal cognitive processes, motivation and interest and collaboration through design are mediated by the

[28] In this study, the learners were the participating teachers.

tools (ICT) in the apex and the tools are supported by the functions at the base, i.e. the rules, community and division of labour (Du Plessis & Webb, 2008, with reference to Lim & Chai, 2004). These interactions between these functions have been shown to result in authentic learning experiences (Du Plessis & Webb, 2008).

21. SUMMARY

This chapter provided an overview of the literature in order to design and to implement the cyberhunt strategy. In this chapter, the following aspects were addressed:

- What is meant by ICT implementation and integration?
- What examples and types of ICT integration are known to us, as well as what are the stages of ICT integration?
- Why it is important to design artefacts with reference to ICT?
- What models-frameworks are available related to ICT integration?
- What are the theoretical perspectives for designing cyberhunts?
- What do learning theories imply for teacher development?
- What models-frameworks are available for teacher development?
- What are the important aspects related to teacher development, and what are the theoretical perspectives on teacher development and implementation of ICT within this study?
- What are the first and second order barriers to be addressed, and how does one ameliorate these first and second order barriers?,
- What is meant by the diffusion of innovation? And
- What is complexity learning and what is activity theory and how did these two factors influence this project?

As Internet access is not common in South African schools, approaches or strategies have to be designed and implemented to ascertain which approaches could be implemented to introduce the Internet to teachers and learners within a constructivist learning context. It was argued that cyberhunts seem to be a promising approach that could be used to introduce teachers and learners to the Internet. It is important to note that the cyberhunt approach is only one of many approaches and not ‘the’ approach. Therefore, it was important to draw on what the literature states related to perceptions of ICT integration, knowledge generation and professional teacher development, as this informed the professional teacher training development process for this project.

Activity theory was used to visually present the theoretical aspects underpinned by learning being a social and individual construct within a community of practice underpinned by cognitive apprenticeship, knowledge generation theory and learning as complexity theory. Activity theory was also used to assist the project facilitator to plan the cyberhunt design teacher development process.

CHAPTER 3

METHODOLOGY

1. INTRODUCTION

Methodology refers to the way in which a person approaches research. The methodology implies that there is a research design, underpinned by certain philosophical principles, as well as a research design process. It is important to not confuse the research design and the research design process (Gibson & Brown, 2009). The research design refers to a specific or particular approach to research e.g. experiments, case studies, ethnography, action research, etc., whereas the research design process refers to "the practice of working through a given focus for research and the generation of a research plan and design for that topic" (Gibson & Brown, 2009, p. 48). The research design process includes deciding about the type of data required to explore, as well as how to generate the data, i.e. what data gathering tools are required and what the contents of the different data gathering tools will be (Gibson & Brown, 2009). Hence, the methodology provides the overall framework in order to understand how the study was developed and why particular decisions had been made.

In this chapter an overview of the metacognition (the thinking about my thinking) process used by the researcher to arrive at the ontological and epistemological position of this study is provided. Different research paradigms are reviewed to locate the study, the debate between qualitative and quantitative research methods is briefly discussed, the critical realist perspective or position related to research is probed, and the case study method is explored. In-depth discussions of the different data instruments that have been utilised, as well as their value, are also included. In addition, the specific sampling method, ethical considerations, as well as data collection instruments, data interpretation, data analysis and issues of validity, reliability, credibility and triangulation are discussed. The intervention designed to prepare and develop the participating teachers during the project are also briefly indicated, as well as the operational strategy of the project (see Appendix B for a detailed overview).[29]

2. THE METACOGNITION PROCESS

One of the issues I had to deal with was the question, 'Will I first select a paradigm or perspective underpinned by a certain ontological, epistemological and methodological position and then frame the research question and objectives of the study; or should I first determine the research question and objectives of the study and then decide which ontological, epistemological and methodological position would serve the objectives of the study?'

Savenye and Robinson (1996, 2004) believe that there are two ways in which research questions are framed and directed; the first is that one's perspective (or the paradigm to which one ascribes) will direct the type of research question and the methods used. This approach implies that one first has to indicate within which paradigm one is working in and then frame the questions and methods. Their second option is that researchers define their research question, thereafter they select the methods they will use based upon the questions that will drive the study, and then identify the paradigm(s) within which they are working (Savenye & Robinson, 1996, 2004). They argue that researchers should consider the second option and be careful not to force themselves to either follow a qualitative or quantitative route – seeing the two approaches as being separate – as this could result in limiting and inhibiting the quality of the research to be undertaken (Savenye & Robinson, 1996, 2004).

In a similar manner, Gay and Airasian (2000) and Punch (2005) argue that the topic statement or research questions provide the direction for the research plan, thus the problem under investigation suggests the types of data that may possibly exist or that could be probed. Punch (2005, p. 20) cautions against "methodolatry"; "putting method before content", hence, the research questions have to be developed first and then the researcher fits the methods and techniques to the questions (Punch, 2005, p. 21). At the same time, Punch (2005, p. 21) acknowledges that "methods can also indirectly influence research questions, constraining what can be studied" but he also

[29] PLEASE NOTE: All the data referred to as in the appendices and all appendices are attached to this thesis on a CD containing the PDF files. All references to any Appendix are available on the CD.

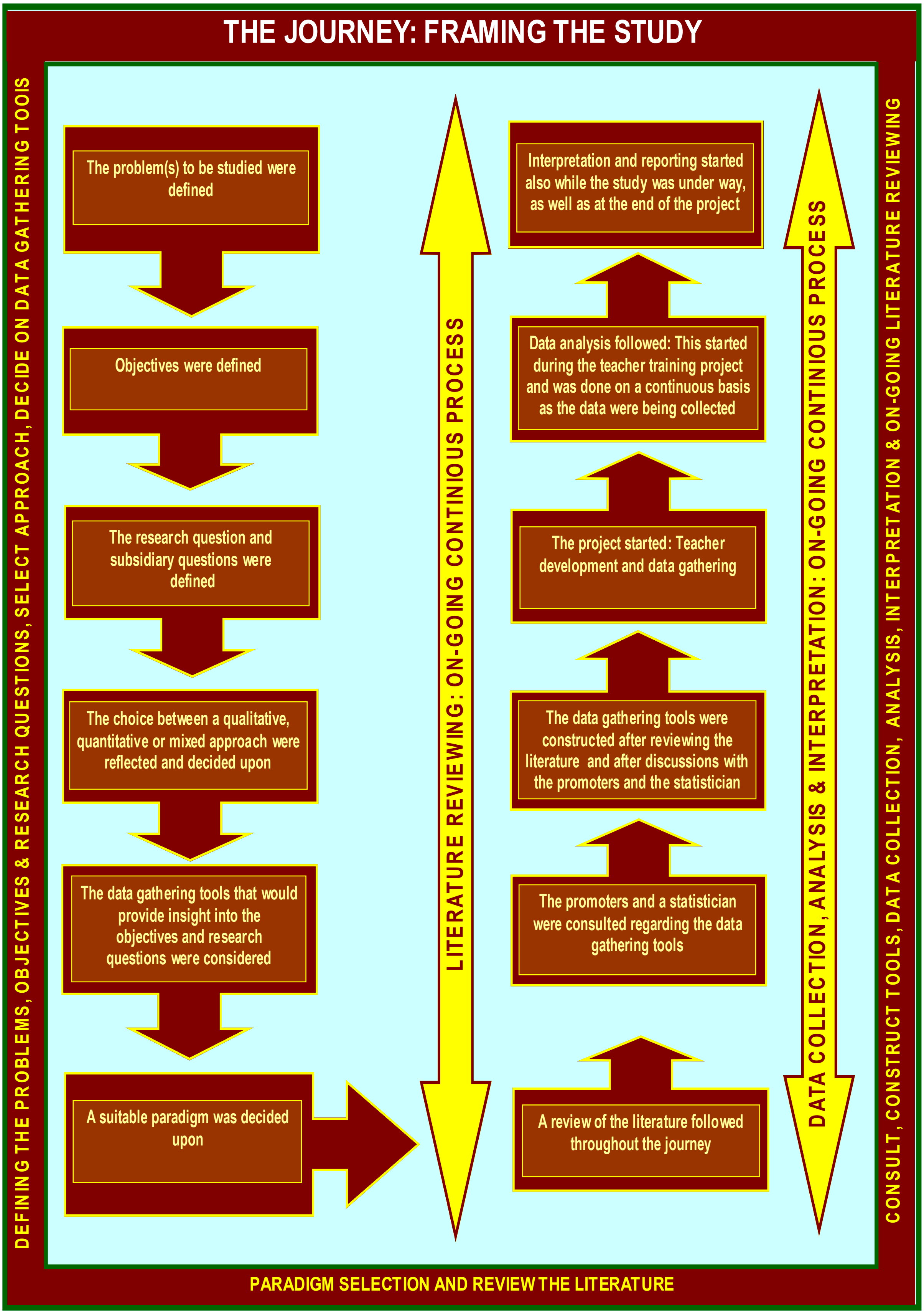
emphasises the importance of formulating the questions first, and then deciding on the methods to be used.

By taking heed of all of the above, I embarked on the journey to frame this study. I conceptualised the research in the following manner:

- The problem(s) to be studied were defined,
- Objectives were defined,
- The research question and subsidiary questions were defined,
- Next I thought which approach will work best; quantitative, qualitative or a mixed approach,
- Then I thought which data gathering tools could be used to provide insight into the objectives and research questions,
- A suitable paradigm was decided upon,
- An expanded review of the literature followed,
- The promoters and a statistician were consulted,
- The data gathering tools were constructed after reviewing the methodological literature,
- Then only did the teacher development project started as well as the data gathering process,
- Data analysis commenced right through the teacher development process as the data were collected,
- Interpretation and reporting also started while the study was under way and continued at the end of the project.

This process, as indicated above, is schematically represented in Figure 3.1 on the next page.

Figure 3.1: A schematic overview of the research journey



3. BACKGROUND, CONTEXT, PROBLEM STATEMENT, OBJECTIVES AND RESEARCH QUESTIONS

Before I frame the research by providing the ontological, epistemological and the methodological assumptions about how the study was approached, it is important to follow the journey on which I embarked to arrive at these assumptions. The rationale for framing this study ontologically and epistemologically is that:

> *All practice is rooted in some theoretical framework, if not explicitly, then implicitly. Since methods are based upon epistemology, and epistemology is based on ontology, educational practice is never value-free.*
>
> *(Gamache, 2002, p. 286)*

The initial context[30] was as follows (see Chapter 1, Section 9): Six disadvantaged schools (four primary schools and two high schools) in the Missionvale area in Port Elizabeth (Eastern Cape Province) South Africa formed the convenience sample for this project. Each of these six schools had received twenty computers from the Dell Foundation through the Centre for Educational Research, Technology and Innovation (CERTI) at the Nelson Mandela Metropolitan University (NMMU). Each school selected six teachers to participate in the project. The six schools formed the case to be investigated. The needs and concerns that these schools voiced during the Science Mathematics and Information in Schools (SMIS) project meetings, were as follow (see Chapter 1, section 5, for the problem statement):

- There is a lack of contact between the teachers and the computer facilitator (if the school has one).
- What happens in the computer room is not directly linked to what happens within the classroom.
- Teachers responsible for their own class's computer integration do not know what to do as they lack basic computer and Internet skills.

[30] In this section, I repeat what has been mentioned in Chapter 1, in order to provide a more detailed and comprehensive picture in the methodology chapter.

- There is a need to establish the integration of computers within learning areas and assistance with the implementation of integration.

- There is a need to become personally involved with computer integration and to play an active part in the establishment and implementation of computer integration at schools.

- In many cases, one person is responsible for teaching computer literacy to the whole school.

- The Internet has to be introduced to teachers and learners, but teachers do not have access to the Internet, nor do they know how to introduce the Internet or how to implement Internet related strategies in teaching and learning.

Support related to e-Education from the Port Elizabeth Education District, which resorts under the Eastern Cape Department of Education (DoE), is not provided. Inspections of previously disadvantaged schools in the Missionvale area in Port Elizabeth during 2007, revealed that these schools either have no computer technology or have very old equipment that is in need of replacement. Internet connectivity was also observed to be virtually non-existent. The teachers from these disadvantaged schools indicated that they would like to be empowered to become skilled users of computers and the Internet. Hence, it became evident that the problem is the need for teachers to be able to use and integrate the Internet as a tool in their teaching and learning, as required by the *Draft White Paper on e-Education* (Department of Education, 2003, 2004).

By keeping the above-stated context and problem areas in mind, the following aims were formulated to enable the formulation of the research questions and to provide direction for the teacher development process (study intervention). These aims were to:

- Develop a strategy to introduce the participating teachers to the Internet in an integrative manner.

- Establish what the problems, concerns and barriers are that mitigate against the implementation and integration of the cyberhunts as an ICT learning and teaching strategy and how the identified barriers can be addressed.

- Establish, on a continuous basis, how participants experienced the professional training development process used to prepare them for cyberhunt implementation in order to address teacher needs during the process with a view to make any necessary changes and to assist with future planning and teacher development-training sessions.

- Ascertain whether the cyberhunt approach can address the critical outcomes of the South African National Curriculum Statement (NCS).

- Establish to what extent the cyberhunt approach can enhance motivation and interest in teachers.

- Determine in what way the creation of a cyberhunt encourages collaboration.

These main aims informed the main research question of the research project, namely: Can teachers be trained in a collaborative and motivational manner to effectively use a generative ICT strategy based on cyberhunts to address the critical outcomes of the South African National Curriculum Statement? From this main research question, the following subsidiary questions emerged and have been investigated in this study as indicated in Table 3.1 below. It must be noted that some data collection tools were designed in such a manner that they could be used to assist with more than one subsidiary question, for example, journals and reflection sheets (Appendix K, L & M) and semi-closed-open-ended questionnaire (Appendix N, O & P) gathered data on more than one research question (see Table 3.1). The data gathering tools that have been used in this study have also been indicated in Table 3.1 adjacent to each subsidiary question.

Table 3.1

Subsidiary research questions and related data gathering tools

Subsidiary questions	Data tools used
Question 1: How ready are the teachers and their schools for ICT integration as perceived through the eyes of the participating teachers?	Likert scale questionnaire [Appendix E] Computer skills questionnaire [Appendix F] Informal unstructured interviews Internet user group [Appendix I] Observations [Informal]
Question 2: What skills or aspects are developed by teachers-as-learners during their participation in the cyberhunt approach?	Journals and reflection sheets [Appendix K, L & M] Semi-closed-open-ended questionnaire [Appendix N, O & P] Interviews [Appendix W] Final pre-post Likert questionnaires [Appendix S, U] Informal unstructured interviews Task elicitation [Appendix R] Informal observations and observation such as indicated in Appendix Q
Question 3: Does the creation of a cyberhunt encourage motivation and interest?	Journals and reflection sheets [Appendix K, L & M] Semi-closed-open-ended questionnaire [Appendix O & P] Interviews [Appendix W] Pre-post Likert questionnaires [Appendix T] Informal unstructured interviews Informal observations and observation such as indicated in Appendix Q
Question 4: Does the creation of a cyberhunt encourage collaboration?	Journals and reflection sheets [Appendix K, L & M] Semi-closed-open-ended questionnaire [Appendix O] Interviews [Appendix W] Pre-post Likert questionnaires [Appendix T] Informal unstructured interviews Informal observations and Observation such as in Appendix Q
Question 5: How should the teacher development process for ICT integration using cyberhunts be managed?	Journals and reflection sheets [Appendix K, L & M] Semi-closed-open-ended questionnaire [Appendix P] Interviews [Appendix W] Pre-post Likert questionnaires [Appendix V] Informal unstructured interviews Informal observations and observation such as in Appendix Q

This approach enabled me to define the research questions first, after which I investigated which paradigm would be most suitable. Hence, it was the research questions that informed the selection of a paradigm for this research and not the paradigm forcing the researcher to formulate research questions linked to a specific paradigm. The rationale was that I did not want the methodology to inform the research question(s). However, I do acknowledge that it could be possible that previous research and the previous paradigms, in which my previous research had been framed, could have sub-consciously played a role in the manner in which the questions were formulated and thus the paradigm decided upon.

4. THE RESEARCH PARADIGM JOURNEY

To arrive at a framework for this study was a long journey, as I had to review the different paradigms and their ontological, epistemological and methodological assumptions. A review of the research methodology literature suggests that three main paradigms exist; namely (1) positivism (empiricism) or post-positivism, (2) interpretivism or hermeneutics and (3) critical theory (Usher, 1996; Cohen et al. 2000, 2007; Denzin & Lincoln, 2005). However, further reviews suggest that other thinking related to paradigms do exist. This receives attention below.

Guba and Lincoln (2005) refer to positivism, post-positivism, constructivism, critical theory and participatory paradigms. A closer inspection indicates that Denzin and Lincoln's (2005) position can be grouped into three main paradigms by grouping their paradigms into (1) positivism and post-positivism, (2) constructivism and (3) critical theory and participatory paradigms. Healy and Perry (2000) acknowledge the first three, but add a fourth paradigm; realism. Creswell (2003) and Creswell and Plano Clark (2007) also consider the traditional three paradigms; namely (1) post-positivism (they exclude positivism), (2) constructivism and (3) advocacy and participatory paradigms, but they also define a fourth one namely (4) pragmatism. Mertens (2005) mentions four paradigms, namely (1) positivism/post-positivism, (2) constructivist, (3) transformative and the (4) pragmatic. However, she does not explicitly refer to critical theory, but then critical theory can be seen as corresponding to the transformative paradigm when comparing what Denzin and Lincoln (2005), Guba and Lincoln (2005) and Mertens (2005) mention related to ontology, epistemology and methodology. As an understanding of these paradigms impacted on the design of this study, these paradigmatic perspectives are discussed below.

4.1 Positivism

Ontologically, positivism sees reality as something that is apprehensible; and epistemologically it holds a dualist/objectivist view which sees findings as true, based upon verification of hypotheses to establish facts or laws (Denzin & Lincoln, 2005; Guba & Lincoln, 2005). Methodologically the focus is on quantitative methods (Denzin & Lincoln, 2005; Guba & Lincoln, 2005; Mertens, 2005). Positivism assumes that the social world can be studied in a similar manner to the natural world through a value-free [objective] method (Mertens, 2005). Positivism's goal of knowledge is to describe the experienced phenomena, and therefore the role of science is to uncover what one can observe and measure by deductive reasoning through experimentation in an objective manner (Trochim, 2000a). Cohen et al. (2007, p. 11) state that positivism claims that "science provides us with the clearest possible ideal of knowledge." In positivism, verification determines whether something is true or false (Cohen et al., 2000, 2007), or in the words of Guba and Lincoln (2005), a verified hypothesis establishes whether something is a fact, factual or a law. Observation and measurement are the central tenets in positivism, based upon empiricism (Trochim, 2000a).

Usher (1996, p. 13) views positivism as an approach that is "unreflexive with its focus on determinism, rationality, impersonality and prediction", which implies a strong negation of qualitative data. Quantitative research studies focus on numerical data and involve some kind of measuring (Walsh, 2001, p. 7). Cresswell (2003, p. 18) adds that quantitative research is characterised by cause and effect thinking, reduction, the use of measurement, the testing of theories and/or the use of experiments and surveys, in order to collect statistical data by means of implementation of a pre-determined research plan. Thus, so-called scientific procedures are applied to seek answers (Cohen et al., 2000, 2007).

Struwig and Stead (2001) describe quantitative research as a form of research that involves relatively large data samples and that requires fairly structured data collection procedures, thus quite more structured than qualitative research tools. Furthermore, they continue, the analysis of quantitative data is normally predetermined prior to the research process. However, I would like to argue that if the researcher uses fixed pre-determined interview questions or fixed pre-determined open-ended questions in an open-ended questionnaire, that this pre-determined qualitative data collection tool could also become much more structured and lends itself also to 'easier' analysis. Cohen et al. (2007, p. 11) argue that human behaviour and social phenomena are complex and therefore in striking contrast "with the order and regularity of the natural world." This complexity becomes evident in classroom contexts and one may legitimately ask whether it is advisable to use the positivist approach in educational research.

4.2 Post-Positivism

According to Trochim (2000a, p. 2), post-positivism "is a wholesale rejection of the central tenets of positivism." Ontologically, post-positivism views reality as apprehensible, but only partially or imperfectly (Denzin & Lincoln, 2005; Guba & Lincoln, 2005). Thus, absolute objectivism by an individual is not possible, as all people are biased and their observations are therefore distorted as a result of being theory-laden (Trochim, 2000a).

Epistemologically, post-positivism holds a modified dualist/objectivist and critical position, as the focus is not on verifiability, but on falsification, holding that the research findings are only probably true (Denzin & Lincoln, 2005; Guba & Lincoln, 2005). This flows from the fact that our perceptions and constructions of reality are imperfect and fallible (Trochim, 2000a; Mertens, 2005) and absolute truth can never be found (Creswell, 2003). This is the part where positivism and post-positivism clearly differentiate, as in positivism a verified hypothesis establishes that something is a fact or a law, whereas in post-positivism it is a non-falsified hypotheses that constitutes possible or probable facts or laws (Denzin & Lincoln, 2005; Guba & Lincoln, 2005).

Methodologically, post-positivism focuses on quantitative data, primarily (Mertens, 2005), but qualitative methods may be included (Denzin & Lincoln, 2005; Guba & Lincoln, 2005). According to Creswell (2003, p. 7) "Post-positivism reflects a deterministic philosophy in which causes probably determine effects or outcomes." Theory 'verification' (Cresswell, 2003) through attempts at falsification, is paramount in this approach (Denzin & Lincoln, 2005; Guba & Lincoln, 2005).

4.3 Interpretivism and/or constructivism

Ontologically, interpretivism or constructivism views reality as being socially constructed (Creswell, 2003; Denzin & Lincoln, 2005), resulting in subjective realities (Johnson & Onwuegbuzie, 2004). Epistemologically, interpretivism or constructivism holds a transactional/subjectivist view of created findings (Creswell, 2003; Guba & Lincoln, 2005; Denzin & Lincoln, 2005) based upon consensus of individual and/or collective reconstructions (Guba & Lincoln, 2005; Denzin & Lincoln, 2005). Interpretivism presents us with a “complexity of views rather than narrowing meanings into a few categories or ideas” (Creswell, 2003, p. 8). The aim of interpretivism is understanding and therefore the participants “provide an account of their world in their own words” through language as a tool in as normal and authentic as possible way (Henn, Weinstein & Foard, 2006, p. 14). This implies obtaining accounts that come from the inside and not the outside, by providing a detailed version of human experience through the eyes of the participants, or by getting “inside the person and to understand from within” (Cohen et al., 2007, p. 21).

Methodologically, interpretivism or constructivism focuses on qualitative data methods (Denzin & Lincoln, 2005) within an analytic-inductive method, not to test theory, but to build it (Henn, Weinstein & Foard, 2006). However, Creswell and Plano Clark (2007) state that while qualitative data are typically associated with this approach this does not imply that quantitative data are excluded. Multiple methods of qualitative data collection are used within qualitative research (Cresswell, 2003) such as different types of interviews, observation, documentation analysis as well as open-ended questionnaires.

Bogdan and Biklen (2003) mention that qualitative research has been called many different names, for example, the anthropologists use the term ‘fieldwork’, whereas the educational researchers use the term ‘naturalistic’ because the researcher investigates the events where they naturally occur by means of a natural behaviour, for example, visiting, talking, observing. They also inform us that other names for qualitative research is ethnography, inner perspective, case study, interpretive, ecological, descriptive and symbolic interactionism.

4.4 Critical theory

Ontologically, critical theory and its associates have a 'virtual' perspective on reality that is shaped by social, economic, ethnic, political, cultural and gender values (Guba & Lincoln, 2005; Denzin & Lincoln, 2005). Epistemologically, critical theory holds a subjective and value-mediated view of co-created findings (Denzin & Lincoln, 2005). Research within this perspective can therefore never be "entirely objective or value free" (Henn et al., 2006, p. 17). Methodologically, the emphasis is on qualitative data through a dialogic and dialectical approach (Guba & Lincoln, 2005; Denzin & Lincoln, 2005), but again quantitative data approaches cannot be excluded (Creswell & Plano Clark, 2007). Within the educational context, participatory action research is associated with critical theory, as it has at its aim to improve classroom practice. Participatory action research is a cyclical process by identifying a problem, designing a plan for improvement, implementing or acting, observing during and after implementation or practice and reflecting on the whole process with a view to identifying problem areas and successes and to addressing the problem areas by starting the cyclical process again (Cohen, at al., 2000).

4.5 Pragmatism or mixed research methods

Pragmatism has been termed a paradigmatic stance which claims that knowledge is produced as a result of "actions, situations and consequences", which is in contrast to the post-positivism's "antecedent conditions" (Creswell, 2003, p. 11). Ontologically, pragmatism acknowledges the existence of singular and multiple subjective realities (Creswell & Plano Clark, 2007). Epistemologically one could then argue that as a result of the singular and multiple subjective realities ontologically, the position will be an objective-subjective position, but Creswell and Plano Clark (2007) do not provide a clear stance here. The only position epistemologically is that of practicality (Creswell & Plano Clark, 2007), which could imply both closeness and distance between the researcher and the research aspect or participants. Closeness and distance might also imply the combination of post-positivistic and interpretive/constructivist epistemologies.

Methodologically pragmatism includes a pluralistic approach in which qualitative and quantitative data can be used as a mixed method design method (Creswell, 2003; Creswell & Plano Clark, 2007). A mixed method approach can be undertaken in four different designs, namely a triangulation design procedure, embedded design, explanatory design or exploratory design – each one focusing on both qualitative and quantitative data collection methods (Creswell, 2003; Creswell & Plano Clark, 2007). The difference between these approaches is the sequence of qualitative or quantitative data collection, and which of these two data collection strategies will be the starting point and main emphasis for the research: concurrent or sequential and qualitative or quantitative data as the first data collection approach (Creswell, 2003; Creswell & Plano Clark, 2007).

When using a pragmatic approach (mixed methods) researchers are at liberty to use all or any appropriate methods to understand the problem (Creswell, 2003). According to Creswell (2003, p. 12), "pragmatism opens the door to multiple methods, different worldviews, and different assumptions, as well as to different forms of data collection and analysis in the mixed methods study."

Johnson and Christensen (2008) highlight the fact that there is a distinction in mixed research methods between mixed method research and mixed model research. They state that in mixed method research, qualitative and quantitative data are collected either concurrently or sequentially in separate studies (Johnson & Christensen, 2008). Thus, for example, the first phase could have a qualitative research study phase to generate qualitative data for theory generation, and in the second phase one could then construct a quantitative questionnaire with a separate sample or group to test whether it is probably true or not (Johnson & Christensen, 2008). In mixed model research again, the researcher uses both qualitative and quantitative research within a stage or across two of the stages in the research process (Johnson & Christensen, 2008) with the same group or sample. The qualitative data can be analysed qualitatively and/or quantitatively or some of the data could be converted to variables and then analysed quantitatively (Miles & Huberman, 1994).

5. CRITICAL REALISM AND REALIST SOCIAL THEORY

The following section deals with the question 'what is critical realism' and continues to explore the way in which the researcher arrived at the research perspective used in this study. Critical Realism is based on the assumption that "there is a world existing independently of our knowledge of it" (Sayer 2000, p. 2), "independent of, and often defying, our desires of it and attempts to understand

and change it" (Benton & Craib, 2001, p. 120) which results then in the existence of a mind independent reality (Wikgren, 2005). Benton and Craib (2001) note that this independent reality is stratified or layered (Benton & Craib, 2001). They state that the distinctive features of critical realism as a theory of science are (Benton & Craib, 2001, p. 130):

(i) *It recognizes science as a social practice, and scientific knowledge as a social product;*

(ii) *It recognizes the independent existence of the objects of scientific knowledge;*

(iii) *It has an account of scientific experiment and discovery as simultaneously material and social practices in virtue of which both (i) and (ii) are sustained.*

The argument of an independent reality is succinctly summarised by Mingers (2004, p. 92):

> *With regard to perception, we can note that as human beings we have to learn (as babies) to perceive things and events; that our perceptions can change (e.g., visual illusions); and that scientists, for example, have to be trained to make observations correctly. These all imply that there must be a domain of events that are independent of our perceptions of them (what Bhaskar calls an intransitive domain). And, indeed, that these events would exist whether or not they were observed or there even were observers. There is thus a domain of actual events, only a (small) subset of which are perceived and become empirical experiences.*
>
> *(Mingers, 2004, p. 92)*

Wikgren (2005) states that as a result of these previously stated assumptions, ontology and epistemology are separated within the realist philosophy. Critical realism is relatively open to epistemology (Sayer, 2000, p. 32). Where critical realism assumes a mind-independent reality, empiricism assumes a mind-dependent reality (Wikgren, 2005). Mingers (2004, p. 92) adds to the above that there is a domain of events existing without us knowing about it, events that we do not observe – even if we were observing- yet, this does not mean that these events do not exist. Thus, to believe that "what we think is all what is" leads, towards "epistemic fallacy" (Wikgren, 2005, p. 14, with reference to Bhaskar).

This is where critical realism and empiricism are in conflict, as the empiricist argues that only that which can be observed or perceived can exist; where-as the critical realist in opposition, argues that "causal effect on the world implies existence, regardless of perceptibility" (Mingers, 2004, p. 93). With reference to causality, critical realism is concerned with this aspect as one should determine the causal mechanisms that are responsible for the observed regularities or action (Mingers, 2004, pp. 97-98; Wikgren, 2005). Science should thus move beyond the empirical experience by discovering, identifying and describing the unobservable structures or objects within the stratified reality (Wikgren, 2005 & Carlsson, 2003, both with reference to Bhaskar). Wikgren (2005) argues that within the critical realist perspective, the focus is on explanation, not on prediction, and that interpretive investigational forms are propagated.

Critical realism perceives the world as complex, yet, despite the complexity and the "fallible and situated nature of knowledge", critical realism contends that "it is possible to develop reliable knowledge and for there to be progress in understanding" (Sayer, 2000, p. 30) by working in such a manner that any misleading appearances can be identified and addressed. This, would imply that current beliefs are fallible and therefore open to correction as a result of work in the form of observation, experimental evidence, interpretations, theoretical reasoning and dialogue (Benton & Craib, 2001). Critical realism does not recognise the existence of multiple realities, as it was stated in the first paragraph in this section that critical realism assumes that there is a reality independently of our knowledge (Sayer, 2000). Johnson and Onwuegbuzie (2004, p. 16) also highligts that there is potential probblems associated with the ontological assumption of multiple realities. They state that instead of multiple realities, one should rather refer to multiple perspectives, opinions or beliefs:

The strong ontological relativistic or constructivist claim in qualitative research that multiple, contradictory, but equally valid accounts of the same phenomenon are multiple realities also poses some potential problems. Generally speaking, subjective states (i.e., created and experienced realities) that vary from person to person and that are sometimes called "realities" should probably be called (for the purposes of clarity and greater precision) multiple perspectives or opinions or beliefs (depending on the specific phenomenon being described) rather than multiple realities (Phillips & Burbules, 2000 cited in Johnson & Onwuegbuzie, 2004). If a qualitative researcher insists on using the word reality for subjective states, then for clarity we would recommend that the word subjective be placed in front of the word reality (i.e., as in subjective reality or in many cases intersubjective reality) to direct the reader to the focus of the statement.

(Johnson & Onwuegbuzie, 2004, p. 16)

According to Carlsson (2003, p. 12) "Critical realism was developed as an alternative to traditional positivistic models of social science as well as an alternative to postmodern approaches and theories and constructivism." Epistemologically critical realism is non-positivistic, as values and facts are difficult to unravel because of being interlinked (Carlsson, 2003, p. 12).

In summary: Critical realism acknowledges also that our knowledge of reality is open to correction, or that our knowledge is fallible. However, this does not imply that there is no such thing as truth, but that the so-called truth or findings of research is open to correction or adjustable, depending on current or newly collected evidence.

6. CASE STUDY

Case study research is descriptive in nature, as it is describing and interpreting events, situations and/or conditions (Picciano, 2004; Thomas, 2003), or as Cohen et al. (2007, p. 253) state "It provides a unique example of real people in real situations, enabling readers to understand ideas more clearly than simply by presenting them with abstract theories or principles" by allowing the researcher to "penetrate situations in ways that are not always susceptible to numerical analysis" (Cohen et al., 2007, p. 253).

Hence, the purpose of a case study is to examine, describe, explain and interpret in detail the events, activities, person(s) or/and organisation(s) (Tellis, 1997, Thomas, 2003; Picciano, 2004), as it is happening at the present moment, thus providing a chance to examine specific phenomena in a thorough manner (Picciano, 2004). A case study thus adds uniqueness to a research study (Thomas, 2003; Cohen et al., 2007). A case study should reflect the views of the 'actors' in the case under study (Tellis, 1997), "seeing the situation through the eyes of the participants" (Cohen et al., 2007, p. 57) by providing them with an opportunity to give their voice to it.

In this research project, the case study method was used as I wanted to gain insight into the perceptions of the participants of the participating schools in an ICT training and development project related to introducing the Internet through cyberhunts. Furthermore, I wanted to explore how they perceived this intervention and whether they felt that they had gained something by participating in it. The underlying assumption was that the case study speaks for itself or as Cohen et al. (2000, p. 182) state:

> *Case studies strive to portray 'what it is like' to be in a particular situation, to catch the close-up reality and 'thick description' (Geertz, 1973b) of participants' lived experiences of, thoughts about and feelings for, a situation. Hence it is important for events and situations to be allowed to speak for themselves rather than to be largely interpreted, evaluated or judged by the researcher … This is not to say that case studies re unsystematic or merely illustrative; case study data are gathered systematically and rigorously.*
>
> *(Cohen et al., 2000, p. 182)*

Researchers are active participants in case studies, however, this could be regarded as a weakness or disadvantage, as the objectivity of the study can be questioned (Pring, 2004, p. 41). However, the strength of a case study lies in the fact that it allows me as the researcher to portray how a variety of factors influence the event or phenomena being studied and in addition, it also offers uniqueness (Thomas, 2003, p. 35). Furthermore, a case study also allowed me to explore in-depth insights regarding the participants' experiences (Mouton, 2001).

In spite of all the positive aspects which a case study can offer, this approach is frequently criticised, because of its dependence on a single case; the singularity factor in opposition to the pluralistic factor. Singularity, it seems, limits a generalising conclusion (Cohen et al., 2000). In a similar manner, Berg (1998) argues that one limitation of the case study is its weak potential to generalise. However, Kozma and Anderson (2002, p. 390) argue that within technology based cases "the focus is not on the uniqueness of these cases, but on what can be learned from them about how technology is being used to support educational change." This was indeed useful for this study as the rationale was to learn from this case with a view to improving future interventions and training of teachers.

As generalisation is problematic within case studies, as seen above, and as voiced by Yin (1994, 2003b), Pring (2004) and Mouton (2001), case study research does not necessarily imply that the findings in a case study are useless or irrelevant. Rather, the results are relevant and useful for the specific case and the results could be relevant in other contexts. Wolcott's (2005, p. 167 cited in Merriam, 2009, p. 228) statement regarding case studies is very handy here, as he states that "every case is, in certain aspects, like all other cases, like some other cases, and like no other case."

Stake (1995, p. 86) argues that although case study researchers do not seek to make generalisations, readers do as:

> *Our readers often are more familiar with the cases than we researchers are. They can add their own parts of the story. We should allow some of this input to analysis to help from reader generalizations. The reader will take both our narrative descriptions and our assertions: narrative descriptions to form vicarious experience and naturalistic generalizations, assertions to work with exiting propositional knowledge to modify existing generalizations.*
>
> *(Stake, 1995, p. 86)*

Merriam (2009) concurs, as she states that case study readers use case study research to ascertain whether the situation reported upon in the case study matches theirs. This can be done by providing rich and thick descriptions of the phenomena researched (Merriam, 2009) (see Validity & Reliability).

Yin (1994, 2003b) states that the value of case studies lies in the possibility of the single case to confirm, extend or challenge a well-formulated theory. Thus, it could assist to enlighten the researcher whether the theoretical propositions are correct or whether alternative explanations are relevant (Yin, 1994, 2003b). Tellis (1997) concurs, as he argues that a case study could provide parameters that could be useful for further research. Thus, one could contend that the results seem to indicate that basic strands could be applicable to teachers, learners and schools within a similar context, but one cannot verify these absolutely. Alternatively, the findings within a case study could be used for hypothesis generation with a view to a follow up future study.

However, should one include multiple cases (using participants from different schools) within a case study, as it is the case within this research project, it could assist with confirmation of certain aspects and/or the discovery of contradictions or differences (Yin, 1994, 2003a, 2003b) among the cases related to certain aspects. Multiple cases could therefore be helpful to assist and to enlighten the researcher as to whether the theoretical propositions are correct or whether alternative explanations are relevant (Yin, 1994, 2003b).

A case study allows the researcher to use a wide variety of data collection tools, qualitative as well as quantitative (Hakim, 2000; Pring 2004) and thus contributes towards a more complete and holistic study (Hakim, 2000, p. 59). However, case study researchers have to avoid the following according to Nisbit and Watt (cited in Cohen et al., 2000, p. 182, 2007, p. 254):

- "Journalism (picking out only the more striking features of the case, thereby distorting the full account in order to emphasize these more sensational aspects)
- Selective reporting (selecting only that evidence which will support a particular conclusion, thereby misinterpreting the whole case)
- Anecdotal style (degenerating into an endless series of low-level banal and tedious illustrations that take over from in-depth, rigorous analysis)
- Pomposity (striving to derive or generate profound theories from low-level data, or by wrapping up accounts in high-sounding verbiage)
- Blandness (unquestioningly accepting only the respondents' views, or only including those aspects of the case study on which people agree rather than areas on which they might disagree)."

Case studies can be either single or multiple-case designs (Yin, 2003a, 2003b) and the one undertaken in this study is a single case study in which I wanted to explore, explain and describe perceptions (see Yin, 1994, 2003a , 2003b) and experiences of the participants and to ascertain whether there is growth as perceived through the participants' eyes.

Validity is problematic in qualitative research and the case study as research method has been a source of criticism because of potential investigator subjectivity (Cohen et al., 2000, pp. 26-27,184; 2007, pp. 24-25). According to Yin (1994, pp. 34-35) investigator subjectivity can be overcome by the following as counter measures namely, (1) using multiple sources of evidence, (2) establishing a chain of evidence and (3) having a draft case study report reviewed by key informants. In this case study, I tried to implement these suggestions, as I made use of quantitative and various qualitative data gathering tools to collect data from the same phenomenon. Furthermore I have indicated the procedures followed for data collection and provided a detailed overview of how the project and study developed and what happened in each phase and stage (see Appendix B). In addition, triangulation was employed through the use of several kinds of data sources (qualitative and quantitative). Using these multiple sources became what Patton (1990, 2002) refers to, a 'strengthening mechanism' that assists with validity.

7. FRAMING THE RESEARCH: INTERPRETIVE CASE STUDY WITHIN THE AMBIT OF POST-POSITIVISM WITHIN A CRITICAL REALIST PERSPECTIVE[31]

A paradigm refers to "A set of very general philosophical assumptions about the nature of the world (ontology) and how we understand it (epistemology). Paradigms also typically include specific methodological strategies linked to these assumptions and identify particular studies that are seen as exemplifying these assumptions and methods" (Maxwell, 2005, p. 36). Patton (2002, p. 69) states that:

[31] The 'Framing the research' section refers to the research design.

A paradigm is a worldview – a way of thinking about and making sense of the complexities of the real world. As such, paradigms are deeply embedded in the socialisation of adherents and practitioners. Paradigms tell us what is important, legitimate and reasonable. Paradigms are also normative, telling the practitioner what to do without the necessity of long existential or epistemological consideration. But it is this aspect of paradigms that constitutes both strengths and weakness – a strength in that it makes action relatively easy, a weakness in that the very reason for action is hidden in the unquestioned assumptions of the paradigm.

(Patton, 2002, p. 69)

Burrel and Morgan (1979, p. 24) state in their seminal work, that it is necessary to select a research tradition or paradigm, as a paradigm functions as a guideline or map, it assists you to "know where you are, where you have been and where you want to go in future." Durrheim (1999, p. 36) writes that paradigms or worldviews "act as perspectives that provide a rationale for the research and commit the researcher to particular methods of data collection, observation and interpretation." Paradigms are informed by ontological and epistemological perspectives and researchers can draw on more than one paradigm at one time, depending on the kind of work/research being conducted (Terre Blanche & Durrheim, 1999).

The first perspective I considered, was pragmatism, as pragmatism is open to quantitative and qualitative data. Pragmatism, as indicated in section 4.5 in this chapter, seems to be in opposition to the necessity to indicate a paradigm, as it seems that the focus of pragmatism is on practicality and answering the research question(s) at hand, as "pragmatism opens the door to multiple methods, different worldviews, and different assumptions, as well as to different forms of data collection and analysis in the mixed methods study" (Creswell (2003, p. 12). Thus, it seems that the focus of pragmatism is jut 'get to the answer'. As this study leaned towards the pragmatic position to the extent that it combined both quantitative and qualitative data in a mixed model research context with the same sample or participants (see Johnson & Christensen, 2008 in section 4.5 in this chapter), the researcher was tempted to argue that the pragmatic position was acceptable. However, it was decided not to avoid metaphysical concepts such as truth and reality [ontology] and how we come to know [epistemology] (Mertens, 2005, pp. 9, 27), as accepted by pragmatists. The caution of Archer (cited in

Dobson, 2002) was influential here, as she states that stating one's ontology is important, as it influences methodology, or in her own words (Archer, 1995, p. 17 cited in Dobson, 2002, p. 8):

> *An ontology without a methodology is deaf and dumb; a methodology without an ontology is blind. Only if the two go hand in hand can we avoid a discipline in which the deaf and the blind lead in different directions, both of which end in cul de sacs [italics added].*
>
> *(Archer, 1995, p. 17, cited in Dobson, 2002, p. 8)*

Hence, I decided that it was important to state an ontological and epistemological stance for this study and that the pragmatic stance was not suitable. The next stance was that of the positivistic approach. Brandt (2006, with reference to Irwin, 2004) argues that the positivist approach has merit when it involves laboratory processes and/or calculations, but the moment that research involves people and interactions with one another, positivism has its limitations, as people are not chemicals or plants and thus, it is difficult to isolate or to identify certain variables e.g. emotions or thoughts. Furthermore, positivists claim that they are mere observers and have thus no influence on the research, thus the results are completely objective (Brandt, 2006).

This study was not a huge survey from which generalisations could be made, as it was positioned within a case study framework. In addition, a convenience sample had been used, as the participating schools were the ones who received computers. The research questions that were asked endeavoured to determine issues related to the readiness of the participating schools for ICT implementation and integration. These questions focused on the teachers' perceptions and personal experience about the project with a view to determine the positive and negative aspects related to design related the skills involved while designing cyberhunts, collaboration aspects and motivation and interest. In this research study, the researcher was working with people. The researcher was also participating in the research and was not just a mere observer. The researcher also defined the questions and designed the data gathering tools. Hence, the researcher could not be completely neutral, and hence subjectivity could have infiltrated. Therefore a positivist approach was not deemed as suitable for this study. The research questions, the type of data to be generated (quantitative and qualitative) and the focus on human experience suggested that positivism would not be a suitable paradigm, as I wanted to understand and interpret the participants' human experience, not just the numerics.

The next approach that I considered was the constructivist approach. The constructivist approach focuses mainly on qualitative data (Denzin & Lincoln, 2005; Guba & Lincoln, 2005), however the researcher may also employ quantitative measures within the constructivist approach (Creswell & Plano Clark, 2007). However, the constructivist approach seems to be focusing ontologically on multiple realities and denying critical realism's viewpoint that we "can strive for "reality" within a certain realm of probability" (Mertens, 2005, p. 11). In addition, the constructivist approach primarily focuses on qualitative data. Hence, this approach was also not deemed as appropriate.

The next position to be considered was post-positivism. The post-positivist position posits that a reality does exist, but that we can know reality only imperfectly due to our own human limitations, including subjectivity (Mertens, 2005). The imperfectly and subjectivity part of post-positivism is in contrast with the positivist position. Another important aspect of post-positivism is that it allows for both quantitative and qualitative data to be used (Denzin & Lincoln, 2005; Guba & Lincoln, 2005). However, Mertens' (2005) statement that methodologically, post-positivism focuses primarily on quantitative data was also acknowledged, but then again the word 'primarily' does not imply that qualitative data are excluded. By taking the above into consideration, it seemed that the research undertaken for this case study would best be positioned within the ambit of post-positivism within a critical realist perspective, based upon the argument that post-positivism is seen by many as the opposite of positivism (Niglas, 2001) and due to the fact that critical realism is seen as a fairly recent form of post-positivism (Brandt, 2006). Niglas (2001, p. 2) argues that the term post-positivism is a term that is used in so many different meanings. She argues that:

On the one hand some authors use this term as a common label for all philosophical thought and research that is not positivistic (or is qualitative), on the other hand authors like Guba and Lincoln (1994) describe post-positivism as a newer version of positivism, which is in opposition with qualitative (or constructivist) paradigm. On the scheme under discussion post-positivism denotes mainly views which have influences from both positivism and hermeneutic traditions and accept quantitative as well as qualitative research as valid ways of finding out about social life.

(Niglas, 2001, p. 2)

Rahmawati (2008) adds that "interpretive is part of post positivist paradigms, because it uses many perspectives to study a phenomenon. It is very natural research; it can observe the situation with different views to solve the problems. Therefore, it results in many solutions and interpretations." He argues that it is more difficult to be objective in human related research than in the science setting, and add that generalisation is difficult in educational research because of the complexity of educational phenomena (Rahmawati, 2008).

Having said that, I sat with another problem that I had to overcome, as I do believe that we construct reality socially and individually through human interaction and personal experience and that this reality is subjective. This tends towards the constructivist, multiple subjective personal realities and interpretive paradigms, yet the post-positivist position also acknowledges the role of subjectivity. Ontologically, I believe that we strive towards obtaining a better understanding of a reality and that there is reliable knowledge to be found, but that the knowledge found through data analysis and construction is not infallible or the ultimate truth. I also thought that if knowledge is socially constructed and if multiple subjective realities or multiple subjective perspectives do exist, we as researchers tend to subscribe or relate more to certain realities than to others and that we can change our subscription to realities at any time. Hence, what we see as truthful or reliable knowledge today can be different tomorrow, next week or next year. However, I argue that we tend to move to a so-called ultimate reality, although it seems that we are not to able to discover it absolutely, as knowledge is fluid. Thus, the post-positivist paradigm within a critical realist position deemed to be suitable, as critical realism seems to be quite open to epistemology (Sayer, 2002, p. 32), and this assisted to overcome my initial problem mentioned above in the first sentence of this paragraph.

As a result, the following framework was formulated: Ontologically, the research has been framed as post-positivistic within a critical realist position (Sayer, 2000; Benton & Craib, 2001; Carlsson, 2003 and Mingers, 2004). Hodgkinson-Williams (2006) argues that the critical realist position can be adopted by ICT in Education as:

> *The usefulness of critical realism as a philosophical underlabourer*[32] *(Bhaskar 1979; 2002) for ICTs in education, is that unlike positivism, it reminds us that the world – and especially for teachers and learners and their social reality – does not operate as the closed system of a scientific experiment, but is always an open system*
>
> *(Hodgkinson-Williams, 2006, p. 3).*

The argument of critical realism seems thus that we as researchers can only discoverer reality "within a certain realm of probability" and thus "they cannot "prove" a theory, but can provide evidence to make a stronger case" (Mertens, 2005, p. 11 with reference to Reichardt & Rallis, 1994).

Epistemologically, the research was informed by the social cultural perspective (Vygotsky, 1978), including situated learning within communities of practice (Brown et al., 1989; Wenger, 1998; Wenger, 2004), recognising the cognitive, social and situated learning dimensions of teacher learning (Putnam & Borko, 1997; 2000; Anderson et al., 2000). The social cultural theory of development emphasises the fact that social interaction and language embedded within a cultural context is crucial for cognitive development (Eggen & Kauchak, 2007). Thus, social interaction implies interaction between "more knowledgeable others" (Eggen & Kauchak, 2007, p. 46) which means that there is activity between the learner [who can also be an adult] and the more capable other person(s). Language plays a vital role, as it provides a learner with (1) access to knowledge, (2) with a cognitive tool which makes it possible to think about the world and to solve problems, and lastly (3) it provides us with a way for regulating and reflecting about our own thinking (Eggen & Kauchak, 2007). Hence,

[32] The 'underlabourer' concept refers to the relationship between philosophy and science where science is seen as the deliverer of the goods and philosophy as tool to assist the scientist when he/she experience difficulties (Benton & Craib, 2001, p. 93).

it is important to scaffold a learner or person to move him or her through the Zone of Proximal Development (ZPD). The situated learning dimension or situated cognition is also a 'flavour' of social constructivism just as social cultural theory is. Situated learning sees learning as a social construct which cannot be separated from the context in which it occurs (Eggen & Kauchak, 2007; Wenger, 1998; Wenger, 2004). Thus, learning becomes an activity through "mediation of human action by cultural artefacts" (Engeström & Miettinen, 1999, p. 11).

With reference to this study, the researcher is of the opinion that the combination of both quantitative and qualitative data, provided the participants of this study with multiple opportunities to respond to the issues under investigation. This resulted in providing the researcher with a more comprehensive picture of the participants' previous socially constructed experiences related to ICT and with their current socially constructed experiences related to ICT as a result of their participation in the cyberhunt teacher development project. Furthermore, the use of collaboration within groups and the use of capable peer-facilitation to assist with the learning process or 'how we come to know', was also seen as the creation of a learning space to assist with the understanding process through social interaction, as it was previously stated that social cultural theory implies that language and social interaction provide opportunities for access to knowledge, that language is an important cognitive tool as it makes thinking possible, and that language provides opportunities for reflection about our socially interacted experiences. In the data gathering tools section, section 12 in this chapter, it is indicated that teacher journal reflection writing formed and important part for not only data gathering purposes, but also for the articulation or explicit making of the participants' experiences, hence linking to the reflection aspect by means of language and writing as tools to the social cultural perspective.

Regarding the objectivity issue that was raised previously, it is important to state that although post-positivists acknowledge the fact that objectivity is important (Mertens, 2005; Brandt, 2006), absolute neutrality and absolute objectivity is not possible (Brandt, 2006), as the methods that one selects and the type of statements and questions that one compose are selected by an individual and the moment that one selects, there is some form of subjectivity. In the words of Guba and Lincoln (2005, p. 208), "… objectivity is a chimera: a mythological creature that never existed." Thus, within this study, it is assumed that true or absolute objectivity is not possible, although one tries to strive towards it.

Methodologically the research has been conducted within an interpretive position, using quantitative and qualitative data within a case study. The aim of the interpretative paradigm is understanding or "Verstehen" (Held, 1980, p. 308) of what one sees and discovers. Cohen et al. (2007, p. 21) succinctly summarise the understanding aim as "… to understand the subjective world of human experience," and Cantrell adds that interpretivism helps "to understand phenomena and to interpret meaning within the social and cultural context of the natural setting" (Cantrell, 1993, p. 84). Dialogue and discussions of findings are important, as social reality is 'dialogic' and not 'monologic' as suggested by empiricism (Habermas, 1981, p. 161). Chamberlain (2000, p. 290) adds that one should also try to move beyond 'what' only questions to include asking 'how?' and 'why?' questions, as 'how?' and 'why?' questions assist not only with understanding, but also with interpretation and thus meaning making. Yin (1994, 2003b) is in agreement, as he states that case studies stem from the desire to understand complex social phenomena and assist to provide answers to 'why' and 'how' questions.

In this study, six disadvantaged schools were part of a convenience sample, resulting in one main case (research project). In a case study, the selection of the case to be studied is not done randomly, but purposefully, i.e. the particular person, site, program, process, community or other bound system to be studied, is selected because the researcher is interested in the characteristics it displays (Merriam, 2009 with reference to Eisner, 1991). Therefore, for this study, a convenient sample was used, as it would serve the investigation best as the majority of participants were teachers from the schools who received donated computers.

In this case study research project, both quantitative and qualitative data collection tools were used to obtain a picture that is as descriptive as possible of the perceptions of the participating teachers of the participating schools. The idea was not to test theory, but to arrive at the end at possible findings – generating possible theory - that could be tested deductively in a follow up study pertaining to either advantaged, disadvantaged or both types of schools.

Although interpretivism is associated with the constructivist or interpretivist paradigms, I do argue that a post-positivist position within a critical realist perspective, allows the researcher to interpret both the quantitative (numerical) and qualitative (textual) data to obtain a more realistic grip on reality. Regarding interpretivism, it is important to take note of the argument of Denzin and Lincoln (2005, p. 22) who state that "All research is interpretive, it is guided by the researcher's set of beliefs and feelings about the world and how it should be understood and studied." Denzin and Lincoln (2005, p. 22) argue further that some beliefs may be assumed, taken for granted and may even be invisible, yet other beliefs might be very problematic and controversial

Within this study, the quantitative data have been interpreted through statistical numeric reporting in tabular format and the qualitative (textual) data have been analysed and presented for interpretation in the form of textual format in tables by linking the qualitative data to certain codes and themes. Thus, the value of combining both quantitative and qualitative data lies in the fact that their combination provides opportunities to compliment quantitative and qualitative findings [one another], to indicate contradictions between the quantitative and qualitative findings or to indicate differences between the quantitative and qualitative findings and/or to highlight new insights (Kelle and Erzberger, 2004; Flick, 2006, 2007). New insights can thus be obtained from either quantitative or qualitative data or from both. Thus, new corresponding insights might be found from both the quantitative and qualitative data or only from one of these two data types. Therefore, either or both the quantitative and qualitative data may reveal insights, but it is also possible that insights are not corroborated by both (Kelle & Erzberger, 2004; Flick, 2006; 2007). By using both quantitative and qualitative data within an interpretive paradigm, it becomes thus possible to get a greater handle on reality, yet the knowledge about reality is fallible. Hence, the responses of the participants in the quantitative and qualitative data gathering tools were explored and interpreted with a view to establish greater understanding of the participants' perceptions.

8. QUALITATIVE AND QUANTITATIVE DATA GATHERING TOOLS

Researchers have been debating the qualitative-quantitative debate for years, as the argument is that mixed methods or mixed models are more appropriate to answer research questions as mixed methods or mixed models provide deeper understanding of the phenomena under investigation (Savenye & Robinson, 1996, 2004; Greene & Caracelli, 1997a, 1997b; Tashakkori, & Teddie, 1998; Creswell, 2003; Johnson & Onwiegbuzie, 2004; Creswell & Plano Clark, 2007; Morgan, 2007; Johnson & Christensen, 2008; Ercikan & Roth, 2008). Traditional positivists on the other hand, argue that one cannot combine qualitative and quantitative data within the same research project (see Guba & Lincoln, 2005; Denzin & Lincoln, 2005; Mertens, 2005), as qualitative data are not objective.

Miles and Huberman (1994), Johnson and Christensen (2008) and Denzin and Lincoln (2005) posit that many researchers use qualitative data quantitatively or statistically when they analyse data and report their findings, while many qualitative post-positivist researchers do not analyse data by means of complex statistical ways, for example, regression and log-linear analysis (Denzin & Lincoln (2005). Trochim (2000b) points out that quantitative and qualitative approaches are not so different from one another, as all qualitative data can be coded in a quantitative manner and furthermore, all quantitative data is based upon qualitative judgment (see also Miles & Huberman, 1994).

Savenye and Robinson (2004) add that technology (including ICT) is changing so rapidly (as it is a complex field) that it requires different approaches to really be able to construct a picture about what is happening, for example, when a new approach or a new technology is implemented. Merriam (2009), Denscombe (2003) and Green and Caracelli (1997b) state that both quantitative data and qualitative data can be collected within a case study. The combination of qualitative and quantitative data can create a “powerful mix” (Miles & Huberman, 1994, p. 42) which can result in a more coherent picture. Johnson and Christensen (2008) state that qualitative and quantitative data can be used in mixed method research, mixed model or mixed research. Greene and Caracelli (1997a) note that social phenomena are complex, therefore multiple methods could assist to increase our understanding of these complex social phenomena. Yet, they recognise that “all methods have their limitations and biases," but continue by stating that "using multiple methods can help to counteract some of these biases" (Greene & Caracelli, 1997a, p. 7).

Critical realism acknowledges that quantitative data and qualitative data can be used within the same research project (Mingers, 2004), as "once we know what we are looking for, any number of approaches can be adopted and applied in different novel ways, the target being to unearth the real structures and mechanisms within a particular research situation" (Dobson, 2002, p. 9). According to critical realism, quantitative data can be useful for explanation, but should not be used for prediction, as knowledge will always be fallible. In spite of that, critical realism does acknowledge that reliable knowledge is still possible. Qualitative data can complement quantitative data to portray the real story behind the statistics (Dobson, 2002), thereby making it useful to use in the interpretive approach.

The value of using qualitative data research methods within the South African context is illustrated by Lemmer (1992), as he argues that it provides access to valuable insights within educational contexts. In addition, Lemmer (1992) states that statistical analyses (quantitative data findings) can be supplemented with qualitative approaches which provide detailed descriptions, as it "focuses on depth, detail, process and the context" (Lemmer, 1992, p. 294). Likewise, Hitchcock and Hughes (1995) argue that qualitative research is very useful in educational research:

> *It has been our view for some time that the processes of education, teaching and learning are so complex and multifaceted that to focus only upon cause and effect, products, outcomes or correlations in research on schools is of limited value. The complexity of education demands the use of many different research techniques and models. The most productive approach we believe is a qualitative one.*
>
> *(Hitchcock & Hughes, 1995, p. 25)*

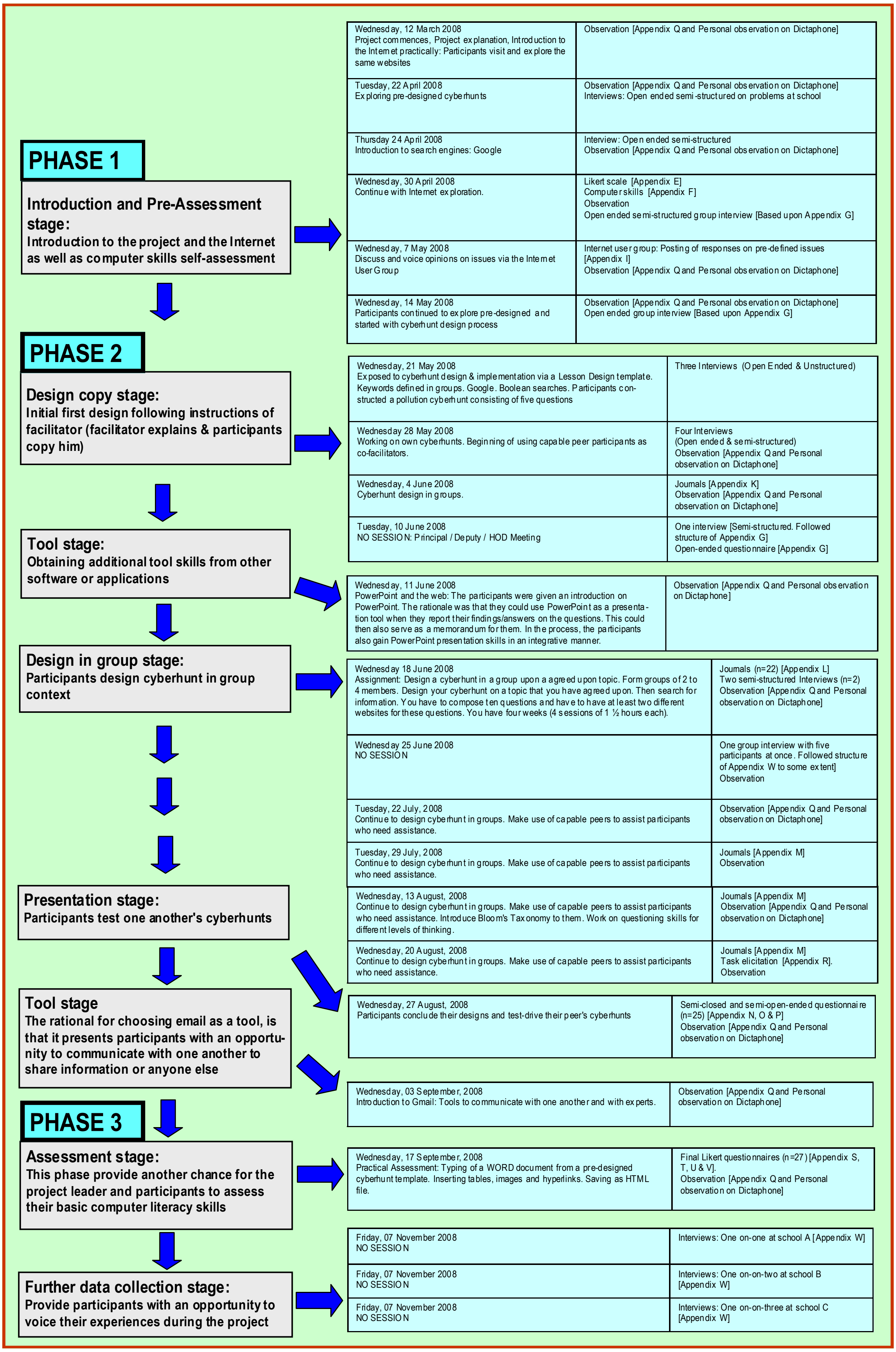
Kelle and Erzberger (2004, p. 174) state that the use of qualitative and quantitative data may be useful to report during research findings as it could assist with convergence, complementarity and divergence. Combining quantitative and qualitative data could thus assist the researcher with triangulation, as it could help to foster agreement, to supplement or to indicate contradiction (Kelle & Erzberger, 2004; Flick, 2007) and in the process assist to address biases and subjectivity.

9. RESEARCH DESIGN PROCESS

This section of the report not only provides an overview of the steps of the project to enable the reader to obtain a picture of how the project was implemented, but also provides an audit trail of activities. Furthermore, it provides an explanation of what happened in each phase and stage, as well as the dates of the various sessions and the data gathering tools used at each specific point. Figure 3.2 provides a short overview of the process (for the full process, see Appendix B).

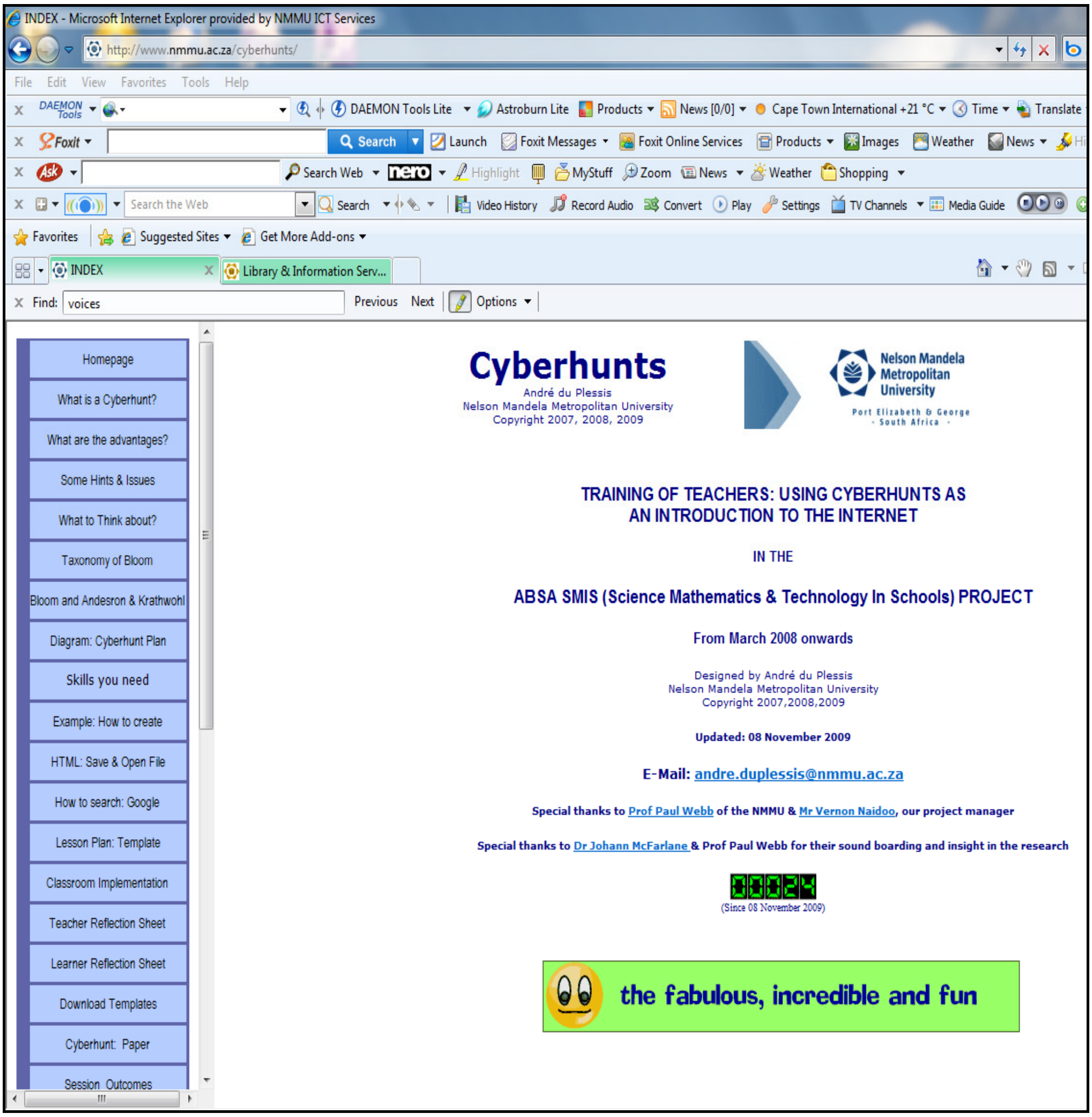
The reader will note that the dates overlap among the phases. This occurred as not all the data collection instruments were designed before the research project commenced. For example, after the initial Likert scale questionnaire and computer skills questionnaire, interview questions were determined to explore and clarify certain responses and perceptions of the participants. However, these interviews were semi-structured in nature. During Phase 1, the journal-reflection data gathering tool was developed, but changed towards the end of Phase 1 and adapted again during the initial stages of Phase 2. During Phase 2, the journal-reflection data gathering tool was for example, altered after the first time it was distributed and analysed in order to improve its usability. The semi-closed-open-ended questionnaire was designed in June and July 2008 after it was noticed that the additional semi-structured interviews that were designed towards the end of Phase 1 and the beginning of Phase 2, did not provide enough quality data and that it was also very time consuming. Thus, it was decided to design the semi-closed-open-ended questionnaire which provided quantitative and qualitative data simultaneously. A draft of the final pre- and post-perceptions Likert scale questionnaire were designed during Phase 1, but it was redesigned towards the middle of Phase 2 because observations during Phase 1 seems to necessitate it. Further literature reviewing prompted me to add and reword aspects and a discussion with the statistician served to reword and to regroup certain items in order to improve the quality of the data gathering tool.

Figure 3.2: Overview of the project



The participating schools had no Internet connection and the majority of participating teachers had not experienced using the Internet. To assist the teachers, a cyberhunt guide manual was compiled (Appendix X) as well as a website www.nmmu.ac.za/cyberhunts (use a web browser and type www.nmmu.ac.za/cyberhunts. See Figure 3.3 for a snap shot of the website).

Figure 3.3: Website for the project at www.nmmu.ac.za/cyberhunts



To ensure reliability and validity/credibility, the data collection tools were designed, fine-tuned and implemented in phases, as indicated in Table 3.2.

Table 3.2

Data gathering design tool process, data analysis, reporting and interpretation

PHASE 1: Data for subsidiary research questions 1 and 5 (January to May 2008)

Step 1: Data tools were designed after the research questions had been defined. The data gathering tools were designed based upon the requirements of the research questions and related aspects from the literature. These data tools were the initial Likert scale questionnaire, Computer skills questionnaire and interview questions.

Step 2: These designed data tools were then discussed with the two promoters of this study as well as a statistician from the Nelson Mandela Metropolitan University. Changes were made where it was deemed necessary after consultation.

Step 3: The data gathering tools were printed and used in the phases on the dates indicated.

Step 4: Data gathering tools were collected and read.

Step 5: Data gathering tools were converted to electronic format on computer in Microsoft Word and Excel.

Step 6: Electronic data were compared with original completed data gathering tools, with the original digital recorded interview data and with the original digital recorded observational notes.

Step 7: Changes were made where needed.

Step 8: Follow up interviews were conducted to establish clarity on certain aspects and to explore certain aspects on a deeper level.

Step 9: The statistician analysed all the quantitative data. The findings were discussed. These findings were prepared and presented in tabular format.

Step 10: Follow up interviews were conducted again to establish clarity on certain aspects and to explore certain aspects on a deeper level.

Step 11: Codes were determined for the qualitative data by taking the quantitative data into consideration.

Step 12: Electronic data were coded using the pre-determined codes and new codes were created when required.

Step 13: Data belonging to the same categories from the different data gathering tools were grouped together.

Step 14: The grouped data were allocated to the different research questions.

Step 15: The headings and sub-headings were determined and altered when deemed necessary.

Step 14: Draft chapters for each subsidiary question were compiled and presented to the two promoters. Quantitative raw data were examined to determine whether any specific patterns could be established from participants from the same school's responses. This was then indicated in the discussion whenever a certain pattern was observed.

Step 15: Changes were made by using the feedback from the promoters.

PHASE 2: Data for subsidiary research questions 2, 3, 4 and 5 (April 2008 to January 2009)

The same steps were followed more or less as for PHASE 1

The data tools developed were interviews, the three separate pre- post Likert Scale Questionnaire, a post Likert scale questionnaire. These data tools were altered after a discussion with the statistician as his recommendations were included and the necessary deletions suggested were brought about. The semi-closed-open-ended questionnaire was designed after it was noticed that the additional semi-structured interviews that were designed towards the end of Phase 1 and the beginning of Phase 2, did not provide sufficient data and that these interviews were also very time consuming.

PHASE 3: Data from all the different data gathering tools were re-read and re-examined and second draft copies of the findings were written by taking into account what was learned through the re-examination of the data (January 2009 to March 2009).

Third draft copies were prepared after the suggestions were received from the supervisors related to the second draft copies.

PHASE 4: The fourth and final copies of the results and interpretation chapters were compiled and handed to the promoters for final assessment (April 2009 to June 2009).

To practically enhance reliability, participant member checking and feedback from other sources can be implemented to ensure credibility (Silverman, 2000). As a result, a colleague was asked to do spot checks. In addition, the quantitative data collection tools were examined by a statistician at the Nelson Mandela Metropolitan University prior to the research to establish whether the statements and questions conformed to the requirements for statistical data analysis. The results of the completed quantitative data instruments were captured into Excel and an independent person selected at random a number of completed quantitative data instruments to establish the accurateness of the entered data. The quantitative data were analysed by the same statistician who examined the data tools.

10. SAMPLE AND RESEARCH CONTEXT

Convenience sampling was used within this case study. The reason was that these schools formed part of the ABSA SMIS (Science, Mathematics, and Information Technology in Schools) project and because the schools involved had received 20 computers each from the DELL Foundation *via* a request initiated by the project. Convenience sampling is useful "where the researcher is interested in getting an inexpensive approximation of the truth. As the name implies, the sample is selected because they are convenient" [33]

It is important to note of the disadvantage of convenience sampling Calkins (2005:IS[34]) states:

> *Convenience sampling is the easiest and potentially most dangerous. Often good results can be obtained, but perhaps just as often the data set may be seriously biased. Consider collecting GPA information from students in detention. It may be convenient, but perhaps not representative of the entire student body!*
>
> *Calkins (2005:IS)*

Note has been taken of these concerns. However, the aim of this study was not to generalise *per se*, but to explore and explain what has been observed and recorded with the data tools within this specific case study which involved six disadvantaged schools. It was previously argued that these results could then be used for a follow up study in a deductive manner.

The project ran from March 2008 to the end of September 2008 at the Missionvale campus of the Nelson Mandela Metropolitan University (NMMU). The Missionvale campus was selected as venue for teacher training, as the campus is located in a disadvantaged community and is very close to the participating teachers' schools, and because the campus has the necessary computer and Internet infrastructure within which the teacher training could be conducted.

As noted before, teachers from four primary schools and two secondary schools in the Port Elizabeth Missionvale area formed the convenience sample used in this study. These six schools received 20 computers each from the Dell Foundation. In each school approximately six teachers

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[33] www.statpac.com/surveys/sampling.htm [Accessed 10 February 2008].

[34] The abbreviation IS, stands for Internet Source without a page number

participated. Teachers from other schools on the SMIS project, but which did not receive computers, were also invited to participate in the training. The project commenced on 12 March 2008 with 38 participants. During the project, some decided not to continue and a few new teachers also decided to join. Attendance varied, but the average attendance per session was 27 participants.

11. ETHICAL CONSIDERATIONS

Ethical issues are concerned with human dignity during research (Cohen et. al., 2000, 2007). Hopf (2004, p. 334) states that:

> *Under the keyword 'research ethics' it is usual in social sciences to group together all those ethical principles and rules in which it is determined – in a more or less binding and more or less consensual way – how the relationships between researchers on the one hand and those involved in sociological research on the other hand are to be handled.*
>
> *(Hopf, 2004, p. 334)*

Ethical principles may include the following:

- Approval from an Ethics Committee (Zuber-Skerrit, 1996; Denscombe, 2003) and the related departments.
- Principle of informed consent (Hopf, 2004, Heaton, 2004; Mason, 2002) and voluntary participation (Henn et al., 2006).
- Termination of participation at any point in time (Henn et al., 2006).
- Truthful reporting without harming the participants or betraying their confidentiality (Creswell, 2003; Hopf, 2004), results for the "good of society" (Henn et al., 2006, p. 71).
- Secure and safe keeping of data (Denscombe, 2003; Heaton, 2004).
- Restricted access and distribution of data (Denscombe, 2003).

- Anonymity during reporting (Cohen et al., 2000, 2007; Lichtman[35], 2010) and using and reporting of the data as originally specified (Denscombe, 2003).

Before the research project commenced, the Department of Education (Port Elizabeth District Office), was approached *via* a letter (see Appendix D2) addressed to the district director. A telephonic conversation followed where the project was further discussed and a letter of approval was faxed to the researcher. Principals and representatives from their respective schools were invited to attend various meetings where the research project was explained. In addition, a letter was sent to each school which stipulated the requirements.

The teachers from the participating schools had to voluntarily indicate whether they wanted to participate in the project. Only a limited number of teachers at a school were asked to volunteer. The participants could terminate their participation at any point in time. The principal was also asked to indicate whether the teachers may participate, as he or she is the representative of their employer, the Department of Education. The data instruments did not contain any personal questions that could be harmful or undignified to teachers, or be used against them in any manner.

12. DATA GATHERING TOOLS AND DATA COLLECTION

Data were generated in this research project by using quantitative and qualitative data gathering tools. The quantitative data gathering tools that had been used were Likert scale questionnaires (see Appendix E, S, T, U & V) and a computer skills questionnaire (see Appendix F). The qualitative data gathering tools that had been used were journals and reflection sheets (see Appendix K, L & M), semi-closed-open-ended questionnaire (see Appendix N, O & P), interviews (see Appendix W), task elicitation (see Appendix R), informal observations and observation such as indicated in Appendix Q. These mentioned data gathering tools are discussed below.

12.1 Initial Likert scale questionnaire

The Initial 7 point Likert scale questionnaire was designed in order to determine which first- and second order barriers (Ertmer, 1999) existed according to the participants. A 1 on the scale

[35] This is the date indicated in the book, although it is now 2009.

indicated ‘strongly disagree’ and a 7 ‘strongly agree.’ Responses ranging from 1 to 3 were grouped as disagree. Responses greater than 3, equal to 4 or equal to 5 were grouped as neutral or uncertain. Responses greater than 5, equal to 6 or equal to 7 were grouped as agree. Items which could not be grouped in groups of two or more statements pertaining to the same factor/aspect, were discussed individually. The Cronbach alpha (α) reliability score was calculated where two or more items could be grouped under the same factor. A Cronbach alpha value of 0.50 or greater is seen as items that may be grouped together. The further above 0.50 the Cronbach alpha value is, the greater the reliability (Ary et al., 2002). The calculations were done by a statistician of the research office of the NMMU.

The main items and their respective statements in this Likert questionnaire were constructed from issues mentioned in the literature review related to first and second order barriers. In addition, items were also included which the researcher deemed necessary by taking into consideration previous experience and research. This Likert questionnaire was also updated and improved after consultation with the statistician, who also assisted with the quantitative data analysis. The consultation was done in order to improve reliability by ensuring that items were correctly worded and grouped for data analysis.

12.2 Computer skills questionnaire

Participants completed a computer skills questionnaire which tried to determine how participants used computers at that stage, as well as the participants’ levels of use. This was done before the project started to assist the researcher to obtain a picture of the participants’ computer usage and levels of use. A five point scale was used which contained the codes ‘Never’, ‘Rarely’, ‘Sometimes’, ‘Often’ and ‘Fairly Often’ regarding the participants’ computer usage. Participants also completed statements related to their level of computer use. This was done by means of a four point scale which included ‘Non’, ‘Beginner’, “Confident’ and ‘Expert’ as levels.

12.3 Internet user group message board for teachers

Participants were encouraged to share concerns, positive aspects as well as suggestions regarding the teacher training-development process in order to provide the researcher with additional data. This was communicated by means of an online Internet user group. As this was quite time consuming, this was done once only during the research project. In a similar manner as before, this data were used to supplement, clarify or even contradict certain findings of the quantitative and qualitative data instruments.

12.4 Individual and group interviews

Qualitative data, including the outcomes of interviews, are often labelled as being 'soft' (Bogdan & Biklen, 2003, p. 2), but Bogdan and Biklen argue that the dynamics of qualitative data is that it is rich in description of people, places and conversations and hence are not easily handled statistically. Lankeshear and Knobel (2004, p. 198) define an interview as a "pre-arranged interaction between two or more people where one person is responsible for asking questions pertaining to a particular theme or topic for formal interest and the other(s) is/are responsible for responding to these questions."

Schostak (2006, p. 10) states that "the interview can be described in terms of individuals directing their attention towards each other with the purpose of opening up the possibility of gaining insight into the experiences, concerns, interests, beliefs, values, knowledge and ways of seeing, thinking and acting of others." Thus, one could argue that an interview provides opportunities to create dialogue and to share different views or ideas (Schostak, 2006) from both the interviewer and interviewee (Lambert, 2002).

Taylor and Bogdan (1998) state that the interview assists the researcher to learn about events and activities that cannot be observed directly and they add that the interviewees act in actual fact as informants to the researcher, acting as eyes and ears in the field. Patton (2002, pp. 340-341) adds that people are interviewed "to find out from them those things we cannot directly observe." He continues by arguing that interviews are more appropriate than observations as:

> *We cannot observe everything. We cannot observe feelings, thoughts and intentions. We cannot observe behaviors [or feelings or perceptions] that took place at some previous point in time. We cannot observe situations that prelude the presence of an observer. We cannot observe how people have organised the world and meanings they attach to what goes in the world. We have to ask people questions about those things. The purpose of the interviewing, then, is to allow us to enter into the other person's perspective.*
>
> *(Patton, 2002, pp. 340-341)*

In a semi-structured interview the researcher-interviewer uses pre-prepared questions that are used to guide the interview process. However, the researcher-interviewer is free to explore responses on a deeper level and in addition has the opportunity to add questions when he or she deems it to be necessary for example if he or she comes up with a question or series of questions which was not thought about before, but seems to be relevant to ask at a specific point in time during the interview. Henn, Weinstein and Foard (2006, p. 162) add that the interviewer should use probing and prompting, as probing and prompting allow the interviewer to engage the interviewee in further dialogue. Probing creates an opportunity to clarify ideas, concepts and different interpretations (Baker, Costa & Shalit, 1997, p. 45), thus helping to create a shared understanding.

The semi-structured interview promotes flexibility, as it allows one to move beyond the initial pre-determined questions and as a result helps one to capture personal experiences outside the realm of the pre-determined ones (Creswell, 2003), and as a result contributes to being a very productive data gathering tool (Gilham, 2000, p. 65). Flick (2006, p. 149) adds that people are able to express themselves to a greater extent in semi-structured interviews than in pure structured interviews.

Schostak (2006, p. 10) succinctly summarises the value of the interview as a provider of "attention towards each other with the purpose of opening up the possibility of gaining an insight into the experiences, concerns, interests, beliefs, values, knowledge and ways of seeing, thinking and acting of the other." In this research study, follow-up semi-structured individual interviews were conducted after the initial Likert questionnaire was analysed, in order to assist with further interpretation of the quantitative data, as the qualitative interviews operate like "night vision goggles, permitting us to see that which is not ordinarily on view and examine that which is often looked at but seldom seen" (Rubin & Rubin, 2005, p. vii). Qualitative interviews also "brings new information and opens windows into the experiences of people you meet" and "is a way of finding out what others feel and think about their own world" (Rubin & Rubin, 1995, p. 1).

Reflection plays an important role in the interview, as the interviewees are encouraged by the interviewer to "reflect in detail, on events they have experienced" (Rubin & Rubin, 1995, p. 2) or to state their feelings, attitudes or perceptions related to future or anticipated events. The aim in this research study was to explore by means of interviews why teachers have responded in certain ways during data gathering and to clarify aspects that were not clear to the researcher (Kvale, 1996; Kelle and Erzberger, 2004). Furthermore, the interviews were also valuable to verify certain responses, as mentioned previously, or in the words of Cantrell (1993, p. 96) "to allow the researcher to gather descriptive data in the participants' own words and to access the unobservable."

All interviews were recorded on a dictaphone. The tape recording of the interviews enables the researcher to transcribe the interview in a reliable manner and hence provides the recording material as evidence for reliability checks (McMillan & Schumacher, 2006, p. 205). The interview questions were coded and categorised during the design of the interview questionnaire and grouped accordingly to assist with data analysis. Schostak (2006, p. 1) cautions against the perception that interviews are an easy data collection tool "with which to mine information." On the contrary, interviews create opportunities for divergent and enhanced views (Schostak, 2006).

Group interviews, consisting of 2 to 3 participants, were also conducted during the research study, as it is quicker and thus saves time (Cohen et al., 2007). In addition, a group interview is beneficial, as it assists with the generation of a variety of perspectives and responses and provides participants with an opportunity to increase their confidence through participation (Patton, 2002). The reason for using group interviews in this research study was that the group interviews provided a chance for participants to listen to the responses of others and to add to the thinking of others, as well as to make additional comments to their previously voiced replies (Patton, 2002). The group interviews thus assisted the researcher of this research study to bring people of varied opinions together resulting in a wider spectrum of ideas than an individual interview (Cohen et al., 2007). Patton (2002) adds that the focus in group interviews is not necessarily on consensus, but that alternative perspectives are invited, as the purpose of the group interview is "to get high-quality data in a social context where people can consider their own views in the context of the views of others" (Patton, 2002, p. 386).

12.5 Observations

Sacks (cited in Silverman, 2000) suggests that the audio recording of field notes is valuable, as a person cannot rely completely on human memory for recollections, and because it is virtually impossible to take everything down that is being observed. Patton (1990, 2002) adds that observation data assist with description such as the observed setting, the activities that occurred, the participants in these activities and the ‘meaning-making’ of what was observed. The aim is thus to enhance understanding of the described situation (Patton, 1990, 2002). The rationale for using a dictaphone as tool to record observational notes while the sessions were in progress, is the fact that the researcher realised that one cannot possibly remember everything that one observes and then write what was observed after the session. It is important to take note that it is the not advisable to rely on observational data as the only data source (Paton, 2002), but that one should also use other complimentary data collection tools such as interviews for example (Walsh, 2001). This point is well summarised by Denscombe (2003, p. 193) as he cautions that the drawback of observations is that it could be influenced by the researcher’s perceptions, thus compromising objectivity. In spite of the caution, Merriam (2009, p. 119) suggests that observation does have value as “Observation makes it possible to record behavior as it is happening.”

Observation and reflections by the researcher were recorded by means of a dictaphone during and after sessions. Participating teachers were comfortable with the dictaphone, as they had been introduced to the dictaphone from the start of the project as a tool for data collection. The value of the researcher being a participant observer in this research study was that the researcher could see what was happening firsthand, and therefore it assisted the researcher in utilising his own knowledge and expertise in interpreting what was observed.

It is important to note that the observational notes were not the primary data source, as indicated by the various data sources that had been discussed in section 12 in this chapter. The value of the observations was that it assisted the researcher to record data on what was noticed regarding the participants’ computer skills and aspects related to cyberhunt design. Furthermore, the observational data assisted to confirm or to add new aspects which the other data tools could not capture.

12.6 Teacher journal reflection writing

The rationale behind journal writing is built upon meta-cognition (see Ainley et al., 2002), thinking about one’s own thinking and doing. In the case of this study, journals were used to provide the participants with an opportunity to portray their feelings and experiences in terms of the cyberhunt praxis adopted. Each session started and ended with teachers making entries in their journals. Entries at the start of the contact sessions focused on goal setting and entries, while at the end of the session the participants reflected on what they had learned, problems experienced, whether problems were solved (by whom), what they found easy or difficult and any other general remarks or reflections about the project. The data generated by these journal entries enabled the researcher to plan how to further assist the teachers and learners, and raised awareness in terms of the successes attained and of potential problem areas that might have arisen.

12.7 Likert scale project assessment questionnaires

Teachers' perceptions related to the critical outcomes; motivation, interest and collaboration; and computer skills were obtained by using three separate 5 point Likert scale questionnaires. Table C7 (see Appendix C7) provides an overview of which designs skills relate to which critical outcomes. Each of these three Likert questionnaires had a pre- and post- scale column. The computer skills section enabled the researcher to gather whether there was an improvement on the results of the computer skills.

The 5 point pre- and post-Likert scale questionnaire contained items to which participants had to indicate whether they 'strongly disagree' or 'strongly agree.' Responses ranging from 1 to 2.9 were grouped as disagree; responses equal to 3 as neutral or uncertain; and responses greater than 3, equal to 4 or equal to 5, as agree. Items which could not be grouped in groups of two or more statements pertaining to the same factor/aspect were discussed individually. As before, Cronbach alpha (α) reliability scores were calculated by the same statistician of the research office of the NMMU that calculated all the results pertaining to all the quantitative data gathering tools.

The fourth Likert scale questionnaire did not have a post-section, as it referred to cyberhunt items specifically, and as cyberhunts were totally new to the participants, these specific statements should all have yielded the same pre-response. The Likert scale for these ones was also a 5 point scale. The analysis was done in the identical manner as described above for the other Likert scales.

12.8 Task Elicitation

The task elicitation procedure was completed at the end of the project, based on the research of Carver et al. (1992). Participants had to list all the tasks that they had to complete to develop their cyberhunts. On the following pages, numbered sections were placed, each containing a section on what had helped and what had hindered them in the completion of the tasks that they had written down on the first page (see Appendix R). The task elicitation assisted to ascertain whether there had been growth in teacher thinking. The task elicitation procedure was based on the work of Cantor and Kihlstrom (1987, cited by Carver et al., 1992) regarding life tasks and strategies, and was completed at the start of the project. Cantor and Kihlstrom contend that the tasks which a person mentions are central organising forces in an individual's behaviour. Hence, the mentioned tasks could indicate what a person values in a project. However, the task elicitation procedure did not provide data that the other data gathering tools did not.

12.9 Semi-closed-open-ended questionnaires

A questionnaire can be defined as a set of printed questions to gather opinions, perceptions and facts from respondents (Thomas, 2003, p. 66) and can either by structured, semi-structured or even unstructured (Cohen et al., 2007). An open-ended response provides the respondent with the opportunity to give his or her own free response without being lead, thus the respondent can give any answer which he or she feels comfortable with (Neuman, 2003, p. 77) or which expresses or reflects his or her own view (Denscombe, 2003, p. 156). The analysis of an open-ended questionnaire is also more time consuming, because respondents might provide a wide variety of different responses.

The questionnaire enables the researcher to collect data by asking participants or respondents directly about specific aspects related to the study or case (Denscombe, 2007). Some academics, such as Gay and Airasian (2000), view the questionnaire as a quantitative data gathering tool. However, I would argue that this depends on the type of questions that one uses to populate the questionnaire. If the questions in a questionnaire are open, thus providing the respondent with an opportunity to provide the researcher with the respondent's own unique answer, then the questionnaire cannot be regarded as quantitative, but as qualitative, as the answer will not be in numerical format, but in textual format. A questionnaire can thus become quantitative, if the answers to questions are provided in numerical format or when the respondent has to make selections from certain pre-defined options. A questionnaire can also become quantitative and qualitative if it contains both numerical responses and open-ended responses.

In this research study the semi-closed-open-ended questionnaires explored aspects related to collaboration, motivation and interest, as well as suggestions to project preparation and training. The semi-closed-open-ended questionnaires were distributed near the end of the research project and included 'Yes', 'Uncertain' and 'No' as responses, but also prompted the respondent to provide a reason or reasons why he or she had answered in that manner. Thus, the questionnaire provided opportunities for closed and open responses. In many instances, respondents were required to respond only to an open-ended question in the semi-closed-open-ended questionnaire. The open-ended questionnaires in this research study, were used to gather data to add and/or supplement, clarify or even contradict certain findings of the quantitative data instruments (see Kelle & Erzberger, 2004), thus providing the quantitative data with a human voice. Therefore, within the context of this research project, the open-ended questionnaire had been used to assist with the discovery of barriers, concerns and teacher skills that the quantitative questionnaire could not portray.

13. DATA ANALYSIS

Data analysis and data interpretation are not synonymous. The following sections provide more clarity on these two issues. Analyses can be described as " 'breaking up' the data into manageable themes, patterns, trends and relationships" (Mouton, 2001, p. 108). Hence data analysis assists the researcher to understand the key elements in the data and helps the researcher to determine possible trends or patterns within the data (Mouton, 2001) or even inconsistencies (Walliman, 2001). Lictman (2010) argues that data analysis is an ongoing non-linear iterative process that requires the asking of questions to find meaning.

By submerging oneself in the data, one creates an opportunity to develop new theories or to validate existing theories (Walliman, 2001). The rationale behind identifying themes and patterns within the data is to assist with data reduction (see Walliman, 2001, p. 308). Data analysis is thus a process of making meaning, transforming data into findings or in Patton's own words (2002, p. 432), data analysis “involves reducing the amount of raw information, sifting trivia from significance, identifying significant patterns, and constructing a framework for communicating the essence of what the data reveal.”

Henn, Weinstein and Foard (2006) advise that data analysis should start as soon as the data has been collected. Thus, after the data have been collected, the researcher should start to transcribe or type it, read it and identify common themes, thus coding the data (Hein et al., 2006). Hence we can say that qualitative data interpretation could assist the researcher with understanding, enlightening and drawing conclusions (Patton, 1990, 2002) or highlight causes, consequences and relationships (Patton, 1990, 2002).

The need for triangulation arises from the need to confirm the validity of the research process (Cohen et al., 2007). Cohen et al. (2007, p. 141) define triangulation “as the use of two or more methods of data collection in the study of an aspect of human behaviour” and Stake (1995) adds that triangulation is the use of several or different protocols to ensure accuracy and to assist with confirmation, as triangulation is a process in which the researcher uses multiple perceptions to clarify and verify meaning, as well as the researcher’s interpretation.

Denscombe (2003, p. 38) states that case studies encourage the researcher to make use of multiple methods to obtain a better picture of the complexity of reality and therefore “fosters the use of multiple sources of data.” It is therefore important to note that questionnaires, interviews, observations and documents for example, should not be viewed as competing data collection sources, but as supportive or complimentary when combined (Denscombe, 2003). Patton (1990, 2002) states that triangulation can be a ‘strengthening mechanism’, as the use of several kinds of data sources (qualitative and quantitative within this research project) could inform one another during the research process and hence lead to greater validity.

Leedy and Ormrod (2005) caution that inexperienced researchers should not become too much embroiled with data collection, data ordering and data presentation in such a manner that they fail to interpret the data. In this research study, all the data had not been analysed at the end of the project, but on a continual basis as the data were collected, as suggested by Leedy and Omrod (2005).

The moment that data were collected, the data were typed in either Microsoft Word or Microsoft Excel and then exported to MAXQDA and STATISTICA; data analysis software packages. This was done as note was taken about the caution of Leedy and Omrod (2005) above. By typing the data as soon as it was collected, the analysis process started in an informal manner (Lichtman, (2010). While typing the data, the researcher was able to look for any conflicts, contradictions, irregularities and inconsistencies within the data (see Coffey & Atkinson, 1996; Flick, 2004, 2006, 2007) and to follow up with the participants when any of these aspects had been noted. When unexpected findings were noted in this study, so-called irregularities or inconsistencies, the data were rigorously re-examined to try and find possible explanations from the data (Coffey & Atkinson, 1996, p. 46). This had been done to achieve what Coffey and Atkinson (1996, p. 46) refer to as "to move beyond the codes, categories [themes] and data bits back to what the 'whole' picture is or may be," with a view to look at the data in new and different ways.

Taylor and Bogdan (1998) assert that data analysis implies that one follows certain distinct activities, the first and most important being the ongoing discovery, which refers to the identification of themes and developing concepts and propositions. The second activity is the coding of the data and the refinement of the researcher's understanding of the subject matter (Taylor & Bogdan, 1998). Hence, data analysis requires that the researcher immerses himself or herself with the data, as immersion with the data could provide valuable insights, providing "a chance to get a feel for the cumulative data as a whole" and this can be done by transcribing all or some sections of one's own interview transcriptions (Patton, 2002, p. 441).

Adler (2001, p. 46) elucidates the role of the narrative in qualitative research when stating, "The story I tell is partial. However, partiality is a feature of all social research, an inescapable reality rather than a necessary weakness." Schostak (2006, p. 15) concurs on the issue of partiality with reference to interviews, as he states that interviews provide us with incomplete and biased accounts of the state of affairs. As a result, careful consideration was given during data analysis in this research study to ascertain whether some responses were provided by participants to merely satisfy the researcher or to get into his "good books" (anticipating what answers the researcher would like to hear) or whether the responses were from the heart – trustworthy.

Therefore, when one analyses qualitative data, it links with critical realism's viewpoint that knowledge will never be absolute, that we cannot ever be sure of reality, but that we can develop reliable knowledge about reality. Likewise, the researcher in this research project acknowledges that there might be subjectiveness, as the research context and questions were decided upon by the researcher. However, by acknowledging that subjectiveness might exist, the researcher still tried to be as objective subjectively as possible. By doing this, it is believed that the analysis will add to the validity and reliability of this research as this is acknowledged.

During this research project, codes had been assigned in the code system section of a demonstration version of the software package, MAXQDA. Certain codes have been pre-determined, based on the theoretical principles (see previous section on theoretical perspectives in chapter 2). The idea during the data analysis was to explore common themes, patterns and regularities, as suggested by Yin (2003) and Coffey and Atkinson (1996). However, Schostak (2006, p. 70) warns that analysing and interpreting interview data cannot be equated with "straightforward reading", as respondents may answer certain questions in such a manner that the researcher will have to read between the lines what the respondent is actually saying. Hence, during data analysis, the researcher should code carefully and follow up where necessary with another interview for clarification purposes in order to enhance credibility (Schostak, 2006).

The importance of coherent coded data was another aspect that received attention, as one had to move beyond coding to achieve meaningful interpretation, as mere coding in it-self is not interpretation (Bogdan & Biklen, 1992; Coffey & Atkinson, 1996), but coding could assist to move towards interpretation. Interpreted and meaningful data, derived from the coding process, can contribute to theorising and generalising (Coffey & Atkinson, 1996). In order for the data 'to speak' to the researcher, as well as to the prospective audiences, one should not focus merely on description (the "what?" question), but should engage with the "how?" and the "why?" questions when one analyse data, as the latter two questions assist with interpretation (Chamberlain, 2000, p. 290, also referred ton in section 7 of this chapter). During the analysis, careful consideration was given to the above.

The quantitative data were examined and analysed using statistical methods. For statistical significance, the t-test had been calculated and for the practical significance, Cohen's d was determined. The statistical findings were examined with rigour and supplemented with qualitative data to examine the quantitative findings in such a way, as to obtain a greater understanding of what the statistical numbers really tried to tell the researcher and to clarify the findings. This is in agreement with what Kelle and Erzberger (2004) and Flick (2006, 2007) have stated regarding quantitative and qualitative data analysis, being that quantitative and qualitative data analysis are there to support one another, to assist with agreement, to supplement or to indicate contradiction.

The quantitative data responses in the Likert scale questionnaires and computer skills questionnaire were limited to an extent, as these data gathering tools provided the respondents with only a certain number of statements or questions to which they could only respond by means of a cross, tick or circle. The qualitative data assisted to counter this aspect, as it assisted with the discovery of new themes and patterns which the quantitative data could not provide. Hence, the qualitative data added a "human touch" and personal point of view.

In conclusion: Careful consideration was given to the role of the researcher during the data analysis process to counter issues of subjectivity. Blignaut (2005, p. 114) however states that complete objectivity is problematic:

> *Data can never completely "speak for itself" but will always be dependent on the researcher to generate meaning from it. Interpretation and construction of meaning, involve "mental labour" – always a hermeneutic exercise where the researcher acts as a filter through which meaning is distilled. Without the mind of the researcher meaning making is neither possible nor realizable nor is it desirable.*
>
> *(Blignaut, 2005, p. 114)*

14. DATA INTERPRETATION

Data analysis is not enough, interpretation is also very important. But what is meant by interpretation? Patton (2002) summarises it succinctly, as he states:

> *Interpretation, by definition, involves going beyond the descriptive data. Interpretation means attaching significance to what was found, making sense of the findings, offering explanations, drawing conclusions, extrapolating lessons, making inferences, considering meanings, and otherwise imposing order on an unruly but surely patterned world.*
>
> *(Patton, 2002, p. 480)*

Struwig and Stead (2001, p. 172) state that interpretation entails "giving meaning to raw data," thus it provides the researcher with insight. Hence, data interpretation (1) confirms what we know supported by the data, (2) disabuses us of misconceptions and (3) illuminates important things that we didn't know but should know (Patton, 2002). Mouton (2001, p. 109) states that interpretation connotes that the researcher relates the research findings to existing theories, but also whether the existing theories are supported or refuted based upon the research data findings. Drew, Hardman and Hosp (2008) suggest that part of the interpretation process requires the researcher to ask 'what', 'why' and 'how' questions (see also Chamberlain, 2000, to which was referred previously) and at the same time to as 'What are the implications for theory', but equally important 'What are the implications for practice" (Drew et al., 2008, p. 364).

In this study, the researcher tried to be as truthful as humanly possible by making it transparent how the results of this research was arrived at (Mason, 2002).

15. VALIDITY, RELIABILITY, CREDIBILITY AND TRIANGULATION

Validity asks the question whether we are measuring what we are supposed to be measuring (Silverman, 2000) or "Put qualitatively the question is whether, by using certain methods, we are investigating what we say we are investigating" (Blignaut, 2005). Validity is thus not seen as corresponding with reality (Blignaut, 2005). In this study, both the quantitative and qualitative data gathering tools were designed to obtain a picture of the participants' and their schools' readiness for ICT implementation and integration.

This research study also aimed to inform the researcher whether the Internet based cyberhunt approach, and the manner in which the teacher training was implemented, could realise the critical and embedded outcomes of the South African National Curriculum Statement (NCS). Furthermore, this research study ascertained whether the cyberhunt approach was motivational and whether it created motivation and interest within participants, and whether the cyberhunt approach and the training actually promote collaboration. The quantitative tools were discussed with a statistician and the qualitative tools with the promoters of this study.

The meaning of validity was referred to in the first paragraph of this section. The meaning of validity is expanded here, to being referring to as trustworthiness or credibility, hence to the extent to which inferences can be made from the data collection tools that are appropriate and meaningful to the specific study (McMillan & Schumacher, 2006; Mertens, 2005). Struwig and Stead (2001) and Punch (2006) provide criteria or guidelines related to validity, as they mention:

- Descriptive or contextual validity (whether the information provided is factually accurate and comprehensive or whether it is distorted or whether some aspects are omitted) (Struwig & Stead, 2001; Punch, 2006).

- Interpretative validity (whether the participants' meanings-perspectives are accurately reported, (Struwig & Stead, 2001) and does it connect with the lived experiences of the participants (Punch, 2006)).

- Theoretical validity triangulation (whether there is a common agreement between the researcher and the participants about the concepts or theory used to refer to the phenomena described. But, what if the participants have a vested interest in providing certain viewpoints?) (Struwig & Stead, 2001).

- Triangulation (combining two or more data collection tools or methods in one design to be either complimentary and/or to indicate contradiction) (Struwig & Stead, 2001).

- Researcher effects (whether the researcher is biased in reporting and interpreting findings and whether the respondents are honest with their responses) (Struwig & Stead, 2001).

- Generalisability or applicability (the degree to whether the data can be generalised within a group or to other groups. Internal validity refers to the research design, how true is it a reflection of reality? External validity refers to the generalisability of the study's findings) (Punch, 2005).

Validity is problematic in qualitative research and in case study research. Cohen et al. (2000, 2007) state that validity has been a source of criticism, because of potential investigator subjectivity. According to Yin (1994, pp. 34-35) criticism regarding validity can be overcome by the following as counter measures, namely (1) using multiple sources of evidence, (2) establishing a chain of evidence and (3) having a draft case study report reviewed by key informants. The critical realist position of this study acknowledges that observation is value-laden (Dobson, 2002), but although acknowledging that subjectivity does play a role, the critical realist position implies that although we can never be completely objective, we can still obtain reliable knowledge.

Merriam (2009) summarises the dilemma which qualitative researchers have to cope with when studying or researching human beings by stating that when using qualitative research methods, the question is not whether the research findings can be replicated —yielding the same results — but rather whether results are consistent with the data collected, as human beings do not always behave in the same manner (Merriam, 2009). Merriam (2009, p. 221) also cautions that there can be various or numerous interpretations of the same data, but adds that the important question is whether the results are consistent with the data collected.

According to Anastas (2004, p. 63), trustworthiness refers to the "quality of qualitative data" and she argues that trustworthiness should rather be used than reliability and validity. To enable the researcher to portray a trustworthy portrayal of the findings, the words of Merriam (2009) should be noted, as she states that strategies to promote validity and reliability could include (1) triangulation, (2) member checks, (3) adequate engagement in data collection, (4) the researcher making his position public, (5) peer reviewing, (6) audit trials, (7) rich and thick descriptions and (8) maximum variation in sample selection.

To ensure validity within this research study, the researcher made use of the guidelines of Guba and Lincoln (1985, p. 290), who claim that four questions can be asked and answered to determine trustworthiness. In addition, the seven questions of Denscombe (1998) were also answered to indicate what was done to ascertain trustworthiness. Guba and Lincoln's (1985, p. 290) questions are:

1. How can one establish confidence in the "truth" of the findings of the study for the respondents with whom, and the context in which, the study was conducted? This was established by making use of triangulation (qualitative and quantitative data), thick descriptions, working with the participants during the study and hence making it known that I as the researcher was involved. However, being involved does not mean that I cannot try to be as objective as possible. Yet, I was aware that subjectivity might play a role in interpretation, but then I made an effort to try and be as objective as humanly possible.

2. How can one determine the extent to which the findings of this study have applicability in other contexts or with other respondents? Guba and Lincoln (1985, p. 298) argue that the responsibility of the researcher ends when he/she has provided sufficient descriptive data to make similar judgments possible. Hence, the argument is that it is not the researcher's responsibility to prove that the findings are transferable, but that it is indeed the responsibility of the person(s) who intend to apply these findings somewhere else (Guba & Lincoln, 1985).

3. How can one determine whether the findings of the study could be repeated if the study were replicated with similar respondents in a similar context? Guba and Lincoln (1985, p. 316) argue that the researcher should demonstrate credibility in the study, as credibility takes care of dependability. This can be done by means of triangulation and by understanding one's participants by spending enough time with them. Both of the above have been employed, as I used methodological triangulation and as I had also been the project facilitator and the trainer of the participants, I had spend a considerable amount of time with the participants.

4. How can one establish the degree to which the findings of the study are determined by the respondents and conditions of the study and not by the

biases, motivations, interests, or perspectives of the researcher? This refers to neutrality, but in this case study I have already indicated that I could not be entirely neutral and totally objective, as I was the project facilitator and trainer during the project. Furthermore, I have argued that no research can claim absolute objectivity and as such the researcher should be aware that subjectivity does play a role in research.

In addition to the questions of Guba and Lincoln above, the researcher has also noted that Denscombe (1998, p. 213-214) propose seven questions that could assist with trustworthiness. Hence, the researcher of this study tried to provide an answer under each one of the questions below. These questions are:

1. Do the conclusions do justice to the complexity of the phenomenon being investigated and avoid "oversimplifications", while also offering internal consistency? I would answer yes, as I have tried to employ conclusions based upon various data sources.

2. Has the researcher's self been recognised as an influence in the research, but not a cause of biased and one-sided reporting? Again, I have previously indicated that I was aware of the role that subjectivity could have played, as I was the project facilitator. However, being aware of my subjective involvement, I consciously endeavoured to underplay and respect my findings as accurately and objectively as possible.

3. Have the instances selected for the investigation been chosen on explicit and reasonable grounds as far as the aims of the research are concerned? ICT integration is a world wide phenomenon and teachers are constantly asking how it could be implemented and what it offers. There are also proponents who are very sceptical about ICT. Hence, it is worthwhile to show to others that ICT implementation strategies do have benefits.

4. Have alternative possible explanations been explored? As the researcher of this research study, I have conducted an in depth reading and in depth study of related literature linked to ICT, learning theory, motivation, collaboration and the design skills model.

5. Have the findings been "triangulated" with alternative sources as a way of bolstering confidence in their validity? Data triangulation was employed as multiple data sources had been used.

6. Have the research findings been fed back to informants to get their opinion on the explanation being proposed? This was provided informally to participants and formally at subsequent SMIS meetings.

7. How far do the findings and conclusions fit with the existing knowledge on the area, and how far do they translate to other comparable situations? The findings of this study had been informed and compared with existing research and literature on the aspects under study, in order to be able to show how the findings support (confirm) and differ from existing findings in the literature.

In quantitative research, reliability refers to the consistency of measurement and in qualitative research to the dependability of the data (Punch, 2005). Thus, reliability refers to the consistency of measurement, thus, how similar will the results of the instrument be if it is used in another context or on another occasion (Mertens, 2005; McMillan & Schumacher, 2006) or as Punch (2005) and McMillan and Schumacher (2006) state, what is the consistency over time. Regarding the quantitative part of this study, content validity was used to ensure trustworthiness. Two questions (Mertens, 2005) have to be asked when content validity are used, namely (1) is the instrument (data gathering tool) really measuring the concept we assume it is measuring? and (2) are there enough and adequate examples of items that represent the concept or constructs to be investigated?

To be in line with the above, the Cronbach alpha (∝) or coefficient alpha was calculated to ensure validity and reliability by a qualified statistician employed by the Nelson Mandela Metropolitan University. The Cronbach alpha (∝) or coefficient alpha was used to determine the internal consistency reliability estimation within this research study. According to Punch (2006), internal consistency requires only a once off administration of the instrument. The p values (000 implies $< .0005$) were also determined to ascertain whether there was a high significant statistical value and Cohen's d scores were calculated to indicate the effect size (0-0.19 not significant, 0.20-0.49 small difference, 0.50-0.79 moderate difference and 0.80+ large differences).

In conclusion: As a critical realist, the researcher is aware that knowledge is fallible. Furthermore, the researcher is aware that other researchers might record different results than those recorded in this study, and that other researchers might indeed have found even better results, depending on their context and experience. The words of Merriam (2009) support this notion, as she states that although generalisability in the statistical sense (from a random sample to the population) cannot occur in qualitative research, that's not to say that nothing can be learned from a qualitative study" (Merriam, 2009, p. 224). Patton (2002) joins the generalisation debate, as he argues that one should rather promote the notion of extrapolating than generalisations. In his own words:

> *Extrapolations are modest speculations on the likely applicability of findings to other situations under similar, but not identical, conditions. Extrapolations are … problem orientated rather than statistical and probabilistic.*
>
> *(Patton, 2002, p. 584)*

Hence, the findings in this study can be seen as modest extrapolations which could lead to applicability in other similar, but not identical, situations.

16. SUMMARY

This interpretive case study was underpinned by a post-positivist position within a critical realist perspective. The researcher embarked on this research project aiming at obtaining reliable and useful knowledge related to the questions at hand. Although the aim was to obtain as objective a picture as possible, it is acknowledged that complete objectivity is not possible. A case study approach has been used, thus it was not possible to make generalisations, but the focus was not on data that will predict accurately and definitively, but on "tendencies" that could provide information and perspectives on certain principles that could be useful for the planning and implementation of similar ICT integration preparation projects in the future (Dobson, 2002, p. 10).

Both quantitative numeric data and qualitative text data were generated in order to obtain answers to the research questions at hand. The quantitative data refer to standardised measuring instruments, for example, Likert scale questionnaires and a computer skills questionnaire. The quantitative data were examined and analysed using the t-test to determine the statistical significance and Cohen's d to determine the practical significance. Qualitative data was generated via interviews, observations, semi-closed-open-ended questionnaires, task elicitation, an Internet user group and journal reflection sheets. The use of different forms of data collection approaches allowed a greater understanding of the participants' world or context. Furthermore, the operational strategy has been made explicit in this chapter, as well as the ethical considerations that were taken into account.

CHAPTER 4

QUANTITATIVE AND QUALITATIVE FINDINGS

1. INTRODUCTION

This chapter provides a systematic examination of the data generated by the quantitative and qualitative data collection tools *via* the methodology described in chapter three. The quantitative and qualitative data were combined to provide a coherent picture for each question. This approach enabled the researcher not only to interrogate the data and to provide rigour to the data analysis and interpretation process, but also to provide a portrayal that is as reliable and objective as is possible. Each subsidiary research question is dealt with separately and below each of the questions the data generated by the different quantitative and qualitative data gathering tools have been indicated. However, each data gathering instrument is not represented in every case if there were no meaningful responses or if they did not add any value.

The data are considered in terms of the research questions, namely the readiness of teachers and their respective schools (first and second order barriers to success), the skills or aspects developed by the participating teachers-as-learners during designing of cyberhunts, their motivation and interest, the promotion of collaboration by the cyberhunt design process, and how teacher development related to ICT integration should be conducted.

2. HOW READY ARE THE TEACHERS AND THEIR SCHOOLS FOR ICT INTEGRATION?

The data related to the first and second order barriers were gathered to provide possible answers to question 1, *viz.*, how ready are the teachers and their schools for ICT integration?

2.1 First order barriers

First-order barriers are extrinsic to teachers and include aspects such as lack of access to appropriate software and hardware, lack of time, lack of support and lack of training, for example how to use the computer, computer literacy skills and how to use the computer in an integrative manner within teaching and learning (Ertmer, 1999). These issues are reported below.

2.1.1 The participants' access to computers and overview of training received

Computer skills questionnaire

The questionnaire data indicated that only 17 of the 30 participants (or 57%) had their own computer. Of those that did not have a computer, nine participants (or 30%) had used a computer before while two had not used a computer before (see Table 1 in Appendix A)[36]. The teachers who did not own a computer, had access to a computer at their school or at a library. However, in all cases Internet access was limited. More than 50% of the participating teachers had not received any training related to ICT integration, and where training had occurred, it was primarily school based.

2.1.2 How do teachers use the computer?

Computer skills questionnaire

Combining the 'often' and 'fairly often' responses revealed that only 38% of the participants had used a computer to type worksheets, 37% to type tests or examination papers, 20% to report to parents regarding learners related aspects and 24% to store tests, examination or assignment marks (see Table 2 in Appendix A). Seventy six percent of the participants had never used the computer to search for information on the Internet and only 4% had used it either often or fairly often (see Table 3 in Appendix A). A similar trend of no or little use was found for email usage, as 79% indicated that they had never used it and 10% that they had used it rarely. Ninety percent indicated that they had never used the Internet for teaching and learning.

Responses related to using the computer for teaching and learning also revealed that over 90% of the participants indicated that they had never used drill and practice software, simulations software, tutorial software, hypermedia software, multimedia software, presentation software or the Internet for teaching and learning (see Table 4 in Appendix A). Data pertaining to the participating teachers' general computer skills indicated that the majority felt that they fell in the 'non' or 'beginner' level categories (see Table 5 in Appendix A). A very small number of participating teachers indicated that they fell in the 'expert' level. A similar pattern, as expressed above, is evident regarding word processing skills, spreadsheet skills and presentation skills (see Table 6, 7 and 8 in

[36] All the data referred to as 'see Table # in Appendix A' in the text have been included on a CD. The CD contains all other material referred to as 'see Appendix #.'

Appendix A). Internet and email related skills of the participating teachers also fell mainly in the 'non' or 'beginner' categories (see Table 9 in Appendix A). Software usage was predominantly Microsoft based. Word processing seems to be the most used software application (see Table 10 in Appendix A).

Interviews

Regarding teachers' computer skills at his school, Teacher 26 stated, "If I can rate them on the level of 1; 2; 3; 4. The majority of them are, let's say they are very good. The majority of them I would say are on level 2, meaning that they have the basic skills - opening, typing and saving the document." Teacher 38 declared that at his school:

> *Most of the staff members are more or less 60 – 70 % computer literate and they know the basics. [They know] How to switch it [the computer] on and how to switch it off. Most of them are using Microsoft Word and not the Internet, but Excel almost everyday.*

Open-ended questionnaire

Teacher 25 stated in an open-ended questionnaire that the staff members at her school were not particularly computer literate, but that they want to become computer literate. Teacher 35 stated that about a third of his staff had computers at home. Teacher 11 stated that the majority of teachers had the basics, as they had received training from the Ubuntu Education Fund (a NGO). This was echoed by a head of department (HoD) who confirmed training through Non-Governmental Organisations (NGOs).

In spite of the lack of basic computer skills, the participants appeared to be very positive and eager to learn, as illustrated by Teacher 11 who said:

> *The staff is eager to learn, because they want to be computer literate. [The] Only [problem is] that they were never exposed to that. Even during teacher training there was no computers included, its only now when we are upgrading at UPE*[37] *and VISTA we only get modules for computers, before there were no modules for computers.*

[37] The University of Port Elizabeth (UPE) and Vista University were merged to form the NMMU in 2005.

Observational data

Observational data in the early stages of the project indicated that the teachers made many typing errors. They left spaces between words in web addresses which resulted in non-access of Internet sites and their mouse and keyboard skills were poor. This trend continued during the second session, as I recorded the following on 22 April 2008 in my field notes on the Dictaphone, "It was noticed that the majority of the participants still struggle with typing skills as well as mouse skills. Some have difficulty in moving the cursor with the mouse and also struggle with the scroll down radio/turning button on the mouse."

2.1.3 Vision, focus and goals

Likert scale questionnaire

The overall summary in the initial Likert scale questionnaire, which focused on the barriers that teachers and their respective schools experience, revealed that 53% of the participants indicated that they were uncertain whether their school had a clear vision and specified goals related to computer integration.[38] Thirteen percent indicated that they disagreed that their schools had a clear vision and specified goals related to computer implementation (see Appendix 13B in Appendix A). Regarding the specific statement in the Likert Scale, 'Our school has a clear vision in place related to computers', only 40% of the participants indicated that their school had a vision, while 43% were uncertain and 17% disagreed. However, in spite of not having a clear vision, 63% felt that their school would know what to do should they receive computer hardware and software.

Interviews

Teacher 38 stated "Ja, [Yes] we do have a vision. We want to use the computer; we want to make the kids know how important the computer is." Teacher 11 said:

> *My school's vision regarding computers is to have more computers for the learners, because we have a lot of learners. We expect to even have more than one lab. We've got a staff of 35 then we also need training for computers, so we really need computers.*

[38] Please note that the percentages were rounded off. In some instances the total when adding disagree, uncertain or agree, might be less than 100% when the computer rounded e.g. 27.3% off to 27%. The same applies to e.g. 27.6 % which was rounded off to 28%. This resulted in that the total sometimes being more or less than 100%.

Teacher 24 explained that:

> *With computers we want to be computer literate and also make our own learners computer literate, and we especially want to teach the kids to search the information on their own. They can do their homework and assignments and do it well.*

Her colleague, Teacher 26 from the same school stated, “We would like to have our teachers and community to be computer literate, so that when they go to the working world they know what to do and implement what they have learnt from our school.” Teacher 28 noted that the school’s vision is “in a developmental process” and said, “I can’t say it’s a clear vision, we have but we are trying to get there.” He added, “Basically we see computers as a tool that makes it easy for the teachers to integrate their learning areas so that the learners could actually be involved in the teaching.”

Forty-three percent of the participants indicated that they were uncertain and 30% said that they disagreed that their schools had set clear goals related to ICT / computer implementation and integration. However, this situation was turned around early in February 2009 when each participating school submitted a report related to the schools vision (see Table 11 in Appendix A).

2.1.4 Participation and consultation related to computer implementation

Likert scale questionnaire

Sixty percent of the participants indicated that they had been consulted regarding a computer implementation plan for their school (see Table 12 in Appendix A), but they either disagreed or were uncertain as to whether there were regular staff meetings where participants could share and discuss ICT issues in their schools.

Interviews

Teacher 38 stated, “It was the collection of vision, we sort of discuss it for a long time and then we find out why the school need the computers and we come up with the vision of broader the horizon of the kids.” His principal affirmed this as he said:

Well, the entire school's vision was drawn up initially by the SMT [school management team] and the SGB [school governing body] and learners were requested to make input into it. As a result they did and now we are having a school's vision that everybody buys into it.

Teacher 17 from another school stated that all staff members had input in the school vision. Teacher 24 noted that the computer committee played "a vital role" and that all staff members decided collectively what the final vision should be. Teacher 11 stated that they arrived at their vision by looking at other schools' vision statements, especially more experienced schools in more advantaged areas of the city.

Teacher 28, when asked whether their school has regular computer meetings, replied:

Maybe quarterly there is a committee which we called a computer committee under the leadership of a young man (teacher) there. Ja [Yes] he is our person who is in charge of computers. We are trying to do some developments because he attends meetings at Ubuntu where he had to meet about the computer lab.

Another teacher stated that they often discussed equipment problems and problems that the learners experienced in the computer room "everyday." However, this was done in an informal way among staff members. A principal of one of the participating schools stated that they discussed as a group "how effective computer makes us to our schools and the short comings that people encounter when they make use of computers." He also noted that they looked at "How can we budget to keep the programme sustainable and of course some costs are look at by the entire school." Teacher 28 noted that "basically you know as a committee we are not at the same level with one another when it comes to computers. We are more or less focusing on developing our own skills and secondly we look at the challenges that we face at the computers." He also noted that they discussed "what content we want to teach." Teacher 38 also stated that their meetings were more like informal discussion groups than formal gatherings.

2.1.5 Staff participation and consultation

Likert scale questionnaire

The questionnaire data indicated that 97% of the participants valued participation and the sharing of experiences among one another, as the above provided a platform to voice and share experiences. The majority indicated that they shared ideas with other teachers within their own school (80%) and even more of them (90%) indicated that they would like to share ideas with teachers from other schools. Eighty-seven percent of the participants indicated that they saw regular meetings as valuable opportunities to learn from one another and 93% indicated that these meetings provided a platform to assist them with the challenges they experienced and the concerns they had (see Table 13A in Appendix A).

Feedback from teacher-facilitators within the project confirmed that email user group support was valued by 63% of the participants and that consultation regarding the computer integration plan for their schools was seen as being important.

2.1.6 Leadership, support and training from the Department of Education (DoE)

Likert scale Questionnaire

The overall summary related to leadership, support and training from the DoE, indicated that 83% of the participants felt that they could not count on support and training from the Eastern Cape Education Department, 17% were uncertain or neutral, and nobody indicated that they could count on the DoE for any support. Seventy-seven percent felt that the Eastern Cape Education Department does not have the leadership to provide ICT implementation support, 60% indicated that they could not count on support from the Eastern Cape Education Department to successfully implement computers within their classrooms or the curriculum and 87% indicated that the Department of Education did not provide teachers with the necessary training on how to use computers at school. Ninety percent of the participants indicated that the DoE had not provided them with computer equipment (see Table 14 in Appendix A).

Interviews

Interview data supported the questionnaire responses. When asked whether they had received any support or any training from the DoE regarding computers, Teacher 43 responded, “No, we didn’t” and his colleague at the same school (Teacher 45) added, “Not at all.” Teacher 26 from another school responded, “Not yet.” Teacher 45 said that the Education Department had made contact with the school some time before about computers, it this had been a “once off contact.” She noted that a DoE official had visited her school in the past and said that he wanted to know how many people needed ICT support and training, but added that “until now I am still waiting for him to come back to me again.” Teacher 45 indicated that her school received some “old computers from the Education Department.” Other schools which had computers before the project commenced, indicated that they had received them through the UBUNTU Trust (a NGO) and not from the Department of Education (DoE).

Semi-closed-open-ended questionnaire

Responses to the question, ‘At the moment, can you count on support from the Eastern Cape Education Department or District Office to help with computer integration? Please explain or tell us’, yielded similar responses such as these below:

- Past experience has taught one that NGOs are the people who develop schools (Teacher 2)
- Eastern Cape Department is dead as compared to other provinces (Teacher 40)
- They don't support schools at the present moment (Teacher 26)
- Deparment of Education is full of promises (Teacher 28)
- The Department does not want to issue money to other projects. They would rather return it back because the officials want the money for themselves not to help those who are suffering (Teacher 29)

- I cannot answer this because the department does not give schools computers the schools must get computers themselves (Teacher 42)

- Unprofessional. Not helpful (Teacher 38)

2.1.7 Leadership and support from other sources

Likert scale questionnaire

Ninety-three percent of the participating teachers noted that they would like support, not only from their peers at school and colleagues from other schools, but from knowledgeable persons who would also observe what they do in the computer classroom and provide feedback (see Table 15 in Appendix A). Not one teacher indicated that he/she did not want to be visited in their classroom. Similarly, 83% of the participants indicated that they would appreciate visits from knowledgeable persons to assist them with the cyberhunt process. Ninety three percent of the respondents indicated that there was a great need for training in computer implementation and integration (see Table 16 in Appendix A).

Interviews

Many teachers noted that this project was their first exposure to computer training. Teacher 26 noted, "This is the first training that I received for computers" and Teacher 45 confirmed this:

> *I would say I never received any training before; it was something that was new to me. Definitely it was different, because I have to show learners what I have learnt and it took me some time to go through or to go back to the net because I have to practice and practice before I am sure that I am ready to go back to learners.*

2.1.8 School based leadership, support and computer skills

Likert scale questionnaire

Forty percent of the respondents felt that teachers in their schools lacked computer skills while 57% were uncertain whether those who can use computers had adequate computer skills. When the raw data (see Table 17 in Appendix A) were examined in more depth, it was found that only 7% considered the staff members in their schools to be computer literate, 63% of the participants were uncertain and 30% indicated that they were not computer literate. Only 20% of the participants stated that their principals were computer literate, while 47% indicated that this is not the case. Junior staff members were seen to be more computer literate than principals, but overall perceptions of literacy was low (17% of the junior staff members and only 7% of the principals). The majority of teachers also indicated that the principal, senior and junior staff members that use computers did not use the Internet regularly. This could be ascribed to the fact that these schools' computer classrooms are not connected to the Internet. Where teachers did have connectivity to the Internet, it was usually home or at the university (see Table 16 in Appendix A).

The teachers also felt that staff members at their respective schools were not adequately trained to use computers or how to integrate computers within the curriculum, with only one respondent believing this to be the case. Although 50% indicated that there were teachers who were willing to provide support, they indicated that few had the necessary skills to actually do so. Despite the perception that the majority of teachers were not computer literate, 73% of the participants indicated that the teachers at their schools were extremely positive about using computers for teaching and learning. The participants also felt that their principals were very positive and supportive.

Interviews

During interviews two teachers from different schools stated that principals were 'somewhat' computer literate." Teacher 38 said that "I think the principal is computer literate; he is at NMMU so I think he must be computer literate" and because he had a computer in his office, a laptop and a computer at his house." In a like manner Teacher 26 from another school stated that he rated his principal as somewhat computer literate, because of his position in the educational hierarchy. However he added that in his estimation the principal was "struggling." Personal school visits also indicated that the principals did have computers in their offices, but that this does not necessarily indicate that they could use them effectively. This observation was supported by a principal who noted, "What spoils us as principals is that you have a secretary and when it comes to do some typing you just ask the secretary to quickly do it for you."

The teachers interviewed also felt that junior staff members were more computer literate than older teachers, “as they are younger and more up to date with technology” (Teacher 38). This teacher also said, “They are quite computer literate because they are freshly out of tertiary institutions so they actually know what to do.” The respondents were uncertain to what degree they could count on support from the principal to successfully implement computers integration within their classroom/curriculum. This last perception needs more clarification, as it could be interpreted in a negative light, i.e. that the principals were negative. However, this seems not to be the situation, as teachers who were interviewed, indicated that their principals were very positive and supportive. For instance, Teacher 26 said, “The principal is very much eager in that everyone should get involved in the programme [training at the NMMU]” and another one replied “Oh! He is more than willing to assist us” and added that the principal “tried his best to get us involved” [with the ICT training at NMMU].

Regular quarterly meetings held with the principals by myself also indicated that they were very positive and supportive. A possible reason why the participants answered it in this manner could be that they could not count on direct computer skills support, or financial support, as these participating schools are very poor. Thus, they may have received verbal support, but perceived anything further to be difficult.

2.1.9 Teaching/facilitation related to computers for the children (learners): Who is responsible?

Computer skills questionnaire

The participants felt confident that they would be able to be responsible for their learners’ computer training in the future. They felt this way because of the training and professional development that they had received during this project. Fifty eight percent indicated after just three weeks into the project that they were prepared to be responsible for their own class (see Table 18 in Appendix A).

Interviews

Selected responses to the question of who should take learners to the computer lab, i.e. a dedicated person or each individual, were as follows:

- At the present moment there is one person who is doing the computers it is myself. Ja [Yes] otherwise other teachers are welcomed to visit the lab. (Teacher 58)

- We've got one person there that we are trying to build trust on her. She is a learner that has not yet graduated from a technical college. She is appreciating what we are giving her so he is helping us there [and added] Yes he is taking all the classes from grade R up to grade 7. That is why I am saying the first week is for the Foundation Phase and the other is for IP and SP that is grade 7. (Teacher 11)

- It is Mr Vernon at the moment who is taking the classes. He is taking it as a subsequent learning area. (Teacher 17)

- The community have a guy there, one of the guys out of the community; quite good in computers now he is helping. He was running the project but most of the computers were redundant and they are not up to scratch anymore. (Teacher 38)

Basic computer literacy skills were the focus of ICT activities at all the schools. In three primary schools and two high schools, the focus was paint- and drawing software, as well as word processing. In the two high schools, the pattern was similar; the only exception being that Excel spreadsheet software was also a focus area. It was noted that in all schools (primary and high schools) that the usage of computers was not directly related to a specific learning area. Teacher 11 noted that the dedicated person at her school did the following:

> *He started with the grade Rs with the activities of painting, they insert a picture and they paint. With the other grades he tried to make some typing with them. The teachers when they go there if they come for the learning area he asked them to look for information on that learning area. With Maths they do find Maths activities, they do find reading activities by typing up the key words" … They, they write for the typing activity, they write sentences.*

Teacher 58 explained that the focus was on Microsoft Word and Excel at her school, but that they did have a software application and programme for building up a business plan which the learners used. He also noted that the grade 11 and 12 learners were the ones who mostly visited the computer room, where the main focus was typing skills and some real life application for job seeking. He explained that the learners were taught how to switch the computer on and off and how to type curriculum vitae. He acknowledged that more needed to be done, but pointed out that teachers generally did not have the necessary expertise.

2.1.10 Rewards and incentives

Likert scale questionnaire

The importance of rewards and incentives were highlighted by 80% the participants who felt that rewards and incentives were of great importance in terms of motivating (see Table 19 in Appendix A). Similarly, 83% of the participating teachers felt that there was no reward system in place which was of benefit to them should they influence other teachers to undergo computer training (see Table 20 in Appendix A).

Observation

During the second session of the teacher development process, participants were asked whether they would like to receive certificates of attendance for the cyberhunt teacher development training programme. They asked how many sessions there would be and how many they should attend to qualify for the certificate. As it was in the very early stages of the process, it was agreed that the criteria would be discussed at a later stage and that mere attendance to achieve the certificate was not the goal, but that implementation of what they learned was. The importance of incentives was further highlighted when several teachers enquired during a training session whether the certificates that were talked about could be handed to the DoE and whether the DoE would then be able to reward them financially with “emula” or “imali” [money].

2.1.11 Time tabling and time related issues

Interviews

The majority of township schools have more than 800 learners per school. Some high schools have between 1100 and 1400 learners from grade 8 to 12. During an interview Teacher 58 stated, “I wouldn’t say that learners have enough time because there is only one room in the computer lab and we have an enrolment of 1300. At this school there is a ten-day cycle and each learner has one opportunity to use the computer laboratory every ten days. Other teachers confirmed that at this point in time, large numbers in their schools constrained contact opportunities and that this aspect of promoting ICT in their schools was very challenging.

Likert scale questionnaire

Only 20% of the participants indicated that their school time table provided adequate scheduled periods (see Table 21 in Appendix A). Forty-three percent indicated that they were uncertain and 37% indicated that this was not the case at all. Two primary schools (Grade 1 to Grade 7) teachers indicated very strongly that the time table did not provide adequate periods for computer room visits by their learners, as there was not enough time.

2.1.12 Infrastructure and resources

Likert scale questionnaire

The data revealed that 50% of the participants thought that their school did not have the necessary infrastructure and resources and the other 50% was unsure (see Table 24 in Appendix A). None of the participating schools had fast Internet connections. The NMMU project worked with Telkom - The South African monopoly telecommunications company providing landlines – in an attempt to get sponsorship for a fast ISDN line for each school, but this was not forthcoming by the end of the research stage of the intervention.

Seventy percent of the participants indicated that funding via the school for staff training (computers and ICT) was problematic. However, there was one teacher who indicated that money was available and that he had received support from the principal in the past. That specific school’s principal revealed during a school visit that she was prepared to buy the equipment needed to link provide wireless Internet connectivity (see Table 25 in Appendix A).

Observations

Telkom engineers visited the schools and reported that they could not install Internet connections at two of the schools, as the copper telephone lines had been stolen (thieves then sell these copper wire lines to scrap metal buyers). They reported also that they had reinstalled the wires several times in the recent past and were not prepared to reinstall them.

Journals

Journal writing by the participating teachers also revealed that their schools were in need of more computers and an Internet connection. Examples of journal entries are:

- We need Computers, they are not enough even for learners. We have one computer lab for the whole school. It poses a challenge when you need to practise because computer giants are always using them. Then computer illiterate people are in disadvantage. We do not even have Internet that is another challenge (Teacher 44)

- The lab has to be set up. Some of the infrastructures produces have been addressed but a few are still outstanding (Teacher 35)

- Need more computers if its possible install an Internet (Teacher 51)

- Internet (Teacher 11)

- Computers, securities and time (Teacher 32)

- Internet because our school has no Internet and few computers that we have are not enough for the whole school (Teacher 48)

- Electricity, capital, landline, Internet (Teacher 22)

- As we have big numbers in our classes, learners need more computers so that one can have his/her own computer so as to speed up in period (Teacher 9)

Interviews

The need for more computers because of the fact of having large classes was also voiced during interviews. Teacher 11 said, “So we have only 20 computers. So the classes are up to 50 learners. So learners they don’t have the privilege especially those who are slow learners so they don’t get a chance to go to computers because those who are fast always go first.” She continued that maintenance was also an issue (Teacher 11):

> *The other thing that I think is the problem is the maintenance of the computers. Sometimes the computers are less [due to the fact that some are not working] and when you go to the computer room you’ll find out some of them are not working. There are 20 computers and maybe 5 are not working and 15 of them are working. So you have to do trouble shooting. I was trained for trouble shooting. Even if it is not my class, if another class is going there and they find out that certain computers are not working [they ask me to come and do the trouble shooting]. I have to leave my class and go to the computer lab and do trouble sitting. At the moment we are using Shuttleworth’s Open Source. I have to contact them on the number so that they have to again inform over the telephone what must I do and if I find out that it is not working then they are going to send someone to take it out and have a look. Then at the end maybe it is the monitor, they need to take it out and have a look or the mouse or the CPU. Then the other thing that we are experiencing is the problem with the servers and switch, because one server cannot take a lot of computers, when you connect more computers it start to go slow, when it go slow we can’t go on with the work.*

This type of involvement and expertise in terms of maintenance was not the norm in the project. When asked whether they have someone to assist them technically, only two teachers responded in the affirmative. Teacher 58 explained that an individual who has a private company “helps us” and added “we just ring him and he will come and fix whatever needs to be fixed.” Teacher 38 reported that the school did have “an IT guy every day”, but questioned his qualifications and said “I think he is been paid by the SGB [School Governing Body] but I’m not 100% sure.”

2.2 Second-order barriers

The section to follow provides an overview of the barriers that are intrinsic to teachers (Ertmer, 1999) and affect teachers' self-efficacy (Bandura, 1997; Ertmer, 2001, 2004).

2.2.1 Confidence to participate in training

Likert scale questionnaire

The majority of teachers (55%) indicated that they were not hesitant to participate in the project. However, it was interesting that 41% were uncertain (see Table 26A in Appendix A).

2.2.2 Confidence in having the skills to use the computer as a teaching tool

Likert scale questionnaire

The responses indicated that the participants' confidence in terms of understanding how to use the computer in their classrooms, teaching subject matter, having the necessary management and ICT skills was very low (see Table 26B in Appendix). Eighty three percent indicated that they needed training on how to manage the ICT classroom.

2.2.3 Positive attitude towards the use of computers as a teaching tool

Likert scale questionnaire

Eighty three percent of the teachers were 'very positive' towards using computers as a teaching tool (see Table 27 in Appendix A), in spite of their lack of confidence (as indicated previously). Ninety-three percent indicated that they would like to be trained, 70% said that they found the use of computers to be practical for their learners and 83% indicated that they thought that computers are a necessary part of classroom instruction.

2.2.4 Confidence related to computer skills

Likert scale questionnaire

Although the participants did not feel confident initially, the majority (60%) indicated that they felt confident that they were able to learn computer skills. The rest, except one, were uncertain or neutral.

Interviews

During a training session a teacher expressed the need for having a computer of her own and said that she "went to a friend" to try out her new skills. She also noted that her friend did not have Internet access either, which she saw as a limiting factor. Teacher 47 wrote, "Please supply us with our own computers at home to all those who attend please because I am in need."

2.2.5 Computer skills: How do the participants see themselves?

Likert scale questionnaire

Table 29 in Appendix A highlights the fact that the participants had mixed views on how they viewed their computer skills. Only 30% agreed that they had the necessary skills, 37% were uncertain and 33% stated that they saw themselves as not well versed in computer skills.

In spite of the fact that 60% of the participants indicated that they own their owned computer, it was clear that they understood that they lacked skills. Only 27% believed that they had the necessary skills to use the computer effectively (see Table 4.26B) and 47% were uncertain whether they had the skills. Responses to a similar question regarding their computer literacy revealed that 27% thought that they were computer literate, 37% were unsure and 40% indicated that they were not. What was alarming is the fact that only 43% indicated (see Table 29 in Appendix A) that they felt comfortable using the computer and another 40% were uncertain. Five respondents, all from different schools, indicated they did not feel comfortable at all, thus the computer project would be a great challenge for them.

2.2.6 General pedagogy skills

Likert scale questionnaire

Participants confirmed the need for the development of their computer pedagogical skills. The summary table (see Table 30 in Appendix A) shows that only 17% of the participants felt that they had the necessary pedagogy skills and 47% overall felt that there was a 'great need'. Only 23% indicated that they were happy with the way that they teach at the moment and while 30% were not happy at all. This seems to suggest that the teachers involved in this project clearly felt the need to develop their ICT teaching repertoire.

2.2.7 Cyberhunt skills

Likert scale questionnaire

To be able to design a cyberhunt, computer- and Internet skills are a necessity. However, the data generated at the initial stage of the project suggested that not only did the participants perceive that they lacked computer basic computer literacy skills, but they only had little or no Internet skills. A very small percentage indicated that they felt confident enough to use the Internet (see Table 31 in Appendix A). Sixty-percent of the teachers did not understand the different type of questions that can be used to address different levels of cognitive thinking and 30% to 34% indicated that they were uncertain whether they had the skills (see Table 31 in Appendix A).

2.2.8 Planning ability

Likert scale questionnaire

The majority of participants (67%) were uncertain whether planning for computer integration takes longer than planning for a lesson that does not involve integration or computer activities. Thirty-percent indicated that is was not the case (see Table 32 in Appendix A).

Interviews

Interview data suggest that formal computer lesson planning is something new for the teachers. Some said they had used the pre-designed lesson plans from TuxLab. When asked whether he has planned a computer lesson in the past, Teacher 58 responded, "Yes." He had used Linux, which provided Modules that he had used. After further prompting he said that they actually do not plan formally, but use the lesson plans that come with the Linux (TuxLab) software that they had received. Teacher 38 also indicated that computer related lesson planning was new to him, but not difficult and Teacher 11 concurred.

On the question, "Do you think a computer lesson takes longer to plan than a normal lesson?" Teacher 58 responded, "Not really" because you "just a make your main point that you want to achieve then everything is done by the learners." Teacher 38 was in agreement that it does not take longer to plan computer related lessons when he said:

No much quicker, much quicker, I think it will take me a half of the time to do everything. Most of the time these people enjoy these lessons because they don't have to do it manually on the board, they just touch the buttons and the learners are sick and tired of text books.

In a like manner Teacher 11 responded that computer lessons do not take long to plan, "Because they very much straight forward. I did get a sample from the programme called Computer for Kidz and I found that planning for computers is not so long."

2.2.9 Personal goal setting

Likert scale questionnaire

Forty-seven of the participants indicated that they set computer related goals for themselves and 50% were uncertain or neutral (see Table 33 in Appendix A).

Open-ended questionnaire

The open-ended questionnaire data suggest that some of the goals that participating teachers had set for themselves at this stage of the project were a result of the project. Some of these (verbatim) goals are:

- The dream/vision of being able to use cyberhunt in my class in future (Teacher 2)
- To learn the computer was my dream and I didn't have money to do it so this is my first time (Teacher 47)
- To have computer skills in order to teach my learners as well (Teacher 43)
- To show the kids how cyberhunts can improve our schooling (Teacher 38)
- To think I am moving a step forward to being computer literate (Teacher 34)
- To learn more about Internet - that is what I wanted to know. The learners must be computer literate (Teacher 1)

3. WHAT SKILLS OR ASPECTS ARE DEVELOPED BY TEACHERS-AS-LEARNERS DURING THEIR PARTICIPATION IN CYBERHUNTS?

In the following section and subsequent sections numbered 3.1 to 3.10, the data are presented related to question two and focus on the skills developed by the participating teachers while they were designing cyberhunts.

3.1 Decision skills

Pre-post Likert-based questionnaire

At the beginning of the project the respondents indicated that decision making skills were a very problematic issue, but this perception improved substantially by the end of the project. It was interesting to note that 19% of the participants indicated in the initial pre-post Likert based questionnaire that they 'often' find it hard to decide exactly what a topic means when they have to do a project and that this figure actually increased to 31% by the end of the project. A similar trend was found for the statements, 'It is often hard for me to decide what to do for an assignment or project' and 'I find doing projects difficult because I don't always know what to do right away.' The above indicates that the participants perceived greater difficulties after being exposed to the intervention. These results could be interpreted in two ways. Firstly, decision making related to these aspects while designing cyberhunt had been experienced as more difficult than expected or, alternatively, the question was not understood as intended.

On a more positive note, 35% of the participants indicated initially that they found it easy to create questions for the topics after they have read information about the subject, and this increased significantly to 88% in the post responses. When it came to topic selection for cyberhunts, 87% of the participants indicated at the end of the project in the post only Likert questionnaire (see Table 33 in Appendix A) that they find it easy to decide upon a topic for the creation of a cyberhunt.

Interviews

Teacher 43 indicated that it was not easy to pose questions on different levels, while another noted that she was part of a mixed level group during the research project (from Foundation Phase to grade 12) and said:

…. we have to look at the level of the kids and then there after we look at what is relevant for them and what is informative in order for them to work on. So that we don't work with something that is too advanced for them and we don't work with something that is too outdated. We had to plan and we don't just look at the information and say 'water pollution' - we have to really look at what is relevant for our learners.

The view, that not being in groups from the same learning area, made it difficult to generate suitable create keywords, was supported by the statement, "We didn't choose the topic on my learning area - that is why it was difficult for me."

Observation

Initial personal observation suggested that participants struggled at the beginning of the project with topic selection for their cyberhunts, but that this changed, as guidance was given on how to approach the issue. As noted previously, a possible reason why participants initially found this difficult was the fact that the participants were in mixed groups, from different schools, different phases and different learning areas.

Semi-closed-open-ended questionnaire

The observation above was also supported by Teacher 56 in the semi-closed-open-ended questionnaire when he mentioned, "We need to work in our various learning areas." This was confirmed by Teacher 45 when she stated that "… we're teachers of different grades" and she indicated that this was a problem as this had an impact on their decision making pertaining to a topic to be decided upon regarding the cyberhunt to be designed.

3.2 Search, research skills and reading attitude

Pre-post Likert based questionnaire

The initial questionnaire revealed that only 26% of the participants perceived searching related aspects as being 'under control'. However, this increased significantly by 55% to 81% at the end of the project (see Appendix 35A, summary of items). At the start of the project only 12% of the participants stated that they found it easy to create keywords to make searching for information easier. However this increased to 80% at the end of the project. Twenty-six percent of the participants indicated that they created keywords to make the searching process for information easier, and this figure rose to 73% by the end of the project. The perceived ability to create questions about something that had been read also increased from 36% to 83%, as did the ability to answer questions correctly (from 41% to 81% - see Table 35A in Appendix A). Searching for information was also very problematic at the beginning of the cyberhunt training development project. The questionnaire results in Table 35A in Appendix A reveal that only 27% of the participants initially found it easy to search for information. Personal observational data supported the view that this issue was problematic. Finding relevant information was also problematic, as only 12% of the participating teachers indicated that this was not a problem. However, this changed to 65% at the end of the project, which indicates that finding relevant information is not so easy.

Search skills do not only involve finding information, but serve to ascertain whether the information found is useful, reliable and 'truthful'. The data suggest that initially the teachers did not find it easy to find good or relevant information. Only 12% of the participants indicated that they found it easy to obtain good and relevant information, but this perception had increased to over 60% towards the end of the project. Regarding the statement, 'The information that I usually find has nothing to do with my topic' it was found that there was not really any change as 27% indicated that they agreed with this statement at the beginning of the project and 27% also indicated that this was the case at the end of the project.

While searching for information, the participants had to do a great deal of reading. The pre- and post data revealed that participants' understanding of what they read was not really an issue, as 70% indicated that they do understand well what they read in English. However there was an increase of 15% to 85% by the end of the project regarding the statement that the participants understand well what they read in English, which suggests that knowing what information they were searching for on the Internet could assist to enhance understanding of what is read online. It was interesting to note that initially only 46% indicated that they enjoy spending time reading about a wide range of topics related to a project, but that this increased to 85% at the end of the project.

Post only Likert scale questionnaire

The responses to the post only Likert questionnaire data supported the finding that reading became more interesting at the end of the project and that designing using cyberhunts increased their confidence, as highlighted by 91% of the participants. Overall, 87% responded that they felt confident about their reading and the participants also indicated that they found the reading to be more interesting while busy with a cyberhunt.

Observations

It was noted through personal observation that many participants struggled to define keywords related to the topic. When the participants eventually started to search for information in the search engine, Google, it soon became evident that they found it difficult to explore the magnitude of information available, as there were too many hits on the words, phrases or topics that they had searched on. Another observation was that some participants resorted to buying their own flash disks to save their work.

Journals

Journal data suggest likewise that accessing the Internet and searching for information was initially difficult during the first two weeks of the cyberhunt design project (see Table 36 in Appendix A), but that this improved as the project proceeded.

Interviews

Teacher 43 stated during an interview:

> *There is lots of information. If you look for information in class you look in the text book and you teach according to the text book. In a cyberhunt you look for information and if you are not happy you go to another web site to look for the information that is relevant at the present time. There is a lot of information on the top of the page.*

He continued by stating that in spite of what he stated above, the process was still very informative. A female teacher supported the view that finding information was definitely not easy, especially at the beginning of the project, when she put it like this in a group interview:

For us it was just not easy to find information because we were lacking a lot of skills such as how to go about browsing. After some two or three lessons then it was much easier and clearer and we were able to browse and explore. So now we could find information anytime even if somebody whispers something in my ear in my sleep I will stand up and go to my computer.

In spite of struggling initially to search for information, the participants started to become more successful in searching for information towards the end of the project, as indicated by the data in Table 35A in Appendix A. That this was the case was suggested during a group interview where one participant stated:

In general before having this class … it was not easy to find information because we were lacking a lot of skills … [such as] how to go about browsing. After some two or three lessons then it was much easier and clearer.

The teachers appeared to have had difficulties in using information they generated. During a group interview a participant stated, "The problem that I experience is that there is a lot of unnecessary information that won't be suitable for my Grade 4 learners. I think that was my problem" and another added, "The information that we get it is too much and [some of it] it is relevant and I think that I must have the computer and also the Internet because there is lot of information that you can get." A group member concurred when saying "… some of the information is irrelevant, so it does not give you what you are expected to have." Teacher 26 also indicated that searching on the Internet to find information was initially a problem as it was something new, but this changed as he became more skilled, as indicated by is reply, "When I started the project I did not know how to go about searching the net, but as the programme went on I really learned how to search for information in the Internet."

To try and assist participants to narrow the findings and to prevent the overwhelmingly feeling of 'too much data', the participants were introduced to a search engine for children with the web address www.kidsclick.org. This seemed to work for some participants, but not for all, as in some cases the search engine (www.kidsclick.org) provided participants with too little or no useful information, as indicated by Teacher 11 during an interview who said, "We chose the topics there [On kidsclick] but we ended up not finding enough information" and "With kidsclick we have [found] limited information, but with the other one [Google] we have [found] a lot of information. As a result we didn't know which ones [search engines] to take and which to leave, so both have got their disadvantages."

Ascertaining whether the information found was reliable seemed to be difficult for the participating teachers, as they tended to believe what is 'in print'. Teacher 45 highlighted the fact that to check whether information was truthful was not at all easy, when she stated:

> *It is not easy to see that the information is correct or not. But if you get it [online information] and then sometimes they [project facilitator] tell you if you look at the document and you scroll down they [the website] usually tell that this information is outdated [by looking at the date on the website] or this information is very old. It is not easy to say this information is relevant.*

Teacher 43 stated, "It was very exciting to read information from the Internet." Teacher 45 added that using the Internet "is like a new world that you are going to." Other teachers noted that cyberhunts require a great deal of reading and that this poses great difficulty for those learners who struggle with reading and that the learners have no-one to explain to them when working on the computer. This suggests that the teachers had the idea that when learners are busy on the computer, the learners would not be able to receive assistance from the teacher. However, this perception is not accurate, as teachers will still be able to assist learners when they work on computers. A possible explanation for the participants' response could be that the participants meant that the teacher will not be in a position to assist the learners if they do not indicate that they are in need of assistance.

However, the contrary to the above seems also possible due to the fact that the design of cyberhunts by learners on their own could also possibly improve the learners' reading, was suggested during a group interview where it was said:

> *You know these kids have a problem with reading and it means that we are promoting their reading skills [when they are involved with cyberhunts]. So it will be a very, very a beautiful thing to do.*

Semi-closed-open-ended questionnaire

The questionnaire data revealed that many participants assisted others to log on; to access the Internet and to search for information (see Table 37 in Appendix A). In addition, the data suggest that participants regarded the Internet as valuable and exciting, because it provides the following:

- An opportunity to access different Internet requesting one topic and yet get different views on the same topic. (Teacher 2)
- Opportunities to decide what information is useful and what is not (Teacher 28)
- A variety of information (Teacher 38)
- Getting different views on the same topic (Teacher 2)

Teacher 2 stated that reading online would not only influence learners' literacy skills, but also their ability to gain more information through analysis and sequencing of information when they use cyberhunts.

3.3 Knowledge and skills related to composing questions on different cognitive levels

Pre-post Likert based questionnaire

The data generated by the questionnaire (see Table 38A in Appendix A) revealed that there was a 37% increase from participants initial perceptions (23%) related to questioning skills compared to their post perceptions (60%). Initially only 27% of the participants indicated that they understood Bloom's taxonomy, but this increased to 60% at the end of the intervention (see Table 38A in Appendix A). Initially only 15% of the respondents stated that they knew how to formulate higher level thinking questions. This figure increased to 73% at the end of the project. A similar trend was noted as to whether participants were able to implement the various higher thinking levels pertaining to composing questions in their work.

Semi-closed-open-ended questionnaire

Only two references to Bloom could be found during the project, namely by participant 36 who stated that she had thought about Bloom's taxonomy questions and Teacher 26 who stated in his journal that one of his goals was to use Bloom's taxonomy for the questions that he wanted to compose for his learners.

Post only Likert based questionnaire

In the previous sections it was indicated that participants suggested that cyberhunts and the development project has had a positive impact on attitudes and skills related to decision making, searching and locating information, questioning and reading. The majority or 83% stated that they learned a lot of new things about how to compose questions during the cyberhunt project (see Table 38 in Appendix A).

Interviews

Teacher 43 indicated that he did try to ask questions on different thinking levels when he stated that his group " … ask learners questions that are relevant to the level of the learners" and that "We must vary the questions to them, because they [the learners] are not all the same in the classroom situation." However, he did not provide any more detail.

3.4 Planning skills

Pre-post Likert based questionnaire

The questionnaire data suggest that there was a perceived positive improvement in participants' overall planning skills by 59% (from 22% to 81%, see Table 43A in Appendix A). However, the respondents indicated in that they do not spend a great deal of time on setting goals for projects (see Table 43A in Appendix A).

Initially 35% said that they found it hard to achieve their goals, but this changed to 77% as the project commenced. Participants believed that they became more aware of the value of goal setting as the project continued as the scores increased from 33% to 96%. Furthermore, initially participants also indicated that they did not set goals for themselves during projects, but this changed as a result of this project 53% (from 35% initially to 88%). Sixty two percent of the participants indicated that they made use of a timeline to help them to plan. However, personal observations did not reveal drawn timelines of any kind. Nevertheless, it is quite possible that the participants were aware of the fact that they had a specific date on which their cyberhunts had to be completed and hence paced themselves. Participants also stated that they did not often think about what they could do to finish projects on time, but this increased by 30% (from 38% initially to 68% at the end) as the project unfolded.

Forty-eight percent of the participants initially indicated that when they were involved in group projects, they discussed what each person should do. This figure increased to 81% at the end of the project. With reference to planning, initially 54% of the participants indicated that they planned collaboratively. This increased to 73% at the end of the project (see Table 43A in Appendix).

Journals

Journal entries revealed that as the cyberhunt project continued, the teachers spent more time on the goal setting aspects of the project. This may possibly be attributed to the fact the project facilitator continually focused on this aspect. In addition, journal entries revealed that the participants did not particularly enjoy completing their journals, although they stated that it had significant value and that goals were set for various aspects of their work (see Table 44B in Appendix A).

The journals provided an opportunity for participants not only to set goals and to reflect on whether they had achieved their goals that they had set for each session, but the journals also contained a section where participants had to state how they planned to finish their cyberhunt projects on time. Journal data suggest that participants thought that the following could assist them to finish on time (see Table 40 in Appendix A):

- Saving regularly,
- Working faster,
- Working at extra times,
- Punctuality,

- Attending sessions regularly,
- Practicing more,
- Buying a computer,
- Working cooperatively,
- Asking for assistance,
- Coming prepared and doing work at home / homework / extra time,
- Planning for keywords and questions,
- Listening attentively and following instructions,
- Practicing searching skills,
- Reflecting on topic selection,
- Using the notes provided,
- Using the time available effectively and
- Making notes.

In addition, journal responses regarding the question in their journals, “What will I do differently next time?” revealed similar responses to those offered for the question, “How did you plan to finish on time?” namely (see Table 41 in Appendix A):

- Preparing questions in advance,
- Collaborating more,
- Working faster,
- Working on computer skills,
- Persevering,
- Learning from mistakes,
- Managing time well,

- Working alone when possible,
- Searching differently for information,
- Working on typing skills,
- Following the steps,
- Asking for assistance,
- Revising previously done work,
- Working on saving skills,
- Focusing more and
- Taking notes about the new skills.

Interviews

The participants stated that the journals had value in terms of planning, as indicated by teachers during a group interview when one said, "I think it puts us on the right path in that you know what you want to achieve at the end of the day." Teacher 26 said:

> *Ja [Yes], from my point of view they [the journals] were helpful, because I managed to reflect on what I did so that my facilitator can see where I struggle so that in the next session he will be able to help.*

Teacher 26 replied to the question whether he was negative towards completing the journal, that he was not, "No, no, no I think I did not see any problems completing the journal." Teacher 43 indicated that the journals had value as the project facilitator could use them to determine with which areas the participants struggled.

Participants indicated during a group interview that journal keeping was an uncomfortable process, because it revealed when one was not reaching one's goals. This was evident in the reply of a group member who said:

Sometimes you know what you want and you set goals for that, then you realise that you have done some of them but not the way you wanted to. So it means you did not reach your goal and it frustrates you. You are reminded again that you have to go back. It is uncomfortable to write it down, you know.

Nevertheless she felt that journal writing had value when she said, "It does have a positive, because you also started to have a direction with your goal. It does help you to focus."

Comments during interviews suggest that discussion on planning had taken place. Teacher 26 said, "Ja [Yes], during the training we normally worked in groups so we had time to discuss amongst ourselves the topics and choose the topic of our own … and it was fine." Teacher 45 stated that planning was imperative as:

We need to, we need to, as I said before we were a group of different people that are coming from different schools and different phases in our schools. So we have to look at the level of the kids and then there after we look at what is relevant for them and what is informative in order for them to work on. We had to plan around this - we don't just look at the information and say water pollution. We have to really look at what is relevant for our learners.

Teacher 43 said that they discussed aspects related to topic selection and time related issues, "We discussed our topic and the time that we are using in planning our project. Time is very important. I don't have a computer at home." Teacher 45 added:

One of the things that we discuss is the kind of questions that we are going to ask to the learners and the way that they are going to answer the questions. Also we discuss how they are going to get the information. Those are the things that we discuss.

During a group interview, a teacher stated that they planned by delegating tasks:

If we are in a group of four we delegate the work step by step … we know the topic then we compile it in different computers. Then we put it together in one computer. That will make us work faster than the four of us concentrating on one computer and there is only one person who is doing it, rather than going in separate computers.

Semi-closed-open-ended questionnaire

The semi-closed-open-ended questionnaire provided data similar to what were generated by the interviews pertaining to how the participants planned to finish their cyberhunts on time. The responses were as follow (see Table 42 in Appendix A):

- Use their time effectively,
- Work faster,
- Collaborate,
- Divide tasks,
- Prepare in advance,
- Stay focused and
- Budget time to plan more.

Post only Likert questionnaire

The post only Likert questionnaire summary of items section indicated that 71% of the participants agreed that planning was an aspect that was high on their agenda (see Table 43A in Appendix A). Seventy nine percent of the participants indicated that they found it easy to pose questions on different levels of difficulty (see Table 43B in Appendix A). Planning and design pertaining to composing questions either firstly on a computer, or initially on paper, revealed that the majority of the participants composed their questions on paper first before they typed them on the computer (see Table 43C in Appendix A).

Observation

Personal observation revealed that not all participants were able to design cyberhunts on their own. Hence, the responses suggesting that the participants designed the cyberhunts jointly appear believable.

3.5 Catering for audience

Pre-post Likert based questionnaire

While participants searched, planned and designed their cyberhunts, they also thought about their prospective audience, i.e., those who could make use of their cyberhunt as artefact. The data revealed that there was a significant gain from the initial pre-post Likert-based questionnaire response to the response at the end of the project, as thinking about the prospective audience increased by 55% from 26% to 81% (see Table 45A in Appendix A).

In addition, the pre-post Likert-based questionnaire revealed that initially 48% of the participants indicated that they often thought about the people who would use their project, a figure which increased to 65% at the end of the project (see Table 45A in Appendix A), suggesting that the participants started to think more about their users as the project continued. Finding it easy to present ideas to other people also increased in the pre-post Likert-based questionnaire from 27% to 68%.

Semi-closed-open-ended questionnaire

Data from the semi-closed-open-ended questionnaire indicated that during group planning sessions, the participants thought about their audience. Teacher 28 wrote that they discussed "How can we make it interesting and attractive at the same time informative to learners." Other participants concurred, but also added that they thought about the level of their learners (audience). This became clear through the following responses:

- The learners you are creating the cyberhunt for (Teacher 2)
- The audience or the learner (Teacher 26)
- To keep in mind the level of understanding of the kids (Teacher 38)
- The topic and the level of the learners (Teacher 45)
- Level of understanding. Interesting topics (Teacher 11)

Journals

Journal data supported the above findings, as participants stated that they were thinking about posing relevant questions (mentioned 13 times) which will be appropriate for their learners, the level of their learners (mentioned 27 times) and also how to create interest (mentioned 9 times).

Post only Likert questionnaire

In the Post Only Likert Questionnaire 46% of the participants indicated that they considered their audience by using consistent fonts and font sizes (see Table 46 in Appendix A).

3.6 Computer and design skills

Pre-post Likert based questionnaire

The data generated suggest that basic computer skills improved during the project (see Table 47A in Appendix A). However, saving files as web based files or as HTML files, was still problematic. Participants indicated that they became more comfortable using the computer (93%), obtained more computer skills (79%) and felt more empowered, as they have the necessary skills to assist their learners at school (83%).

Semi-closed-open-ended questionnaire

Data from this questionnaire provided evidence that participants have assisted others (see Table 48 in Appendix A) and that they have learned many new skills (see Table 49 in Appendix A).

Journals

Journal data indicated that participants required assistance with skills such as:

- Basic computer skills such as copy, paste and fonts,
- Internet skills,
- Typing skills,
- Cyberhunt design process,
- Saving information and finding saved information and

- Finding and inserting pictures from the web (see Table 48, 49 & 50 in Appendix A).

The data also indicated that participants felt that they became more competent. This became evident in examples of statements from the journals towards the end of the project such as:

- Today things were easy I am becoming competent now (Teacher 20)
- Nothing so far I am slowly getting there (Teacher 50)
- Not at all at least everything was fine. I did not struggle that much as before (Teacher 43)

Interviews

Teacher 29 had the following to say about his computer skills development, "In fact when I came here I didn't know anything about computers, but as time goes on I became an expert myself. I learned the following: word program [Microsoft Word], Internet, saving information, and searching for information." Teacher 20 supported this perception when she stated, "I learned computer basics because when I come here it was my first time to use a computer." Teacher 19 echoed this by saying, "As I have already stated that this was my first time to use computers, I learnt everything."

3.7 Confidence, knowledge and positive attitude when using a computer as a teaching and learning tool

Pre-post Likert based questionnaire

Although the participants initially had limited computer skills, this did not deter them, rather as was previously indicated, their computer skills grew as the project continued. As a result, their confidence to use the computer as a teaching and learning tool also increased dramatically from 17% to 75% with respect to the summary of items section of the pre-post Likert-based questionnaire (see Table 51A in Appendix A).

In the initial pre-post Likert-based questionnaire only 8% of the participants indicated that they had adequate knowledge about how to use computers in their classroom for teaching and learning, but this increased by 59% to 67% at the end of the project. A similar trend was found for participants being able to assist their learners within the computer classroom as this also increased by 58% to 79% during the project.

The participants also indicated that they felt much more empowered to manage the computer classroom at the end of the project as indicated in the questionnaire (see Table 51A in Appendix A). In spite of still being unsure about whether they have the management skills for the computer classroom, the teachers felt that they had required the necessary knowledge to provide their learners with the required feedback related to computer usage, as indicated by the 54% increase from 17% to 71% (see Table 51A in Appendix A).

Interviews

The interview data indicated that cyberhunts were something totally new to the respondents, who admitted that they never knew what cyberhunts were about before participating in the project. The data suggest that the cyberhunt approach is perceived differently from the traditional 'chalk and talk' approach, as explained by Teacher 26:

> *In [normal] class the learners have to listen to what you are telling them to do and on the other hand during the cyberhunt, all learners are actively involved in their learning. So there is a difference between normal classrooms and the cyberhunt.*

Teacher 45 agreed and elaborated that there is a difference, when he stated:

> *Yes, yes because in a normal class we don't have computers. Probably in a normal class you are just told what to do, but in a cyberhunt you just go to the computer and search … it is really different from a normal class.*

During a group interview a participant echoed the above by stating that the role of the teacher in the cyberhunt classroom "Is to go around and assist with some help where it is needed," and another added:

You need to be there when they get stuck - if they have to call you, you move [walk to them] and then you can just come and click a button … but I am sure it is going to be a little bit easier with them, because they don't just ask for help, they first try to find it on their own. So I don't think they are going to rely on us. They are going to find information on their own.

Post only Likert questionnaire

The majority of the participants felt that they had the computer knowledge required to manage teaching and learning, while sixty-five percent felt that they had the necessary skills to implement cyberhunts. Nevertheless, the general feeling was that it was not so easy to design cyberhunts (see Table 51 in Appendix A).

Semi-closed-open-ended questionnaire

The data generated by this questionnaire suggest that participants were aware that cyberhunts would require a different approach from the traditional "chalk and talk" approach, as the learners will be required to get information quickly and independently (Teacher 27), they will have to search for information when they construct their own cyberhunts (Teacher 26) and they would have to explore and make presentations (Teacher 28).

Teacher 28 stated that the cyberhunt approach is the "reverse of the traditional approach" while Teacher 42 noted that the great benefit is that one can use the cyberhunt approach even with big classes. Teacher 43 believed that learners can still work as individuals if this was necessary while Teacher 34 summarised the role of the teacher and learners in the cyberhunt classroom succinctly, "Learners will be able to operate on a computer, find information on their own, rather than [the teacher] giving out info."

Internet user group

Data from the Internet user group concurred that the teachers felt that their learners would become active participants and would be able to communicate [more with one another]. The teachers felt that the cyberhunt approach would mean that in terms of teaching and learning that:

- The role of the learners would be to use Internet and the teacher will facilitate and supervise the learners

- The teacher will give the learners guidance and they will search for the information on the computer
- Learners will actively search for information. Teacher will guide learners to search for information

3.8 Assessment

Post only Likert questionnaire

Only 54% of the participants indicated that they knew how to assess cyberhunt projects (see Table 51D in Appendix A).

Observation

Personal observations provided evidence that some participants had typed memoranda to enable them to assess the answers pertaining to the composed questions. However, the majority of those who compiled memoranda still used pen-and-paper to do so.

Interviews

Teacher 45 stated, "We did something like a memo with some answers and then we looked at these answers to see whether the answers were correct." She elaborated further, "The assessment will be on how they use their computers ... they will be having the hyperlink on how to get [the information to] their questions, so I will be looking on how they answer their questions." The response of Teacher 45 seemed to indicate that she would require not a memo for basic computer skills or for the use of the Internet.

During a group interview a participant hinted that cyberhunt assessment could go beyond a mere memo when she stated:

> *… ask them to choose the topic and look for information on that topic you take from there so that you can see if they did understand what you are trying to do when creating a cyberhunt.*

However, how to assess aspects that go beyond a mere memorandum will also have to receive attention during future teacher development sessions concerning cyberhunt design.

3.9 Reflection skills

Pre-post Likert based questionnaire

The data related to reflection (see Table 52A in Appendix A) revealed a positive increase from 41% to 85% and suggest that most of the participants had realised that it was important to reconsider their designs. Seventy two percent indicated at the end of the project that they had used feedback from their fellow participants to improve their cyberhunt projects. Furthermore, receiving feedback and assistance from their fellow participants assisted the participants to provide useful feedback to other participants when it was required.

In addition, there was a 39% increase in the participants' motivation and they indicated that knowing that other people would be using their design was a motivational element. Eighty percent plus of the participants indicated that they do make changes to their projects after they had completed them in order to increase the appeal factor for their users. It was noted earlier that the participants stated that they did not enjoy completing the journals but, in spite of this apparent early negative stance, more than 80% said at the end of the project that they would recommend the use of journal or reflection sheets for learners and teachers.

Post only Likert questionnaire

The responses from the questionnaire data indicated that 83% of the participants acknowledged the value of reflection (see Table 52C in Appendix A) and only 57% of the participants indicated that the reflection sheets that they had completed during each session helped them with their planning for the next session.

Interviews

During a group interview, a number of participants revealed that their journals sheets should be returned to them at the beginning of each new session in order to review their previous set goals. The participants also stated that the journal reflection sheets provided opportunities for the facilitator to determine where the participants needed assistance, adding that the project facilitator should make a special effort to provide feedback when he said:

… as the other teachers have said, we need feedback so that we can see how far have we gone and what we need to do … to continue on the right track.

Teacher 45 concurred when he stated, “They [journal reflection sheets] are of value, because it is very important to the participant to know in order to repeat what you [the participant] left out in the past lecture.” He added:

It is important for me, because the instructor is trying to make me understand ... [so when I have a problem, I can indicate the problem in the journal] and [then the project facilitator can] explain clearly that particular question that I do not understand.

3.10 Mental effort

Pre-post Likert based questionnaire

The data generated suggest that the design of cyberhunts requires a lot of concentration and thinking, as there was a positive increase from 50% to 80% and 46% to 59% respectively regarding these issues (see Table 52D in Appendix A). Participants also indicated that the cyberhunt design process helped them to stay focused and to think a great deal about ideas.

That the participants believed that they were focused, was indicated by the fact that there was a 15% increase towards notions of losing track of time as the project continued, probably because the participants were concentrating and focusing on what had to be done (see Table 53 in Appendix A). The participants noted that they still found it difficult to order their ideas, even after the practical exposure to the cyberhunt design process. However, the responses in terms of experiencing projects as hard work dropped during the course of the project (see Table 53 in Appendix A).

4. DOES THE CREATION OF A CYBERHUNT ENCOURAGE MOTIVATION AND INTEREST?

In the following section, the data related to motivation and interest are presented to address the question above.

Pre-post Likert based questionnaire

Pre- and post-questionnaire results showed a statistically significant increase in terms of motivation and interest (see Table 63A in Appendix A). Positive responses to the item ‘Doing projects help me to learn in an interesting way’ increased from 54% to 81%, ‘I like to work on projects’ increased from 50% to 76% and a similar trend was noticed from ‘I really enjoy projects as a way of learning about a subject’ (increased from 54% to 77%). Thus, doing and working on projects seemed to be experienced in a greater positive light as a result of participating in the cyberhunt design project.

Table 63A (see Appendix A) shows a 20% increase of ownership of the design process from the pre-questionnaire (65%) to the post-questionnaire (85%). Similarly, an increase of 33% was observed for the statement, ‘I find myself working on projects during my free time.’ In general, the pre-test indicated that participants believed that they would learn new things during projects, as indicated by 69% of the participants (see Table 63A in Appendix A). However, the positive influence on learning by means of cyberhunt projects was clearly indicated as this perception rose to 92%. The respondents also felt that projects assisted people in remembering more about a topic. This was indicated by 54% in the pre-test. Be that as it may, the post-test indicated that this has increased by 30% to 84%. What was very interesting was the fact that only 19% of the participants indicated initially that they do learn more when they do a project than with other types of learning. This perception increased to 46% at the end of the intervention, perhaps suggesting a shift to a more positive perception.

The response in Table 63A (see Appendix A) to the statement, ‘Computer projects are similar to other projects in class,’ is quite interesting, as 85% initially indicated that this was the case, but this perception decreased to 38% after the introduction of the cyberhunt process.

The majority of participants (73%) stated in the pre-test that projects are not boring, which is quite positive. However, this decreased to 62% in their post response (see Table 63A in Appendix A). Another interesting development was the fact that their experience of cyberhunt design and cyberhunt learning; as well as its possible implementation at school level[39] had a very positive impact on their attitude towards teaching and learning. This became evident in Table 63A in Appendix A, as the 23% increase suggests that the teachers became more positive about their teaching and learning. Participants also indicated a 22% increase in their enjoyment of teaching and learning from 69% to 92%.

Post only Likert scale questionnaire

The response to the statement, 'Doing projects sure beats listening in class,' was quite disappointing, as only 50% indicated that this was the case and 29% were uncertain (see Table 64 in Appendix A). The positive impact of the computer as medium is also highlighted in Table 65A (see Appendix A) by the response of participants at the end of the project, as 54% indicated that they would not like to work on projects where they are not allowed to use the computer. Table 65B (see Appendix A) also highlights the fact that 83% of the participants preferred to work on projects in which they use computers. In a like manner, 96% of the participants indicated that they could see the value and benefits of computer projects, which seems to support the previous argument that computers as medium (the computer and Internet), the context, the cyberhunt strategy and the manner in which it was facilitated, seems to have played a significant role to their response (in Table 67 in Appendix A).

Ninety-six percent of the participants indicated that they enjoy cyberhunts as a new tool to introduce Internet based activities to their learners (see Table 67B in Appendix A). A closer examination of the summary of the items in this table revealed that over 90% of the participants indicated that they enjoy cyberhunts as a teaching and learning strategy by which they can introduce the Internet or searching for Internet related information. That this cyberhunt learning project was something new and different to the participants, was underlined by the data in Table 66 (see Appendix

[39] As on 20 March 2009, we were given the go-ahead by the NMMU through Prof Paul Webb to install wireless Internet connectivity to the participating schools. We are awaiting the response from the campus manager of Missionvale and the technical services department. On 29 April 2009 we received the go ahead.

A) which revealed that 78% of the participants indicated that this project was not similar to other projects. Ninety-six percent of the participants pointed out that they could see the benefits of computer projects (see Table 67A in Appendix A).

Semi-closed-open-ended questionnaire

Participants were exposed to cyberhunts in two ways. At the start of the project they experienced and completed pre-designed cyberhunts. As the project continued, the participants were trained to develop and design their own cyberhunts. Fifty seven percent said that they enjoyed designing their own cyberhunts (see Table 54A in Appendix A) and an overwhelming majority (95%) was adamant that they enjoyed cyberhunts more than normal non-Internet related research. One participant stated that he liked both cyberhunt approaches equally, as both the pre-designed cyberhunts and cyberhunts that they had to design by themselves, assisted him with the design process, as he said, "Using the pre-designed cyberhunt showed me which steps to follow and during my own cyberhunt design, I used what I had learnt before" (Teacher 26). This highlights the value of using concrete examples or predesigned artefacts as examples, as these enabled participants to know what to work towards.

Teacher 45 also enjoyed both types of cyberhunts equally, as she stated that it assisted her to be able to anticipate "how my learners will respond to questions." On the other hand, Teacher 28 enjoyed the cyberhunt that he had to design more, as it was "informative and creative."

All participants responded that they enjoyed the type of learning which occurs when cyberhunts are implemented (see Table 54B in Appendix A). Motivating aspects identified by teachers were (see Table 55 in Appendix A):

- They felt empowered,
- They realised a goal,
- They felt that they have achieved a dream,
- They learned new skills,

- They saw it as a new way of teaching and learning that links theory with practice,
- They experienced a sense of competence,
- It opened new possibilities and different ways of thinking,
- It allowed collaboration,
- The design developed creativity,
- They were able to find interesting information,
- They felt they had some control over what they wanted to do, and lastly
- The presentational style of the training sessions was motivational.

Eighty one percent of the participants felt that the role of the teacher was different (see Table 56 in Appendix A). At the same time it is necessary to point out that there were four teachers who had responded that the role of the teacher was not different in the cyberhunt strategy or cyberhunt approach. These four teachers argued that cyberhunt learning should not be any different (except for using computers) as one should be a facilitator and guide in the normal class too. This became apparent in the words of Teacher 5 who said, “In this curriculum [NCS] learners play a vital role as participants and teacher facilitation of computer literacy forms part of the curriculum.” Teacher 28 agreed when she mentioned that “The teacher always provides guidance to learners.” However, one of the other ‘No’ respondents stated that she was unsure whether this was the case and the other ‘No’ respondent did not provide any reason for her response.

Teacher 26 wrote, “The project taught me that gone are the days of giving learners all the information. They [the learners] also have to wander [walk] around.” The participants saw the role of the teacher when using the cyberhunt teaching and learning strategy as being a (see Table 57 in Appendix A):

- Facilitator,
- Skills developer,

- Supervisor,
- Guide that provides feedback,
- Mentor,
- Mediator,
- Helper and problem solver and
- Motivator

Table 58 (see Appendix A) highlights the fact that cyberhunt learning was seen as being different from the teaching and learning in their normal classes by 96% of the participants. The respondents had various reasons for this response. It seems that one aspect that was different was the fact that the Internet brings a new dimension of readily available information to the classroom, “There is not as much information readily available as [on the] Internet in schools” (Teacher 2). It is important to note that the vast majority of schools in South Africa, including these participating schools, do not have computers in their general teaching classrooms. This is illustrated by Teacher 9, who wrote:

> *We do not have computers in our own classrooms. Some children do not come with answers when you ask them to do research because of disadvantaged areas they live in. There is no help at home. Large numbers in class means that a lot of explanation sometimes has to be done.*

The absence of computers was also mentioned by a number of other teachers, for example:

- They don't have a chance to search for more information. I bring information to them and asked them to do whatever I ask relying in the information I brought (Teacher 19)
- We don't even use a computer in my classroom (Teacher 18)

Another response to why ICT projects are seen as being different was that it provides learners with an opportunity to work on their own (Teacher 27). This was also echoed by Teacher 26, but he also added that curiosity and collaboration would also have a positive effect on the learners' experience during the cyberhunt strategy as it “ ... invokes in learners a sense of independence, curiosity, working with other, etc." Teacher 28 stated that the cyberhunt approach is "the reverse of the traditional approach."

Learners were also viewed as having a different role from the traditional passive listening role. In the cyberhunt approach the learners are active and learning is hands-on. This became evident when participants stated that in the cyberhunt strategy learners become (see Table 59 in Appendix A):

- Discoverers and finders of knowledge,
- Designers and skills implementers,
- Readers,
- Active and hands-on,
- Collaborators,
- Reporters and
- Assessors.

Ninety six percent (96%) of the participants indicated that their learners would enjoy cyberhunts (see Table 60 in Appendix A), as learners are fond of computers and because searching for information on the Internet would be novel and appealing, as well as making them aware that books are not the only sources of information. Comments supporting the above statements were:

- Learners do like to use computers, therefore they will be interested (Teacher 27)
- Touching the computer alone is interesting and it is more interesting when you know how to use it (Teacher 20)
- Will be working with computers finding information without going to the library (Teacher 43)
- The availability of info is great (Teacher 38)
- Children can find the information on their own (Teacher 11)
- Work on own. Work in groups (Teacher 36)

- Learners like checking for information from the computer (Teacher 3)

Nearly 88% of the participants felt that learners would enjoy cyberhunt learning more than the normal traditional classroom learning (see Table 61 in Appendix A). Teacher 2 felt that learners would enjoy cyberhunts as it includes elements of play (enjoyment), saying, "Children like learning through play and this will be a totally different way of learning than normal." Thes data suggest that teachers must ensure that (see Table 62 in Appendix A):

- The topic selection is relevant,
- There is an element of simplicity by keeping the level of the learners in mind,
- They provide visual stimulation in the cyberhunt,
- They provide clear explanations,
- They praise learners when appropriate,
- Cyberhunts start in group context,
- They encourage exploration,
- They show confidence in them and
- They provide choice for example in topic selection and/or grouping.

The majority (96%) of the participants indicated that they felt that the cyberhunt project had benefited them (see Table 68 in Appendix A). Participants indicated that the benefits of the cyberhunt project could be attributed to the following (see Table 69 in Appendix A):

- It could improve teaching,
- It introduced participants to new approaches,
- It empowered them,
- It prepared them for change,
- It helped them to become a facilitator,

- It assisted them to teach others how to design cyberhunts,
- It created interest,
- It helped participants to explore new horizons and
- It assisted them to learn (new) Internet skills.

It was noted that empowerment played a vital role as a motivator. This was verbalised by Teacher 36 when she wrote that she has acquired skills that nobody can take away, or in her own words:

> *[I have learned a] skill that nobody will take from me. It's just like learning how to drive a car. I learned to work with others, move, help and discover information for myself.*

Teacher 2 added when she said, “It [the cyberhunt project] is developing me and also it is an opportunity to advance in technology.” Teacher 18 agreed and said, “I learned more about many things and searched for certain things concerning a lesson.” Another teacher, Teacher 38, stated that this type of learning would empower learners as well, and would assist the learners in their learning.

Interviews

One teacher responded to the question, ‘What do you like about this project?’ that:

> *It helps children to be independent as they discover things by themselves - not being told by you as a teacher. I think it stays better in their minds when they discover it on their own.*

Another teacher, Teacher 45, added that cyberhunt learning is different from normal class because:

> *… in normal class you are just told what to do, but in cyberhunts you go to the computer and search … using the computer it is really different from a normal class.*

She also stated that the teacher has a very important role as:

You must see to it that learners don't go to the web sites that are not relevant to them … the educator must be very alert and go around and see to it there is no learner who is lost.

Teacher 45 responded at the end of the project to the question whether the project was interesting or boring as follows:

Oh! Yes it is interesting. You know on Wednesday I was worried because I came late from work ... the computer class is so exciting and interesting.

Teacher 43 added, "Yes it is very much interesting." Another teacher responded during a group interview to the same question:

It was interesting; because by that time I was doing a cyberhunt ... I have gained more skills.

The interview data also indicated that the cyberhunt project was experienced as interesting, as it was new, "I am not interested in a project that is out dated. I only need projects that are going to uplift me" (Teacher 45).

Teacher 45 noted novelty as a motivator when she said, "Yes, yes because in normal class we don't have computers - using the computer it is really different from a normal class." Teacher 43 added, "It is different and it is informative. In cyberhunts you look for information and if you are not happy you go to another web site to that is relevant." A motivation to use Cyberhunts was that it could be tailored for a specific grade. A teacher who had experienced open source material responded as follows:

It is totally different from the open source. Because in open source there was just those activities and I don't think there are activities for the older learners. Their activities are foundation phases focused and most of them are not suitable for the intermediate phase. There is nothing at the moment that we can compare with cyberhunts.

Another one concurred when she added:

Unlike the boring classroom routine where they have to listen to you and they fall asleep while you are talking because they are tired of you. But when they are working with computers it is totally different and it is so exciting for them for the change of environment. Moving out of the classroom going to computer centre it is very exciting for them.

During a group interview at the middle stages of the project, a teacher stated that the Internet has value and is important because:

If you have the Internet it is more boarder than asking them to go to the library in the location. Because the library is sometimes too far [away from school] ….. they don't even get the opportunity to be there. But when they go to the Internet it is so exciting.

The data also suggest that the project was perceived as being beneficial in general terms, as illustrated by the teacher who said:

... when I started the project I did not know how to go about searching the net, but as the programme [training] went on I really learned how do it (Teacher 26).

Teacher 45 added "… this programme [cyberhunt project] helped us to be computer literate."

Teacher 27 stated that learners enjoy working with technology and Teacher 28 added that learners are curious and enjoy discovering things; "They like to figure things out. So this will obviously suit their style."

Novelty as a factor was also highlighted by Teacher 29. His school received new computers via the project and his learners were very excited. He said:

My learners like computers a lot. They even sacrifice to have afternoon classes because to them it's so wonderful to be just in front of a computer.

Teacher 9, whose school had also received new computers, stated that the children "chase him" to use the computers. Teacher 34 also pointed at novelty being a motivator and said, "It will be something new that they will enjoy, fully participating, actively," while Teacher 26 added that, "Some of them [learners] have never used the Internet before" and that the learners would "want to search for more information and interesting topics."

Teacher 20 felt strongly that the fact that the teacher was no longer ‘in charge’ was a motivating factor. Teacher 26 said:

> *In class the learners have to listen to what you are telling them to do but during cyberhunts they are actively involved in their learning. So there is a difference between those two classrooms, teaching and the cyberhunt.*

The same sentiment that a different context and medium could be a motivator was voiced by Teacher 45 who said that the learners would be motivated when they search for information on the Internet when replying that it would be the case “Because they [the learners] are searching for the information from the computer other than books.”

5. DOES THE CREATION OF A CYBERHUNT ENCOURAGE COLLABORATION?

In this section, the data reported refer to collaboration, with special reference to the question; how does the creation of a cyberhunt encourage collaboration?

Pre-post Likert based questionnaire

The data indicated that when the participating teachers had a problem during the cyberhunt design process, that they were more open to ask for assistance as the project progressed (see Table 70A in Appendix A). An increase in the region of 23% was also found in the pre- and post-test in terms of finding it easy to work with participants in groups and for learning new things from group members.

Fifty-eight percent of the participants initially indicated that when they did not understand something, they would rather try to find out for themselves than ask for help, but this perception changed towards the end of the project with 81% being positive about asking for assistance (see Table 70A in Appendix A). Participants also indicated that they were initially not comfortable working with others when they did not understand something. Notwithstanding this initial finding, becoming more comfortable with other teachers when not understanding something, also improved substantially (by 30%) towards the end of the project (see Table 70A in Appendix A).

Initially 40% of the participants indicated that they preferred to work in a group on a project. This score increased by 32% to 72% in the post-questionnaire. The ‘working in groups rather than as an individual’ question responses also increased from 35% to 77%, while positive responses to ‘Learning skills in groups are easier than learning it individually’ increased from 50% to 77%, as did the overall positive perceptions about working with others on a project as this increased from 58% to 85% (see Table 70A in Appendix A).

Seventy-six percent of the participants initially felt that working in groups made projects better, a figure which increased to 96% towards the end of the project. Collaboration with others increased from 69% to 88%. Initially 76% indicated at the beginning of the project that they would prefer to work alone rather than in a group. However, at the end of the project this decreased to 46% which suggests a change in attitude towards collaborating with others (see Table 70A in Appendix A).

However, some responses revealed that certain participants still felt that working alone was the best option. What was interesting was that these responses did not come from the more capable teachers, but from the participants who struggled. The initial pre-post Likert-based questionnaire data indicated that only 27% preferred to work in a group with teachers from another school. This increased to 44% in the post Likert based questionnaire. Initial questionnaire data revealed that the majority (81%) did not experience a lot of conflict in their groups. However, this figure decreased to 69% by the end of the project, which suggests that the perception of conflict increased as the project progressed. Thirty eight percent of the respondents felt that ‘there was more talking and that little then gets done as a result.’ There were thus some differences of opinion among participants (see Table 70A in Appendix A).

Fifty-six percent of the participants said that they initially felt that doing projects gave them a chance to develop their own point of view. This perception increased from 56% to 92% at the end of the project, constituting an increase of 36%. Initially 65% of the participants reported that group work in projects promotes personal growth. This figure increased to 92% at the end of the project (see Table 70A in Appendix A).

Initially, only 32% of the participants felt that the product of group work reflected the individual contributions of participants, but positive responses increased to 60% in the post questionnaire (see Table 70F in Appendix A). Forty-two percent of the respondents indicated that they felt confident to assist others and 46% indicated that they were not confident at all. However, at the end of the project 92% indicated that they now felt confident to assist others when they need assistance with computers (see Table 70A in Appendix A).

Post only Likert scale

The data revealed that 92% of the participants felt that collaboration within groups empowered them to feel more confident to learn about cyberhunts (see Table 70G in Appendix A). Hence, group collaboration seems to have had a positive effect on participants' confidence and willingness to learn about cyberhunts. Helping others and the exchange of ideas among group members was a high priority. Ninety-six percent of the participants stated that they had asked someone else who is 'an expert' in class to assist them if they experienced a problem and 87% pointed out that they had exchanged ideas with other members of their project team (see Table 70D in Appendix A).

Interviews

Interview data suggest that when teachers required assistance they either asked their peers or the facilitator. Teacher 26 replied as follows to the question, 'What do you do when you don't understand something and you don't know how to do it?' that "I always ask" and he continued:

> *When working in a group, I ask the fellow group members and if they don't understand, I ask the facilitator because if you carry on without understanding you won't complete your work and you must do it correctly (Teacher 26).*

Teacher 45 replied in a similar manner that "In most cases I'll call you, André, can you help me that is what I (will) do." Teacher 43 said, "When I am stuck I would like to be assisted by you André and if you are busy with other people I always call someone else." Another teacher added during a group interview that:

You ask the person sitting next to you. If he doesn't know you ask the other group and all the time they are willing to help you. The one [peer-facilitators] who knows is always willing to help some of them [who struggled], they [peer-facilitators] even stand up and go around.

In spite of positive feedback related to collaboration, not all participating teachers were positive about working together, as indicated by Teacher 46 when she stated that "I think it is better to work alone to gain confidence ... then you ask for assistance and then you work on your own again." Teacher 26 was positive about working together and stated that collaborative group work " … increases one's socialising skills", but he also cautioned that one should be aware of the fact that group work is not necessarily quicker, but can be quite time consuming.

Observation

Observations revealed that at the start of the project most of the participants sat adjacent to their peers from the same school. It was also noted that the participants interacted very little with one another during the first four weeks. However, during the fifth week of the project, the situation changed totally as they had to work together officially in groups to design cyberhunts. The participants also started to make more and more use of the peer-assistants. The teachers' rationale for preferring to working with teachers from their own school was that this was more practical, as they could more easily discuss aspects related to planning and design as they are in contact with one another on a daily basis. Furthermore, it was easier to plan appropriate activities for their school as they were aware of their learners' capabilities and needs. In addition, working together with their colleagues made it easier to share their ideas and to voice their problems. Working together could be an enabler in schools, as the behaviours observed suggest that many participants will not be able to design their own cyberhunts successfully on their own.

Semi-closed-open-ended questionnaire

It was revealed that participants asked either the project facilitator (36%) or fellow teachers (36%) for assistance. Twenty percent (20%) of the participants indicated that they asked assistance from both the facilitator and fellow teachers and only 8% stated that they did not ask anyone for assistance, as they solved their problems themselves (see Table 71 in Appendix A). The respondents stated that they felt comfortable asking the facilitator for assistance as he (see Table 72 in Appendix A):

- has the necessary knowledge and skills,
- is very friendly & always willing to assist,
- is honest and active,
- provides certainty and he
- is a good listener.

At the same time they also indicated that they felt comfortable asking their fellow participants for assistance, as they felt that their fellow participants (see Table 73 in Appendix A):

- Could relate to their friend in their group,
- The facilitator did not explain to them in a manner that they understood,
- Group members explained in a clearer manner and
- Group members understood them better.

This was probably because they all speak isiXhosa as their home language. Some participants indicated that they tried to solve their problems on their own through trial and error or just for the sake of doing it on their own.

Reasons given for inquiring or asking the project facilitator, peers or peer facilitator for assistance were that (see Table 74 in Appendix A):

- They could not log-on,
- They lacked knowledge,
- Those they asked were seen as computer experts or knowledgeable and
- Because they are ‘slow learners’.

The areas they most often required assistance with were the following (see Table 76 in Appendix A):

- Logging on,
- Saving,
- Pasting,
- Copying of information and copying of hyper linking,
- Finding information,
- Basic computer skills,
- Deciding on a topic,
- Logging on and
- Cyberhunt design.

Participating teachers who had assisted their peers were to some extent in agreement with the skills the assistance seekers indicated above. Those participants, who had indicated that they helped their peers, indicated that it was primarily with (see Table 77A in Appendix A):

- Saving,
- Pasting,
- Copying of information and copying of hyper linking,
- Finding information,
- Basic computer skills,
- Deciding on a topic,
- Logging on and
- Cyberhunt design.

However, those participants who assisted others also added that they assisted those assistant seekers with how (1) to tab between Internet Explorer and Word, (2) to find pictures, (3) with general computer skills and (4) with typing issues.

The majority of the participants (65%) indicated that their problems were solved (see Table 80 in Appendix A) and that they would like to participate in groups again (see Table 81 in Appendix A). Seventy-nine percent indicated that they enjoyed 'very much' working with others during the cyberhunt project and 21% indicated that they enjoyed it 'fairly much'. No one indicated that they did not enjoy working with others in the computer room during the cyberhunt project (see Table 82 in Appendix A).

Data from the questionnaire suggest that there were problems when working in groups such as (see Table 84 in Appendix A):

- Disturbances from others when they were busy working,
- The different speed at which group members worked,
- Not all members staying focused and
- People not arriving on time.

Eight participants indicated that they did not experience anything negative while working in a group. Further responses indicated that problems that had arisen were (see Table 85A in Appendix A):

- Too much talking,
- Different abilities,
- Finding suitable information,
- Composing suitable questions,
- No manual or guide and
- Lack of computer skills by participants have been experienced.

The respondents stated that those who assisted them were very helpful and positive. The majority of participants highlighted the fact that those who assisted them, assisted without showing signs that they were being hindered in their own progress. However, one participant indicated that although some reacted positively when they were approached for assistance, some appeared bored, which suggests that some of the capable ones did not always want to provide assistance.

The semi-closed-open-ended questionnaire highlighted that participants had shared various issues related to the cyberhunt design process among one another in their groups, such as (see Table 87 in Appendix A):

- Topic selection,
- Developing questions,
- Deciding and developing strategies and procedures,
- Thinking about their audience,
- Internet and internet addresses or websites to be used,
- How to search for information,
- How to assist their learners,
- How to design and plan cyberhunt lessons,
- Planning for the cyberhunt project,
- The usefulness of project and
- How they could assist each other.

The data suggest that participants experienced working together in groups as beneficial as it created opportunities for (see Table 89 in Appendix A):

- Meeting new and different people,
- Getting assistance,

- Receiving explanations from peers and as a result it lead to learning from one another,
- Discussing ideas, encouragement,
- Sharing different experiences,
- Creating enthusiasm to learn more,
- Sharing information,
- Planning collectively,
- Sharing the workload, and
- Planning how to finish on time.

The questionnaire data also indicated that collaborative group work was seen as being valuable, as participants indicated that it assisted with (see Table 90 in Appendix A):

- Sharing of knowledge among one another,
- Encouraging team work,
- Simplifying the process,
- Making it quicker to learn new skills and processes,
- Providing an opportunity for trialability,
- Creating opportunities where they could express themselves,
- Instiling confidence in one another,
- Providing a relaxed atmosphere,
- Stimulating multiple answers to problems and lastly
- Providing opportunities where they could use their home language to assist one another.

A variety of groupings factors were also identified to be kept in mind when collaborative teacher development projects are planned, namely; (1) group participants together from the same school, (2) group according to ability, (3) group in such a manner that there is mixed abilities in order that the more competent ones can assist those who need assistance, (4) groups should not be too large and (5) group members should not work together in the same group for too a long period of time (see Table 93 in Appendix A).

Journals

The participants noted that they asked either the facilitator or fellow teachers for assistance (see Table 75 in Appendix A) and they also indicated that that they felt that the people whom they asked were more knowledgeable than they were. The following excerpts from the journal entries illustrate from whom they asked assistance:

- I was asking Andre [Project Facilitator] but as the programme continued I discovered that some of the teachers also can give help (Teacher 11)
- Teacher 26 [he is also a peer facilitator] because he has a good understanding of computers … (Teacher 23)
- I asked the student assistant [peer facilitator] and the facilitator because they have more knowledge than me (Teacher 48)
- Teacher 26 [peer facilitator] from School A is more advanced than me (Teacher 50)
- I do ask Teacher 26 [peer facilitator] because I've noticed that he has got more knowledge about this (Teacher 51)
- Neighbour or instructor and the advanced people [peer facilitator] in the group like Teacher 26 [peer facilitator] (Teacher 50)
- Teacher 45 [peer facilitator] has experience in working with computers as she is teaching computers in her school (Teacher 19) 2008
- Assistant [peer facilitators] and colleagues if they can't help, I consult the instructor (Teacher 50)
- My facilitation or his assistants [peer facilitator] (Teacher 3)

Journal data triangulated well (see Table 78A and 78B in Appendix A) with the semi-closed-open-ended questionnaire data above, but also highlighted other aspects that were found to be problematic for participants, namely:

- Accessing the Internet,
- Logging on to the network,
- Searching for information / exploring information,
- Tabbing between internet explorer and word,
- Finding and inserting pictures,
- General computer skills,
- Saving documents and opening saved info,
- Copying and pasting information or hyperlinks,
- Starting the program,
- Hyper linking,
- Cyberhunt design,
- Typing skills,
- Topic selection,
- Composing questions based on the topic and
- Dealing with too much information or web hits.

The journal data revealed that many participants did not experience problems or disagreement within their groups (see Table 85B in Appendix A). They wrote in their journals that they had helped each other and that working together assisted them to build a common understanding of what had to be done.

The journal data also indicated that the disagreement or conflict that had occurred was as a result of (1) some members being dominant, (2) issues around topic selection and (3) differences of opinion on which search engine to use. However, participants wrote that consensus was usually reached during disagreements (see Table 85B and 85C in Appendix A).

The journal entries suggested that working collaboratively within groups lead to:

- The participants gaining more knowledge and sharing knowledge with one another,
- Simplifying learning,
- Being more helpful to one another,
- Saving time as obtaining assistance from others make the design process quicker,
- Assisting one another to solve problems,
- Members starting to participating on a greater scale and
- Instiling confidence.

Furthermore, there were indications that the participants found it more enjoyable and interesting to work in groups. However, some participants did not work in groups, but worked alone (see Table 88 in Appendix A).

Participants felt that collaboration by means of group work was ‘positive’ or ‘very positive’. They made the following suggestions to be kept in mind by group members when they are involved in on computer related training and collaborate within groups (see Table 91 in Appendix A):

- Keep on helping each other and work as a team,
- Share information,
- Provide freedom in the groups to ask for assistance and to bring ideas,
- Divide tasks,
- Start working as groups, then provide opportunities for individuals to show their competence,
- Stay focused,

- Be patient with one another and
- Cooperate and compromise as needed.

The following suggestions that were made by participants for project facilitator(s) to keep in mind when collaborative computer training methods are planned or used, were: (1) group according to ability, (2) keep the level of members in consideration, (3) group participants according to their learning areas, (4) be careful how you group members who join later as this can cause frustration among existing groups and (5) cater for food (see Table 92 in Appendix A).

6. HOW SHOULD THE TEACHER DEVELOPMENT PROCESS FOR ICT INTEGRATION USING CYBERHUNTS BE MANAGED?

In the following section the data related to aspects of the process of teacher development for ICT integration are reported, in order to address the question of how should the teacher development process for ICT integration using cyberhunts be conducted?

6.1 Facilitator related aspects

Internet user group

The anonymous Internet user group recorded what the participants thought was positive about the project leader of their Teacher Development Process (TDP) for cyberhunt implementation. The participants' overwhelming responses were that the project facilitator was "friendly and approachable." Issues of friendliness, patience and tolerance were mentioned several times:

- Patience determination openness
- Patience because some people really make it difficult by always being late
- To be lovely and be patient
- Friendly, approachable

One participant wrote that the project leader's "patience, determination and openness" were commendable. Patience, mentioned by another participant in the Internet based online user group, was seen as a very important attribute by another anonymous participant who stated on the online user group that participants are on “Different skill and knowledge levels” and another participant added that patience is important, as he/she said “Patience is needed as I belong to old school of thought and computers are new to me.”

In addition, participants felt that the project leader should take cognizance of their different levels of ability, that their pace of learning differ, that each one of them is unique and that anxiety has to be contained. This became evident from the participants’ writing on the online user group where one stated, “We are unique, so he must do things steady so as to take everyone on board” and another added, “ … be steady with us.”

Another participant stated that the project leader “Should be tolerant and make them [feel] relaxed.” Another commented that it was important to create a relaxing atmosphere as he/she had “No previous knowledge of computers” and another participate typed that some participants are “slow thinkers.” Another participant also stated:

> *The facilitator must not get bored with the students [participating teachers] that do not understand. It is very important, as I am not computer literate and I need more attention.*

Several participants said online in the Internet user group that the project leader or project facilitator should be well versed in what he/she is trying to do. This was seen as a positive aspect, as one participant said that what was positive about the development process during the early stages, was the fact that the project leader was knowledgeable about what he had to do, “he knows his job, he knows how to deal with people and he is really understanding,” but cautioned the project leader that he was “allowing too much time to repeat previous lessons” when participants met for the next session.

It was also clear that clarity is extremely important. Teacher 45 said:

> *I suppose the first and foremost thing is to know the computer and be able to explain clearly so that teachers can hear and understand what you are saying. I think that those are the things that are important.*

Two participants added that what they saw as important was “he [the project facilitator must be able to] can explain clearly.” The participants believed that a project leader should be positive, accessible, and helpful and have some degree of understanding of the participants. This became evident as they voiced in the online user group that the facilitator or project leader was "… very positive about his work", others added that he was "Accessible and very understanding" and "He knows what he is doing and does it best." This was also emphasised by other participants who highlighted the following characteristics and attitudes of the facilitator:

- Friendly, approachable,
- Patience, determination, openness,
- Open to questions.

Furthermore, participants indicated that it was important for them that the facilitator had a 'positive attitude'. This aspect was noted by the Internet user group as "the facilitator was very positive, encouraging and patient" and "He is very positive about his work."

Semi-closed-open-ended questionnaire

Knowledge and skills related to the computer are not the only requirements for an ICT related teacher development project, but assessment of participants' understanding was also seen to be important. Teacher 2 stated that the facilitator or project leader should "Try to make sure that most of the people don't have vast gaps of information, for example one gain 10% and the other 90% of the day's work." Teacher 40 concurred, "He must be observant, must be good in assessing his participants."

The participant suggested that pre-assessment could be done by providing opportunities for individuals to show their competency before a project commences, as articulated by Teacher 38 who said, "[The project facilitator] Must first find out who are computer literate."

Furthermore, it was felt that assessment should be done on a regular basis during the training to ensure that participants are on required level. This implies that the facilitator or project leader has to provide frequent opportunities for participants to demonstrate their newly acquired skills in order to know which participants are in need of more assistance. This was clearly indicated by the following responses in the semi-closed-open-ended questionnaire:

- Try to make it a point that a least everybody understands the day's work (Teacher 2)

- Ensure that everybody understands and we are all going together (Teacher 1)

- Check if everybody knows how (Teacher 3)

Some respondents suggested that assessment could be done by means of small tasks and/or by asking questions, as voiced by Teacher 28 who wrote, "Give them [the participants] tasks and see if they follow" and Teacher 42 added, "By asking teachers." Teacher 3 stated that it is important to provide opportunities to "Let participants show their understanding by answering individually." Teacher 28 noted the need for "Doing evaluations and allowing participants to practise skills in a form of a presentation."

It must be stressed that participants had been presented with opportunities to show their competence, but that they had worked in groups most of the time and only started to design their individual cyberhunts towards the end of the project. Thus, opportunities had been provided to show competence, but it was virtually impossible to assess each group and/or each individual at the end of every session formally, as the participants' demands for assistance were high most of the time. Therefore more competent participants were used to assist those in need of assistance. However, it appears that the participants wanted the seal of approval from the facilitator and not from their peers. This became evident during an interview with Teacher 45 who responded to the question from whom would you like to get feedback on the quality of the project, that she wanted feedback from:

> *From you, because you are the person who manage to help us and you are going to see that this person is the getting better [improving].*

However, she also mentioned that they could ask one another as they could learn from each other's projects.

During the first few weeks of training, the participants were guided via PowerPoint presentations, explanations and modelling using a data projector as teaching aid. Notes were not distributed right away and the participants were in agreement that this should have been done and that clear notes were needed for training purposes as well as notes to guide them with implementation at school. The participants felt that notes or a manual would have been valuable when they had missed a session or to prepare or to recap something at home. This was highlighted by participants when the responded as follow:

- Since I do not have a manual there could be steps that I might not be able to follow (Teacher 2)
- We need notes which can guide me (Teacher 5)
- Make sure that manuals are available before the training starts so that we are able to go through this at home before attending the next day (Teacher 2)
- Participants must have notes. They must be shown what to do and check if they have mastered (Teacher 3)
- Yes. I am the kind of person who wants to achieve the best in anything. So if I can have a textbook that guides me, I will use it for sure (Teacher 29)
- Hand-outs or notes so that we can read the information (Teacher 6)
- If we can have a manual where we can remind ourselves about what we have done in a session that will improve our understanding (Teacher 55 in her journal)
- We need to have manuals or notes to refer to when the problem arises (Teacher 44 in her journal)

It was interesting to note that the majority of participants, who wanted notes, were those teachers who did not join the project right from the start, and who therefore might have felt a little lost. The project facilitator noted during one of the many personal observational recordings on the dictaphone that “I could see how their eyes lit up when I showed them the manual. They really wanted something physical to work from.”

Interviews

One participant felt that her group did not always receive the attention they should have received. She said:

For me at least you can target a certain group of people so that we all get attention because what you did is you are supposed to go back and do that over and to see to it that everyone is okay. We are not satisfied about that because you attend to another group and can't come to us maybe three by three we need a small group maybe, 4 or 5. Then you skip another group at times you do attend to all of us, and we had to help each other, then maybe you have someone and we are struggling also. We want to go forward. And then, if you can group us according to ability because I was bored because I know [some of] these things [Teacher during a Group Interview].

The importance of notes was also referred to during a group interview, when one of the teachers stated:

To me it is really better when we have some notes so that when you are at home you really study the notes. Even if it was before we come here and do something or the steps. Because we don't have these [computers] at home so that we can practise on them [the computers] there. So it will be much better maybe next time to have some notes [from the beginning] even if it is something that is very short, so that you can know exactly because sometimes you just say André come I'm stuck, I don't know what to do.

Teacher 45 stated that school visits is something that the project facilitator should think about, when she said:

There must be somebody that goes around the schools to see how we are doing … So that he can see maybe that a particular person needs some more support or information will be able to get that. And more over you can be everything that they need so that people can contact you and ask whatever their problems are.

Post only Likert scale

The majority of participants (90%) clearly indicated that they would value the opportunity to see how the project leader plans cyberhunts. All respondents (100%) indicated that observation of the project leader in action within a classroom context was helpful and necessary. However, co-planning and demonstrations are not all that is required. Participants also strongly indicated that they do want support from knowledgeable persons, and 93% of the participants indicated that classroom visitations are extremely important.

6.2 Time related issues

Semi-closed-open-ended questionnaire

As teachers have many responsibilities and have many in-service training meetings offered by the Department of Education, they were asked how often, when and what time span should be applicable per training session. The questionnaire data revealed that 55% of the teachers wanted computer training twice a week (see Table 93 in Appendix A). One participant indicated in the 'other' option box that they "need training every day." The predominant response as to why training has to be done on a weekly or biweekly basis, was the fact that the training sessions provide opportunities for practice and that regular practice assist with the automaticity of computer skills. Examples of the types of responses follow:

- To get a chance for practice (Teacher 2)
- To allow teachers to practice what they have learned (Teacher 28)
- So that people can be able to grasp not to forget. And be able to continue from point A to point B (Teacher 29)
- Practice makes perfect (Teacher 38)
- For the sake of practice (Teacher 45)
- So that we don't forget what has been taught. To get also more practice (Teacher 5)

- A computer needs practice every day. Unfortunately in our schools there are no computers (Teacher 40)

- To keep in fact so as to always re-cap what you did the previous week and continue with new work (Teacher 11)

Comments which suggested that training should not be held every week were:

- We are committed to other business (Teacher 47)

- Sometimes a work we are busy with other businesses (Teacher 1)

- There are other programmes that we are involved in (Teacher 3)

One respondent stated that school holidays should be utilised, “If we can be given more time like using ten days holiday attending it from morning session, one can be well equipped with it” (Teacher 9).

It is important to note that school hours are in most schools from 08h00 to 14h00. From 14h00 to 15h00 teachers are required by the DoE to stay at school and to be involved with extra mural activities, administrative tasks, planning and/or attend in-service training. Teachers were clear that they felt that training should not impede their teaching time or influence their schools smooth running. Teacher 26 stated that “The program [cyberhunt training] should not affect the school's program” while Teacher 5 also felt that the cyberhunt training should not be in conflict with school’s programme. Teacher 45 noted that “There is so much that needs to be done at school, especially with the RNCS programme - it wants us to be ‘hands on’. So to miss school is going to cost us.”

Teachers who were of the opinion that training should be in school time, argued in the questionnaire that training should be “part of our working hours.” Teacher 42 noted that the school day “drains their energy” and Teacher 46 mentioned that “after school every teacher is tired and might have had problems at work which may be affecting [their] concentration.”

There was no clear winner between a two hour or 1 hour training session, as 38% preferred two hour training sessions and 33.3% a one hour session (see Table 95 in Appendix A). However, as some participants have to travel quite a distance and/or make use of mini-bus taxis for transportation (often resulting in them arriving late), to come only for a one hour session per week did not seem to be worthwhile. On the other hand, the participants stated that if the training sessions are too long, “it would be tiring and no information would be gained” (Teacher 2). Another added that “Too much time will cause confusion” (Teacher 45). This response possibly suggests that teachers may feel that too much exposure to new computer skills could lead to information overload. Thus it is important to have a balance between learning time and the number of new skills introduced. This highlights the importance of relating to participants needs when embarking on teacher training and teacher development.

Another teacher highlighted the importance of having a break between the two hour training session (Teacher 38) and another one indicated that the first hour should be used for skills introduction and the following hour for practical hands-on application of the new skills acquired, “This will suit us, as after that hour we will be able to go and practice it [new skills or new aspects]” (Teacher 42). However, in spite of having sessions of approximately one–and-a-half hour to two hours, some teachers wanted more time for a session. Two teachers indicated anonymously that “the time frame is very short” and that it was important to “add more time.”

Internet user group

The questionnaire data were supported by responses by the anonymous Internet user group, for example:

- Twice a week at least, because some of us really tent to forget easily.
- On daily basis because some have no computers at home.
- Once every week particularly now that there is light at the end of the tunnel.
- Weekly, otherwise it allows too much of a gap, during which people tend to forget large chunks of what they learnt.
- On weekly basis, because when skipping a lot of days or weeks teachers tend to forget what was done previously.
- Weekly, so not to forget what we've learnt.

One could argue that a participant could practice at home or at school, but then it was shown earlier that not all the participants had computers at home and even if they did have a computer at home, they indicated that they were not very computer literate. Lack of access to computers was clearly voiced by Teacher 46, “Because we don't have our own computer it's easy to forget” and Teacher 40 added, “Unfortunately in our schools there are no computers.”

6.3 The training environment

Semi-closed-open-ended questionnaire

Participants appreciated the fact that the training was not limited to a once-off one-day or once-off one-week training programme, which is the usual format of the Department of Education training, but that the training was ongoing. This became evident in the words of Teacher 11 when she stated that what was positive about the cyberhunt training project, was the fact that it was different form the Department of Education’s training:

> *It [cyberhunt training] was continuous rather than getting a weeks training and you are left with a certificate [like the Department of Education’s training], but knowing nothing. [And then] You are not confident to teach others.*

The importance of regular and continuous training sessions was highlighted by the fact that after a four week holiday, the participants appeared to struggle.

Participants valued the ability to be able to work at their own pace (Teacher 12) and that they were not rushed through the training. This became evident in the words of Teacher 45 when she stated that what she appreciated was “The fact that we are not pushed, we are taught so as to know not in a rush.” Furthermore, it was felt that everybody was accommodated, “This one [cyberhunt training project] accommodates everybody even if they don't have the computer skills” (Teacher 40). However, this does not imply that everything went smoothly, as Teacher 40 also highlighted that by trying to accommodate everyone, there was too much repetition during the training.

Participants stated that they also found the presentation style appealing (Teacher 28) and the fact that they had various opportunities to practice what they have learned, “I had time to put to practice what I've learnt on my own” (Teacher 2). In the previous section, one teacher complained about the repetition, however, repetition was valued by some as Teacher 3 stated, “From the previous [week when] we were able to be trained, then the facilitator would test that part [during the next session] then he would continue with the next one [the new session and introduce new skills].”

Furthermore, the presentation style was seen to be practical with the theoretical side not over emphasised; “Other programmes have been too theoretical, but this one was hands-on” (Teacher 26). Teacher 2 also indicated that the training was different, as normal training sessions focused merely on group discussions. Furthermore, the training was exciting (Teacher 45) and seen as very useful and valuable for future implementation related to their learners (Teacher 38). Teacher 45 felt that the training was “highly beneficial, as even training scheduled on the day a long weekend commenced, did not deter attendance”, and said that “the teachers that are chosen to be in this programme they [are] always looking forward to come, even today they knew is going to be [the start of] a long weekend, we must go.”

Semi-closed-open-ended questionnaire, Internet user group and journal entries

The participants commended the facilitator for creating a relaxed environment in which they felt comfortable and in which they received adequate assistance when the commented:

- Environment is very relaxing (Anonymously in Internet user group)
- The presenter of the program is welcoming makes one feel free to ask questions for any difficulty that one comes across with (Anonymously in Internet user group)
- I feel comfortable and stress free. The facilitator does not harass us. I am beginning to feel a bit confident on typing, although I am still slow, I am improving (Teacher 44 in her journal)
- The facilitator's explanations and gives help when everyone even you need it. Prepared to teach or show when you get confused (Teacher 9 in semi-closed-open-ended questionnaire)
- We received the support of knowing it perfect (Teacher 11 in semi-closed-open-ended questionnaire)

Teacher 36 highlighted in her journal the fact that the training was not rushed and that collaboration was valued, when she stated:

> *The fact that we learn phase by phase. Every week I look forward to new things. Learners will benefit and at the end of the day. The fact that we brainstorm and work together – self-discovery also plays a part.*

Observations

It was clear to me during the project that I was sometimes not able to explain clearly enough to some of the participants and that we misunderstood one another at some stages. This may have been due to the fact that isiXhosa was the first language or mother-tongue of the majority of participants and English was used as the language of instruction/training due to the fact that I as project facilitator, am not conversant in isiXhosa. Perhaps, equally important, is the fact that isXhosa is an indigenous African language that does not, as yet, have computer terminology, which made it also difficult for the participants.

However, I encouraged participants to help one another and to explain to one another in their own mother-tongue. It was observed during June 2008 that a great deal of isiXhosa conversations started to emerge. Observational notes highlighted the following recording on the Dictaphone related to language and decoding:

> *Language is another problem or barrier. I explained in detail in English at the start of every session to the participants what is going to happen. Yet I think language and listening skills, especially converting what I have said into their mother tongue, Xhosa, seems to be the problem. They are decoding from English to Xhosa [their own language]. As many explain what I have said to other participants in Xhosa, something may get lost, probably because many of the computer terminology are not available in their home language, Xhosa.*

During July 2008, I noted in my observational notes, that explaining in the participants' own language, seemed to be more effective. Two participants (more knowledgeable) volunteered to help those who were struggling; hence they became peer-facilitators. They did this out of their own free will. One peer-facilitator was still attached to her group, but she moved around to help others. When many of the participants experienced a problem, they asked her for assistance. A lot of Xhosa speaking was heard. I got the feeling that she explained better than myself to the participants and that they understood her better, as she was using their home language.

6.4 Changes in facilitation practice

The sub-sections below report on aspects related to changes in the facilitation practice.

6.4.1 Number of facilitators

Semi-closed-open-ended questionnaire

It was previously mentioned that capable peer participants were identified during the training to assist the facilitator. The rationale was that these capable peers would be able to attend to participants when the facilitator could not and hence speed up the assistance process to other participants. However, it was shown that many participants preferred the assistance of the facilitator, as he was seen as 'the expert'. The teachers indicated that they would like more than one expert to be used at a time. The majority stated that two experts are required (see Table 96 in Appendix A). Reasons provided in the semi-closed-open-ended questionnaire for having more than one facilitator, were that having more than one facilitator would lead to complementing one another and hence the training would be more fruitful. Furthermore, participants stated that more than one person will speed up the timeframe for providing assistance and this would be very appropriate in large groups. These sentiments are reflected in the following responses:

- So that it can be [more] fruitful (Teacher 40)
- For an [improved] explanation (Teacher 27)
- So that they can complement one another (Teacher 26)
- Facilitator can explain whilst the other check if you understand or give help (Teacher 9)
- So that everyone can get help as soon as possible (Teacher 47)
- There are many teachers who attend to others, then we must wait while the instructor is busy with the others (Teacher 43)
- To be able to assist us all. One person is not able to do so (Teacher 46)

- Due to the number of students and that they do not understand the same when instructions are said (Teacher 45)

- When you need help maybe one person is busy and we are many and the time is going then it is going to drag the process (Teacher 1)

- Since this is a bigger group (Teacher 5)

- Because we are many and don't really understand, so if each individual can see what he does wrong, that will help (Teacher 3)

On the other hand, there were participants who felt that only one person should facilitate the training process, as they were concerned that having too many facilitators could lead to confusion (Teacher 29). Another stated that it is important for first-timers who have little knowledge and experience to have only one facilitator (Teacher 38), as this could possibly form a better relationship between the facilitator and the new comers. One participant felt that as the group was not "too big", hence one facilitator was adequate (Teacher 42).

6.4.2 Grouping

Semi-closed-open-ended questionnaire

Participants were not forced into specific groups, but could decide with whom they wanted to cooperate. Some were very happy with this scenario and many formed groups with members from their own school. Nevertheless, other participants suggested that groups should not be of mixed ability, but rather be formed based on similar ability. On the other hand, some participants felt that having groups with the same ability was not going to serve the interest of all learners. Their argument was that if groups are mixed ability groups, those who are in need of help would have a greater opportunity of obtaining assistance from someone knowledgeable.

Some participants also highlighted the importance that the same groups should not be used for the entire training period, but that rotation of members (re-grouping) should be considered during the training process (see Table 97 in Appendix A). One participant suggested that teachers should be graded and thus two different workshops or training sessions should be conducted: one for those who are beginners and a different one for those who are more computer skilled (Teacher 28). This specific teacher had more computer skils than many other teachers.

7. STATISTICAL AND PRACTICAL SIGNIFICANCE OF THE DATA GENERATED

The data generated in this study were analysed by statistical services at the Nelson Mandela Metropolitan University (NMMU). The software packages Microsoft Excel and Statistica were used as data analysis tools. The quantitative data generated for question 1, were collected through a pre-Likert scale questionnaire only, as the rationale was to obtain a snapshot of the readiness of the participating schools for ICT integration at that point in time, as perceived through the eyes of the participants.

The main focus of this project was to determine to what extent the project seemed to be successful with reference to questions 2, 3 and 4. Hence, the quantitative data generated for questions 2, 3 and 4, *viz*. what skills or aspects are developed by teachers-as-learners during their participation in the cyberhunt approach; does the creation of a cyberhunt encourage motivation and interest; and does the creation of a cyberhunt encourage collaboration, respectively, were treated differently statistically as pre- and post-responses were provided. As a result of the pre- and post-responses, Cohen's d was used to calculate effect size (practical significance) and the Cronbach α (or coefficient alpha) was used to determine the internal consistency reliability estimation for the questionnaire responses.

With reference to question 2, the data were clustered according to (1) decision making, (2) searching, research and reading attitude, (3) knowledge and skills related to composing questions on different cognitive levels, (4) planning, (5) audience, (6) computer skills and design, (7) confidence in using computer as a teaching and learning tool, (8) reflect and evaluate and (9) mental effort. One aspect pertaining to question 2, assessment, could not be calculated, as it did not contain a pre response. The clusters of question 3 were motivation and interest, while items in question 4 were grouped under the construct collaboration. The clustered data are presented in Table 4.1.

Cronbach α is an estimator of reliability and can be used to measure different areas within a single construct. The higher above 0.5 the Cronbach α value the higher the reliability of the grouped items is considered to be (Ary et al., 2002). Standard deviation (σ) is a measure of the variability or dispersion of a population. A low standard deviation indicates that the data points tend to be very close to the same value (in this case the mean) while high standard deviation indicates that the data are spread out over a large range of values.

Table 4.1

The reliability of the pre- and post-intervention questionnaire Cronbach α scores, mean pre- and post- intervention questionnaire scores, mean gain scores, standard deviations and the statistical (probability) and practical (d) significance of the statistical data

	Cronbach α		Mean scores				Inferential statistics			
	Pre-α	**Post-α**	**Pre-**	**Post-**	**Gain**	**σ.**	**t-value**	**df**	**p**	**Cohen's d**
Decision making (n=26)	0.58	0.69	2.71	3.57	0.86	0.91	4.83	25	0.000	0.95
Searching, research & reading attitude (n=26)	0.89	0.93	2.88	4.09	1.21	0.68	9.07	25	0.000	1.78
Knowledge and skills related to composing questions on different cognitive levels (n=25)	0.86	0.69	2.53	3.87	1.34	1.07	6.24	24	0.000	1.25
Planning (n=26)	0.90	0.85	2.92	4.13	1.21	0.70	8.86	25	0.000	1.74
Audience (n=26)	0.84	0.77	3.10	4.06	0.96	0.70	6.98	25	0.000	1.37
Computer skills and design (n=24)	0.98	0.93	2.32	3.67	1.35	1.03	6.41	23	0.000	1.31
Confidence in using computer as a teaching & learning tool (n=24)	0.95	0.95	2.12	3.86	1.74	1.12	7.64	23	0.000	1.56
Reflect and evaluate (n=26)	0.88	0.91	3.31	4.21	0.90	0.91	5.05	25	0.000	0.99
Mental effort (n=26)	0.74	0.73	3.08	3.68	0.60	0.85	3.59	25	0.001	0.70
Motivation and interest (n=26)	0.74	0.74	3.07	3.78	0.70	0.54	6.67	25	0.000	1.31
Collaboration (n=26)	0.92	0.81	3.44	4.05	0.61	0.62	5.00	25	0.000	0.98
Individualisation (n=26)	0.75	0.60	3.83	3.85	0.02	1.24	0.09	25	0.928	n.a.

Probability (p) values were determined for the grouped items to ascertain whether mean changes were statistically significant or not. A $p \leq 0.05$ value indicates that the change in score can not be attributed to chance at the 95% level of confidence while $p \leq 0.01$ operates at the 99% level of confidence. A value of $p \leq 0.000$ implies a value greater than $p \leq 0.0005$. Cohen's d scores were also calculated to indicate the effect size. Effect size (Gravetter & Walnau, 2002; Ary et al., 2002) indicates whether statistically significant differences are significant in practical terms for the group as a whole (0-0.19 - not significant, 0.20-0.49 - small effect, 0.50-0.79 moderate effect and 0.80+ - a large effect).

Overall the α scores are high, suggesting that the questions are reliable, the p values are all (except for individualisation) greater than $p \leq 0.01$ indicating a high degree of statistical significance, and the effect sizes (Cohen's d values) are all large. As such, the data that have been presented in this chapter are highly motivated statistically and indicate a significant effect across the sample.

The data in Table 4.1 suggest there was a significant positive impact on decision making, searching, research and reading attitude, knowledge and skills related to composing questions on different cognitive, aspects pertaining to planning, thinking about the audience, computer skills and general design, confidence in using computer as a teaching and learning tool, reflection and evaluation, mental effort, motivation and interest and collaboration. This indicates that there is a statistically significant difference between the initial pre-perceptions and post-perceptions of the participants pertaining to the above-mentioned aspects, as a result of the design of cyberhunts. The only aspect, in which there was no significant statistical difference, was individualisation. This can probably attributed to the fact that this study focused primarily on designing cyberhunts in a collaborative manner, thus individualisation was not the focus.

8. CHAPTER SUMMARY

This chapter provided the quantitative and qualitative data generated related to each of the specific research questions. The quantitative and qualitative data were combined to provide a more coherent and richer picture and to give a more 'humane voice' to the quantitative data. The statistical and practical significance of the clustered quantitative data were described and are highly motivated statistically, i.e. in most cases probability levels and effect sizes are high and the α scores are satisfactory, suggesting that the question items were reliable. The data related to decision making, searching, research and reading attitude, knowledge and skills related to composing questions on different cognitive, aspects pertaining to planning, thinking about the audience, computer skills and general design, confidence in using computer as a teaching and learning tool, reflection and evaluation, mental effort, motivation and interest, as well as to collaboration; suggest that there is a statistically significant difference between the initial perceptions of the participants and their perceptions related to ICT skills as a result of the design of cyberhunts. However, the only aspect in which there was no significant statistical difference was individualisation. This can probably be attributed to the fact that this study focused primarily on designing cyberhunts in a collective and collaborative manner.

The findings suggest various important aspects that facilitators should take cognizance of when they plan and conduct teacher development programmes related to ICT. All the above-mentioned aspects will be discussed in chapter 5, while in chapter 6 the most important findings are highlighted, recommendations are made and suggestions for future research are provided.

CHAPTER 5

DISCUSSION

1. INTRODUCTION

In this chapter the quantitative and qualitative data that were presented in chapter four are discussed in terms of the research questions, *viz.* how ready are the teachers and their schools for ICT integration; what skills or aspects are developed by teachers-as-learners during their participation in the cyberhunt approach; does the creation of a cyberhunt encourage motivation and interest; does the creation of a cyberhunt encourage collaboration; and how should the teacher development process for ICT integration using cyberhunts be managed? Each of the questions is discussed separately in the light of the literature reviewed in chapter two and the data presented in chapter four. These findings provide the framework for the recommendations made in chapter six.

2. HOW READY ARE THE TEACHERS AND THEIR SCHOOLS FOR ICT INTEGRATION?

This section considers the first and second order barriers faced by the teachers who participated in this project.

2.1 First order barriers

The discussion below focuses on the data related to first order barriers, i.e. extrinsic barriers to computer integration in schools.

2.1.1 Access to computers, Internet and training

The 'ACOT Model' (Dwyer, Ringstaff & Sandholtz, 1990; 1991), the five phase 'Evolutionary Model' (Miller, 1997), the four-stage 'Continuum of ICT Integration' model (UNESCO, 2002) and the 'Toledo' five stage model' (Toledo, 2005) all indicate that before ICT integration can commence, teachers have to be computer literate and able to explore computers in an informal way. This phase, i.e. the phase in which teachers gather information and learn basic computer related knowledge and skills, is termed the 'Teacher-as-Learner Phase' (Sherry et al., 2000). Integration of ICT in schools cannot be expected before this phase (Fluck, 2003).

The data gathered by means of the computer skills questionnaire indicated that the majority of the participating teachers in this study had not used computers on a regular basis. Furthermore, the majority of the participants (76%) indicated that they had not used the Internet for teaching and learning and 79% had never used email before, something that may probably be attributed to the fact that they were not connected to the Internet either at school or elsewhere. This is not unusual for many South African teachers, as the majority of schools in this country do not even have computers, let alone Internet connectivity (Department of Education, 2004; Howie, et al., 2005).

The data suggest that although some training had been offered through NGO's and within their schools, the teachers still lacked basic computer skills. The computer training that had taken place did not include computer integration. It is therefore clear that the majority of the teachers from the participating schools at the beginning of the project were not even in phase one, or the 'entry phase' (Dwyer et al., 1991) or 'teacher as learner phase' (Sherry et al., 2000). This understanding was important in this study, as it is for any teacher development project, because it provided a clear indication of the amount and depth of training that needed to be done to assist teachers to move through the different stages of ICT implementation towards capable and effective integration.

2.1.2 Vision, focus and goals

Establishing a vision for computer integration is an important building block for establishing computer integration within a school (Fullan & Smith, 1999; Wilmore, 2000; Davis, 2002; Gibson, 2002; Schiller, 2002; Creighton, 2003; Flanagan & Jacobson, 2003; Scrimshaw, 2004; Fullan, 2006). Closely related to having a vision, is the establishment of a technology plan (Cradler, 1996; Creighton, 2003; Fishman & Zhang, 2003; Scrimshaw, 2004) which articulates how the vision will be implemented. Carefully phrased goals, which enable schools to assess their progress, form part of this process. The data obtained through the initial Likert scale questionnaire, which focused on the barriers that teachers and their respective schools experienced, indicated that there was 'uncertainty' as to whether the participating schools had a clear vision and goals related to computer implementation. Analysis of the qualitative data indicated that where there were vision statements and technology plans, these were still in initial stages of development and needed refinement. Interview data and document analysis supported this inference.

Vision emphasis was on obtaining more computers and on developing learners to become computer literate, with very little emphasis or knowledge of what is required for computer integration in its true sense. Implementation was aimed at achieving traditional goals and not at assisting to achieve the envisaged, constructivist based, goals of the new South African curriculum. These findings are similar to what the Department of Education (2003, 2004) suggests are the current trends, i.e. that largely, where there is computer implementation in South African schools, there is little or no genuine integration. However, it is important to note that many of the participating schools did not have any computers before the start of the project and one could argue that, as a result of the initiative, visions began to emerge and evolve over time, as suggested by the findings of researchers in the field, for example Fullan and Smith (1999) and Surry et al. (2004).

Goal setting related to computer implementation and integration was another aspect that improved over time. Participating schools had to submit regular reports related to their vision, goals and plans for implementation, something which enabled them to articulate their vision and goals in writing and helped structure their progress towards realising their vision and goals. As individuals and schools develop through different stages at different rates, the development of suitable methods and/or models for teacher preparation appear to be imperative for the successful adoption and implementation of integration strategies in 'ICT novice' schools when they are provided with computer hardware, software and connectivity for the first time.

2.1.3 Participation and consultation

Fullan and Smith (1999), Joseph (2006) and Hinson, et al. (2006) all emphasise the importance of participation and consultation when planning for computer implementation. Similarly, in this study the majority of the participants considered participation and consultation as very important. It was interesting to note that although staff members were involved to some extent in the vision and computer integration plan of their schools, they felt that more opportunities had to be created in the form of development sessions where teachers were able to share their experiences linked to computer issues. In spite of some qualitative data indicating that meetings did take place, a closer look suggest that in many instances staff meetings were seldom held and meetings related to computer issues were 'non-existent'. Where meetings to discuss computer related issues had been convened, they were considered to be 'too informal'.

The majority of participants indicated that they had no problem with sharing ideas with other teachers from their own school and they indicated that they would like to share ideas with teachers from other schools. This appears to be a positive indication that they were not afraid to share with one another at the same school or to share with teachers whom they were not well acquainted with from other schools. Meetings were seen as valuable opportunities to learn from one another and were seen as a platform to assist individuals with the challenges they experienced and as a means of addressing the concerns they might have had.

Feedback from facilitators regarding electronic emailed based user groups suggests that this mechanism was highly valued by the participants. The participants valued the consultation process that had taken place regarding the computer integration plan for their school, as well as the fact that their level of computer knowledge and experience had been investigated. They saw consultation as an indication of being valued and that their needs were considered, sentiments which suggest that supporting structures have to be established to sustain development and innovation (Fullan & Smith, 1999, Wilmore, 2000; Creighton, 2003; Surry et al., 2004,) and that the principal has to take a leading role (Wilson & Peterson, 1995; Leggett & Persichitte, 1998; Ely, 1999; Ertmer 1999).

2.1.4 Leadership, support and training from the Department of Education

Participants were in agreement that they cannot count on ICT support from the Eastern Cape Department of Education. During the interview sessions, the participants noted that the Department of Education was 'full of promises', 'not caring' and 'not accountable'. The semi-close-open-ended questionnaire data revealed that they saw the Department of Education (DoE) as 'unprofessional', 'unhelpful' and 'dead'. They had more faith in NGOs for assistance than in the Department of Education. It appears that support fom the department of Education related to computers, is virtually non-existent, a factor that is viewed as a requirement for systemic progress, as is support from those in leadership positions at schools (Wilson & Peterson, 1995; Leggett & Persichitte, 1998; Ely, 1999; Ertmer, 1999).

2.1.5 Leadership and support from other sources

The participating teachers were not shy to admit that they would like to be supported by their peers at school and colleagues from other schools through a process of sharing. They noted that they would really appreciate knowledgeable persons observing what they did in the computer classroom in order to provide feedback, which is in line with the arguments of Wilson and Peterson (1995), Ely (1999), Ertmer (1999) and Leggett and Persichitte (1998) for whom support is one of the most important factors for sustainability of innovations (Rogers, 2003). The participants also indicated that they would appreciate visits from knowledgeable persons to assit them with the cyberhunt process. Not one teacher indicated that he/she did not want to be visited in the classroom. This could possibly be attributed to the fact that strategies for computer implementation within the classroom were novel to the teachers and that they really wanted assistance to develop their teaching and learning computer implementation skills. However, two participants said that they did not want assistance with the cyberhunt process, as they felt that they could implement the process succesfully as a result of the training they were undergoing.

2.1.6 School based leadership, support and computer skills

Principals were perceived as not being computer literate and junior staff members were considered to be more computer literate than senior staff (but then only a very small number of them). The participants noted that principals, senior and junior staff members did not use the Internet regularly, but mostly because the participating schools' computer classrooms were not connected online. Teachers who did have Internet connectivity accessed it at home or at the university. These data suggest that participating schools did not have a cadre of computer technology leaders at their school, something which Wilmore, (2000), Gibson (2002), Rogers (2003), and Hinson, et al. (2006) believe is imperative for innovation. In schools where there were computer technology leaders, they were not really making a significant difference, something that could be addressed by training or/and by determining whether there are leadership and/or support issues at school.

The participants were uncertain as to what degree of support they could count on from their principals, a perception that required more clarification, as it could be interpreted that the principals were negative. However, this seemed not to be the situation as teachers who were interviewed indicated that their principals were very positive and supportive. What is important is that it seemed that not all principals had the necessary know-how on how to guide the implementation process. A further possible reason for this response could be attributed to their school context, as these participating schools are very poor financially, as their learners come from the disadvantaged townships. Thus, teachers wanting to integrate technology into their respective schools may receive verbal support, but tangible support in terms of resources and money might be more difficult to obtain.

The dominant model used by the participating schools where there were computers prior to the intervention, was that of one person in each school being responsible for teaching all the learners computer literacy skills. The focus in most schools was basic computer literacy skills, while in some cases the training was limited to typing skills or the use of software with no specific relationship to a content- or learning area. This view would constitute implementation without integration, which Jonassen (2000) refers to as ‘learning about’ computers.

2.1.7 Rewards and incentives

Although teachers seemed to be intrinsically motivated to learn computer and implementation skills, they also asked whether they would receive any other form of recognition, for example remuneration from the Department of Education or a certificate that they could use for promotional purpose. The majority stated that they would learn more if they were rewarded. These data suggest that not only intrinsic motivation is important for teachers, but that the participants also value extrinsic motivational aspects such as tangible rewards.

Alderman (1999) suggests that extrinsic and intrinsic awards should not be seen as the only alternatives, but rather on a continuum as each type can assist the other. This seems to indicate that teachers do value teacher development, but that they would like financial benefits to be attached to it, concurring with Ely (1999) on the absence of rewards and incentives as a barrier. Thus, it is suggested that when rewards are not rewarded, rewards could become a barrier. However, rewards for example financial incentives, could also become a lever or push factor in a positive sense, if it is implemented in a transparent manner.

2.1.8 Time tabling and time usage

The majority of township schools have large numbers of learners per school and also a large numbers of pupils per class, i.e. 40 plus. This suggests that time tabling could be problematic. A closer inspection of the quantitative data revealed that at two primary schools (grades 1 to 7) the time table did not provide adequate periods for computer room visits by their learners. A dedicated and reasonably knowledgeable computer teacher, who was always busy with relevant tasks when visited at his school during planned and unannounced school visits, informally expressed his concern that it was difficult for him to ensure that all the learners are given equal opportunities due to the great learner numbers per grade per class.

As noted earlier, there was usually only one person responsible for computer classes. This resulted in time tabling issues and very limited access to the computer room for most learners. Teacher time for planning and learning related to computer lessons was also problematic, as the majority of the participants said that they had very little time to develop their own skills. The only teachers who indicated that they had enough access to the labs were those who were personally responsible for their school's computer classes.

2.1.9 Infrastructure and resources

Data collection on infrastructure and resources was conducted two months after the project computers were delivered to schools. The participating schools thus had brand new and up to date computers and free Microsoft Software through the Microsoft South African Schools Agreement.

Only 41% of the participants agreed with the statement, 'We have the latest/newest software in our computer room.' The schools that had computers prior to the intervention were using TuxLab, a Lynix based operating system with open source software such as Open Office (similar to Microsoft Office 2003 as it contains the applications for Word Processing, Spreadsheets and Presentations) and other free Open Source educational software. The old computers did not use the Microsoft based operating system and Microsoft based applications.

The schools did not have fast Internet connections and, as such, the project members worked with Telkom (the South African landline telephone provider) in order to access sponsorship for a fast

ISDN line for each school. Telkom engineers visited the schools and reported that they would not be able to install Internet connections at two of the schools, as the copper telephone lines had been stolen and they are not prepared to reinstall them as each reinstallation would cost several thousands of rand (ZAR). They also reported that they had reinstalled the stolen telephone lines several times previously, but each time they were stolen by thieves who sell the copper wire lines to scrap metal dealers. ‘Line of site’ connectivity was therefore considered for these schools and negotiations with service providers were in process at the time of completing this study.

The majority of the participants indicated that funding *via* the school for staff training related to computer training, was also problematic. Only one teacher indicated that money was available and that he had received support from the principal when required. That specific school’s principal indicated during a school visit that she was prepared to buy the equipment needed for her school to be linked by means of wireless Internet connectivity. The participating teachers’ journals also revealed that the participating schools were in need of more computers, Internet connection and other infrastructure related issues. Interview data also revealed the need for more computers because of big classes and that some schools had assistance with maintenance, but that this was not the norm. These findings are in agreement with those of Ely (1999), Fullan and Smith, (1999), Surry et al. (2004) and Mueller et al. (2008) who note that support and infrastructure are imperative.

In the following section, the second order barriers are addressed and discussed.

2.2 Second-order barriers

Barriers that are intrinsic to teachers are termed second order barriers (Ertmer, 1999). These barriers are related to confidence and self-efficacy, which is a factor of one's beliefs in his/her ability to successfully complete particular tasks and are improved by positive experiences (Bandura, 1997; Ertmer, 2001, 2004).

2.2.1 Confidence

The majority of teachers indicated that they did not feel hesitant to participate and that they had a positive attitude. However, when probed in terms of their confidence in terms of having the required skills to use the computer as a teaching tool, the data suggest that their confidence was very low (Table 26A and 26B in Appendix A). Nevertheless, the participants did indicate that they did not want other teachers to take their learners for computer classes (93%), suggesting that they recognised their responsibility and that they wanted to acquire the necessary knowledge, skills and confidence to do so.

Furthermore, the participants had a very positive attitude towards undergoing training to use the computer as a teaching tool (see Table 27 in Appendix A), and training was seen as being 'very important'. From these points of departure it could be argued that although the participants did not feel very confident during the introductory phase (Phase 1) of the project, they believed that their ability (and therefore confidence) would improve as the project ran its course.

The data revealed that the participants had mixed perceptions of their computer skills. Only 27% agreed that they were computer literate, 47% were unsure and 27% indicated that they were not[40]. Interview data highlighted how important the teachers felt it was to have one's own computer to be able to practice regularly to develop computer skills. While this point is valid, a counterargument is the fact that that those teachers who did have computers of their own still did not have the basic computer literacy skills required (see Table 5, 6, 7 and 8 in Appendix A), highlighting the point that simply having a computer by no means implies that one will become, or is, computer literate.

[40] Please note that the percentages were rounded off. In some instances the total when adding disagree, uncertain or agree, might be less than 100% when the computer rounded e.g. 27.3% off to 27%. The same applies to e.g. 27.6 % which was rounded off to 28%. This resulted in that the total sometimes being more or less than 100%.

2.2.2 General pedagogy skills

Participants indicated that they needed development of their computer pedagogical skills. The data also suggest that assessment of computer projects clearly needed attention, as did the skill of formulating questions that promote higher order thinking. Only 23% indicated that they were happy with the way that they were teaching at that point in time and 30% very 'not happy at all' (see Table 30 in Appendix A). This seems to suggest that the participating teachers in the project felt that something needed to be done to develop their teaching repertoire.

2.2.3 Cyberhunt skills

In a previous section it was indicated that computer skills were lacking. To be able to design a cyberhunt, computer- and Internet skills are a necessity. However, the data also indicated that not only did the participants feel that they lacked basic computer literacy skills, but at that stage they only had very limited Internet skills. A strength of the cyberhunt approach is the fact that teachers and learners can pose and answer questions at an appropriate range of levels (Bloom, 1956; Anderson & Krathwol, 2000). It was therefore disappointing that 60% of the teachers responded that they did not have the knowledge of the different types of questions that can be implemented to address different levels of cognitive thinking (see Table 31 in Appendix A).

2.2.4 ICT lesson planning

The majority of participants were either uncertain or indicated that they did not know whether computer lesson planning would take longer than normal lesson planning (see Table 32 in Appendix A). It became evident that formal computer lesson planning was new to the participating teachers and interview data revealed that those teachers who said they did plan formally, had actually only used pre-designed lesson plans from TuxLab. Nevertheless, pre-designed lessons are exemplars that could be used to illustrate ICT lesson planning, and teachers who have used them are probably in a better position to plan lessons than those who are starting from scratch.

2.2.5 Personal goal setting

Only 47% of the participants indicated that they set computer related goals for themselves and 50% were uncertain or neutral (see Table 33 in Appendix A). The semi-closed and semi-open-ended questionnaire data indicated that some of the goals that participating teachers had set for themselves, were goals as a result of the project. As the project progressed, teachers had to set goals for themselves for each session and record them in their journals. They also had to indicate in their journals whether they had reached their previous goals or not - a process which was aimed at making them aware of the value of goal setting. Journal entries revealed that virtually all the participants had set goals during intervention sessions held after the first few weeks of the project.

2.3 Summary and implications of first and second-order barriers

Pertaining to first order barriers, the data suggest that there was limited computer use within the participating schools. Another important finding is that the schools had a vision, but that the vision was limited as it embraced mainly basic computer literacy. Participants also felt that existing participation and consultation could be expanded and that staff participation and consultation had to be addressed in a more planned manner. They also pointed out that issues of leadership, support and training from the Department of Education were extremely problematic. However, the participants also indicated that they would value any leadership and support from other sources besides the Department of Education. It was also noted that school based leadership, support and computer skills need more attention. Rewards and incentives were also lacking, as were infrastructure and resources. The predominant school implementation approach was to use one teacher to be responsible for teaching or facilitating computers to the whole school.

Regarding second order barriers, the data suggest that although the participants indicated that they did not have the necessary computers skills and the required confidence to use the computer as a teaching tool at the beginning of the training, they never the less felt confident to participate in the project. The participants indicated that they wanted to become empowered and did not want someone else to teach their class computer skills. They had a very positive attitude towards the use of computers as a teaching tool, in spite of not initially feeling confident that they had the necessary computer skills. They also indicated that they had to receive training in the general pedagogy skills pertaining to computers, as well as cyberhunt related skills. It was also revealed that ICT lesson planning was a skill that had to be developed more, as was the setting of personal goals related to computers.

The findings that various first- and second order barriers do exist within the participating schools mirror the conditions of Ertmer (1999) and highlight Ely's (1999) findings required to enable ICT implementation. These findings suggest that the expressed aim of the Department of Education (2003, 2004) that South African teachers "will leapfrog into the new century, bypassing the unnecessary adoption cycle, and implement a solution that works now, and have the capacity to handle future developments" seems to be highly unlikely. This outcome is even less likely when one considers that the time frames for ICT implementation, as suggested and gazetted by the National Department of Education (2003, 2004), have not been met at all in the Port Elizabeth school districts in the Eastern Cape Province.

The results of this study indicate that basic computer skills hold the key to successful computer integration. It is therefore imperative that teachers first have basic computer skills before they can adopt full integration. However, it was also found that it might be possible to bypass a purely adoption level if teachers are professionally developed in ICT in an integrative manner, if they have access to their own computers and if they receive the necessary ongoing support. However, many teachers are still far from embracing computer technology, computer integration and computer supported learning, a situation similar to situations abroad (see Kopcha, 2008).

What is thus required is ongoing support; support from one another, from the parents, principal and school management team; ongoing ICT teacher development by schools, the Department of Education, NGO's and universities such as the NMMU; access to ICT resources and enthusiastic teachers that are prepared to sacrifice time (Leggett & Persichitte, 1998; Mumtaz, 2000; Vrasidas & Glass, 2005) to become more ICT skilled on various fronts. Only then might ICT implementations become a possible reality within schools. Hence, it appears self-evident that Ertmer (1999) and Ely's (1999) first- and second order barriers have to be addressed before ICT integration is likely to occur on a wide front.

3. WHAT SKILLS WERE DEVELOPED BY TEACHERS-AS-LEARNERS WHILE PARTICIPATING IN THE CYBERHUNT APPROACH?

In the following sub-sections the data generated pertaining to question two, as indicated in the heading above, are discussed. The following main sections feature: (1) decision making, (2) search, research and reading attitude, (3) questioning knowledge, (4) reading skills, (5) goal setting, (6) planning, (7) time management, (8) confidence and knowledge pertaining to using the computer as a teaching and learning tool, (9) the notion of an audience, (10) computer skills, (11) assessment and (12) reflection.

3.1 Decision making

The data suggest that decision making skills were a problematic issue for participants at the beginning of the project, but that this changed marginally towards the end of the project. The fact that this change was small might be attributable to the newness of the cyberhunt strategy, the ICT context, the newness of using the Internet, and language. Personal experience and observation related to research and project skills of disadvantaged teachers indicated that these teachers struggle immensely with projects and research, especially in terms of decision making. The knowledge as design approach (Perkins, 1986, 1991, 1992), which is embedded in the cyberhunt approach, could assist learners (and teachers) to develop decision making skills, as various decisions have to be made during design activities such as interface design, content related aspects, creation (designing), debugging (fixing links) and maintenance (Kafai, et al., 1997).

Lehrer (1993) contends that hyper-composition requires learners to transform knowledge into dimensional representations, thus determining what is important and what is not (decision-making). The rationale is built upon the fact that when learners are involved with the design of cyberhunts, they have to make various decisions, just as when they are involved in using or creating hypermedia, for example, when they need to introduce a definition, elaborate on an explanation or just ‘pass on’ information to their learners (Venezky, 1994). Furthermore, the more learners search for information and read online, the more they become involved in making decisions about which links to select and what to explore for their cyberhunts. Thus, exposure to cyberhunts could become an enabler to improve decision making skills.

Topic selection was also initially problematic, as was deciding what to do for a project. Participants needed a great deal of guidance on how to select a topic and how to proceed further. One factor that contributed to this was the fact that some participants were in groups from different Learning Areas (subjects), different schools and different grades, which made topic selection more difficult. Furthermore, many teachers from previously disadvantaged schools and colleges in South Africa have had an inferior education as a result of Apartheid. Their teachers and lecturers also went through the same discriminatory system and this probably played a role in the development of their students' decision making skills. Also, the participants in this study speak isiXhosa as their home language, not English. Hence, decoding from English to Xhosa could have been problematic, but if this was the case, their understanding of English seemed to have improved by the end of the project. This improvement might be attributable to the way the training was facilitated. They received clear guidance from the project facilitator and regular checks were done to assess whether they had understood the instructions and explanations made in English, and a conscious effort was made to attempt to expand their repertoire. For example, their questioning abilities received much attention, as the cyberhunt approach requires that the participant as designer has to create questions based on the topic and that Bloom's taxonomy (or the revised taxonomy of Anderson & Kratwhol in Wilson, 2005) has to be taken into account when formulating questions based upon the topic content from the web.

It was interesting to note that some of the participants indicated in the initial pre-post Likert based questionnaire that they often found it hard to decide what a topic means. A similar trend was evident in the statement, 'It is often hard for me to decide what to do for an assignment or project.' This suggests that creating cyberhunts is cognitively challenging, as it requires a great deal of thinking about how to decide upon a topic or what problem one wants to explore (Ainley, et al., 2002). However, it was noted that decision making seems to have become easier the more experience the participants gained through practice.

The participants also indicated in their responses to the questionnaire that they found doing projects difficult because they did not always know what to do right away. This problem became more evident in their post-intervention responses, suggesting that decision making related to what a topic really means and how to embark upon a project remained a problem for the participants.

However, it was observed that many of the participants were able to design cyberhunts towards the end of the project, and that the majority had a reasonable grasp of what had to be done. Their final projects were also often a testimony to this. As such, in spite of struggling with some aspects related to decision making, the participants' pre- to post-perceptions improved noticeably (see Table 34A and 34C in Appendix A) during the course of the project. This could be attributed to the fact that the cyberhunt design approach requires teachers (learners) as designers to make various decisions during the design process, such as decisions about the outcomes to be addressed, topic selection, keyword generation, the type of questions to compose, how to implement the designed cyberhunt within the classroom context, and how to present the results. In other words, the more they practiced, the more their decision making skills improved.

3.2 Search and research skills and reading attitude

In this section, aspects pertaining to search and research, as well as to reading, receive attention and are discussed.

3.2.1 Search and research skills

Participants initially struggled to search for information, because they found keyword generation difficult. They stated at the beginning of the project that they did not have any experience of the purposeful creation of keywords to help them to search for information before. However, when they had to design cyberhunts they had no option, as the search process requires the generation of keywords to assist the cyberhunt designer to try to obtain useful and relevant information. This was perceived as difficult, as the participants lacked this skill, because searching on a search engine was new to them. Journal data (see Table 36 in Appendix A) and data from the semi-closed-open-ended questionnaire (see Table 37 in Appendix A) also suggest that accessing the Internet and searching for information was difficult for the participants during the first two weeks of the cyberhunt design project.

Search skills do not only involve finding information, but also ascertaining which of the returned results are to be explored and whether the information found is useful, reliable and hence truthful. Interview data suggest that participants found it difficult to ascertain whether the information they found was reliable and that the participants tended to believe whatever appeared. The pre-post

Likert scale questionnaire data supported this finding. It appeared that the teachers felt overwhelmed by the huge amount of information that the Internet search engines had generated. This aspect appears to have remained problematic for many of the participants throughout the project; however, there was an improvement for finding relevant information on the Internet at the end of the intervention. This seems to be in agreement with Eriksen's (2001) argumentation that the filtering of information is a skill that has to receive serious attention as one needs to 'protect' oneself against too much information. Hence, keyword generation is a skill that has to be taught and practiced.

In an attempt to try to assist participants to narrow their findings, and to prevent the overwhelmingly feeling of too much data, the participants were exposed to a search engine for children, www.kidsclick.org. This seemed to have worked for some participants, but not for all, as in some cases the participants felt it provided them with too little or no useful information. Also, an added difficulty was that the participants struggled to save information (mostly as a result of a problem with the network privileges on the system) and they had no alternative but to make manual notes of what they had found, as well as the websites they had visited. It was noted that some became more proactive as a number of participants started to invest in their own flask disks for saving purposes.

3.2.2 Reading skills

While searching for information the participants naturally had to do a great deal of reading. The pre- and post-data from the pre-post Likert based questionnaire data revealed that participants' understanding of what was read was not really an issue, as 70% indicated that they clearly understood what they read in English (see Table 35A). However there was a marginal increase (by 15% to 85%) of their perception of what they had understood at the end of the project, which seems to suggest that searching for information on the Internet did enhance understanding of what the teachers read online.

Initially only 46% indicated that they enjoyed spending time reading on a wide range of topics related to a project, but this increased to 85% at the end of the project. The data also suggest that reading on the web had a positive influence on the participants' reading confidence and that they felt that this approach could improve their learners' reading skills and their learners' attitude towards reading, probably because of the newness of the Internet, but also because the cyberhunt approach requires the user or designer to read in order to answer and/or to design the cyberhunt.

Teacher 2 stated in the semi-closed-open-ended questionnaire that Internet reading should have an influence not only on the learners' literacy skills, but also on the learners' ability to gain more information through analysis and sequencing information when they use cyberhunts:

> *[Learners will gain] literacy skills: The learners will gain information. The fact [when they are busy with cyberhunts] that they will get more insight and improvement in reading skill [improve their reading skills] as they will be required to do a lot of reading. They will learn to analyse and sequence their [the information found] information.*

The above sentiment follows that of Eagleton and Dobler (2007) and Watts-Taffe and Gwinn (2007) who contend that ICT integration can serve to develop certain literacy skills while using technology, especially the Internet.

Another teacher added that cyberhunts require a great deal of reading and that this poses great difficulties to those learners who struggle to read:

> *Learners who are experiencing problems in doing this will have a problem because they have to do a lot of reading and they have no one to explain when working alone.*

However, the design of cyberhunts by learners on their own should assist learners to improve their reading, as indicated by a teacher during a group interview on the question of how she thought her learners would react when they had to design a cyberhunt for themselves or for other learners to use:

> *You know these kids have a problem with reading and then it means that we are promoting the reading skills. So it will be a very, very a beautiful thing to do.*

Eriksen (2001), Eagleton and Dobler (2007), and Watts-Taffe and Gwinn (2007) all note that ICT offers the possibility to assist with the development of reading skills and as a result, ICT could become a valuable tool to assist teachers to address reading difficulties as learners could assist one another during reading within a collaborative context. These authors also contend that ICT could assist to improve reading related skills through well designed projects. Duke and Pearson (2002) also believe that as digital media are constantly expanding, it is essential to develop digital reading comprehension skills. Hence, reading online has to be developed, as it appears that online media are increasing on a daily basis (Dede, 1992; Eriksen, 2001; Dochy, 2001).

3.3 Knowledge and skills related to composing questions on different cognitive levels

The ability of teachers to create questions around what they had read also increased over the course of the intervention as did their ability to find the answers to questions. A possible explanation for this is the fact that participants had to create questions on different thinking levels, as well as a memorandum to accompany the questions posed in their cyberhunts. These memoranda were checked for accuracy and therefore the issue of creating and answering questions had to receive serious contemplation. In spite of difficulties experienced, it seems that ongoing practice assisted the teachers to obtain relevant information quickly and made a broad range of information resources available to the participating teachers, information resources to which they would not normally have access to. Many learners who live in disadvantaged communities rely heavily on their teachers for bringing resources to class. Access to the Internet would not only provide information, but allows learners and teachers to experience information in a new light.

Only 27% of the participants initially indicated in the pre-post questionnaire that they knew about Bloom's taxonomy, but by the end of the project 60% indicated that they were aware of the different levels (see Table 38A). Personal observation concurs with the above. At the beginning of the intervention only 15% stated that they knew how to formulate questions for higher levels of thinking, but this increased to 73% at the end of the project. A similar trend was noticed about the question whether participants were able to actually implement the various levels of Bloom. The percentage of participants who knew how to implement the various levels of Bloom's taxonomy increased from 30% at the beginning to 64% at the end of the project, which suggest that there is still room for improvement in this area through further teacher development sessions specifically aimed at this aspect.

In spite of the above, only two references could be found to Bloom in the semi-closed-open-ended questionnaire during the project, namely participant 36 who stated in the questionnaire that during the project she had thought about the level of questions, and Teacher 26 who stated in his journal that one of his goals was to use Bloom's taxonomy for the questions that he wanted to ask.

An examination of the participants' completed design products revealed that the questions were either on level 1 (knowledge) in most instances, or on level 2 (comprehension). No questions were asked on the higher levels. Hence, although they thought that they understand Bloom's taxonomy, this was not reflected in their final products. However, it is quite possible that the participants could have had more knowledge about the other levels of questioning, but that they just did not compose questions on the higher levels. This could be a possibility, as Garthwait (2001) asserts that presentations do not always necessarily reveal all that learners [teachers in this project] know. Nevertheless, the fact that the participating teachers were exposed to the different levels through the use of PowerPoint presentations and duplicated examples on Bloom's Taxonomy levels in their training manual, suggests that participants' focus remained on the lower levels of the taxonomy when they composed their cyberhunt questions. As a result, it is suggested that more time and effort should have been allocated to this aspect of the project.

3.4 Planning

In the following section, aspects related to planning receive attention; namely planning itself, goal setting skills, time management and the planning of questions.

3.4.1 Planning skills

Participants indicated in the pre-post Likert questionnaire that they did not spend a great deal of time on setting goals for projects. However, during the project, the participants had to write up their goals in their journals at the beginning of each session and had to determine at the end of each session which goals they had accomplished and which goals they had not accomplished. It was noted that as the project proceeded, the participants spent more time on goal setting, but this was to be expected, as this was a priority aspect of the teacher development programme. It was noted that some teachers tried to complete the goal setting as quickly as possible in order to have more time available at the computer. Initially, participants also said they found it hard to achieve their goals, but this perception changed as the project developed. A possible explanation for this is the probability that the participants became more skilled in the computer related aspects of the project as time went by.

3.4.2 Goal setting skills

Wlodkowski (1999) notes that setting personal goals can become a motivator, particularly if the goals are achieved. Furthermore, goal setting provides focus and helps novices not be distracted by irrelevant aspects. What is clear from this study is that the teachers' planning skills were developed as a result of the regular use of reflection via journal writing, which many researchers consider to be an important aspect of the learning process (Carver et al., 1992; Lehrer, 1993; Kafai, 1996; Herrington & Oliver, 1997, 2000; Hoban, 2002; Turbill, 2002; Gagnon & Collay, 2006; Herrington & Kervin, 2007). The technique (goal setting) also assisted the facilitator to ascertain which areas the participants struggled with and, as a result, the reading of their goals at the end of each session became an enabler to assist the facilitator with the planning for the next session. However, many participants initially said that they did not enjoy completing their journals, although they believed that the journals had significant value as they assisted them with what they wanted to achieve. Possible reasons for the fact that participants at the beginning did not enjoy the reflective journal writing could be that the participants did not find it easy and were uncomfortable at times what the journals revealed for example "... it shows that you do not always reach your goals."

An earlier study also found that although participants found journal writing and goal setting beneficial, they did not always enjoy these activities, as writing of goals are time consuming and the participants would rather side-step the weekly journal writing and goal setting activities in order to maximise their time in front of the computer (Du Plessis, 2004). The use of reflective journals resulted in an increasing and greater awareness of the value of goal setting in this project. A number of participants indicated at the end of the project that their planning for projects was 'very good'. An analysis of their journals revealed that goals were set on a wide spectrum.

3.4.3 Time management skills

The participants knew when their cyberhunts had to be completed and paced themselves to complete their projects on time. The majority of participants indicated that they made use of a timeline to help them to finish on time. However, personal observation did not reveal drawn timelines of any kind. The journals template provided an opportunity for participants not only to set goals and to reflect whether they have achieved their goals, but also contained a section where participants had to state how they planned to finish their cyberhunt projects on time. Journal data revealed that participants thought that they could finish on time by (1) saving regularly, (2) working faster, (3) working at other times, (4) being punctual, (5) attending sessions regularly, (6) practicing more, (7) buying an own computer, (8) working cooperatively, (9) asking for assistance, (10) coming prepared and doing some work at home / homework / extra time, (11) planning for keywords and questions, (12) listening attentively and following instructions, (13) applying searching skills, (14) selecting a topic that is doable, (15) using the notes provided to assist, (16) using time available effectively and focusing and (17) by making notes.

In addition, journal data responses to the question, "What will I do differently next time?", revealed similar responses to the question above, namely (1) preparing questions in advance, (2) collaborating more, (3) working faster, (4) working on their computer skills, (5) persevering, (6) learning from mistakes, (7) managing their time, (8) working alone when possible, (9) searching in different ways for information, (10) working on their typing skills, (11) following the steps of the cyberhunt model, (12) asking for assistance, (13) revising previously done work, (14) working on saving skills, (15) focusing more and (16) note taking of new skills (see Table 5.14). The responses to the semi-closed-open-ended questionnaire responses concurred with the above.

3.4.4 Planning questions

Responses to questions about how participants composed their questions revealed that the majority of the participants composed their questions on paper before they typed them on the computer. This could be attributed to the fact that saving on to the network was initially problematic due to network privileges; however this was rectified towards the end of the project. In spite of this problem, some participants did not design on paper first, but typed their questions directly on the computer. Turkle and Papert (1991), Papert (1993), and Kafai (1996), note that it is important to be aware that all learners do not plan in the same way.

3.5 Catering for an audience

Beichner (1994) and Liu (2003) note that the design of authentic artefacts contributes towards an awareness of an audience. The data from the pre-post Likert based questionnaire suggest that a strong sense of audience was developed during the course of the project (see Table 45A in Appendix A) and that the participants started to think more about their users or prospective audience as the project continued. Journal data supported the above, as participants stated that they were thinking about posing relevant questions (mentioned 13 times) which will be appropriate for their learners, the level of their learners (mentioned 27 times) and also how to create interest (mentioned 9 times).

Participants also indicated that they found it easy to present ideas to other people, probably because they had to design and present their cyberhunts to their peers over several weeks. They acknowledged the value of inserting pictures to enhance their ideas and their users' understanding, but indicated that they found it difficult to find pictures and to paste them into their cyberhunts. Thus, although the participating teachers were aware of the value of pictures, skills pertaining to the insertion of pictures were still lacking at the end of the intervention.

The participants also realised that projects and presentations should help people to make connections among ideas (see Table 45A in Appendix A). Furthermore, the data also suggest that there was an improvement of 50% of participants who tried to present their information in such a way that interested people would find it easy to understand what their projects were about (see Table 45A in Appendix A).

The teachers also realised the importance of spacing text in computer projects in order to make the text more readable to their prospective users. It was observed that participants did try to space their text well, but that they did not always use consistent fonts throughout their designs. This could probably be attributed to the fact that in some instances participants struggled with basic formatting skills, but also to the fact that saving was a problem due to networking issues and many participants had to start some sessions from scratch, slowing down their progress. Hence, they focused on finishing rather than on formatting. The post only questionnaire confirmed this, as 46% of the participants indicated that they used consistent fonts and font sizes (see Table 46 in Appendix A).

3.6 Computer skills and design skills

The results pertaining to the schools' and teachers' readiness for ICT integration revealed that initially the vast majority of the participants lacked the basic computer skills required to use a computer effectively and that the majority also did not have their own computers (see Tables 2 to 9 in Appendix A). The teachers indicated that they had became more comfortable using the computer, had obtained more computer skills and felt more empowered as they developed the necessary skills to assist their learners at school (see Table 47A). Journal data also indicated that participants felt that they had became more competent and that their browsing and searching for information also improved as the project progressed. The findings above were also corroborated by the pre-post questionnaire data. However, at the end of the project, saving files as web based or HTML files were still problematic for the majority of the participants, as was the insertion of pictures.

Data from the semi-closed-open-ended questionnaire provided evidence that participants had assisted others and that the skills that were developed as a result of assisting one another related to (1) accessing Internet, (2) searching for information / exploring information, (3) tabbing between Internet explorer and word, (4) finding pictures, (5) general computer skills, (6) saving documents, (7) copying and pasting, (8) hyper linking and (9) cyberhunt designing. Similarly, the questionnaire data indicated that the skills that improved were aspects with which they needed assistance, namely (1) saving, (2) pasting, (3) copying, (4) finding information, (5) basic computer skills and (6) cyberhunt designing. Journal data also supported the fact that participants required assistance with (1) basic computer skills such as copying, pasting and fonts, (2) Internet skills, (3) typing skills, (4) cyberhunt design process, (5) saving information and finding saved information and (6) finding and inserting pictures from the web.

The participants reported in the semi-closed-open-ended questionnaire that they had learned many new skills. This was well summarised by Teacher 29 when he said, "In fact when I came here I didn't know anything about computers but as time goes on I learned the following: word program, Internet, saving information, searching for information" and Teacher 20 supported this when she said, "I learned computer basics because when I came here it was the first time I used a computer." Teacher

19 echoed this when she said, “As I have already stated that this was my 1st time to use computer I learnt everything.”

The overall picture of computer skills is that these increased noticeably and that the increase can be attributed to the fact that this cyberhunt project required participants to have some basic computer skills in order to design their cyberhunts. New skills were introduced through ‘just-in-time learning’ and by making use of peer-facilitators. This implies that skills were introduced to the participants when they needed it, hence the participants could use the computer skills in context. In addition, the peer facilitators were participants who learned faster than the majority and, as such, they then became co-facilitators. This process enabled the project facilitator to spend more time with those who really struggled, while the peer-facilitators assisted others who had minor queries.

3.7 Confidence, knowledge and positive attitude towards the computer as a teaching and learning tool

Although the participants initially had limited computer skills, this did not deter them. As their computer skills developed together with the project, their confidence also increased significantly. They also indicated that they felt much more empowered to manage computer classrooms, but noted that as they had not yet had an opportunity to implement what they had learned within their own classroom context, they could not be sure how well they would manage. Furthermore, participants also indicated at the end of the project that they had a greater knowledge base of how to use the computer in the classroom as a teaching and learning tool (specifically with reference to cyberhunts). They also felt that they were in a better position to support their learners in the ICT classroom, and that they felt confident that they would be able to provide the required feedback to their learners.

Interview data highlighted the fact that cyberhunts were something totally new to the participants, but by the end of the intervention 65% indicated that they felt that they had the necessary skills to implement cyberhunts in their own classrooms. However, it should be noted that the participants felt that it was not easy to design cyberhunts and that the cyberhunt strategy required a different approach from traditional teaching. Data from the Internet user group platform also indicated that the participants believed that the role of the teacher would have to change from being “a sage on the stage" to a "guide on the side" (Johnson, Johnson & Smith, 1991, p. 81). Furthermore, the cyberhunt approach would require that the learners would also become more active and responsible for their own learning.

Interview data concurred that the cyberhunt approach is different from the traditional "chalk and talk" approach, as explained by Teacher 26:

> *In [normal] classes the learners have to listen to what you are telling them to do, but on the other hand during the cyberhunt all learners are actively involved in their learning. So there is a difference between those two classrooms and the cyberhunt.*

That cyberhunts could assist to move away from the traditional 'teacher talk' approach of teaching and learning towards an active and constructivist approach, was summarised succinctly by Teacher 34 who said, "Learners will be able to operate a computer and find information on their own, rather than [the teacher] giving out info." These responses above also suggest a positive attitude towards the cyberhunt approach.

3.8 Assessment skills

It was quite alarming to note that only 54% of the participants indicated in the post-only Likert questionnaire that they knew how to assess cyberhunt projects, in spite of the fact that they were required to compile memoranda for assessment as part of the project (see Table 51D). Furthermore, throughout the duration of the project participants were made aware of the fact that learners could make presentations in written and oral form based upon the answers to the questions that had been composed, and that these answers would have to be assessed. The participants were even taught how to use PowerPoint, as this software application could also be used as a presentation tool to present the answers to the questions in the cyberhunt.

Cyberhunt assessment can go beyond the mere assessment of answers on a memo, but also include computer and Internet skills (see Starr, 1999; Slayden, 2000; Rechtfertig, 2002). Assessment of these skills would require not just a memorandum with the 'right answer', but probably a checklist or rubric with descriptors, and would require additional skills which were not evident in the assessment the teachers did at any stage of the project. One participant hinted during a group interview that cyberhunt assessment could go beyond a mere memo when she stated, " … maybe, also ask them to choose the topic and look for information on that topic, then see if they understood what needs to be done when creating the cyberhunt." However, if this is to be the case, how to assess aspects that go beyond a mere memorandum will have to receive greater attention during further teacher development sessions.

3.9 Reflection skills

The pre-post questionnaire related to reflection indicated an improvement in the ability to reflect and it appears that the participants realised that it is important for others to look at their designs and provide them with advice from another perspective. Seventy seven percent of the participants stated at the end of the project that they had used feedback from their fellow participants to improve their cyberhunt project (see Table 52A in Appendix A). In addition, receiving feedback and assistance from their fellow participants also assisted them in providing useful feedback to others when it was required. The feedback that was received from the participants seems to have influenced the quality of their design and how they thought they could improve their design. Being aware that others might use their products also seems to have had an influence on how the participants thought about aspects related to design and editing. This is suggested by the data as more than eighty percent of the participants indicated that they did make improvements to their projects after their completion in order to increase the appeal factor for their users. Hence, while they designed and reflected, they had kept their audiences in mind.

The post only questionnaire data indicated that 83% of the participants acknowledged the value of reflection and indicated that reflection helped them with their planning for the next session (see Table 52C). The participants had to hand-in their journal sheets at the end of each session to the facilitator, as they were used by the project facilitator to gain a picture of their highlights, goal setting, needs, etc. This process also allowed the facilitator to plan for the following session. The teachers requested that their journal sheets be returned to them at the beginning of the following session in order to further reflect on their progress and areas in which they were in need of assistance. Generally, opportunities for reflection assisted the participants to express how they felt about issues and about their progress during the project. Reflection enabled them to make explicit to themselves and to the project facilitator what goals they had set for themselves, what they had achieved, and why they did not achieve certain goals.

3.10 Mental effort

The data from the pre-post questionnaire revealed that the design of cyberhunts required a great deal of concentration and thinking, as the participants had to stay focused on what the design process required. This is especially noticeable in Table 52D in Appendix A, which shows that there was a positive increase towards concentration and thinking required by the design process. Furthermore, it was also noted that the design process required participants to stay focused and to think about ideas.

In addition, it was also interesting to note that some participants were so immersed in the design process, that they lost track of time during the training sessions. Participants indicated that design process, searching online and reading of the information found, made it difficult for them to determine in what order to put their ideas. This seems to suggest that the design process required a great deal of concentration and mental effort.

Furthermore, the data also revealed when using the computer as a tool, it is in fact the learner (or teacher-as-learner during this project) that has to do the thinking and not the computer. This concurs with Derry and Lajoie's statement that the computer can become a “mind-extension cognitive tool” (1993, p. 5). Hence, it is the learner (or teacher as learner during this project) who provides the intelligence and not the computer (Reeves, 1998). An example of this is when the learner becomes active in the design process; learning also becomes an active constructing process (Jonassen, 2002). In spite of all the mental effort required, it was interesting to note a decrease related to experiencing projects as hard work, probably caused by the fact that the participants enjoyed the design of the project, although it seemed to require a great deal of mental effort (see Table 52D in Appendix A).

3.11 Summary and Implications of skills and attitudes developed

The data revealed that it was initially difficult for participants to make decisions regarding topic selection and keyword generation. Participants also indicated that they found it hard to decide what a topic meant, which could probably be attributed to the fact that English is their second language. Furthermore, the participants also indicated that they did not always know what to do right away for a project.

Participants indicated that searching on the Internet was initially problematic, but this improved as the project continued. Assessing the reliability of information was another aspect that also needed more attention. It was also found that composing questions on information improved as the project continued, but then the majority of questions were still on level 1 or 2 of Bloom's taxonomy, in spite of participants having received training on the different levels and the type of questions pertaining to each level.

Planning skills also improved and it is probable that goal setting and reflection on the journal reflection sheets contributed to this, as it enabled the participants to be able to know where they were going. However, participants stated that they did not enjoy completing the journals, but then they also added that they had noticed its value. The journals assisted the participants to plan how to finish on time and the process also helped them with topic selection, the planning and composing of questions, and with deciding upon the responsibility of each person.

The design process made them more aware of their audience for whom they designed their cyberhunts and hence the participants constantly referred to the fact that they had to keep their learners' level in mind, probably also as their learners' mother tongue is isiXhosa and all the information found was in English.

The design process also contributed to thinking about layout and presentation of their products. Furthermore, the design process assisted them to present their ideas more easily than they had before and that enabled them to realise the importance of making connections among ideas.

General computer skills also improved significantly. It is important to note that the computer skills were not taught separately from the context, but as part of the context in a 'just-in-time' manner; meaning that the skills were taught when they were needed. Participants' confidence and knowledge grew regarding using computer as a teaching and learning tool. However, it was found that more assistance was required regarding assessment.

Perceptions regarding reflection also improved, as participants stated that their reflection on the reflection sheets (their journals) assisted them with future planning, and they highlighted the value the reflection sheets had for the project facilitator. The value that the reflection sheet had, was the fact that it could help the facilitator to plan for the next contact training session. Equally important, reflection assisted the participants to think about their audiences. Furthermore, participants also indicated that there was an increase in the perceived value of feedback from peers as being useful. The above emphasises the importance and value of reflection as a learning strategy. Regarding mental effort, it was noticed that the cyberhunt design process requires a significant degree of thinking and focusing, as the computer became a cognitive tool which requires that the learners have to produce the thinking and not the computer.

4. DOES THE CREATION OF A CYBERHUNT ENCOURAGE MOTIVATION AND INTEREST?

This section focuses on motivation and interest with the following aspects being identified and receiving attention; (1) which cyberhunt type was the most interesting?, (2) what promotes teacher enjoyment, motivation and interest in cyberhunt learning?, (3) the changing role of the teacher, (4) learner interest and motivation, (5) how to keep learners motivated and interested during the cyberhunt activity?, and (6) perceptions about motivation and interest related to projects. Each of these aspects has been divided into sub-sections where appropriate.

4.1 Which cyberhunt type was the most interesting?

The participants were exposed to two cyberhunts. At the start of the project, they experienced and completed pre-designed cyberhunts. As the project continued, they were trained to develop and design their own cyberhunts. It was anticipated that participants would like the designing of their own cyberhunts, the most. This was indeed how 57% of the participants responded (see Table 53A in Appendix A). It was however expected that this percentage would be much higher. What was interesting is the fact that 33% indicated that they enjoyed both cyberhunts equally. A possible explanation for this could be that it was the majority's first exposure and experience to the Internet, thus novelty could have had an influence on how they responded in both instances (Malone & Lepper, 1987).

The interview data suggest that the perceived value of both approaches, being exposed to pre-designed cyberhunts and designing your own cyberhunt, can be ascribed to the fact that both of the approaches prepare one to understand what cyberhunts are about and how to approach the design process. This highlights the value of using concrete examples or pre-designed artefacts as examples as concrete examples enable participants to know what to work towards.

4.2 Teacher enjoyment, motivation and interest in cyberhunt learning

It was clear that teacher enthusiasm was great at the start of the project. The responses from the teachers were overwhelming, as all responded that they had enjoy cyberhunt learning (see Table 53B in Appendix A). The pre-post Likert based questionnaire also revealed a similar result (see Table 54 in Appendix A). In the following sub-sections, reasons are provided with reference to why the cyberhunt project was enjoyed and why it was experienced as interesting and motivating.

4.2.1 Motivational theory and collaboration

A closer examination of the summary of the items in Table 54 in Appendix A shows that nearly all of the participants indicated that they had enjoyed cyberhunts as a teaching and learning strategy by which they could introduce the Internet or searching for Internet related information. The question that arose thus was; what was causing this enjoyment and excitement? Aspects that teachers identified that caused motivation during the training were (1) that they felt empowered, (2) that they had realised a goal, (3) that they felt that they have achieved a dream, (4) the learning of new skills, (5) that they saw cyberhunts as a new way of teaching and learning that is linking theory with practice, (6) that they experienced competence, becoming experts, (7) that cyberhunts opened new possibilities and different ways of thinking, (8) collaborating together, (9) that the design of cyberhunts developed creativity, (10) that they were able to find interesting information, (11) that they felt they had some control over what they wanted to do and lastly, (12) the presentational style of the training sessions (see Table 55 in Appendix A). These aspects which were identified are in line with collaborative theory (Johnson, Johnson & Smith, 1991; Johnson & Johnson, 1999, 2004) and motivational theory (Keller, 1983; Malone and Lepper, 1987; Wlodkowski, 1999), and are issues that designers and implementers of similar projects have to bear in mind.

4.2.2 Empowerment

It seems fair to state that the abovementioned aspects (indicated in 4.2.1) can be summarised with the word 'empowerment.' Responses to the semi-closed-open-ended questionnaire confirmed this view. Teacher 36 wrote eloquently that she has acquired skills that nobody can take away, or in her own words:

> *[I have learned a] skill that nobody will take from me. It's just like learning how to drive a car. I learn to work with others, move, help and discover information for myself.*

The advancement, development and empowering effect of the training was also evident in the words of Teacher 2, "It is developing me and also it is an opportunity to advance in technology." Another teacher, Teacher 38, stated that this type of learning will be empowering learners too, as it could assist them in their learning, thus it would be useful to the learners. Hence, one can conclude that this project has been experienced as empowering and has had a positive influence on the participating teacher's motivation and interest.

All these aspects above highlight the vital role of empowerment as a motivational element in any teacher training development programme. Thus, to feel empowered, teachers have to feel confident and competent, as suggested by the seminal work of Keller (1987) and Bandura (1997), hence confidence and competency are vital motivational factors.

4.2.3 Novelty

Another important motivator this project revealed, is that newness or novelty could result in the *"fingertip effect"* (Perkins, 1992, p. 145), which is the belief that "When we put opportunities at learners' fingertips, they take the opportunities" (1992, p. 145). However, at the same time, Perkins (1992) cautions that seizing new opportunities might not necessarily always happen. During this project, it was expected that the learners [the teachers in this project] would be interested in exploring and using new opportunities to which they are exposed to. This had occurred in this project.

During this project, the participants stated that this new cyberhunt Internet approach had opened a new world to them, thus suggesting that the *"fingertip effect"* of Perkins (1992) had occurred. However, one should take heed of Blumenfeld et al's. (1991, p. 375) caution that one should guard against the danger of novelty, as "interest may sometimes be heightened at the expense of cognitive engagement." Thus, technology cannot be the sole motivator – the so-called *'silver bullet'* - or be the only answer to the complex problem of the motivation of learning. According to Mellon (1999, p. 31), it is the learners' "willingness or ability to learn that is paramount," as the computer is only one of the tools for learning and in some cases, it might not even be the best tool (see Mellon, 1999). The data from this project suggest that not only novelty had played an important role as motivator, but that there was also a willingness to learn together with substantial encouragement that also had an impact on the participants' learning.

4.3 Role of the teacher

The following sub-sections deal with the role of the teacher, as the change in roles from a traditional perspective to a constructivist design perspective according to the participating teachers, enhanced motivation and interest.

4.3.1 Teachers examine their educational beliefs

Pajares (1992, p. 326) argues that teachers' educational beliefs inform their practice. One could thus argue that teachers' planning, instructional decisions and classroom practices are firmly rooted in a certain educational belief system. Pajares (1992) and Kagan (1992) also argue that teachers teach the way they were taught in many instances. It is therefore possible that the way that teachers had been taught at school and during their studies after school have a significant impact on their educational beliefs and classroom practice. Cuban (2001) argues in a similar manner that teachers do not change their practice easily and hence he concludes that this is why ICT is not well embraced within schools.

Gamache (2002, p. 286) argues that practice is explicitly or implicitly rooted in some theoretical framework. Hence, this implies that change is a difficult process (Fullan & Smith, 1999; Fullan, 1999, 2003), as beliefs are firmly entrenched within people. Participants indicated that cyberhunts have the potential to change the traditional way of teaching, as the approach is new and interesting. This response is in agreement with Mumtaz (2000) who argues that experiencing and seeing the fruitfulness of something new, may influence adoption and hence influence the process of change.

The participants also mentioned that they were confident that their learners would also find the cyberhunt approach appealing. However, one should be clear about the fact that a cyberhunt is only one approach to teaching and learning related to the Internet. Furthermore, the cyberhunt approach used was especially developed for teachers who did not have a great deal of computer and Internet experience. Therefore one could say that the cyberhunt approach could be useful to introduce computers, the Internet and various software applications (Word Processing, Presentation software, Browsers, Email) in an integrated approach.

The data also suggest that this project has had an impact on the participating teachers' educational thinking, succinctly summarised by Teacher 26 who stated, "The project taught me that gone are the days of giving learners all the information. They also have to wonder around." This response is an indication that the cyberhunt approach requires less "teacher-talk" and more guidance. This type of shift is what Johnson, Johnson and Smith (1991, p. 81) refer to as "Becoming a guide on the side instead of being a sage on the stage."

4.3.2 The teacher becomes a facilitator, guide, provider of feedback and a motivator

From the data it becomes evident that the great majority of the participants felt that the role of the teacher is different in the cyberhunt context (see Table 56 in Appendix A). At the same time it is necessary to point out that the four teachers who said that it was not different, argued that cyberhunt learning <u>should</u> not be any different (except for using computers), as one should be a facilitator and guide in the normal class too. The participants indicated in the semi-closed-open-ended questionnaire (see Table 57 in Appendix A) that the role of the teacher, when using the cyberhunt teaching and learning strategy, is that of facilitator, skills developer, supervisor, guide, provider of feedback, mentor, mediator, helper and problem solver and even motivator.

Although some of the terms, for example the term facilitator, could encompass all of the above roles, it seems appropriate to list all the roles as indicated by the participants, as these articulated roles indicate that the project has also had an impact on expanding the concept 'facilitator'.

4.3.3 Participants see the fruitfulness of this approach

The data portray a picture that the project had influenced the participating teachers in such a manner, that they experienced the cyberhunt approach as being fruitful. This was well summarised by a teacher during a group interview when she said that what she had liked about the project, was the fact that “It helps children to be independent as they discover things by themselves - not being told by you as a teacher” and “I think it stays better in their minds when they discover it on their own.” The reply of the participant seems to be in line with Mumtaz (2000) who argues that teachers would probably try to implement a new approach at their schools, if they can experience or see the approach’s fruitfulness. From the data, it became evident that the cyberhunt approach seems to have a relative advantage, because the cyberhunt approach is relatively easy to plan and implement; and the participants could observe how the project facilitator demonstrated the implementation process. Thus, being part of the cyberhunt teacher development project has played a role in participants experiencing this approach as powerful. This confirms the argument of Rogers (2003) that the above-mentioned elements should be experienced for change of practice or for a new innovation to be implemented.

The data also revealed that the teacher development process had influenced the participants to become positive and motivated, as (1) the participants indicated clearly what the advantages of cyberhunts are, (2) the participants stated that the cyberhunt approach is in line with the NCS requirements and (3) the participants also indicated that the cyberhunt approach it was not difficult to implement. This was probably as a result of the participants’ participation in the designing of cyberhunts and the fact that they had several opportunities to observe the facilitator in action. Thus, their exposure to the innovation, the knowledge acquired through practice, their observations and their positive experiences of cyberhunts had a positive and motivational impact. The data in the semi-closed-open-ended questionnaire regarding the benefits that the cyberhunt project had on participants (see Table 69 in Appendix A) concurred with the above, as participants indicated that they valued cyberhunts, as the cyberhunt approach provided them with opportunities that could (1) improve teaching, as cyberhunts introduced them to new approaches, (2) cyberhunts were empowering, (3) cyberhunts prepared them for change, (4) cyberhunts enabled them to become facilitators that could teach others how to design cyberhunts, (5) cyberhunts created interest, (6) cyberhunts enabled them to explore new horizons and (7) cyberhunts provided them with useful Internet skills. These results are in agreement with Roger's (2003) proposed aspects to be present for innovations to be explored or to be tried out.

4.4 Learner interest and motivation

In the sub-sections below, explanations are offered as to why cyberhunts could have a positive influence or effect on learner interest and motivation.

4.4.1 Computers bring a new context to the school

The great majority of the participants indicated that cyberhunt learning is different from the teaching and learning in their normal classes (see Table 58 in Appendix A). Interview data suggest that the Internet could bring a new dimension of readily available information to the classroom, especially to disadvantaged schools which are lacking basic resources. Teacher 2 said in this regard, "There is not much information readily available [at school] as [on the] Internet." Interview data also suggest that the change of the traditional classroom context to the computer room could play an important role in terms of motivation. This became evident when Teacher 43 referred to the fact that when learners are busy with their cyberhunts, it is not the teacher anymore who is in charge, but the learners. This was echoed be Teacher 26 when she said:

> *In class the learners have to listen to what you are telling them to do and in the other hand during the cyberhunt all learners are actively involved in their learning. So there is a difference between those two classrooms, [the] teaching [classroom] and the cyberhunt [computer classroom].*

4.4.2 The changed role of the learner

The cyberhunt approach could provide learners with an opportunity to work independently. Teacher 27 noted that "It is quicker and learners can search for information themselves and work independently." Teacher 26 echoed this; however, he also added that curiosity and collaboration would also have a positive effect on the learners' experience during the cyberhunt strategy, "It invokes in learners a sense of independence, curiosity, working with other, etc." Teacher 45 summarised it well when she stated:

It helps children to be independent as they discover things by themselves - not being told by you as a teacher. I think it stays better in their minds when they discover it on their own.

Learners were also viewed in a different context from the traditional passive listening role, as learners were seen as being active and hands-on learners, suggesting that the teachers did see their learners as those envisaged in the South African National Curriculum Statement.

Teacher 27 stated that learners enjoyed working with technology and Teacher 28 added that learners are curious and enjoy discovering things, "They like to figure things out. So this will obviously suit their style." Furthermore, learners were seen as (1) discoverers and finders of knowledge, (2) designers and skills implementers, (3) readers, (4) active and hands-on students, (5) collaborators, (6) reporters and (7) assessors (see Table 59 in Appendix A). The above are in line with the critical outcomes of the Department of Education (1997, 2002b) and constructivist principles (Brooks & Brooks, 1993; 1999).

4.4.3 Greater learner enjoyment as they become 'designers of knowledge'

Nearly all the participants indicated that their learners would enjoy cyberhunts (see Table 60 in Appendix A) and that the learners would enjoy designing the cyberhunts themselves more than pre-designed ones designed by the teacher, a stance that is supported Jonassen, Myers and McKillop (1996) who stress that that designers are the beneficiaries during the design process.

4.4.4 Accessing alternative sources of knowledge

As noted earlier, participants mentioned that their learners would enjoy cyberhunts, as they are fond of computers and because searching for information on the Internet would be novel to the learners. The participants also felt that cyberhunts help to make learners aware of the fact that books are not the only sources of information, a notion that is very important. Regarding the books as the only so-called legitimate source of knowledge, Prawat (1992) has strongly objected to this perception of the text book being the only source of knowledge. Hence, if learners can experience from a young age that knowledge is not only limited to books, but that other sources such as the Internet provide multiple forms of knowledge, it might encourage learners to explore a wider range of resources rather than just exploring paper-based printed books.

Carver et al. (1992), Lehrer, (1993), and Lehrer et al. (1994) have also argued that the design process of hypermedia could lead to seeing knowledge in a fundamentally different way and in addition, that the design process could lead to the development of certain critical cognitive aspects such as project management skills, research skills and organisation skills. Hence, being aware of the fact that there are different sources of knowledge besides the traditional paper based printed books might thus become a 'push factor' to manage, search and organise information differently as a result of Internet connectivity.

4.4.5 Learners [and teachers] experience cyberhunt design as play

Teacher 2 suggested that learners would enjoy cyberhunts, as cyberhunt is very similar to playing, as it includes an element of enjoyment. He put it like this, "Children like learning through play and this will be a total different way of learning than normal." This corresponds to the thinking of Webster, Trevino and Ryan (1993) who attribute the element of 'playfulness' as another important factor that can enhance motivation and interest towards computer activities, based on the theory of "Optimal Flow." According to Csikszentmihalyi (1990, p. 4) optimal flow is "the state in which people are so involved in an activity that nothing else seems to matter; the experience is so enjoyable that people will do it even at great cost, for the sheer sake of doing it."

During some sessions, I as project facilitator, had to inform the participants that it was time to go, which made it evident that some had lost track of time during the training sessions. Furthermore, some participants remained seated and continued for quite a while after I had made the announcement that the sessions had ended, observations which support Csikszentmihalyi's (1990) notion of optimal flow.

4.4.6 Novelty or newness

Interview data suggest that the learners were highly motivated when the new computers had been installed. The learners were so highly motivated, as one teacher put it, that "They even sacrifice to have afternoon classes, because to them it's so wonderful to be just in front of it." Another Teacher from another school that also had received new computers stated, "They [the learners] like computer sessions, they will even remind you. They enjoy learning/getting information for themselves." Thus, as noted by Perkins (1992) and Wlodkowski (1999), novelty provides motivation for learning.

4.5 Keeping learners motivated and interested

In previous sections, reasons were indicated why learners could possibly enjoy cyberhunts and why they would enjoy it more than their normal classes. The data from the semi-closed-open-ended questionnaire (see Table 62 in Appendix A) suggest that the teacher had to ensure the following to keep their learners interested and motivated during the cyberhunt approach, namely (1) ensure that the topic selection is relevant, (2) ensure that there is an element of simplicity by keeping the level of the learners in mind, (3) ensure that the teacher provides visual stimulation in the cyberhunt, (4) provide clear explanations, (5) praise the learners when appropriate, (6) start the cyberhunt process in group context, (7) encourage exploration, (8) show that you have confidence in your learners and, (9) allow the learners to choose their own topic and to choose the group in which they want to work. These requirements are corroborated by motivational theory (Keller, 1983; Malone and Lepper, 1987; Wlodkowski, 1999), the 'situated perspective' on learning (Lave & Wenger, 1991; Wenger, 1998) and notions of self-efficacy (Bandura, 1997; Schunk, 2004).

4.6 Perceptions about projects: What does the quantitative data reveal?

The pre and post results in Table 63A in Appendix A indicate a significant gain with regard to motivation and interest. Thus, doing and working on projects seemed to be experienced in a more positive light as a result of the participants' participation in the cyberhunt projects. In the following section an overview is provided regarding motivational perceptions.

4.6.1 Ownership instils motivation

A significant increase from the pre- to the post results was observed with respect to ownership, as indicated by the statement, 'When I have designed and completed a project, I feel like it's mine.' Hence, participants felt stronger in their post- responses that their completed cyberhunts were theirs; they were thus the 'owners'. There was also a 33% increase at the end of the project from participants who indicated that they were working on the project during their free time, which also suggests that the participants wanted to complete their cyberhunts, even if it meant that they had to spend extra time on the design process. However, if one looks at this increase, one would tend to ask why only an increase of 33%? A possible explanation for this response could be the fact that the majority of participants did not possess their own computers nor have access at school to the Internet.

Thus, those participants who had indicated that they were working in their free time were those who came earlier to sessions and started to work on their cyberhunts before the sessions had officially started and were those participants who stayed afterwards to work a bit longer. Interview data also highlighted the fact that participants felt empowered and wanted to take what they had learned further, a finding with respect to the issue of ownership, which is similar to the findings of Lehrer (1993) and Du Plessis (2004).

4.6.2 Learning new things

The data from the pre- and post-test in Table 63A in Appendix A showed that the participants indicated that they had been confronted with many new things during the project. The positive influence on learning by means of cyberhunt projects was evident as 92% of the participants indicated that they did learn lots of new things during projects, an increase of 23% from the pre-test. Participants also pointed out that projects did assist people to remember more about a topic, learning new things and remembering more about the new things that had been learned, which concurs with the findings of Lehrer (1993), Beichner (1994), Chen (1999) and Yildirim (2005); as they argue that the design of artefacts, especially hypermedia based material by learners, assist in this regard.

It was previously shown that Carver et al. (1992), Lehrer, (1993) and Lehrer et al. (1994) have also argued that the design process of hypermedia could lead to seeing knowledge as not something that is merely paper based, but that the design process could also develop new critical cognitive skills such as project management skills, research skills, presentation- and organisation skills, as well as reflection skills. This was also discussed in section 3 in this chapter.

4.6.3 Computer projects are different from other projects

An interesting response was noted to the statement in the questionnaire which says, 'Computer projects are similar to other projects in class,' as 85% initially indicated that this was not the case. In the post-test, only 38% of the participants indicated that they felt that computer projects were not similar, thus indicating a significant change. A possible explanation could be that participants had seen that although the computer was being used for cyberhunt projects, the computer based project still had the same attributes of other projects. Thus, the only difference from a non-computer project seems to be the fact that the computer and the Internet are used as a medium. Many anti-computer prophets would quickly reply that they told us that there is no difference, so why use computers? A response to them could be that although it is only the medium that is different, the medium has a significant impact on motivation and interest. The positive impact of the computer as medium is also highlighted in Table 63 (see Appendix A) by the response of participants at the end of the project, as the majority or 54% indicated that they would not like to work on projects where they are not allowed to use the computer.

Mellon (1999) says that not all learners have the same learning styles, thus one should try to make provision for all learning styles when possible or to alternate the types of learning (strategies) to accommodate all learners. The Clark (1994) and Kozma (1994) debate on whether media influence learning thus surfaced again as a result of the above claim. What was observed is that the context, the media (computer and Internet), the cyberhunt strategy and the manner in which it was facilitated, played a very important role in the positive way in which the participants have experienced the project, hence the above could have influenced the participants' response.

4.6.4 Computer projects have value

The majority of the participants indicated that they could see the value and benefits of computer projects, and this confirms the previous argument that computers as a medium (computer and Internet), the context, the cyberhunt strategy and the manner in which it had been facilitated, played a significant role to their response in Table 67A in Appendix A. Rogers (2003) and Mumtaz (2000) argue both that the value or usefulness of something, for example something that is new to them, are strong motivational factors for people to test something new. As the participants indicated that they valued the cyberhunt approach, it is likely that they would implement the cyberhunt approach at their schools, conditions permitting, as they had personally experienced its value during the training.

4.6.5 Computer projects are interesting

Regarding the statement in the Likert scale questionnaire, 'I think projects are boring', Table 63A in Appendix A indicates that 19% of the participants felt in the pre-test that projects were boring. However, this increased to 27% in their post response. This was made me wonder, as interview data suggest the contrary, namely that participants had experienced the project as very interesting. Teacher 45 responded at the end of the project to the question whether the project was interesting or boring:

> *Oh! Yes it is interesting. You know, when I saw it was Wednesday, I was worried because I came late from work. I am going to the computer class because it is exciting.*

Teacher 43 added, "Yes it is very much interesting. Especially if we could practise what we did here at our schools it will be much interesting."

Possible explanations for the contrary responses in the Likert scale questionnaire and the interviews could be twofold: Firstly, it could be as Teacher 43 had indicated above, attributed to the fact that the participants could not have implemented the cyberhunt approach yet at their schools, as the schools did not have an Internet connection yet. Hence the cyberhunt idea became irrelevant to them. Secondly, it could be that as the participants became more confident and skilled in the designing of cyberhunts, they could start to experience the design process as boring. At the same time, other responses in the Likert scale questionnaire indicated that participants had enjoyed working on projects and, that projects helped them to learn in interesting ways, as indicated by the increase from 50% in the pre-test to 70% plus in the post-test to the statements, 'Doing projects help me to learn in an interesting way', 'I like to work on projects' and 'I really enjoy projects as a way of learning about a subject' (see Table 63A in Appendix A). Thus, the negative result regarding the statement 'I think projects are boring' is contradicted by the data and argumentation as indicated above.

4.6.6 Computer projects provide new hope

In the previous sections, it was revealed that participants were very positive about the cyberhunt projects and that the majority of participants had indicated that the projects were interesting. Another interesting development was the fact that participants' experience of cyberhunt design and cyberhunt learning, as well as their possible implementation at school level,[41] has had a very positive impact on the participants' attitude towards teaching and learning. This became evident in Table 63A in Appendix A, where the percentage of participants being positive about their teaching

[41] As on 20 March 2009, we were given the go-ahead by the NMMU through Prof Paul Webb to install wireless Internet connectivity to the participating schools. We are awaiting the response from the campus manager of Missionvale and the technical services department.

increased by 23 % from 62% to 85%. The data also indicated a 22% increase related to the participants' enjoyment of teaching and learning from 69% to 92% of the respondents.

The positive increases above, seems to highlight the fact that despite all the negative publicity about teacher attitudes in South African newspapers and television, despite teachers' unhappiness and despite lack of resources; that the cyberhunt approach as an alternative to the usual pen-and-paper projects, might have given the participants new hope. Hargreaves and Goodson (2003) note that what we need in education is practical and sustainable hope. It is possible that the use of cyberhunts and ICT could make a contribution towards the promotion of hope in disadvantaged South African schools, something which makes further research on the implementation of cyberhunt projects an exciting possibility.

4.7 Summary and implications of motivation and interest

The data suggest that novelty, the sense of empowerment and aspects related to motivational theory and collaboration contributed to motivation. Although there is the notion that teachers teach the way they were taught and that they do not easily change their practice, the data generated during this study suggest that the cyberhunt teaching strategy has had a positive impact on teachers. The data also suggest that the teachers experienced the cyberhunt process as meaningful, as it 'opened a new world' to the participants. In a like manner, the cyberhunt approach could do the same for the participants' learners, as indicated previously. Furthermore, participants saw the changing role of learners and teachers within this context as being very positive.

In the cyberhunt approach, the role of the learner changes to that of being independent, creative, curios, active and collaborative. The context in which learners design their own cyberhunts could also contribute to learner motivation and interest, as the cyberhunt approach leads itself to them experiencing learning as play (see Csikszentmihalyi, 1990; Webster et al., 1993). Equally important, is the fact that the cyberhunt approach could generate interest, as learners could experience in practice that information is not only limited to books.

Cyberhunts could also be motivational, as it is computer related and computer projects seem to be different from projects where the computer is not involved. Hence, novelty could be contributing towards motivation. The idea of ownership, designing one's own product, was also seen as something that could promote motivation.

Lastly, teachers experienced the cyberhunt approach as something that provided them with more hope and stated that it might influence their perception about teaching. As a result, it is suggested that the cyberhunt ICT approach could play a significant role as both a motivator and as an information source; especially within disadvantaged schools that lack paper based resources. Hence, the cyberhunt approach could assist to tip the resource scale and at the same time foster the motivation and interest of learners.

5. DOES THE CREATION OF A CYBERHUNT ENCOURAGE COLLABORATION?

According to the critical outcomes of the NCS, collaboration and working in teams are paramount for life-long learning (Department of Education, 1997). In the following section, the promotion of collaboration by means of the cyberhunt design is discussed. To address collaborative aspects, the following main aspects have been identified and are discussed, namely (1) how did participants feel about asking for assistance?, (2) who was asked by the participants for assistance and why?, (3) what kinds of help were required?, (4) how many people were assisted during collaboration?, (5) how should the group composition be done?, (6) did the participants favour individual or group work?, (7) what were the problems and conflict experienced within groups and (8) how did the participants feel about group work?

5.1 How did the participants feel about asking for assistance?

The next section examines how participants felt about asking for assistance.

5.1.1 Asking for assistance from others increased

Collaboration implies that people are able to make use of the expertise among them to solve problems. Participants assisted one another during the learning process to move through the Zone of Proximal Development (ZPD) (Vygotsky, 1978). The ZPD can be defined as "the distance between actual developmental level as determined by independent problem solving and the higher level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86; Hedegaard, 1996). Hence, peers (whether learners or teachers) could assist one another to move through the ZPD by being 'ferrymen' (see Vygotsky, 1978). This implies that a particular peer assists another peer by ferrying the peer over 'the river', but in the process, the ferryman tries to empower the person being ferried to also become a ferryman who can assist other peers when they encounter a similar problem. This implies amongst others discourse among participants. As this study encouraged discussion and peer assistance among participants as part of the learning strategy, it supported social constructivist principles (see McMahon, 1997; Gagnon & Collay, 2001; Slavin, 2003; Marlowe & Page, 2005).

The data from the pre-post questionnaire revealed that there was a 30% increase from 69% to 96% related to participants asking someone else for assistance about problems encountered (see Table 70 in Appendix A). Observational data showed that initially there existed some reservations about asking for assistance, but this changed when participants started to collaborate within groups. Collaboration was extended to transcend group contexts as the project continued, as a result of the introduction of peer-assistants or peer-facilitators to assist participants when they required assistance.

With reference to 'finding it easy to work with participants in groups' and for 'learning new things from group members' (see Table 70A in Appendix A), a substantial increase was found in the pre- and post Likert from 54% to 77%, and from 62% to 85% respectively. Observational data showed that there was a great deal of teacher interaction towards the end of the project. However, it was also observed that some of the participants started to work on their own, as some of them wanted to design their own cyberhunts and did not want to design a group cyberhunt. This could probably be attributed to the fact that participants wanted to practice their design skills to indicate to themselves whether they could design it alone.

5.1.2 Finding it easier to show that they need help

It was previously noted that participants indicated that it was not too easy for them to ask for help or to learn from group members initially. This however, changed as the project continued, probably because the participants had been working together in communities of practice. As a result, the participants moved from the outer periphery as newcomers, towards the inner core of the community with the guidance of their fellow group members, the peer-facilitators and the project facilitator. Furthermore, the participants experienced the project facilitator, peer-facilitators and fellow group members as always willing to assist, patient and knowledgeable (see Table 72 in Appendix A). Thus, participants felt comfortable within the learning context, which could possibly be attributed to the development of a learning community (Lave & Wenger, 1991; Wenger, 1998, 1999, 2004).

5.2 Whom did they ask for assistance? Facilitator and Peer facilitators

The post only Likert project assessment questionnaire indicated that 96% of the participants stated that they had asked someone who was an 'expert in class' to assist them when they experienced a problem. As the project continued, peer facilitators were identified by the project facilitator to assist other participants with their questions or problems. The peer facilitators were identified during the fifth week of the project, just before the groups started to embark on their cyberhunt designs. Participants discovered that the peer-facilitators were extremely helpful, knowledgeable and that the peer facilitators could explain in a way that they could understand. Hence, some started to make use of the peer facilitators, as indicated by responses in their journals for example, "I was asking from André [Project Facilitator] but as the programme continued, I discovered that some of the teachers can also give help" (Teacher 11). Teacher 23 wrote that he had asked "Teacher 26 [Teacher 26 was also a peer facilitator], because he has a good understanding of computers" and Teacher 48 indicated, "I asked the student assistant [peer facilitator] and the facilitator, because they have more knowledge than me."

The post only Likert scale questionnaire revealed that participants felt that they really exchanged ideas with other members of their project team. Interview data and observation data confirmed that teachers interacted a great deal with one another and that some participants spoke in their home language, isiXhosa, when explaining something to their peers. The ability of their peers in their groups and the peer-facilitators to speak isiXhosa, could have attributed to the fact that they had asked the peer facilitators, as the project facilitator was not able to converse in isiXhosa. Hence, the participants may have found it easier to understand when their peers explained to them and therefore felt more comfortable asking the peer facilitators instead of asking the project facilitator. However, the semi-closed-open-ended questionnaire revealed that participants felt comfortable to either ask the project facilitator or fellow teachers for assistance to the same degree (see Table 71 in Appendix A).

A quantitative analysis of the qualitative journals of the participants concurred with the above, as 50% of the participants indicated that they had asked the facilitator for assistance and 50% indicated that they had asked their fellow participating teachers or the peer-facilitators for assistance, a pattern that was noticed throughout the journal writing period (see Table 75 in Appendix A). Participants stated in the questionnaire that they felt comfortable asking the facilitator for assistance, as they felt that he had the necessary knowledge and skills, he had a friendly nature and because he paid attention to them (see Table 72 in Appendix A).

The questionnaire data indicated several reasons why the participants also felt comfortable asking their fellow group members or other participants besides the peer facilitators or project facilitator for assistance. These reasons were as follow: participants felt (1) that they could relate to their friends in their groups, (2) that their group members explained in a clearer manner and, (3) that their group members understood them better. This was probably because all participants could speak isiXhosa, their first language, which the facilitator could not speak. However, some participants indicated that they had refrained from asking for assistance, because they would rather try to solve their problems on their own through trial and error or just for the sake of doing it on their own (see Table 76), as this enabled them to 'cement' their learning.

5.3 What areas required help?

The questionnaire data revealed that participants needed assistance with basic computer skills and cyberhunt design (see Table 74 and 76 in Appendix A). Journal data seem to backup the above (see Tables 77A and 77B in Appendix A), but also highlighted other aspects that were found to be problematic namely, (1) accessing Internet, (2) logging on to the network, (3) searching for information / exploring information, (4) tabbing between Internet explorer and word, (5) finding and inserting pictures, (6) general computer skills, (7) saving documents and opening saved info, (8) copying and pasting information or hyperlinks, (9) starting the program, (10) hyper linking, (11) cyberhunt designing, (12) typing skills, (13) selecting topics, (14) composing questions based on the topic and (15) dealing with too much information or web hits simultaneously.

A possible reason why the journal data revealed more problem areas than the semi-closed-open-ended questionnaires is the fact that the journals were completed every week at the end of each session, and hence the participants were able to put their thoughts on paper while these were still fresh in their minds. The semi-closed-open-ended questionnaires were completed at the end of the project, and therefore it is quite possible that some of the participants could have forgotten the details of the problems they had experienced.

5.4 The numbers of participants who provided assistance to others

The semi-closed-open-ended questionnaire data revealed that only two participants indicated that they did not help anyone. A deeper analysis of the questionnaire data revealed that these two (Teacher 6 and Teacher 43) had previously indicated themselves that they frequently had to ask for assistance and had struggled through the process. Teacher 43 had said before that he needed much more practice and that he should invest in his own computer. However, he indicated during the last session that he continued to struggle as much as before. Teacher 6 constantly said that she struggled with basic computer skills, such as copying and pasting. Hence, a possible reason why they had not assisted anyone could be the fact that they did not feel comfortable to assist others while they themselves were still lacking certain skills and did not feel competent to help their fellow students. This again highlights the importance of engendering confidence and competence (Keller, 1983; Malone & Lepper, 1987; Wlodkowski, 1999) in teachers before they will feel comfortable to assist fellow teachers.

In contrast to those who had not assist anyone, it was noted that many of the participants, who had indicated that they had helped more than four participants (see Table 78), were in fact identified by the project facilitator to be fellow peer facilitators, as these peer facilitators had rendered assistance to fellow participants on a regular basis. Table 79 in Appendix A reveals that most participants asked either one person or two persons for assistance. This shows that most of the participants had asked either the same person from his/her own group for assistance or that they had asked the project facilitator and/or specific peer-facilitators.

The majority of the participants said that their problems were solved by either the project facilitator of peer-facilitators. However, personal observation seems to indicate that many participants still experienced problems until the end of the project and it is possible that not all the participants were able after the completion of the programme to design and implement their own cyberhunts within their respective school contexts.

5.5 What is preferred: Working alone or in groups?

The data suggest that there were initially some concerns about working together, however these concerns seemed to become less of an issue as the project commenced. The data from the semi-closed-open-ended questionnaire (see Table 81 in Appendix A) indicated that working in groups was experienced as very positive. Interview data concurred.

5.6 Problems experienced within groups

It was noted that 15% of participants indicated that they don't usually experience conflict within their groups. However, this increased to 27% at the end of the project. The data thus suggest that there was conflict, but that the conflict was limited. It was expected that some forms of conflict may surface, as the participants did not necessarily work together with their colleagues from their schools in the same groups. The data from the semi-closed-open-ended questionnaire showed that there were problems when working in groups, such as (1) disturbances from others when they were busy working, (2) the different speed at which group members worked, (3) the fact that not all members had stayed focused and (4) late arrivals (new comers) or people not arriving on time (see Table 84 in Appendix A).

Journal data also revealed that many participants did not experience many problems or disagreements within their groups (see Table 85 in Appendix A). Furthermore, the data indicated that participants had helped each other and that working together assisted them to build a common understanding of what had to be done. In addition, journal data also revealed that the disagreement or conflict that had occurred was as a result of (1) some members being dominant, (2) issues around topic selection and (3) differences of opinion on which search engine to use. In spite of some instances of conflict, the participants said that consensus had been reached during disagreements (see Table 85B and Table 85C in Appendix A).

5.7 The promotion of collaboration through the creation of cyberhunts

In the following sub-sections, it is discussed how collaboration could be promoted through the creation of cyberhunts. Five aspects were identified namely, (1) cyberhunt design promotes individualisation and collaboration, (2) cyberhunt design promotes discussion about cyberhunt design issues, (3) cyberhunt design promotes working together as a community of learners, (4) cyberhunt design promotes the development of social skills, and (5) cyberhunt design promotes the development of confidence. These aspects are discussed below.

5.7.1 Cyberhunt design promotes individualisation and collaboration

The heading above seems to be contradictory. However, it is important to take note that the rationale behind Vygotsky's thinking about the ZPD is that a person is scaffolded or helped by someone else in such a manner, that the person in need of assistance can do what he or she had not been able to do without assistance. Hence, the rationale behind collaboration is that people collaborate with respect to a given task in order that they may be able to complete the task on their own. In addition, collaboration does not imply that one should not develop one's own point of view. Collaboration should thus also assist people to grow individually and to develop their own ideas at the same time. This was indicated in the pre-post Likert based questionnaire, as 56% of the participants indicated initially that doing projects gave them a chance to develop their own point of view. This perception increased to 92% at the end of the project. A similar significant increase was found related to group work promoting personal growth at the end of the project. Thus, collaboration seems to foster individual development.

5.7.2 Cyberhunt design promotes discussion about cyberhunt design issues

The initial data from the pre-post Likert based questionnaire indicated that the vast majority of participants found it easy to share their ideas with other group members and that this number increased even further at the end of the project. Initially 62% of the participants indicated that they had found it easy to raise their point of view and this increased to above eighty percent at the end of the project.

However, it was interesting to note that only 18% of the participants initially felt that it was easy to express a different point of view to other teachers about how to proceed with projects. This figure increased to 64% at the end of the cyberhunt teacher development project. A possible reason why the participants' responses were different here from the one in the previous paragraph could be attributed to the wording of the statement as the wording was referring to a different point of view on how to proceed with projects. In the previous paragraph, the wording did not specifically refer to projects.

The questionnaire data highlighted the fact that participants had shared various issues related to the cyberhunt design process among one another in their groups, such as:

- Selecting topics,
- Developing questions,
- Deciding and developing strategies and procedures,
- Thinking about their audience,
- Discussing which internet addresses or websites to be used,
- Discussing how to search for information,
- Discussing how to assist their learners,
- Considering how to design and plan cyberhunt lessons,
- Discussing the planning for the cyberhunt project,
- Discussing the usefulness of project and
- Deciding how to assist one another (see Table 87 in Appendix A).

The data thus suggest that collaboration within communities might be able to provide a platform through which participants can share their experiences (Hawley & Valli, 1999; Williams et al., 2000; Burns, 2002; Birman et al., 2000; Garet et al., 2001; Vrasidas & Glass, 2005) and that the articulation of their experiences (Polman & Pea, 2001; Nonaka, 1994) become opportunities to learn from one another.

5.7.3 Cyberhunt design promotes working together as a community of learners

The journal data provided evidence of how working collaboratively within groups had lead to (1) participants gaining more knowledge and sharing knowledge with one another, (2) the simplification of learning (in a positive sense), (3) helping one another improved, (4) the saving of time, (5) assisting one another to solve problems and (7) the instiling of confidence. Furthermore, the participants also stated that it was more enjoyable and interesting to work in groups. However, some participants stated that they had not worked in groups, but worked alone (see Table 88 in Appendix A). The semi-closed-open-ended questionnaire data confirmed that participants had experienced working together within groups as beneficial, as it created opportunities for (1) meeting new and different people, (2) obtaining assistance, (3) receiving explanations from peers and as a result learning from one another, (4) discussing ideas, (5) encouragement, (6) the sharing of different experiences, (7) creating enthusiasm to learn more, (8) sharing information, (9) planning collectively, (10) sharing the workload and (11) planning how to finish on time (see Table 89 in Appendix A).

Receiving encouragement, sharing information and different experiences, receiving assistance and explanations, as well as meeting new people, are indicators of the establishment of a community of practice (Lave & Wenger, 1991; Wenger, 1998; Wenger, 2004). The peer-facilitators started at the periphery of this community of practice, but soon moved towards the centre as they obtained more expertise. The other participants recognised the fact that some participants had become experts and started to make use of these peer-facilitators' expertise (see Lave & Wenger, 1991; Wenger, 1998; Wenger, 2004).

The semi-closed-open-ended questionnaire confirmed that collaborative group work was perceived as valuable, as participants felt that collaborative group work (1) assisted them to share knowledge among one another, (2) encouraged team work, (3) simplified the learning process, (4) enhanced the learning of new skills and processes, (5) provided an opportunity to try-out the innovation, (6) created opportunities for participants to express themselves, (7) instiled confidence among one another, (8) provided multiple answers to problems and lastly (9) provided opportunities for the participants to use their own home language to assist one another (see Table 90 in Appendix A).

5.7.4 Cyberhunt design promotes the development of social skills

Interview data indicated that participants had learned social skills from one another (see Table 91 in Appendix A). Part of socialising skills is the virtue to be patient and to be tolerant towards one another. The findings within this study concur with Johnson and Johnson (1999) who argue that social skills are paramount for successful collaboration.

5.7.5 Cyberhunt design promotes the development of confidence

The participants' computer skills initially had been very underdeveloped (see first section of the findings in Chapter 4). Hence, it was expected that the majority of participants would not feel confident enough to assist their peers or fellow teachers when their peers sought assistance. However, this preconceived notion changed significantly towards the end of the project from 42% to 92%, a 50% increase indicated that they felt confident enough to help others when these others needed assistance (see Table 70 in Appendix A).

The post Likert questionnaire data indicated that 92% of the participants felt that collaboration within groups with respect to the cyberhunt design process, empowered them to feel more confident to learn about cyberhunts. Hence group collaboration seems to have had a positive effect on participants' confidence, and this again made participants more willing to learn about cyberhunts (see Table 70G in Appendix A). Group interview data generated indicated that collaborative group work assisted participants to assist one another, as one participant stated, "We can work in groups so that we can help each other." Hence, a sense of community assisted them to move through the ZPD (Vygotsky, 1978).

To conclude, most participants felt that collaboration by means of group work for the design of cyberhunts was very positive. The participants suggested that group members endeavour to take cognizance of the following while they are involved in computer related training and collaborating within groups: (1) keep on helping each other and work as a team, (2) share information, (3) provide freedom in the groups to ask for assistance and to bring ideas, (5) divide tasks, (6) start working as groups, then provide opportunities for individuals to show their competence, (7) stay focused, (8) be patient with one another and (9) cooperate and compromise as needed (see Table 91 in Appendix A).

5.8 Summary and implications of collaboration and individualisation

The data revealed the following: Initially participants were hesitant to ask one another for assistance, but this changed as the project continued, probably as a result of making use of peer-facilitators, as the project progressed. The data also suggest that participants felt reasonable confident to either seek assistance from the facilitator, peer-facilitators or fellow group members. Assistance was mainly required related to (1) accessing the Internet, (2) logging on to the network, (3) searching for information / exploring information, (4) tabbing between Internet explorer and word, (5) finding and inserting pictures, (6) general computer skills, (7) saving documents and opening saved info, (8) copying and pasting information or hyperlinks, (9) starting the program, (10) hyper linking, (11) cyberhunt design, (12) typing skills, (13) topic selection, (14) composing questions based on the topic and (15) dealing with too much information or web hits.

Participants also indicated that they would rather work in groups than individually. Working within groups was not always easy, as some forms of conflict occurred at some points in time during the cyberhunt project. This was caused by (1) too much talking, (2) differing abilities, (3) struggling to find suitable information, (4) struggling to compose suitable questions, (5) lacking a manual or guide at the beginning of the process, (6) late coming and (7) lacking of computer skills. It was also found that other aspects that had lead to conflict, was as a result of (1) some members being dominant, (2) issues around topic selection and (3) differences of opinion about which search engine to use. However, participants indicated that consensus was reached about disagreements in most instances.

The data revealed that the cyberhunt design process promoted individualisation and collaboration, promoted the discussion on cyberhunt design issues, promoted working together as a community of learners, promoted the development of social skills and lastly, promoted the development of confidence. Thus, the findings regarding collaboration in this study support the fact that dialogue and collaboration within a social constructivist learning context, provide opportunities to learn from one another (see McMahon, 1997; Gagnon & Collay, 2001; Slavin, 2003; Marlowe & Page, 2005).

6. HOW SHOULD THE TEACHER DEVELOPMENT PROCESS FOR ICT INTEGRATION USING CYBERHUNTS BE MANAGED?

This section consists of a discussion of what the data revealed with respect to the teacher development process.

6.1 Key aspects of the development of teachers

In this section, the themes pertaining to the aspects that are important and valued in the teacher development context by the participants, in terms of the facilitation process are highlighted and discussed.

6.1.1 The importance of the facilitator's people skills

The participants indicated that people skills such as friendliness, patience, tolerance, approachability, helpfulness and portraying a positive attitude are extremely important aspects and characteristics for a project facilitator. These attributes were highlighted in the Internet user group and in the semi-closed-open-ended questionnaire. Patience seemed to create the idea of a 'safety net' for participants, hence establishing emotional scaffolding (Mahn & John-Steiner, 2002). Havelock and Zlotolow (1995), Wlodkowski (1999) and O'Connor and Ertmer (2003) have also identified people skills that are vital for the facilitator during teacher development, for example, establishing and portraying a caring attitude and building positive relationships. The importance of taking people's needs into consideration was also highlighted by Hawley and Valli (1999), Blumenfeld et al. (2000), Watson (2001) and Royer (2002).

The challenge for any facilitator is to contain anxiety and to create a climate of trust and care (George & Camarata, 1996; Havelock & Zlotolow, 1995; Harris, 2002) and people skills play an important role in this regard. The creation of a positive teacher development environment or context is thus paramount factors for teacher development. Equally important, participants also said that a project leader or facilitator should be positive, accessible, and helpful and have a solid understanding of the participants.

Furthermore, participants indicated that it was important for them that the facilitator or project leader had a positive attitude. This is in line with Havelock and Zlotolow (1995) and

O'Connor and Ertmer (2003) who state that trust, support and care, are key elements of successful teacher development processes.

6.1.2 The importance of an awareness of the differing skills of participants

Participants who had used the Internet user group felt that the project leader should have taken cognizance of their different levels of ability, of the fact that their pace of learning differs (Ertmer, 2001), that each one of them is unique, and that anxiety has to be contained (George & Camarata. 1996). This corresponds with the findings of Ertmer (2001) who argues that teacher development sessions should be built around individual's needs.

6.1.3 The competence of the facilitator

Several participants voiced their opinions anonymously in the Internet user group that the project leader should be well versed in what he/she is trying to train the participants to do. Competence thus instils confidence within participants, as competent facilitators exhibit and share expertise (Maxwell & Plamondon, 2005). Thus, facilitators should be experienced (Whitfield, 2005). However, knowledge and skills related to computers are not the only requirements; assessment of participants' understanding is also important, as it assists with taking the planning process forward.

6.1.4 Clarity with respect to explanations

Participants noted that facilitators should always be able to explain what had to be done in a clear and understandable manner. This was noted in the Internet user group by various participants and is in agreement with Maxwell and Plamondon (2005) and Whitfield (2005) who also stress the importance of clear explanations. The value of clarity contributes to the containment of anxiety, as participants are more relaxed and comfortable when they know what is expected from them and what they have to do.

6.1.5 Assessment and feedback on a regular basis is key

Participants posited that assessment and continuous feedback have to play an important role during teacher development sessions, concurring with Birman et al. (2000), Herrington and Oliver (1997, 2000), Garet et al. (2001), Hoban (2002), Turbill (2002), Sherry and Gibson (2005) and Herrington and Kervin (2007). The participants highlighted the fact that assessment should be done on a regular basis during the training to ensure that participants are on the level required. This implies that the facilitator or project leader has to provide frequent opportunities for participants to demonstrate their newly acquired skills, in order to inform the facilitator which participants are in need of more assistance.

Participants suggested that assessment could be done by means of small tasks and/or by asking them suitable questions that were linked to what they had been doing. It must be emphasised that participants had been presented with opportunities to show their competence, but that they had been working in groups most of the time and only started to design their individual cyberhunts towards the end of the project. Thus, it was not possible to assess each group and/or each individual at the end of every session formally, as the facilitator was too busy most of the time assisting participants. Therefore, the more competent participants were used to assist the facilitator. However, it seemed that the participants wanted the facilitator to fulfil this role, as the facilitator provided what was seen as an official 'seal of approval' and furthermore, the project facilitator could be seen as a self-efficacy enhancer (see Bandura, 1997; Schunk, 2004).

6.1.6 Written support material

During the first few weeks of training, the participants were guided by using PowerPoint presentations, as well as by clear explanations and through modelling. A data projector linked to a laptop was used as a teaching aid. Notes were not distributed right away. Participants agreed in their responses to the semi-closed-open-ended questionnaire about the importance of clear notes for training purposes, as well as notes to guide them with implementation at school. Notes or a manual would also have been of value to them in the case of them missing a session or preparing or recapping something at home.

It was interesting to note that the majority of participants, who wanted notes, were those teachers who did not join the project right from the start. Hence, these participants who had not been with the training from the first sessions, felt a bit lost. The manual was seen as a crutch or scaffold that could be one of the tools to help them through the Zone of Proximal Development (Vygotsky, 1978). This highlights the importance of notes or guides, especially for those who join teacher development sessions at later stages.

The importance attached to printed guides or/and manuals are in line with the argumentation of Leach and Moon (2000) who note that teachers need clear guidelines on how to integrate ICT into the curriculum. Furthermore, Leach and Moon (2000) argue that the chances are slim that new technologies will have a significant influence on systemic improvements if the necessary printed guidelines are not available. The same sentiment has been shared by Hodgkinson-Williams (2005) who argues that there is a lack of information on how teachers and schools are expected to practically integrate or make use of ICT in practice within the South African context. The *Draft White Paper on e-Education* (Department of Education, 2003, 2004) has gone to great lengths to indicate the importance of ICT in education, but it does not provide any clear practical guidelines on the 'how to' aspects of implementation (Hodgkinson-Williams, 2005).

6.1.7 The importance of co-planning lessons with the facilitator

The majority of participants indicated that they would value the opportunity to see how the project leader plans cyberhunts (see Table 93A in Appendix A). Thus, the project leader should not just be someone who has knowledge about planning, but should also have the skills and practical experience regarding planning. This highlights not only the value of cognitive apprenticeship (Brown et al., 1989), but also the importance of experiencing learning within authentic contexts with an expert acting as the 'hand holder' or 'scaffold' (Brown et al., 1989; Lave & Wenger, 1991; Wenger, 1998).

6.1.8 The need for demonstration and observation in practice

Not only is co-planning very important, but practical demonstration by the project leader is too. All participants indicated that observations of the project leader in action within a classroom context were necessary (see Table 93B in Appendix A). This highlights the importance of having access to expertise (Herrington & Oliver, 1997, 2000; Herrington & Kervin, 2007) and the value of cognitive apprenticeship (Brown et al., 1989) or a collaborative apprenticeship framework (Glazer et al., 2005).

Through observing the facilitator or project leader in action during the teacher training development sessions, the participating teachers became cognitive apprentices, as suggested by Brown et al. (1989), when the project leader demonstrated his tacit knowledge in an explicit manner. Through their observations and personal experiences of the cyberhunt learning context, the participating teachers tried to make connections between their existing tacit knowledge and the project leader's explicit knowledge through a process of accommodation and assimilation (see Piaget), which may result in a re-organisation of a participant's tacit knowledge (Nonaka, 1995).

6.1.9 Regular classroom visits

Participants indicated that they would value support from knowledgeable persons (see Table 93C in Appendix A) to visit them in the ICT classroom at their school in order to provide assistance to them by means of feedback. This concurs with research findings that support is key during teacher development (Ely, 1999; Ertmer, 1999; Fullan & Smith, 1999; Surry et al., 2004; Mueller, Wood, Willoughby, Ross & Specht, 2008).

6.1.10 Frequency and length of training sessions

The majority of teachers indicated that they would prefer computer training twice a week (see Table 94A in Appendix A). The fact that the participants were extremely serious about the ICT training, despite having full schedules at their respective schools, became evident from the data as they stated that they did not want training every second week, but rather every week. The predominant response why training had to be done on a weekly or two weekly basis, was the fact that it provided opportunities for the regular practice of ICT skills, and that regular practice assists with the automaticity of computer skills, as 'practice makes perfect'.

One also has to bear in mind that the majority of the participants did not have their own personal computers and Internet access, thus regular training sessions could have been seen by them as opportunities for more regular access and practice. The feedback of the participants confirmed the value of regular contact sessions in helping participants to remember what had been learned. The majority of the participants (see Table 94B in Appendix A) indicated that the training should be done after school so as not to impede their teaching or adversely affect their schools' smooth running.

Teachers also indicated that the school day was tiring. Hence, the duration of the training is important. There was no outright winner between a two hour and a one hour training session (see Table 95 in Appendix A). However, as some participants had to travel quite a distance, and at the same time were making use of mini-bus taxis for transportation (resulting in arriving late on occasions), it did not seem viable to have a weekly one hour session. However, it was noted that too much exposure for a newcomer to computer skills, could lead to information overload. Thus, it became evident that a balance has to be maintained between learning time and the number of new skills being introduced. This again highlights the importance of relating to participants' needs when embarking on training and development (Havelock & Zlotolow, 1995; Ertmer, 2001).

6.2 Training aspects

Participants experienced the training as different from the normal Department of Education training and other forms of training they had received previously. What was positive about the training during this project is highlighted in the subsequent sections.

6.2.1 Training has to be ongoing and not 'once-off'

Participants appreciated the fact that the training was not limited to a 'once-off-one-day' or one week training programme, which is typical of the training provided by the Department of Education, but that the training was ongoing. This concurs with the suggestions of Royer (2002), Hinson, et al., (2005), Hinson et al. (2006) and Lawless and Pellegrino (2007) that training should be regular and ongoing. The importance of regular weekly training sessions without missing a week or two is highlighted by the fact that the project facilitator observed after a four week holiday period that the students struggled during the first session after the holiday. This indicates that the participants had lost some of their newly required skills as a result of being absent from the training over a period of time.

6.2.2 Pace of training

Participants valued the ability to be able to work at their own pace and that they were not rushed through the training. Overall, the participants felt that everybody was accommodated, but this does not imply that everything was satisfied. Some teachers said that by trying to accommodate everyone, there was too much repetition during some phases of the training. Ertmer (2001) also refers to the importance of maintaining the correct pace.

6.2.3 Presentation style and format

The way and format in which training is presented are always of vital importance. Participants should find it appealing. During the training, the emphasis was on being practical, with a 'hands-on' approach. In conveying the theory behind the cyberhunts, we throughout refrained from going too deeply into the theory. The thinking behind this was to close the theory-practice gap, an important issue according to Watson (2001) and Royer (2002).

6.2.4 Training environment

The training environment or context is an important aspect of teacher development. This was highlighted by the participants, as they commended the facilitator for creating a relaxed environment in which they felt comfortable and received adequate assistance. This sentiment concurs with those of George and Camarata (1996) who highlight the importance of containing anxiety during computer training. Havelock and Zlotolow (1995) also emphasise the value of good relationships between facilitators and their learners in authentic learning settings or contexts (Brown et al., 1989; Lave & Wenger, 1991; Wenger, 1998; Herrington & Oliver's, 1997, 2000; Herrington & Kervin, 2007).

6.2.5 The value of using the mother-tongue

It became evident to the project facilitator during the project that at some times he was not able to explain clearly enough to some of the participants. This resulted in misunderstandings between the project facilitator and participants at some stages. This was due to the fact that isiXhosa is the first language or mother-tongue of the majority of participants and English was the language of instruction and communication during the project. Equally important, isiXhosa is an indigenous African language which does not have computer terminology. However, participants were encouraged to assist one another in their mother-tongue. It was observed from June 2008 onwards that isiXhosa speaking started to emerge on a regular basis. It was also noted in my observational notes that explaining to one another in their own home language seemed to be effective.

6.3 Changes in facilitation practice

Although the participants indicated that they had experienced the training as very positive overall, it was felt that the number of facilitators and the way participants were grouped should be reviewed for training in future projects. Therefore, participants were asked to respond to aspects related to facilitation. This receives attention in the following section.

6.3.1 Number of facilitators

It was previously mentioned that capable peer participants (peer-facilitators) were identified during the training to assist the facilitator. The rationale behind this was that these capable peers would be able to attend to participants to whom the facilitator could not when he was busy, so as to increase the speed with which participants could receive assistance. However, it was shown that many participants preferred the assistance of the facilitator, especially at the start of the project, as he was seen as the expert. As a result, participants indicated that more than one expert should be used in order to assist simultaneously with facilitation. The majority stated that two experts would be required for a group of 30 participants, which was approximately the size of each cyberhunt training session (see Table 96 in Appendix A).

The participants stated that the reasons for wanting more than one facilitator were that they would complement one another, and hence the training would be more fruitful. On the other hand, those who felt that one person should facilitate the training process, were concerned that if there were too many facilitators, it could lead to confusion. Another participant stated that it was important for first timers, who had little knowledge and experience, to have only one facilitator. It is also evident from the data that as needs are different, the project facilitators should be able to respond individually to each person's individual needs and assist him/her accordingly. This would again highlight the importance of being responsive in one's design to individual needs, as suggested by Wlodkowski (1999) and Ertmer (2001).

6.3.2 Grouping

Participants were not forced into specific groups, but were allowed to choose with whom they wanted to cooperate. Some participants decided to collaborate with those next to them, even if the participants next to them were not from the same school. Some participants were very happy with their group scenario, as they chose groups from members of the same school. Nevertheless, some participants suggested that groups should not be of mixed ability, but rather be formed based on the same ability. On the other hand, some participants felt that having groups with the same ability was not going to serve the interest of all learners. Their argument was that if groups were of mixed ability, those who required assistance had a greater chance to obtain assistance from a fellow group member. Some participants also highlighted the importance of the fact that the same groups should not be used for the entire training, but that rotation of members (re-grouping) should be considered during the training process.

One participant suggested that the participating teachers should be graded or grouped according to their abilities, thus two different workshops should be conducted: one for those who are beginners and a different one for those who are more computer-skilled, which again highlights the different levels of some of the participants. This specific teacher was more computer skilled than many other teachers, but the fact still remains that if one is able and in a position to explain to others how something should be done, one not only empowers those who need assistance, but also improves one's ability to teach or facilitate these skills to others.

6.4 How to ensure success

One of the key aspects here is the fact that had been previously highlighted by the participants, namely ongoing practice and enough time for practice. As many participants did not have their own computer to practice on, the solution was simple, as stated by Teacher 9 in her journal, "The only way to improve my skill is to buy myself a computer and get to know it better and get more practice at home." Teacher 23 concurred in her journal, "If we can have computers in our homes that can leave us will full knowledge so as to take home homework so that when we come back we get a good training." Other important aspects that were also emphasised, were "regular attendance of the class [training]" (Teacher 27), "following the instructions while at class" (Teacher 26), "to fully participate" (Teacher 28), "to ask for assistance when one is unsure" (Teacher 29), "to be positive" (Teacher 1), "to do one's best" (Teacher 38) and "to keep on practicing" (Teacher 45).

6.5 Summary and implications of teacher development process

The participants highlighted the importance of the role of the facilitator during teacher development projects and placed a high priority on that person's people skills and competence. Furthermore, it was noted that clear explanations, approachableness and constant feedback were highly valued. This is in line with Havelock and Zlotolow (1995), Harris (2002) and George and

Camarata (1996) who argue that building relationships and trust, as well as the containment of anxiety, are vital for teacher development.

In addition, participants indicated that they would highly value that the project facilitator visit them at school to assist them with classroom implementation. This was indeed a very positive stance, as teachers are the champions of change and classroom support could probably assist them to experiment with alternative approaches (Fullan & Smith, 1999; Mumtaz, 2000; Kirkman, 2000; & Mouza, 2005), for example by using the cyberhunt strategy. This is in line with Wilson and Peterson (1995), Ely (1999), Surry et al. (2004), Wilmore (2000) and Creighton (2003) who highlight the role of support.

Participants also highlighted the importance of a paper based guide and notes during training as this gave them some form of security. This seems to concur with Leach and Moon (2000) and (Hodgkinson-Williams, 2005) who highlight the importance of clear guidelines for implementation. Participants also said that they had experienced the training as totally different from any other training they had been involved with before. Data analysis suggests that the positive attitude, patience and good listening skills were valued by the participants. Participants also highlighted the fact that the atmosphere was relaxed and that this was appreciated, which is in agreement with George and Camarata (1996) who emphasises the importance to contain anxiety when technology is introduced to people.

Participants also explained that the training was different, because it was ongoing, not like the normal one day sessions. This emphasis of the importance of training that is spread over some time, concurs with Royer's (2002) thoughts. Overall, the majority of the participants stated that the pace of training was important. An aspect that made the use of capable peer facilitators very different and attractive, was the fact that the peer-facilitators could assist their fellow peers in their home language, isiXhosa. This enabled them to often render greater assistance to their peers than could be done in English. Consideration of the language ability of participants during teacher training is thus very important, as this could influence the successfulness of the training.

It seems fair to say that the teacher development process (training process) that was implemented in this study; which is underpinned by the collaborative, motivational, knowledge generative and situated cognition approach and cognitive apprenticeship; appears to be an effective strategy, especially with respect to the use of the peer-facilitators, as this instiled confidence within the participants. However, one should take cognizance of the recommendations of the participants related to the teacher development process (training process), as well as to what is expected of a facilitator, as seen through their eyes. These recommendations have been embedded within the proposed planning framework for teacher development (see chapter 6).

7. SUMMARY

The discussion in this chapter focused on the presentation and interpretation of the quantitative and qualitative data related to each of the five subsidiary questions. Question 1 addressed the first and second order barriers related to ICT implementation. The data suggest that there is still a great deal that has to be done, as the majority of the participating schools are still in stage 1 or in a pre-phase or entry phase of stage 1 (see Table 2.2 in section 5 of chapter 2). This implies that most of the participants are thus in the ‘Learn the basics of using the new technology’ phase (Dwyer et al., 1990, 1991), ‘Teacher as learner phase’ in which teachers seek information-gathering and the learning of new knowledge and skills pertaining to computers (Sherry et al., 2000) or the ‘pre-integration phase’ (Toledo, 2005).

Overall, the computer usage by teachers was still limited, as was the vision, focus and goals of the participating schools. The data indicate that existing participation and consultation could be expanded, and that staff participation and consultation pertaining to ICT have to be coordinated on a greater planned scale. Furthermore, teachers stated that leadership, training and support from their schools have to be expanded and that the Department of Education should provide sufficient support. Hence, the participating teacher value support from any appropriate sources.

In the majority of the schools, one person was responsible to teach learners the necessary computer skills. It was also noted that rewards and incentives as motivators were lacking. As a result of the large class sizes, time allocation on the time table was problematic. The participants also indicated that they were in need of more computer skills, cyberhunt skills and skills related to ICT pedagogy. In spite of these existing barriers, participants were still very positive about ICT implementation. Therefore it is argued that several first- and second order barriers are in serious need of attention.

Question 2 tried to find answers pertaining to the skills addressed through cyberhunt design. It was found that the design of cyberhunt artefacts have the potential to promote the following skills in participants, and therefore also in learners, namely (1) decision making, (2) planning, (3) participants' attitude with respect to research and reading – including research skills (4) how to pose questions on different and higher levels, (5) confidence in using the computer as a teaching and learning tool, (6) audience, (7) computer skills, (8) assessment and (9) reflection.

Regarding motivation and interest, the data related to question 3 suggest that the design of cyberhunts has had a positive impact on the motivation and interest of participants, as the design process contained aspects associated with motivational theory. It was found that novelty was a great motivator and that the design process provided opportunities to experience empowerment. Furthermore, the practical experience and exposure to cyberhunts, has had the desired effect on teachers as they experienced the changing role of the teacher from being a 'sage-on-the-stage' (Johnson, Johnson & Smith (1991, p. 81) to a facilitator, as positive. In addition, participants also experienced the fruitfulness of the cyberhunt strategy and indicated that the cyberhunt approach should have a positive impact on their learners, as it brings another dimension to learning as well as to the role of the learner. The participating teachers became aware of how to motivate their learners during the cyberhunt activity and indicated that the design project could instil a sense of ownership. A very interesting observation was the fact that the teachers indicated that this strategy might be able to bring new hope for teaching and learning, as the cyberhunt approach was something totally new to the teachers and hence, it could have the necessary positive impact on their deprived learners.

Collaboration was another aspect that was addressed by the responses to question 4. It was found that the cyberhunt design process within a collaborative context, promoted participants' boldness to ask for assistance. Furthermore, participants suggested that the context enabled them to ask assistance from anyone, not just from the project facilitator. When help was required, it was often needed with respect to computer skills. Participants also indicated that they preferred working in groups than working individually. Furthermore, the participants found the identification of peer-facilitators as additional helpers, to be positive. It was also noted that collaboration is not always 'plain sailing', and that conflict situations had arisen at some stages. Hence, collaboration offered participants the opportunity to address and resolve conflict. It was found that working together also had a positive impact on individualisation, that it promoted discussion opportunities and confidence, the development of social skills as well as creating a context conducive to the establishment of learning communities.

Question 5 addressed the aspects that are important or valued within the teacher development context with reference to the project facilitator. It was found that a good or effective facilitator requires excellent people skills such as tolerance, patience, friendliness, approachableness, being helpful and having a positive attitude. Also important is that he or she also has to keep the level of the group in mind. Furthermore, the participants felt that the facilitator should not only possess the necessary expertise and knowledge, but that the project facilitator should also be able to demonstrate his/her expertise, knowledge and skills in such a manner that the participants don't feel threatened. Hence, the project facilitator should motivate the participants constantly and has to show that he or she believes in them. Equally important is the fact that the project facilitator should be able to explain in a clear manner. Hence, the demonstration of what is required should be demonstrated to participants in a clear and practical manner.

It was suggested that project facilitators should make use of peer-facilitators who are able to translate to participants in their own mother tongue. The rationale behind this is that it increases confidence and assists participants to have a clearer understanding of which aspects the participants struggled with. The use of peer-facilitators also had a positive impact on the peer-facilitators themselves, as the peer-facilitators experienced themselves as valuable.

Furthermore, participants indicated that regular feedback is very important, as it could assist them to ascertain their progress. In addition, the facilitator should provide ongoing support in the form of regular school based classroom visitations. The data suggest that teachers could be trained in a collaborative and motivational manner to effectively use a generative ICT strategy based on cyberhunts to address the critical outcomes of the South African National Curriculum Statement. However, some teachers would need extended opportunities to be equally empowered with others.

In chapter 6, the emphasis is on the following: (1) a proposed overview is provided about the teacher development process underpinned by learning as complexity and activity theory, (2) a proposed simplified cyberhunt framework is indicated and discussed, (3) general conclusions are made, (4) the limitations and suggestions for future research and recommendations are made and lastly, (5) the researcher reflects on the question whether the aims of this research project have been achieved.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

1. INTRODUCTION

This study reported on an intervention in which several teachers from disadvantaged schools were introduced to the Internet through cyberhunts. The participants also had to design cyberhunts. The following questions were addressed in this study, namely:

- Question 1: How ready are the teachers and their schools for ICT integration as perceived through the eyes of the participating teachers?
- Question 2: What skills or aspects are developed by 'teachers-as-learners' during their participation in the cyberhunt approach, as perceived by the participating teachers?
- Question 3: Does the creation of a cyberhunt promote motivation and interest?
- Question 4: Does the creation of a cyberhunt promote collaboration?
- Question 5: How should the teacher development process for ICT integration using cyberhunts be managed?

The data gathered from these questions were presented in chapter 4 and discussed in chapter 5. A summary of the findings pertaining to each of the above questions has been made after each question that was discussed in chapter 5 in sections 2.3, 3.1, 4.7, 5.8 and 6.5 respectively.

In this chapter, conclusions are drawn and formulated in the light of both the data generated and discussed (see Chapters 4 & 5) in the study and the literature reviewed in chapter two. The claims of this study are presented and a teacher development process for cyberhunt implementation and integration is proposed by means of a pictorial representation in Figure 6.1. This proposed process is also further explained. In addition, it is also shown that a learning community was developed. Furthermore, it is also indicated how complexity theory can be used to explain the emerging complex learning community that appears to have developed and how activity theory can be used to explain the positive findings. Schematic diagrams are also presented to assist facilitators with the planning process for cyberhunt design based on activity theory principles (see Figure 6.4) and to indicate the activity theory framework that underpinned this study (see Figure 6.5). It is also important to note that the principles that underpin the planning process could also be used when other forms of teacher development sessions are planned for ICT or non-ICT related development sessions. Furthermore, it will be shown how knowledge creation (see Figure 6.6) can be established as a result of the teacher development process that was followed. Equally important, a simplified cyberhunt design framework (see Figure 6.7) is also presented.

In addition, the limitations of the study are clarified, recommendations are made in terms of future teacher development programmes, suggestions are made for further research and lastly, the study is reflected upon in terms of the initial goals of this research.[42]

2. CLAIMS

This study claims that the cyberhunt approach (indicated in Figure 6.6), as a means of introducing the Internet to participants, was successful in terms of helping to develop participants' decision making skills, search skills, planning skills, questioning skills, computer skills and reflection skills. Reading online was experienced positively and the participating teachers felt that reading online could also have a positive impact on their learners' attitude towards reading.

The teachers developed skills embedded in the critical and developmental outcomes of the South African National Curriculum Statement, namely decision making, search and research, questioning knowledge, goal setting, planning, time management, confidence and knowledge pertaining to using the computer as a teaching and learning tool, notion of audience, computer skills, assessment and reflection. Furthermore, the participants also found collaboration to be very useful, they also developed high modes of interest and found the cyberhunt process as empowering and motivating. These claims are backed by the triangulated quantitative and qualitative data generated in the study and is justified by the published work of a wide range of literature.

[42] No summary of the findings is made in this chapter, as a summary of the findings has been made at the end of each question in Chapter 5.

It was noted that the findings of this study, as indicated and discussed in chapters 4 and 5 respectively, seem to be equally positive and consistent with the findings of a number of researchers related to the design of artefacts or hypermedia products such as improved higher order thinking skills, increased self-esteem and confidence, ownership, greater awareness of audience, commitment and enthusiasm, improved motivation, interest and cooperation, internalisation of design skills, seeing knowledge in a fundamentally different way and developing critical standards for knowledge and different ways of designing approaches and valuable reflection. Furthermore, the study revealed that the simplified cyberhunt design framework is useful in assisting facilitators and teachers with a strategy to introduce the Internet to teachers and learners in a meaningful and integrative manner.

The findings of this study concur with the findings of Carver et al. (1992), Lehrer (1993), Liu and Hsiao (2002) and Liu, (2003) in that the skills embedded in the hypermedia-composition design skills model can be addressed not only within a hypermedia as design context, but also in a cyberhunt design context (in this case with teachers from disadvantaged schools in South Africa).

The study also highlighted the importance of well-planned training aimed at raising the self-efficacy of teachers via elements of personal mastery and/or success, vicarious experience (observing people or people/social modelling in practice), verbal or social persuasion (I/we know you can do this!) and emotional arousal (helping people to believe that things causing anxiety or fear can be controlled). Journal writing, reflection and sharing of positive and negative experiences during teacher development sessions had a positive impact on the participants' professional development and computer skills. Finally, the perceived positive role of peer-facilitators who acted as cognitive apprentices and who assisted participants highlighted the value of collaboration. In turn, the fact that their peers appreciated being helped in their home language is worth noting.

As such, this study revealed that the cyberhunt initiative used in this study is a viable strategy to introduce the Internet to teachers and, if implemented successfully, should allow most of their learners to meet many of the requirements of the critical and developmental outcomes of the South African National Curriculum Statement (NCS). The intervention is being confirmed as a viable way of improving certain design skills linked to the critical and developmental outcomes as indicated in the literature review. In addition, the intervention also indicated that cyberhunt design has a positive impact in participants' collaboration and on their motivation and interest.

However, it is painfully evident that even with the most thorough planning for teacher development related to ICT, these envisioned plans will not necessarily immediately bear the envisaged, unless a sustained and vigorous intervention is undertaken coupled with the necessary ongoing support.

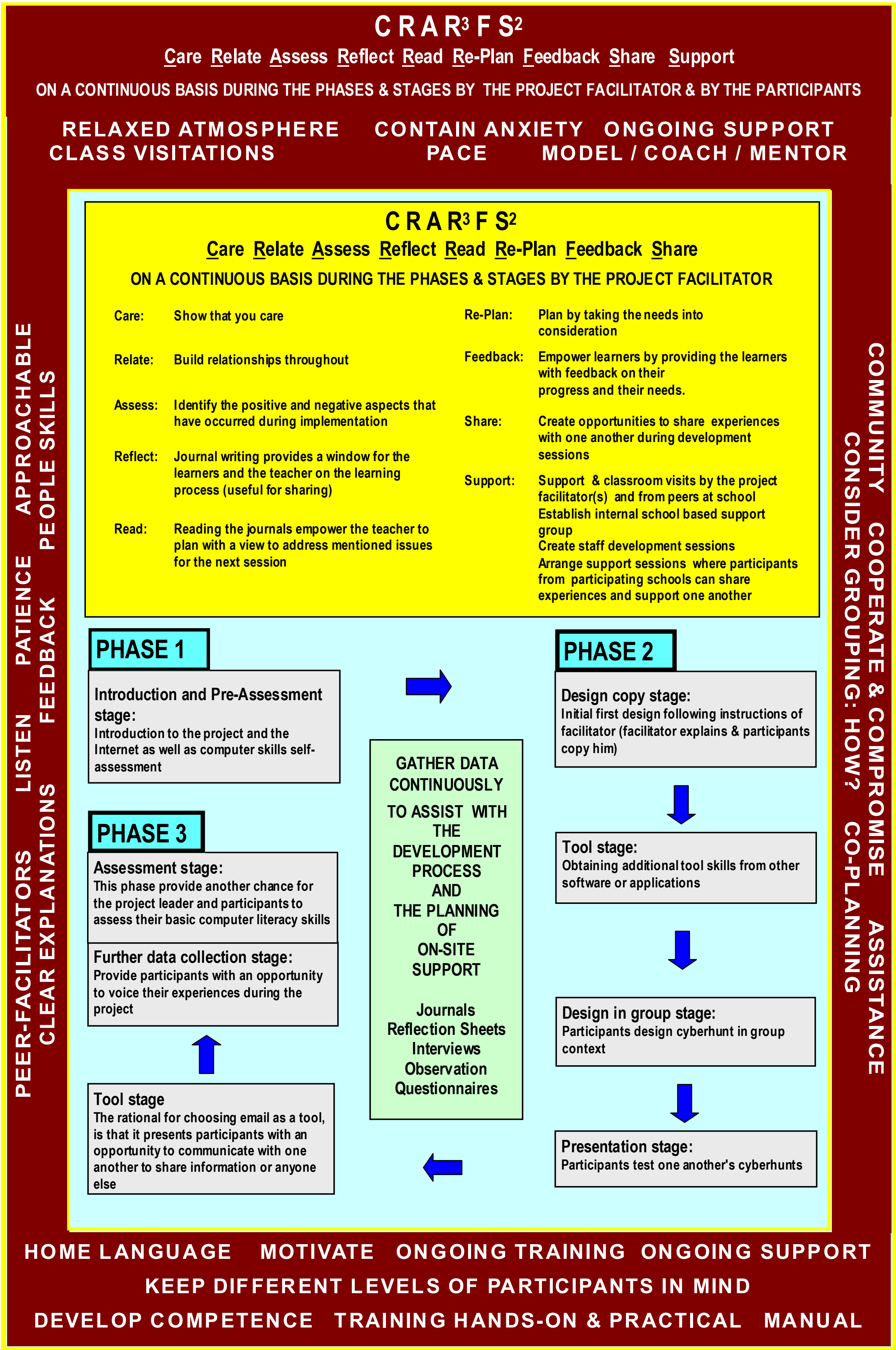
3. THE TEACHER DEVELOPMENT PROCESS FOR CYBERHUNT IMPLEMENTATION AND INTEGRATION

This study confirms that the teacher development process (training process) that was implemented in this study, and which was underpinned by the collaborative, motivational, knowledge generative and situated cognition and cognitive apprenticeship approaches, is an effective strategy. However, one must take cognizance of the recommendations made by the participants regarding the development process. These recommendations have been embedded within a proposed planning framework for teacher development and for classroom implementation (see Figure 6.1).

3.1 A proposed framework

This study has found that the following aspects encompassed by the acronym C R A R^3 F S^2, as indicated in Figure 6.1, hold the key for teacher development and classroom implementation. The C R A R^3 F S^2 acronym represents the verbs or actions that the participating teachers highly valued during implementation and what they have indicated as being important. The aspects underpinning this framework, and encompassed by the acronym C R A R^3 F S^2, are indicated in burgundy on the sides of Figure 6.1. The verbs or actions of the C R A R^3 F S^2 framework are (1) Care, (2) Relate, (3) Assess, (4) Reflect, (5) Read, (6) Re-Plan, (7) Feedback, (8) Share and (9) Support. The diagram also provides an overview of the proposed process for teacher development aimed at empowering them to use cyberhunts as a means to introduce the Internet to teachers.

Figure 6.1: Proposed phases and stages for teacher training and development related to cyberhunts



The same elements that were valued by the teacher participants during the teacher development training process should also form part of the implementation process of ICT related learning in their classrooms. Thus, whenever a teacher implements ICT related activities in a class (not necessarily cyberhunts), the C R A R^3 F S^2 framework and the aspects indicated in burgundy on the periphery of Figure 6.1, should be planned and catered for. Equally important, when teacher development sessions are planned pertaining to ICT, the C R A R^3 F S^2 framework and the aspects or elements on the periphery of Figure 6.1, should also be taken into consideration and should be adequately planned for.

Within the C R A R^3 F S^2 framework, reflection through journal writing or by means of the completion of reflection sheets plays a vital role, as it affords participants with opportunities to make their tacit thinking explicit. The reflection process could therfore assist with the personal and collective knowledge generation process.

Care refers to establishing a learning context in which learners can experience and see that they are cared for and believe that the will be able to succeed with the new approach. Relate refers to building a relationship between the facilitator and the learners. Assess implies that the teachers should assess and identify the positive and negative aspects that have occurred during implementation.

Reflection refers to the completion of reflective journals consisting of several questions to which participants can reflect upon. The rationale behind the reflective journals is that they are a tool that enables both the designer and the teacher to obtain a snapshot of his/her progress for future planning. Hence, journal writing is strongly advocated as a tool to assist both the teacher and the learners in their planning, to determine their progress and to identify areas in which assistance is required.

Read refers to the teacher who has to read what the learners have written in their journals with a view to identifying aspects that would need attention the next time they continue with their cyberhunts. Re-plan and read is interlinked, as the teacher reads the journals to plan or re-plan for the next session in such a way that he/she addresses the issues at hand. It is also important to note that learners could also read one another's personal reflections in their journals, in order to assist them to understand that they are not the only ones who struggle with certain cyberhunt design aspects. Alternatively, the journals sheets could become an identifier of the 'capable peers' in their class whom they might approach when they need assistance.

Feedback is another important element, as constructive feedback during the lesson, at the end of the lesson, after personal observation, or feedback given after scrutinising the participants' (learners') journals, should assist the teacher to provide adequate feedback and help with preparation and planning for the next session. Share refers to the teacher creating opportunities for the learners to share their experiences of the learning process with their peers either in their groups or with the whole class in order to articulate their tacit knowledge, experiences, successes and needs. Lastly, support refers to both the project facilitator's and participants' role of rendering ongoing support when the school based implementation process commences.

Support implies support that is ongoing. This implies support from the project facilitator (or from the teacher when the teacher is involved with his/her learners) and from fellow expert participants (the peer-facilitators or from fellow learners within the school context) during classroom implementation. Thus, just as the project facilitator supported the participants during the training process, the participating teacher supports his/her learners in the classroom and the peers support one another too in a similar manner. Support also implies classroom visits by either the project facilitator and/or other capable peers in order to render assistance and/or to discuss the successes, the areas where assistance is required and to plan how to address the identified issues at hand. The support aspect goes beyond classroom visits, as it also requires the establishment of an internal school based support group which will have to meet regularly to establish caring support. Furthermore, support implies that the principal and the senior management team (SMT) create the necessary learning space for the participants from their school, and support them on emotional, motivational and resource levels. In addition, support requires the institution of staff development sessions in order that the participants, who have received training, can share with other staff members who did not attend the training sessions what they had learned. Equally important, the staff development sessions can then also serve as training sessions for other staff members who want to be trained. Support also implies that the project facilitator and the participants decide upon specific times when all the participants from the different schools can meet in order for the participants to share their school-based experiences with participants from other schools.

The support session for teacher development thus become forums and during these sessions a platform is created to identify the areas in need for further training. These platforms enable the project facilitator to plan for future ongoing support training sessions, as the facilitator plans by taking the identified need of the participants into consideration. The project facilitator can then decide whether the future training sessions will be planned by either the project facilitator alone, with the assistance and input of expert participants or by the expert participants on their own. Without the necessary ongoing support, it is highly likely that the implementation process at schools and the staff development at the participating schools could grind to a halt.

The facilitator (or the teacher who implements the ICT related activity at school) should also take note of the following aspects and responsibilities, which are indicated on the sides of Figure 6.1, during the teacher development process. These aspects and responsibilities forms part of the C R A R^3 F S^2 framework and have to be planned for and kept in mind for the teacher development process to be successful, namely:

- Establish a relaxed atmosphere,
- Contain anxiety,
- Pace the training by taking the progress of the participants into consideration, as well as their individual needs,
- Use peer-facilitators,
- Model/coach and mentor when appropriate and when required,
- Be patient, approachable, and listen to the their learners' needs, motivate them constantly, assist them and compromise when necessary (people skills),
- Ensure that the training is ongoing and progress feedback should be provided on a regular basis,
- Ensure that the training is hands-on, practical and explanations are clear,

- Encourage the use of the participants' home language to explain to one another,
- Provide ongoing support keeping the school context in mind,
- Develop competence, and
- Provide opportunities for personal goal setting, reflection and the sharing of experiences.

All the elements of the C R A R^3 F S^2 model can be addressed at any point in time within the teacher development-training process. However, the care, relate and support components should receive attention from the start and should be ongoing, as these components contribute to the creation of a positive learning context from the start.

In order to put the C R A R^3 F S^2 model in perspective, the proposed phases and each stage embedded within a phase, are presented in Figure 6.1. Phase 1 consists of one stage namely, the 'Introduction and assessment stage: Introduction to the project and the Internet as well as computer skills self-assessment.' In Phase 1, the cyberhunt project and the Internet are introduced to participants. In addition, a computer skills self-assessment questionnaire has to be completed by participants for the project facilitator to obtain an overview of the skills and needs of the participants. These results can assist the project facilitator to plan future teacher development sessions.

Phase 2, named the 'Design copy stage', consists of five stages namely, (1) the design copy stage, (2) tool stage, (3) design in group stage, (4) presentation stage and (5) tool stage. In the design and copy phase, participants follow the design process in a step-by-step manner, as they copy what the project facilitators demonstrates. As a result, the project leader is drawing from his/her tacit knowledge (see Nonaka, 1995) during this stage, and by articulating this tacit knowledge, he/she is converting the tacit knowledge into explicit knowledge. Being part of the design copy stage, afforded the participants with an opportunity to learn from the modelling process and to improve their self-efficacy through personal mastery, vicarious experience and verbal persuasion (see Bandura, 1997; Schunk, 2004). Equally important during this phase, is the use of peer-facilitators to help the project leader. These peer-facilitators have to decide for themselves whether they feel capable to assist fellow participants during the training session on a full-time basis. This could lead to them becoming project leaders. In addition their self-efficacy is being raised through them sharing their tacit knowledge as they make it explicit by assisting their peers. It is important to note that the time allocated to this stage may vary, depending on the ICT skills of the participants.

In the ‘Tool stage’, the focus is on obtaining additional tool skills from other software or applications that can be utilised as part of the cyberhunt planning, design and/or presentation phases. For example, PowerPoint can be used as a presentation tool of the answers to the Cyberhunt or as a presentation tool for deeper explored aspects related to the topic at another time. The ‘Design in group stage’ is a stage during which the participants have the opportunity to design their cyberhunts in a group context. During this stage, participants are yet again afforded an opportunity to share their tacit knowledge with one another through articulation by means of discussion and peer assistance. As a result the tacit knowledge becomes explicit and participants have the opportunity to try to link the new knowledge to their existing knowledge structure. The newly acquired explicit knowledge becomes tacit knowledge when it is linked to the existing knowledge structure.

The ‘Presentation stage’ is the stage in which the participants test one another's cyberhunts. Thus, this stage affords the participants with an opportunity to showcase their finished cyberhunt products and to obtain feedback from their peers, a kind of alpha testing, i.e. ascertaining whether their design works. The feedback serves as informal assessment with a view to showing the participants where improvements can be made and to acquire feedback on how the tester or prospective user is experiencing the completed product. The presentation stage also provides a final opportunity to those cyberhunt designers, who have not yet completed their products, an opportunity to obtain further assistance from more capable peers or peer facilitators to complete their final products. For the project leader, this stage affords another opportunity to assess the competence of the individual or group’s final design and computer skills.

The last stage in Phase 2 is another ‘Tool stage’. The same applies here as in the previous tool phase. The rationale for choosing email as a tool at this point is that it presents participants with an opportunity to communicate with one another with the objective to share information, but also to see the value of this tool enabling them to communicate with any other person who could assist one.

The last phase, Phase 3, comprises of two stages, namely (1) the assessment stage and (2) further data collection stage. The assessment stage affords the project facilitator and participants a final opportunity to assess the progress of the participants. This phase concludes by providing a platform for the participants, as well as the project facilitator, to share their experiences with respect to the teacher development process and to make useful recommendations for future similar teacher development sessions.

It is argued that all the elements of the C R A R^3 F S^2 model (Care, Relate, Assess, Reflect, Read, Re-Plan, Feedback, Share and Support) should be acknowledged and taken into consideration during all the phases and stages of the teacher (learner) training development process. Hence, the project facilitator should ask himself/herself during any of the stages whether it is possible for the facilitator to care, relate, assess, reflect, read, re-plan, feedback, share and support by means of whatever way possible in order to promote successful teacher development.

3.2 Developing a learning community

The data generated in this study suggest that the motivational elements embedded within the cultural responsive teaching model, namely (1) establishing inclusion, (2) developing positive attitudes, (3) providing opportunities for enhancing meaning and (4) engendering competence (Wlodkowski, 1999); and the ARCS motivators, namely (5) attention, (6) relevance, (7) competence and (8) satisfaction (Keller, 1983) have had a positive motivational impact. Furthermore, the use of journals and goal setting (something that is embedded in the cyberhunt approach), as well as reflection and sharing of experiences, have all had a positive impact.

In addition, the climate of trust and care that was experienced by the participants, and the constant articulation by the project facilitator of the belief that they would succeed, seem to have contained anxiety and assisted the participants to believe that they were able to do the task at hand - a manifestation of perceptions of self-efficacy. Equally important, the modelling and assistance by both the project and peer-facilitators have had a positive influence on the participants' confidence. Lastly, the participants experienced a feeling of empowerment as a result of their participation in the project and their experiences of feeling competent.

The findings from this study suggest that the journal writing; reflection opportunities; the opportunities to share experiences with each other, with their peers and with the project facilitator; had enabled the participants to make their concerns and successes explicit within the learning community. This sharing made it possible for both the project facilitator and peer-facilitators to assist those who required assistance. The verbal sharing of the participants' reflections with one another and with the whole group assisted the participants to internalise the explicit shared experiences and information, resulting in building tacit knowledge within the participants. Thus, the participants were in a position to support each other through knowledge generation through sharing their experiences.

Being part of a community of learners, provided the potential for conflict, but it also provided the participating teachers with opportunities to learn how to manage conflict, recognising their responsibilities through the division of labour, collecting and analysing information and solving problems more effectively within a learning community.

3.3 Complexity theory and activity theory

From a complexity theory viewpoint (Davis & Simmt, 2003; Sinclair, 2004; Davis & Sumara, 2008), the data suggest that internal diversity, redundancy, organised randomness, neighbour interactions and decentralised control had played a positive role in developing what may be described as an emerging complex learning community. These aspects receive attention below.

During this study, the concept of becoming a community of learners was a key aspect. Within the community of cyberhunt learners, the data indicate that the participants were on different ICT levels and that the participants had different needs, indicating that there was internal diversity. On the other hand, redundancy refers to the fact that many people can do the same thing, allowing for the development of a common understanding through interaction among one another by allowing for others to compensate when there is a need – making it possible to compensate for one another's failings (Davis & Simmt, 2003; Sinclair, 2004; Davis & Sumara, 2008). The data suggest that the participants started to interact more with one another as the project continued. Participants interacted with their more capable peers in their groups, with the peer-facilitators and with the project-facilitator, whenever the participants were in need of assistance with for example the formulation of questions, how to search for specific information, when they required certain computer skills, etc. Hence, whenever there were needs or short comings, either capable peers within a group, peer-facilitators or the project facilitator provided assistance. Therefore, redundancy played an integral part during the cyberhunt project. Redundancy was thus not seen as a weak point in this study, but within this study redundancy became a strong point, as more and more participants learned the basic skills that are required to enable oneself to design cyberhunts. Thus, as the project continued, more participants became well skilled and were able to assist others with their short comings.

Equally important, the data suggest that neighbour interactions, i.e. interactions among participants and between participants and the project leader regarding for example, the formulation of questions, how to search for specific information, when they required certain computer skills, etc. had played a positive role in developing what may be described as an emerging complex learning community. This became evident in the data reported and discussed pertaining to collaboration. This was affirmed by the participants' responses regarding collaboration, as participants indicated that they assist other participants when they were in need. Hence, learning emerged as a result from the sharing of their expertise.

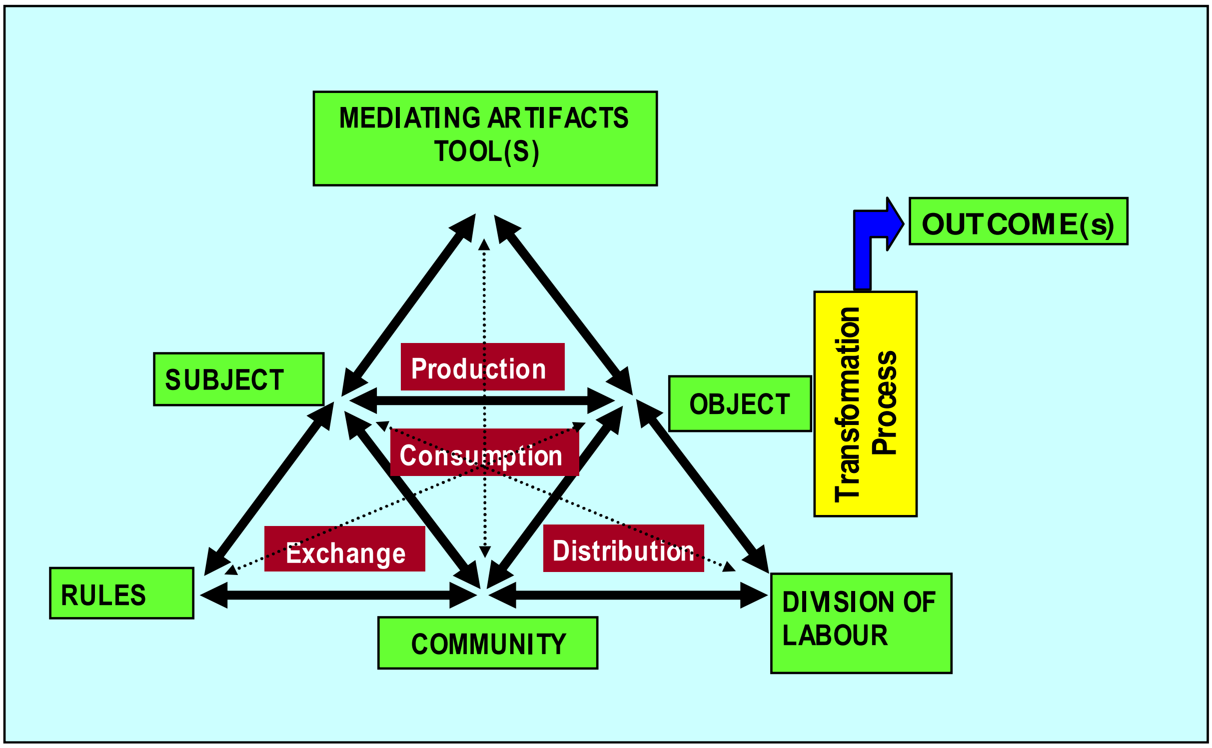
The data also suggest that there was also organised randomness in a similar sense to what Davis and Simmt, (2003), Sinclair (2004) and Davis and Sumara (2008) referred to, as it was not an "anything goes" milieu, but there was control from what the cyberhunt design process requires, as participants knew what they had to do and when they had to complete their final designs. The above becomes evident as during the cyberhunt design process in this project, the participants were given guidelines on how to proceed with the design process, the so-called ground rules. However, these guidelines or ground rules were not prescriptive, but postscriptive i.e. within boundaries there was freedom to approach and to proceed with the design process in a manner that was most suitable to the participants (see Davis & Simmt, 2003; Sinclair, 2004; Davis & Sumara, 2008). During the cyberhunt project, the participants were free to explore and design their cyberhunts either in Word or PowerPoint. The participants were also free to select any topic and to use any website, as long as it was linked to their topic. Furthermore, participants could design either on paper first and then on the computer or start the design directly on the computer. This thus indicates that there was an organised randomness, as the participants were given direction, but they did not have to follow it blindly. With reference to the skills development section (section 3 in chapter 4 and section 3 in chapter 5), the data suggest that there was an organised randomness, as participants had the freedom to select the topic, had freedom in the manner in which they wanted to explore the web results during the search process and, they had the freedom to decide upon whether they wanted to design their cyberhunts first on the computer or first on paper. Therefore it can be argued that all of the above assisted to constitute organised randomness, as there was freedom to choose and freedom to think 'out of the box' during the cyberhunt design process.

During the cyberhunt design project, there was also decentralised control, as all the authority did not reside with one person, the project facilitator. As the project continued, authority was shared on a greater scale, as peers assisted one another in their groups and the peer-facilitators assisted any participant who required assistance. Furthermore, participants were in control during the design process of their cyberhunts as they were not controlled during the session. Although each session started with a recap of what was observed during the previous session and with the demonstration and introduction of new skills at the beginning too, the great majority of time while the participants were designing their cyberhunts, the participants were in control of the design process.

In summary: The training and teacher development approach for this research project has drawn from the complexity literature with respect to (1) internal diversity, (2) redundancy, (3) organised randomness, (4) neighbour interactions and (5) decentralised control, as indicated above.

From an activity theory framework position (see Chapter 2, section 19), it seems that the unmediated functioning at the base of the triangle (see Figure 6.2) through the division of labour and the negotiation of rules through reaching consensus within the learning community, assisted with the establishment and creation of a milieu conducive to learning. The role of the higher level mediated cognitive tools (language, computer, Internet and other ICT's) at the apex of the activity theory triangle (see Figure 6.2), in conjunction with the unmediated tools (rules, community and division of labour) at the base of the triangle (see Figure 6.2), assisted the participants to achieve the critical and developmental outcomes embedded in search/research skills, decision making skills, computer skills, questioning skills and planning.

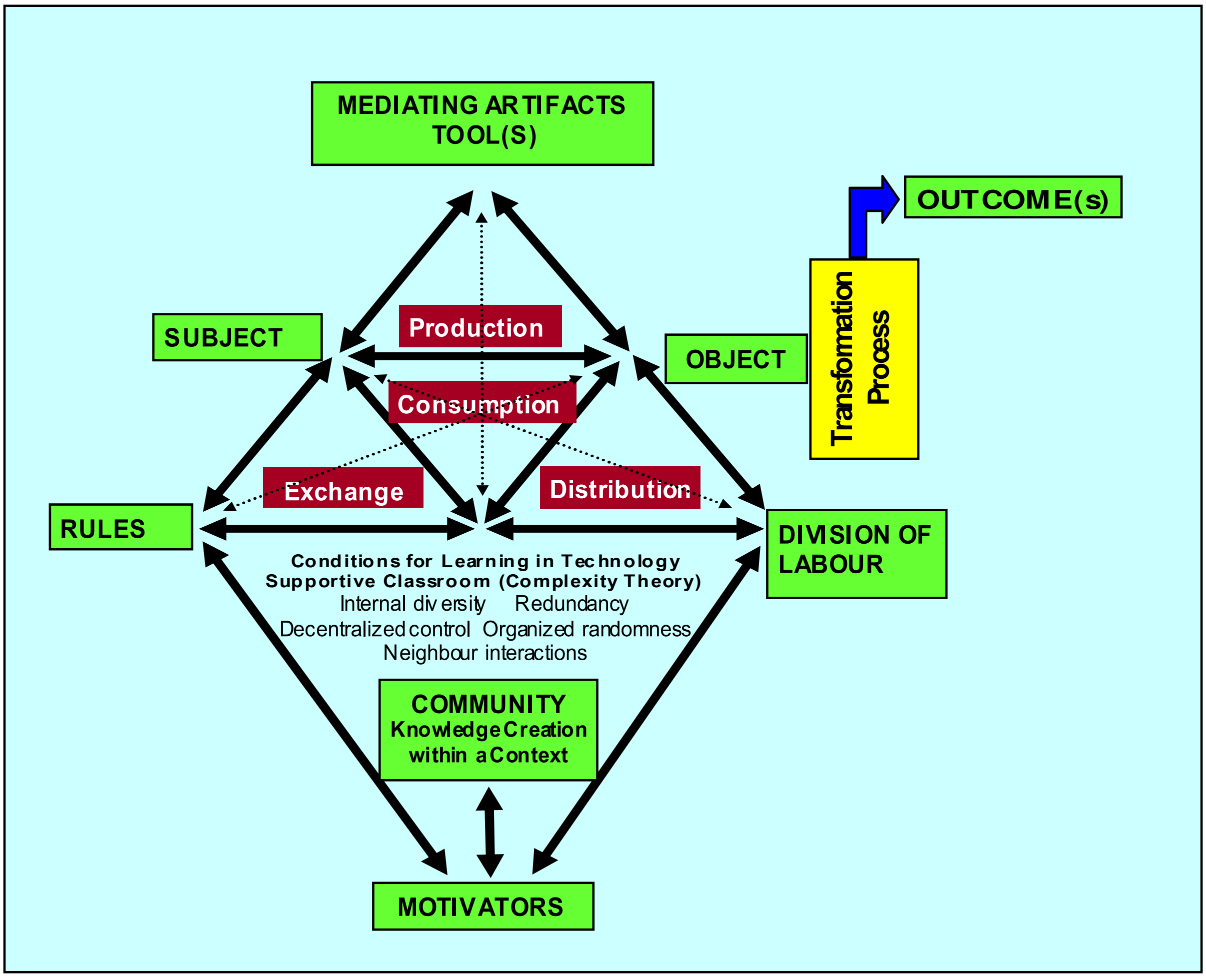
Figure 6.2: Mediational structure of an activity system (Adapted from Engeström, 1999)



The data suggest that during the cyberhunt design process, motivation and interest increased significantly, as did collaboration. This positive increase in motivation, interest and collaboration can probably be attributed to the interactions between the higher order mediated elements (language, computer, Internet and other ICT's) and the unmediated functioning at the lower base of the triangle, hence as a result of the interactions between Vygotsky's (1978) unmediated and mediated functioning.

Figure 6.3 denotes an expansion of the mediational structure of an activity by supporting the base of the triangle with complexity theory. As a result, it is argued that the functioning at the base of the triangle (rules, community and division of labour) are informed by the theoretical elements, namely (1) internal diversity, (2) redundancy, (3) decentralised control, (4) organised randomness and (5) neighbour interactions based upon the ideas of Davis and Simmt (2003) and Sinclair (2004), as argued above.

Figure 6.3: Expanded mediational structure of an activity system

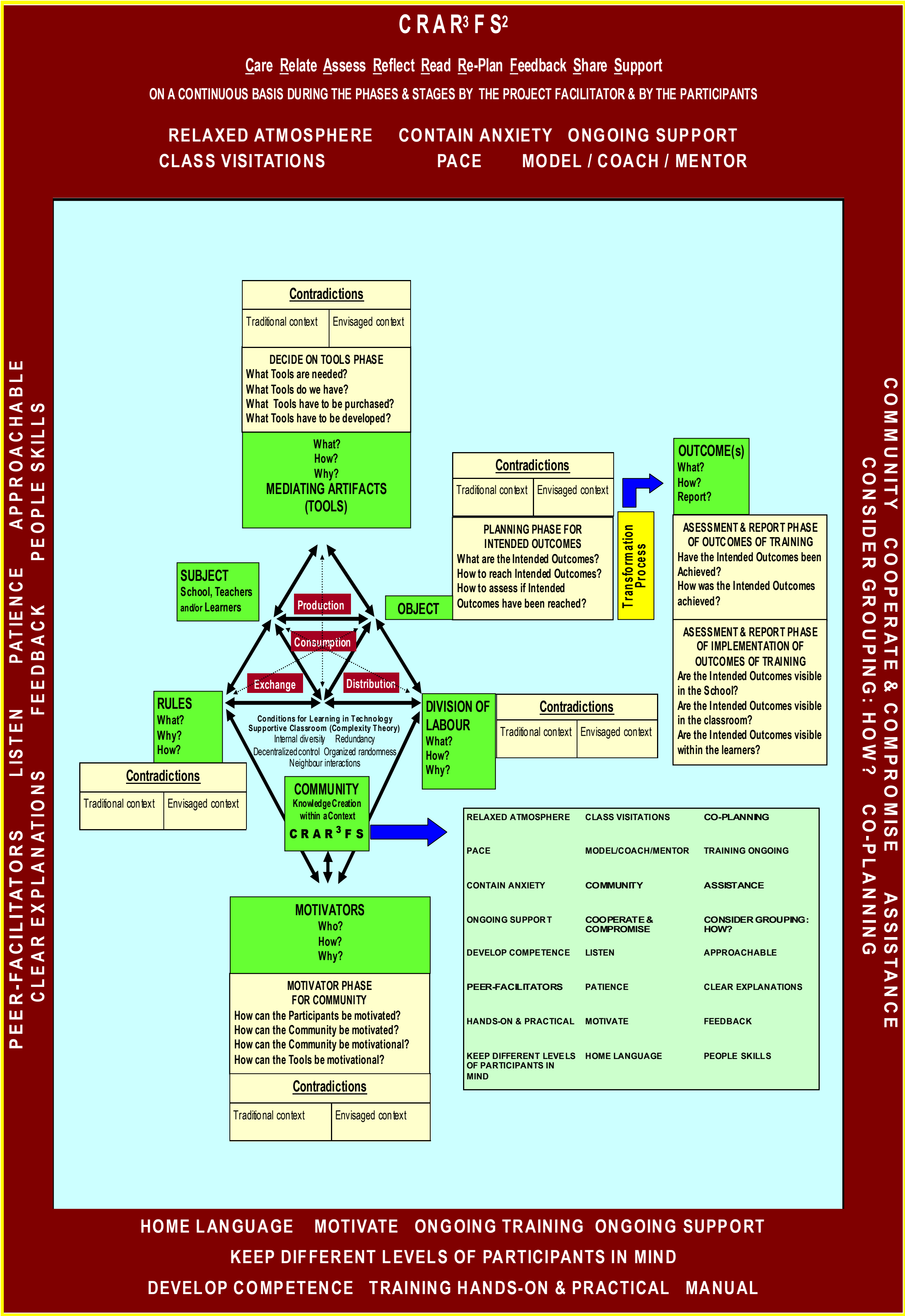


These theoretical elements mentioned in the previous paragraph, can be integrated in the following manner: Within the community there are people at the periphery who are new to an idea, strategy, approach, opportunity, process, etc. There are also people who are experts at the centre of the community. Then there are people between the periphery and the expert centre. Internal diversity, redundancy and neighbour interactions, decentralised control and organised randomness come to realisation within this community. The internal diversity, redundancy and neighbour interactions assist with the division of labour, as one can determine who are the more capable ones (capable peers) at the start or during the training and use their skills and knowledge to assist the division of labour through peer-facilitation. While rules have to be determined, there should be a certain amount of organised randomness which allows the participants freedom to explore and choose different ways to achieve the desired outcomes, but within certain boundaries (enabling constraints). Decentralised control facilitates natural division of labour and implies that when different tasks are planned, heed must be taken that the community, not the individual, is the focus as it is through shared understandings that learning emerges.

In addition, the rules and division of labour should be informed by motivational aspects in order to promote intrinsic motivation. The rationale is that if one builds in motivational elements, it becomes possible for the participants to not see the rules as restrictive, nor the division of labour as a burden (especially if one is a capable peer who not only has to complete his/her own responsibilities, but also has to assist during the training). The words of Ormrod (2004, p. 425) seem very appropriate here, as he states that motivation is as "an internal state that arouses us to action, pushes us in particular directions, and keeps us engaged in certain activities."

By using the adapted mediational triangle to represent activity theory visually (see Figure 6.4), it is argued that one should think about the usefulness and/or possibilities of new activities to transform traditional ways of teaching by identifying what the activity intends to achieve when completing the different sections of the activity theory mediational triangle (see Figure 6.4). The rationale behind the proposed diagrammatic representation in Figure 6.4 is that the questions below each heading in the diagram assist facilitators to plan teacher development sessions and to view the process through an activity theory lens. Furthermore, the boxes labelled contradictions alert one to thinking about each aspect through both the traditional lens and the new envisaged lens. One can then compare how the traditional and envisaged context and approaches differ. This enables one to determine whether one has in fact made provision for what one wants to achieve.

Figure 6.4: Planning process for teacher development based upon activity theory, complexity theory and underpinned by motivational principles



The planning and thinking represented on the activity theory mediational triangle could enable one to proactively establish whether an activity would impact on traditional ways of teaching and learning by identifying any contradictions that may emerge as a result of the new activity. Therefore, it is suggested that activity theory's mediational triangle should be the point of departure when designing and thinking about implementing a new activity, for example a teacher development session.

3.4 Planning for technology integration

The diagram represented in Figure 6.4 could be useful in assisting designers and practitioners to plan teacher development training sessions. The questions to be asked have been indicated under each element. However, it is also suggested that this planning process should be informed by the aspects which have been valued by participants as embodied in Figure 6.1, which relate to training and development of ICT teachers in general.

It is proposed that facilitators start their planning for teacher development sessions by determining what is the object of the teacher development sessions and what are the intended outcomes and assessment strategies (see Figure 6.4). The thinking behind this is that teacher development facilitators have to design instruments; for example reflection sheets, questionnaires (open-ended, closed, or a combination of open-ended and closed questionnaires) and/or checklists to ascertain whether the development sessions planned were achieved.

The plural form, sessions, is intentionally used, as it is important that teacher development sessions should not be once-off, but should be ongoing. Furthermore, these teacher development sessions should include follow up in-context school visits in order to determine what has been learned and implemented within the school context. Classroom observations will help to determine the needs of the participants, and to inform further support strategies. Hence, ongoing support by means of regular school visits should be an important intended outcome during the planning process.

As noted earlier, where possible, teacher development should be tailored according to the specific needs of individuals. To render a picture of the participants, it is recommended that some kind of data is collected to obtain information (background knowledge and/or prior knowledge) about the subjects or participants. Hence, the creation of a simple data gathering tool could be useful to assist the teacher development facilitator in this regard. Furthermore, classes or training groups should be kept at manageable sizes, something which also becomes important in terms of being able to provide classroom support.

The project facilitator should also identify capable peer-facilitators as early as possible during the training process. The rationale behind this is that these peer-facilitators could become experts within the learning community and could therefore assist their fellow participants during the training process as well as after the training process at their schools. A proposed outcome during the teacher development planning process should also be the creation of collaborative communities of practice which meet on a regular basis outside the formal teacher training development sessions. Within these collaborative communities of practice the capable peer-facilitators can fulfil a key role as being the experts to consult for assistance. Using capable peers also creates a context in which these peers feel valued. Furthermore, it creates a context in which the other participants experience the learning process as not being one-sided with an outside expert being the only source of knowledge, but rather as a learning community in which every person's contribution is valued. In other words, the teacher development sessions become underpinned by the principles of cognitive apprenticeship within communities of practice, the rationale being that "education must be life it self" (Dewey, cited by Duffy and Cunningham, 1996, p. 173). In turn, the C R A R^3 F S^2 framework can be seen as reflecting real-life in terms of caring, relating, assessing, reflecting, reading, re-planning, feeding and sharing.

The facilitator also has to think about the tools to be used during the teacher development sessions, and in addition, whether there will be any contradictions if certain tools are used during these sessions. For example, if computers, the Internet and new teaching-and-learning strategies are introduced and used as tools during teacher development sessions, the facilitator has to think what the contradictions could be; hence what problems could be experienced as a result of the new tools introduction and usage by participants. The rationale behind this is that participants could be accustomed to traditional tools and that the new tools could thus contribute to anxiety, feeling uncomfortable and thinking that the teacher development session is unnecessary, because 'why change now if what I have been doing is working for me and my learners?' Hence, planning for these possible contradictions could cause the teacher development sessions to run more smoothly. In addition to planning, it is proposed that the teacher development facilitator is well versed in what he or she wants to achieve during the teacher development sessions, as the facilitator has to sell the intended outcomes to the participants. Thinking about tools, also implies that the facilitator has to think about what tool(s) are going to be used, how they are going to be used and introduced, and why these specific tools are to be used.

Teacher development sessions underpinned by the C R A R^3 F S^2 framework should take note of the following responsibilities of the facilitator if the process is to be successful. These aspects, of which the facilitator should take note, have also been mentioned previously in section 3.1 in this chapter, but are mentioned below again, namely the facilitator should:

- Establish a relaxed atmosphere,
- Contain anxiety,
- Pace the training by taking the progress of the participants into consideration, as well as their individual needs,
- Use peer-facilitators,
- Model/coach and mentor when appropriate and when required,
- Be patient, approachable, and listen to the their learners' needs, motivate them constantly, assist them and compromise when necessary (people skills),
- Ensure that the training is ongoing and progress feedback should be provided on a regular basis,
- Ensure that the training is hands-on, practical and explanations are clear,
- Encourage the use of the participants' home language to explain to one another,
- Provide ongoing support keeping the school context in mind,

- Develop competence, and
- Provide opportunities for personal goal setting, reflection and the sharing of experiences.

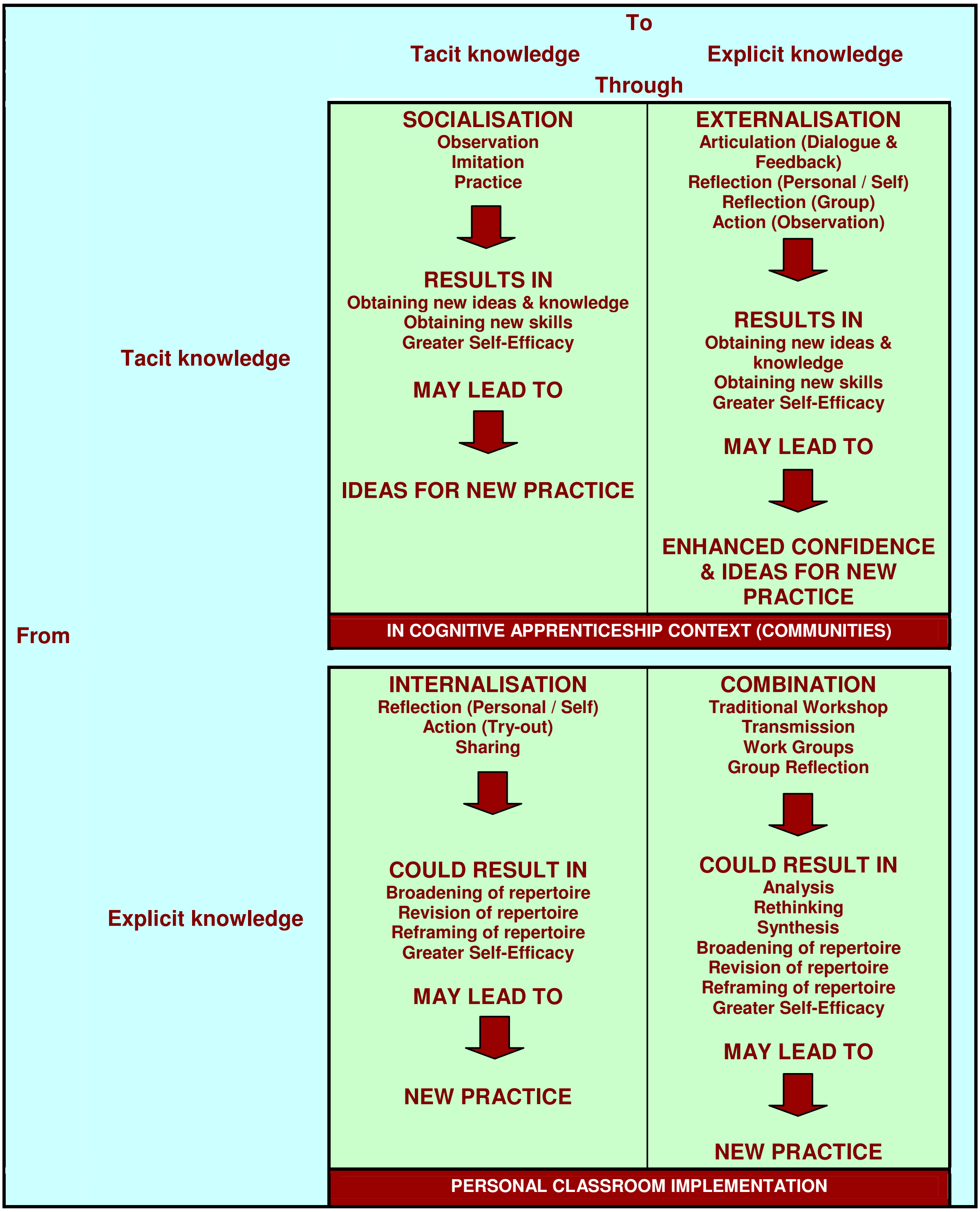
Equally important is the importance of creating the necessary motivators within the community during teacher development sessions. It is paramount that the teacher development addresses ways in which the participants and community can be motivated and how the tools to be used can be motivational. This study suggests that the creation of motivation and interest can be established by fostering a cultural responsive teaching context (Wlodkowski, 1999) and by taking ARCS (Attention, Relevance, Competence & Satisfaction) and the other motivational aspects (see Figure 6.5) into consideration when planning.

Lastly, the teacher development process should take the division of labour into account during the sessions, and it is important that the participants experience and are aware of the rules pertaining to division of labour. The rules must be very clear, as it is here where contradictions will manifest themselves in terms of traditional beliefs and approaches associated with non-constructivist teaching and learning approaches. The goal should be to allow teachers to experience the fruitfulness of the new approach and context underpinned by the C R A R^3 F S^2 framework.

3.5 Knowledge creation

The knowledge creation model of Nonaka (1994) was useful to provide a schematic diagram and theoretical representation to explain how and why the cyberhunt teacher professional development project resulted in positive attitudes towards ICT and its implementation within the classroom(s). It is suggested that the learning related aspects below the concepts (1) socialisation, (2) externalisation, (3) internalisation and (4) combination in Figure 6.5, played a pivotal role in assisting participating teachers to rethink and possibly to influence them to rethink existing practice(s). The reasoning behind this is as follows: During this project, the participating teachers were provided with opportunities related to all the aspects indicated in Figure 6.5, in order to assist them with their own development related to the new ICT Internet based cyberhunt integrative process. Hargreaves (1999) argues that it is the interactions between tacit and explicit knowledge that leads to knowledge creation. Figure 6.5 provides an overview of the types of interactions that had occurred. Hence it is important for project facilitators to provide opportunities for articulation to the participants in the form of discussions and through the sharing of experiences after reflective journal writing, as this could assist with knowledge creation within onself and to knowledge creation in other participants. Sharing could therefore be an important aspect in the quest to knowledge creation.

Figure 6.5: Modes of knowledge creation in a Community of Practice (COP) teacher development framework



It becomes evident from the knowledge creation process that in a teacher development context, learning is not a linear process; not a single event or a final product; it is ongoing. The knowledge creation presentation in Figure 6.5 shows that teacher learning becomes a dynamic process in which tacit and explicit knowledge 'interplay'. As a result, learning and planning for teacher development as learning construct, are both in need of revision. My reflection on all of these aspects helped me to formulate the following definition of becoming part of a community of learners:

> *The process of becoming a member of a community of practice requires active participation through inquiry [by means of apprenticeship, coaching, mentoring and/or modelling] by making use of all possible tools; in order to develop one's knowledge, skills and attitudes continuously, thus it is an ongoing and evolving process that has as its aim the fostering of transformative practice(s).*

It is therefore suggested that planning within a teacher development context should embrace the following:

> *The planning for learning within a teacher development context requires that the facilitator or initiator of the teacher development process should take the participating teachers' needs, contexts [situational perspective], prior knowledge, beliefs, values and current practices into consideration [cognitive perspective].*

Figure 6.5 also highlights the importance and value of learning opportunities or learning spaces in which learning tools such as observation, imitation, articulation, reflection and action are utilised. These tools could assist participants to 'grow' new knowledge, to obtain new skills and to improve their self-efficacy. Figure 6.5 also suggests that the growth in knowledge as a result of the practical new skills, imitation and articulation, may also assist participating teachers in becoming more confident (raising self-efficacy) and that this might result in them trying out the new practice. Furthermore, it is envisioned that the teacher development process that was followed during this research, has the potential to afford participating teachers with opportunities to re-analyse and rethink their current repertoire(s) or practice(s). This could again lead to teachers adapting or re-designing their practices related to ICT usage for teaching and learning.

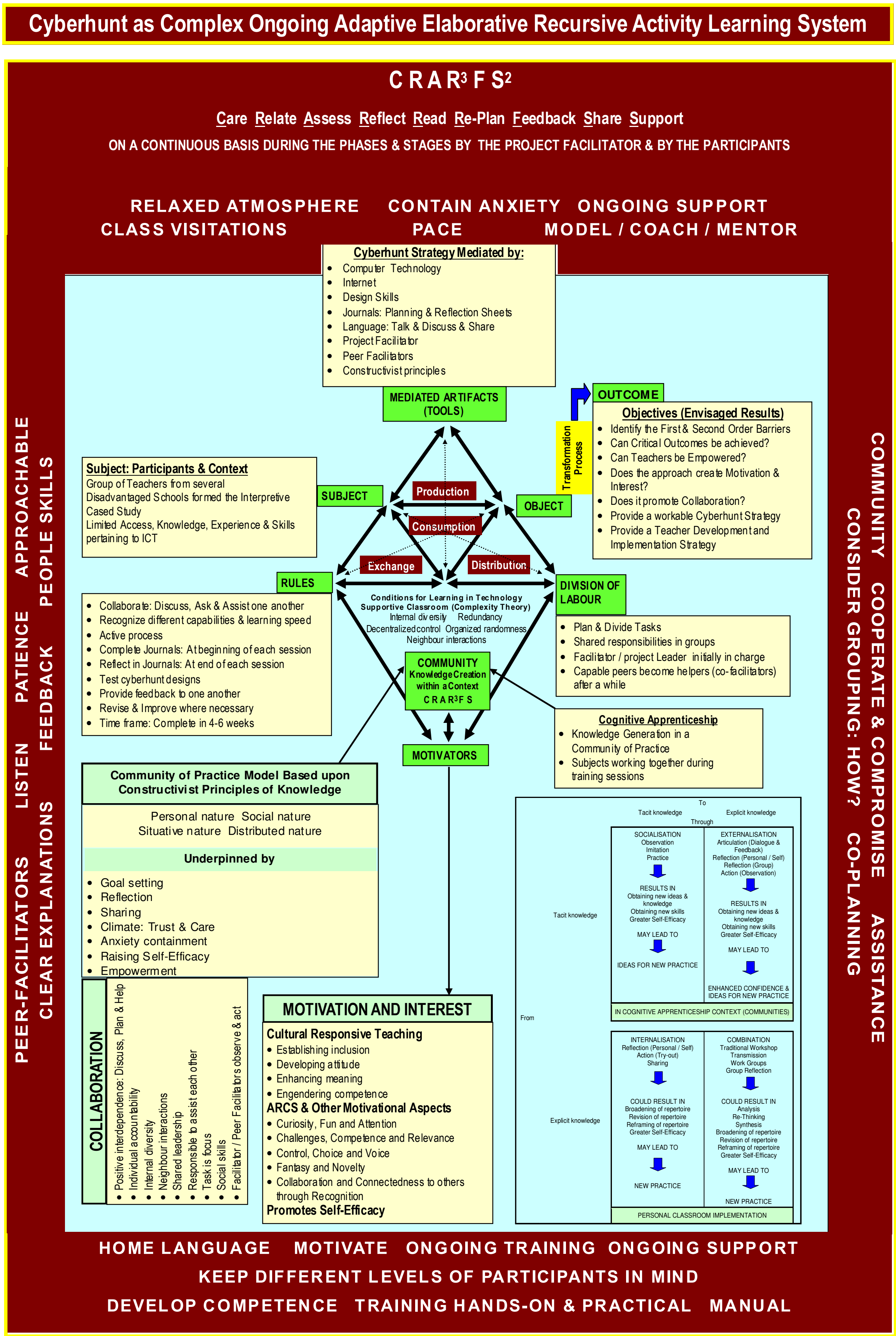
3.6 Cyberhunt approach

As indicated in the literature review, computers can be used (1) without any integration happening, (2) for integration to achieve the traditional goals or (3) for integration to transcend traditional ways of teaching and learning. In this study the cyberhunt approach that was used can be situated in group 3. This statement is based upon the fact that the participating teachers said that this approach requires a change in both the role of teachers and learners where learners become much more active and take on more responsibility for learning. In the cyberhunt approach, the teacher fulfils several roles such as that of a facilitator, guide and mentor. Furthermore, the cyberhunt strategy can be situated within a collaborative context. This is important as learning can be identified from a social cultural perspective as activity.

The interpretation of the data generated in this study, suggest that the unmediated functioning of the mediational triangle (the community at the base of the triangle) played an important role in providing a milieu conducive for success. Furthermore, the introduction of the higher order elements of decision making, planning, mental effort, novelty (computers, Internet and new cyberhunt strategy), the ability to create questions based on the information 'googled', the ability to design a cyberhunt for a particular audience and reflection skills, as reported by the respondents, can most likely be attributed to the mediating tools (technology, the Internet and ICT media, language, i.e. the apex of the triangle) provided.

Hence, the positive statistical significance of the data on collaboration, confidence and motivation (unmediated functioning at the base of the triangle), as well as the positive statistical significance for searching, design, reflection, computer skills, audience, questioning knowledge and decision making skills (mediated functioning at the apex of the triangle) suggest that the defining factor producing a highly motivational collaborative group of participants can be attributed to the interactions between Vygotsky's (1978) unmediated and mediated functioning (see Figure 6.6).

Figure 6.6: The Activity theory based framework that underpinned this study



Testing new activities through the lens of activity theory informed by motivational constructs, as well as aspects related to situative cognition and complexity learning theory, suggest an approach which could possibly help identify transformative aspects of the activity.

3.7 A simplified cyberhunt design framework

This study also resulted in the development of an altered form of the cyberhunt framework using the design model of Carver, et al. (1992), Lehrer (1993) and Lehrer, et al. (1994) as point of departure. The following model (see Figure 6.7) emerged as a result of the findings of this study. It is important to note that the facilitator or teacher cannot simply assume that teachers and learners have the necessary reading and comprehensions skills (or the strategies required to implement them. Skills pertaining to reading and comprehension have to be taught. Likewise, keyword generation, decision making skills (e.g. topic selection and ascertaining the truthfulness of information), as well as Internet search skills are skills that have to be taught.

What makes the process appealing is that it includes not only the design phases, but also the classroom implementation phase in detail, including what should happen in the classroom. This is indicated in Figure 6.7 under each of the stages.

The design for the cyberhunt approach comprises ten stages (see Figure 6.7), namely:

- Stage 1: Teacher preparation for teacher created cyberhunt(s)
- Stage 2: Classroom implementation
- Stage 3: Learner product preparation to teacher and class (if required)
- Stage 4: Learner product presentation
- Stage 5: Learner and/or teacher assessment
- Stage 6: Enrichment activities
- Stage 7: Teacher class feedback
- Stage 8: Learners create own cyberhunts (and presentation required if applicable) by using same processes as used in Stage 1

    - Proposed classroom implementation
    - Journal questions (teacher)
    - Journal questions (learners)

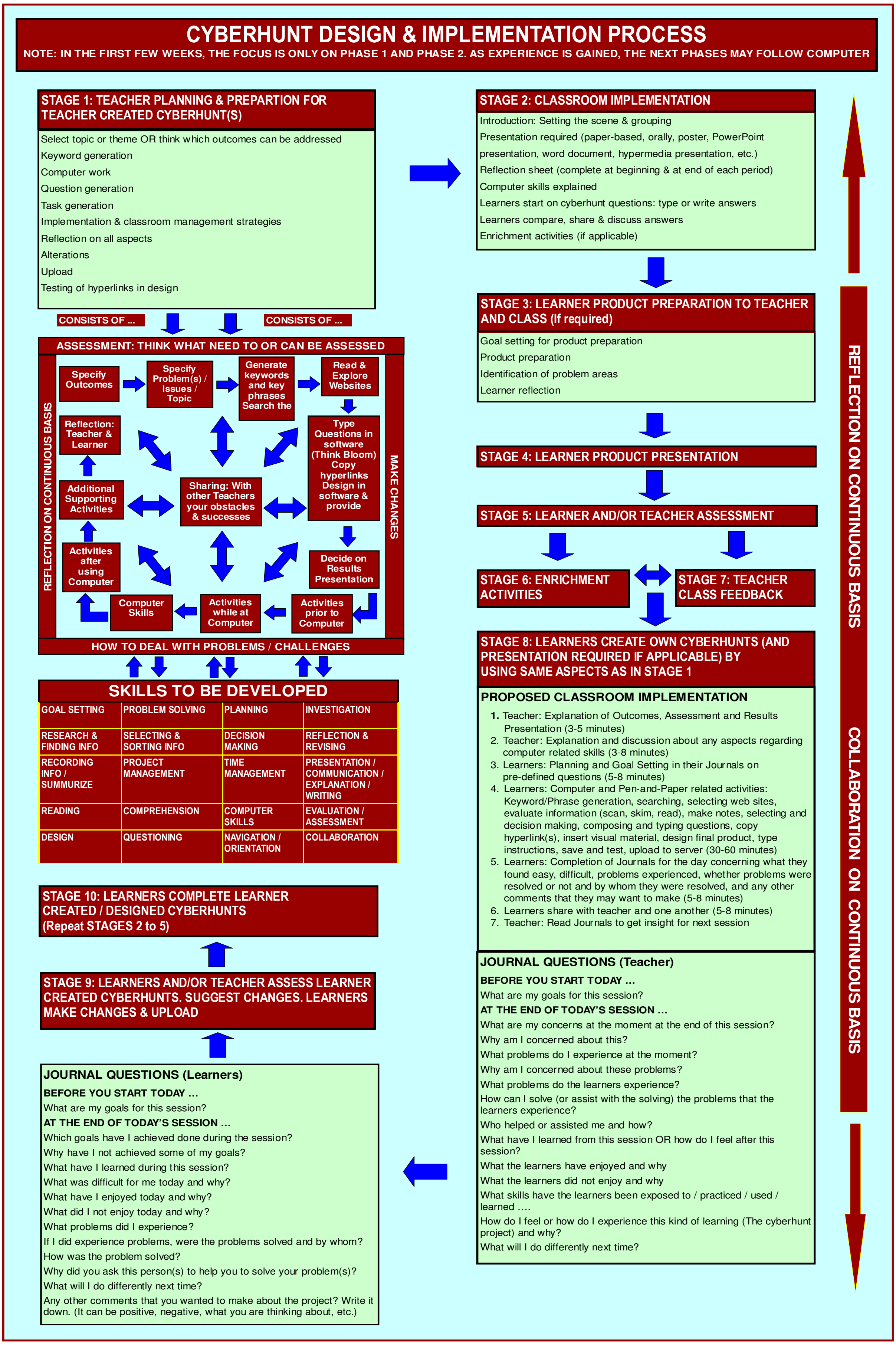
- Phase 9: Learners and/or teacher assess learner created cyberhunts. Suggest changes. Learners make changes & upload

- Phase 10: Learners complete learner created / designed cyberhunts (repeat stages 2 to 5 if required)

Stage 1, the planning and preparation stage, is the most important stage, as it sets the scene for the rest of the stages to follow. Stage 1 encompasses of the following:

- The thinking that entails the specification of the learning outcomes
- The identification of the topic, theme or problem,
- The generation of keywords and key phrases,
- Searching for, exploring and reading of the web results,
- Question generation related to Bloom's taxonomy or according to Anderson & Krathwhol (see Wilson, 2005),
- Hyperlinking,
- The designing of the cyberhunt in a suitable software application,
- Deciding upon the results presentation,
- Deciding upon any activities prior to using the computer, if required,
- Deciding upon activities while busy on the computers,
- Determining the computer skills that are necessary,
- Deciding upon activities after using the computer,
- Deciding upon any other additional non-computer related activities, and
- Preparing learner reflection sheets.

Figure 6.7: The Cyberhunt Design and Implementation Process



Stage 2, is the classroom implementation stage and comprises of the following:

- Introduction: Setting the scene & grouping.
- Presentation required (paper-based, orally, poster, PowerPoint presentation, word document, hypermedia presentation, etc.).
- Reflection sheet (complete at beginning & at end of each period).
- Computer skills are explained.
- Learners start on cyberhunt questions: type or write answers.
- Learners compare, share & discuss answers.
- Enrichment activities (if applicable).

Stage 3, is the learner product preparation stage. During this stage, the learner(s) can make individual or group presentations to the teacher and/or to the class. This stage is optional, depending on the outcomes that the teacher wants to address. During this stage, the learners are required to set their goals for their product preparation, they prepare their presentations or products, they identify the problem areas and they write these identified problem areas on their journal sheets. It is also possible that the teacher and the learners can decide jointly what types of presentation are required.

In Stage 4, the learners present their created products to the teacher, to their group and/or to the whole class; depending on what was decided upon during Stage 1 by the teacher. During their presentation, the learners are assessed by means of a rubric or checklist, either by their teacher or by their peers, which is Stage 5. The teacher could also have planned for an enrichment activity or activities related to the topic, and this activity or activities follow after stage 5, hence Stage 6 is called the enrichment activity phase. During Stage 7, the teacher provides feedback to the class regarding their assessment and any other aspects that he/she deem to be necessary.

As the learners become more competent and confident to complete the teacher-created cyberhunts and to present their findings, the teacher can proceed to the next stage, Stage 8. This stage is a higher level as it requires that the learners become the designers of their own individual or collaborative cyberhunts on given topics. During this stage, the learners plan in a similar manner as the teacher did during Stage 1, as the learners have to engage with the aspects that have been indicated in Stage 1. These aspects will be indicated shortly. During Stage 8, the learners follow the proposed classroom implementation procedure, as indicated under Stage 8 in Figure 6.7. This proposed procedure comprises of the following:

- The teacher explains the intended outcomes, assessment and results presentation (3-5 minutes).

- The teacher explains and discusses any aspects regarding computer related skills (3-8 minutes).

- The learners plan and set their goals in their journals on pre-defined questions as indicated in Appendix K, L and M (5-8 minutes).

- The learners plan and start with the design process (computer and/or pen-and-paper related activities, 30-60 minutes), namely:

    - Keyword/Phrase generation,
    - Search by using search engines,
    - Select and/or bookmark relevant web sites,
    - Evaluate information (scan, skim, read),
    - Make notes or summaries,
    - Select and decide on the questions to be composed,
    - Type the questions in their selected design software,
    - Copy the hyperlink(s),
    - Insert visual material (if required),
    - Type the instructions
    - Save and test their product, and
    - Upload to server if required

- The learners complete their journals (5-8 minutes) at the end of the day's session pertaining to what they found easy, difficult, the problems experienced, whether the problems were resolved or not, by whom they were resolved, and any other comments that they may want to make (see Appendix K, L & M for examples). The teacher may also decide to complete a journal with similar questions (see Appendix M).

- The learners share their experiences with their teacher and one another (5-8 minutes). These experiences are recorded in their journals.

- Alternatively, the teacher may decide that the learners are not going to share their experiences at the end of every session, but only during some of the sessions. The teacher may then decide to read the learners' responses in their journals alone at an appropriate time. The learner reflection assists with further planning, as it provides the teacher with insight of the learners' needs.

Stage 9 is the stage when the learners and/or teacher assess the learner created cyberhunts. During this stage, suggestions are made and the learners are afforded with opportunities to make the necessary changes. After the changes have been made, the learners save their designs and upload it to the server.

The final stage is Stage 10. During this stage the learners can complete one another's or the collaborative created cyberhunts of other groups. The teacher has also the option that learners from other classes or other grades could use the learner-designed cyberhunts as a learning tool.

4. LIMITATIONS OF THE STUDY

This research project has been an interpretive case study. Berg (1998) has voiced his concerns regarding a case study's inability to generalise. Yin (2003), Pring (2004) and Mouton (2001) have also noted this concern, but they argue that this does not imply that the findings of case study research are useless or irrelevant.

As this was a case study involving technology, the words of Kozma and Anderson (2002, p. 390) should be noted as they argue that within technology-based cases "the focus is not on the uniqueness of these cases but on what can be learned from them about how technology is being used to support educational change." These authors' argument is that the results of a case study are relevant and useful for the specific case and the results could be relevant in other contexts. Stake (1995, p. 86) argues that "although case study researchers do not seek to make generalizations, readers do."

While taking these concerns and arguments into consideration, the following case can be built: Although only a few schools participated in this study, these schools have similar experiences related to poor ICT infrastructure and non-Internet connectivity as other previously disadvantaged schools in South Africa. This assumption is supported by the school connectivity report in the literature review (section 6.1 and 6.2 in Chapter 2). Hence, it seems fair to suggest that one would find similar results in a similar study within the same context.

5. RECOMMENDATIONS FOR ICT RELATED PROJECTS, TEACHER TRAINING AND IMPLEMENTATION

Several recommendations can be made with respect to general aspects of training and implementation, as there are several first and second order barriers (Ertmer, 1999) that still have to be addressed if ICT implementation is to make inroads into the schools. It is proposed that schools should not receive computers from sponsors or from the Department of Education before the teachers have been trained and are computer literate. Training should precede delivery as, if done the other way round, delivery does not benefit the learners, as these gifts stand unused in many instances - what Hodgkinson-Williams (2005) has referred to 'as gathering dust on the keyboard'.

A further recommendation is that schools should be held accountable for what they do with their computers. This could be achieved by assisting the school leadership and the teachers to draft a technology plan that includes a vision, goals for ICT use, timetabling and assigning staff to be responsible for specific grades in their school. However, this is not enough, as teacher's need support in order to implement ICT plans, and those who supply computers should provide in-school support and visit the teachers regularly. It should be made crystal clear that the focus is not to 'check-up' on teachers, but rather to support and learn from their challenges in order to gain a better understanding of each individual school's context and what could be done to assist them. Equally important, the principal and leadership team of the school should check on a regular basis whether the teachers involved in ICT implementation, are actually using the computer room on a regular basis.

It is also recommended that teachers should be encouraged to use their home language when they express themselves, when they ask for assistance, and when they explain to others. It was observed that a great deal of isiXhosa was used during the training sessions and that participants seemed to both explain and understand more clearly when using their home language. Participants should be encouraged to work together in groups and to work on the same topic in the initial phases when introducing Internet based searching.

Participating teachers should also have their own computers, as this will allow them to practise these skills that they have acquired during training, at home. Without having one's own computers, many of the acquired skills may 'disappear'.

Lastly, the importance of ongoing support, as indicated in section 2.1 in this chapter, is imperative to sustain the implementation of the new approach. This also implies support and buy-in from the principal and SMT. However, if there is one person at school who is responsible for ICT classes, it is imperative that this person also buy into the new approach. Therefore it is important that this staff member should also be part of the training process and the support group, as he/she is to play a vital role in the success of the new envisioned approach.

6. RECOMMENDATIONS FOR FURTHER RESEARCH

It is suggested that the following issues warrant further investigation. These, amongst others, are:

- What are the factors that hamper computer integration and teachers' abilities after teachers had been developed and empowered through computer training.
- How learners from disadvantaged schools experience the cyberhunt Internet based learning approach.
- Whether learners can take the cyberhunt approach to another level of Internet based learning.
- Whether the skills the teachers have learned as a result of their participation in the project are also developed within their learners.
- Whether the cyberhunt approach has a positive effect on the motivation, interest and collaboration on learners from disadvantaged schools in South African.
- What strategies learners employ to ascertain whether information is reliable and truthful.

- Whether cyberhunts have any influence on teachers' thinking about teaching.

- Whether the cyberhunt approach has a positive influence on learners' attitudes towards learning and school in general.

- Which reading and comprehension skills learners use when reading on the Internet.

- What inner and private speech is used when learners are engaged in cyberhunt use and cyberhunt design, and

- Exactly how does hypermedia creation influence motivation, interest, collaboration, knowledge generation and emotional development.

7. REFLECTION ON THE PROBLEM STATEMENT, RELEVANCE OF THE STUDY AND AIMS

In this final section, a deliberate effort is made to reflect upon the problem statement, relevance of the study and the aims of the study, as indicated in chapter 1. This is done to indicate that these aspects have been achieved.

7.1 Reflection on problem statement

The following aspects indicated in bullet format below, were highlighted in chapter 1 under the problem statement. These aspects are reflected about below each bullet, in order to indicate whether they were addressed.

- There is a lack of contact between themselves and the computer facilitator (if the school has one).

  During this study, the computer facilitator from the schools which had one, were also invited to be part of the project. From the six participating schools that had received computers from the DELL Foundation through Investec, four schools' facilitators attended reasonable regularly. One high school's facilitator never attended and one primary school did not have a main computer facilitator at that point in time. Hence, this project has made inroads to start addressing the above-mentioned problem. Although this study tried to make inroads to empower teachers in order that the empowered one can also start to take their own classes to the computer room, school visits during the project and after the project training had been completed, indicated that the main facilitator was still in charge for the whole school. School visits during 2009 also indicated that in many of the schools, they do not adhere to the time tables for ICT periods that they had submitted in 2009.

- The fact that what happens in the computer room is not directly linked to what happens within the classroom.

  This project tried to address the integration aspect via the implementation of cyberhunts. As the schools did not have Internet connections, participants were also shown during sessions in 2009 (after the research part of the project had been completed) how to integrate PowerPoint Presentations and Excel as part of the curriculum, as well as how to integrate Microsoft Encarta. The cyberhunt integration at the schools could thus not happen at the beginning of 2009. However, it was noticed during school visits that integration is still at a very low level and that some schools still focus predominately on non-integrated computer literacy.

- Teachers want to be responsible for their own class's computer integration, but they are unsure what to do as they lack the basic computer and Internet skills.

  This concern was addressed as the participants were shown how to address integration through the use of cyberhunts. Participants were also shown how to integrate PowerPoint Presentations and Excel as part of the curriculum, as well as how to integrate Microsoft Encarta. Furthermore, a simple computer lesson planning template was developed for the schools to assist teachers with their computer integration planning.

- There is a need to establish the integration of computers within learning areas and assistance with the implementation of integration.

  In the previous bullets it was shown that this was addressed.

- There is a need to get personally involved with computer integration and to play an active part in the establishment and implementation of computer integration at schools.

  This project created opportunities for the participating teachers to become personally involved by empowering them with the necessary skills.

- In many cases, one person is responsible for teaching computer literacy to the whole school.

  This project tried to assist schools to change this, by empowering participating teachers to become computer skilled and pedagogically skilled to become fellow computer facilitators at their schools.

- The Internet has to be introduced to teachers and learners, but teachers do not have access to the Internet, neither do they know how to introduce the Internet how to implement Internet or related strategies in teaching and learning.

  The Internet was introduced to the teachers. However, the participating teachers only had access during the training at the NMMU Missionvale campus and not at their schools. The participants were also trained how to implement the Internet for teaching and learning by means of cyberhunts.

- It was also envisaged that the research findings would make a contribution towards computer technology integration within the curriculum at the participating schools and that the participating teachers would serve to inform the debate and contribute to future teacher development programs related to ICT.

  The research findings, discussion, claims and recommendations, assisted the researcher to make recommendations for further research, as well as about how the teacher training process should be managed. The final chapter, chapter 6, also indicated which skills could be addressed and concurred about the need for ongoing training and ongoing onsite support. It was also argued that support from the school's principal and SMT is vital and that staff development meetings and the creation of a school computer support group are other key issues that have to be addressed.

7.2 Reflection on the relevance of the study

In this sub-section, it is reflected upon whether the aspects indicated by the bullets below and which were stated in section 8 in chapter 1, namely the relevance section, were achieved. The reflection part follows below each bullet.

- Many teachers feel that research and teachers' actual practices are too far removed from one another (Royer, 2002) and that researchers and their research do not take teachers' needs into consideration (Blumenfeld, Fishman, Krajcik, Marx & Soloway, 2000). Watson (2001) notes that 'home-grown experts', it is teachers who have classroom experience and theoretical understanding, seem to hold the key to assist with the creation of a context for professional information technology teacher development, as they are in the classroom and have the theory (Watson, 2001).

During this research project, the researcher and participants worked together in order to ensure that the research was not far removed and in order that the participants' experiences and journal writing could inform the future sessions during the project. The project also assisted with the development of home-grown exerts, as participants indicated that they could identify the more capable peers and made extensively used of the peer-facilitators that emerged during the project. Hence, these capable participants could fulfil the role of home-grown experts at their respective schools. At this point in time, a special open ended questionnaire has been distributed to the participating schools on 17 September 2009 in order to ascertain where the problem areas are, as it has been indicated that the computer rooms were utilised as it has been anticipated. Furthermore, follow up interviews will also be conducted with the main peer-facilitators that emerged during the project, as well as with other participants and their SMT's to determine why the computer integration and further development of home-grown experts were not being realised.

- This study aimed at enabling the participating teachers to develop both the theoretical and practical experience to be able to contribute to the idea of becoming 'home-grown experts'.

  Participants were informed by the theoretical perspectives of cyberhunts and were introduced to the taxonomy of Bloom. The participants were also practically involved in the cyberhunt design process, creation of cyberhunts and reflection.

- The rationale behind empowering teachers to use technology is to try to start with a small intervention in order to try to close the digital divide within the participating schools.

  The cyberhunt project was a small scale intervention as only a small number of schools were involved and the average attendance per session was approximately 27 teachers.

- 'One-shot sessions' of computer technology development sessions for teachers are not proving to be effective, and have failed to assist them to understand the benefits of integrating computer technology in their classrooms (Royer, 2002; Hinson et al., 2005; Hinson et al., 2006).

  This project was not a 'one-shot' session, but consisted of various sessions over a period of nine months to address the concern and value of a once-off training session.

- The NRF states on their website in "Research Theme 4: Human Resource Development Teacher Education and Development", that teachers play a pivotal role as change agents in the teaching and learning process. Furthermore, the NRF (2006) states that there is a definite need for an INSET (In-service Education and Training) strategy that could contribute towards a framework for educator development.

  This study was an INSET programme and concluded with recommendations and a framework for future teacher development ICT training projects based upon the findings during this project and informed by the theory in the literature review.

- "Research Theme 5: Curriculum, Pedagogy and Assessment" (NRF, 2006) stated that there is a need for teachers to review their conceptual foundations regarding pedagogy and assessment and that the development of appropriate INSET strategies could play a vital role in this regard. This research study therefore resonates with the ideas of SAIDE and the NRF, as well as with the South African Department of Education's (2003, p. 26; 2004, p. 33) call for "evaluation, experimentation and research" to improve practice and for research that is "linked to practice" (Department of Education, 2003, p. 26; 2004, p. 33).

  This study was a deliberate attempt to address the need as indicated above.

- ICT integrated learning provides different learning opportunities, it is also noted that that ICT learning opportunities are difficult to assess with traditional forms of assessment, and that in the process, opportunities are being lost to assess other facets such as group work (collaboration), critical thinking, communication, etc. (which are important life skills). The findings of this study could contribute to our understanding of these above-mentioned aspects of the learning process.

The developed and implemented data gathering tools assisted to assess whether several skills, as embedded in the critical outcomes of the NCS, were addressed and to what extent they were. Furthermore, the data indicated that the design skills related to the critical outcomes were achieved and that cyberhunt design had had a positive impact on the participants' collaboration, motivation and interest.

7.3 Reflections on the aims of the study

The main aims of this research project have been indicated in chapter 1 and 3. In order to reflect whether these main aims have been realised, evidence is provided below each of the bulleted aims to indicate that each of the aims were achieved:

- Aim 1: To develop a strategy to introduce the participating teachers to the Internet in an integrative manner.

  This aim was achieved, as the cyberhunt strategy was developed before the project commenced. Furthermore, the cyberhunt strategy was implemented in this research study and reflected upon in section 3.6 in this chapter. As a result, an altered cyberhunt design and implementation process has been indicated in section 3.6.

- Aim 2: To establish what the problems, concerns and barriers are that mitigate against the implementation and integration of the cyberhunts as ICT learning and teaching strategy and how the identified barriers can be addressed.

  This aim was achieved, as the first- and second order barriers have been indicated in chapter 4 by reporting the barriers indicated in the data gathering tools. In chapter 5, the first- and second order barriers were discussed. In section 5 in this chapter, recommendations were made on how to address the barriers by keeping the identified aspects in mind.

- Aim 3: To establish, on a continuous basis, how participants experienced the professional training development process used to prepare them for cyberhunt implementation in order to address teacher needs during the process with a view to make any necessary changes and to assist with future planning and teacher development-training sessions.

  The aspects related to this aim, were analysed and discussed in chapters 4 and 5 respectively. This aim assisted with the creation of a proposed model for teacher development pertaining to ICT, as indicated in section 3.1 in this chapter. Equally important, it was described in section 3.3 in this chapter that a learning community has been established as a result of the teacher development process that had been followed in this research project. Suggestions have also been made to assist project facilitators on how to operationalise and to realise these suggestions indicated in sections 3.5 and 7.

- Aim 4: To ascertain whether the cyberhunt approach can address the critical outcomes of the South African National Curriculum Statement.

  Research question 2 and 4 dealt with these above-stated aspects pertaining to cyberhunts. These aspects were highlighted in chapter 4 (sections 3 and 5) and were discussed in chapter 5 (sections 3 and 5). In addition, complexity learning theory and activity theory were used in section 3.3 in this chapter to provide theoretical evidence that the critical outcomes have been achieved as a result of the unmediated and mediated functioning within the activity theory triangle, as indicated and discussed in section 3.3.

  The positive results related to search and research, decision making, questioning, computer skills, reflection, design skills and audience have been reported and it was argued that these positive results could most likely be attributed to the functioning of the mediational tools such as the computer technology, the Internet, the software that had been used and language. Equally important, the data suggest that the interaction between both the unmediated elements and higher order mediated elements of activity theory, have probably been the defining factors which created high levels of motivation, interest, collaboration and a positive classroom culture through which the critical and developmental outcomes of the South Africa curriculum can possibly be achieved within a complex learning community.

- Aim 5: To establish to what extent the cyberhunt approach can enhance motivation and interest in teachers.

  Research question 3 dealt with the aspects pertaining to motivation and interest. The findings to this question were indicated in chapter 4 and discussed in chapter 5. In Aim 4, motivation and interest have been referred to with reference to complexity and theory and activity theory. The findings related to motivation and interest suggests that the activity theory triangle could be expanded to specifically include motivators, as indicated in section

3.3 in this chapter. Hence, aim five has been addressed and realised, as the data suggest that the cyberhunt approach has been experienced as interesting and motivating.

- Aim 6: To determine in what way the creation of a cyberhunt encourages collaboration.

  Research question 4 dealt with collaboration. In chapter 4 the findings related to collaboration were revealed and in chapter 5 the data pertaining to collaboration were discussed. The data suggest that the cyberhunt approach/strategy was extremely successful to deal with and in improving collaboration.

8. CONCLUSION

The responses to the problem statement, relevance of the study and to the aims of this study, as indicated above, suggest that they have been achieved. It is hoped that this study, coupled with further research, might provide a starting point in unravelling a range of complex questions that could assist disadvantaged learners and their teachers to perceive school as being different to what they usually experience. This study suggests that in this way ICT implementation in schools could become a tipping point, not only by helping close the digital divide between third and first world countries, but by helping teachers transform their practice through seeing the fruitfulness of the approach and the possibilities that exist. Ongoing support is the key in this quest.

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APPENDICES

APPENDIX A

Data referred to in findings chapter (Table 1 to Table 97)

DATA REFERRED TO IN FINDINGS CHAPTER

Table 1: Overview of the participants' computer access (n=29)[44]

Data descriptor	**Number**
Do you have your own computer?	
Yes	17
No	12
What kind of computer?	
Desktop	16
Laptop	1
If you do not have your own computer, do you use a computer?	
Yes	9
No	2
If you answered yes above, where do you have access to a computer?	
School	8
Post net	0
At a friend	0
Library	1
Other place	0
Access to the internet	
School	2
Post net	0
At a friend	0
Library	1
NMMU	4
Internet Cafe	2
Councillor's Office	1
Have you received any computer training?	
Not at all	6
Through my own studies	9
Training arranged by the school	17
Training by the education department	1
From family and friends	4
What training have you received to help you with how to integrate computers within the curriculum?	

[44] One of the 30 participants completed only the first section of the Teacher Skills Questionnaire, thus the n=29 is some instances

Not at all	16
Through my own studies	3
Training arranged by the school	10
Training by the education department	1
From family and friends	1

Table 2: How participants use the computer (n=29) [45]

			Never		Rarely		Sometimes		Often		Fairly Often	
	Mean	SD	1		2		3		4		5	
I use the computer to type worksheets	2.93	1.51	8	28%	3	10%	7	24%	5	17%	6	21%
I use the computer to type my tests or examination papers	3.10	1.61	7	24%	4	14%	7	24%	1	3%	10	34%
I use the computer to record the marks of my learners on a mark sheet	2.17	1.61	17	59%	3	10%	0	0%	5	17%	4	14%
I use the computer to report to my parents about the learners' progress	2.07	1.60	19	66%	0	0%	4	14%	1	3%	5	17%
I use the computer to make posters or flashcards for my classroom	2.10	1.52	17	59%	2	7%	4	14%	2	7%	4	14%
I use the computer to store my learners' test results, assignment marks or exam marks	2.21	1.72	18	62%	1	3%	3	10%	0	0%	7	24%
I use my computer to write letters to parents, the principal or the Education Department	2.41	1.76	16	55%	1	3%	4	14%	0	0%	8	28%

[45] Please note that the percentages were rounded off. In some instances the total when adding disagree, uncertain or agree, might be less than 100% when the computer rounded e.g. 27.3% off to 27%. The same applies to e.g. 27.6 % which was rounded off to 28%. This resulted in that the total sometimes being more or less than 100%.

Table 3: How participants use the computer (n=29)

			Never		Rarely		Sometimes		Often		Fairly Often	
	Mean	SD	1		2		3		4		5	
I use the computer to search for Information on the Internet	1.52	1.02	22	76%	1	3%	5	17%	0	0%	1	3%
I use the computer to search for information on CD ROM or DVD based encyclopaedias	2.45	1.66	14	48%	3	10%	3	10%	3	10%	6	21%
I use the computer to communicate by using E-mail	1.38	0.90	23	79%	3	10%	2	7%	0	0%	1	3%
I use the Internet for teaching and learning	1.28	0.88	26	90%	0	0%	2	7%	0	0%	1	3%
I use the computer to make a flyer, poster or presentation to market my school	1.83	1.20	18	62%	2	7%	6	21%	2	7%	1	3%

Table 4: How participants use the computer for teaching and learning (n=29)

			Never		Rarely		Sometimes		Often		Fairly Often	
	Mean	SD	1		2		3		4		5	
I use drill and practice software for teaching and learning	1.07	0.37	28	97%	0	0%	1	3%	0	0%	0	0%
I use simulation software for teaching and learning	1.07	0.37	28	97%	0	0%	1	3%	0	0%	0	0%
I use tutorial software for teaching and learning	1.07	0.37	28	97%	0	0%	1	3%	0	0%	0	0%
I use hypermedia for teaching and learning	1.00	0.00	29	100%	0	0%	0	0%	0	0%	0	0%
I use a multimedia encyclopedia for example Encarta for teaching and learning	1.21	0.68	26	90%	1	3%	1	3%	1	3%	0	0%
I use a word processor, for example Microsoft Word, for teaching and learning	1.86	1.43	20	69%	1	3%	3	10%	2	7%	3	10%
I use presentation software, for example PowerPoint, for teaching and learning	1.17	0.66	27	93%	0	0%	1	3%	1	3%	0	0%
I use web design software, for example FrontPage, for teaching and learning	1.14	0.74	28	97%	0	0%	0	0%	0	0%	1	3%
I use the Internet for teaching and learning.	1.14	0.44	26	90%	2	7%	1	3%	0	0%	0	0%

Table 5: Participants' general computer skills (n=29) [46]

Statement: General Computer Skills	Mean	SD	NON: You do not have the skill		BEGINNER: You can do it, but with some help		CONFIDENT: You are able		EXPERT: You are very capable & can even help other people	
			1		2		3		4	
I can use Explore to find files on my computer	2.28	1.00	6	21%	14	48%	4	14%	5	17%
I can find saved files	2.66	1.04	4	14%	10	34%	7	24%	8	28%
I can create folders	2.45	1.06	6	21%	10	34%	7	24%	6	21%
I can rename folders	2.45	1.06	6	21%	10	34%	7	24%	6	21%
I can scan for viruses	1.48	0.95	21	72%	5	17%	0	0%	3	10%
I can connect a digital camera to the computer	1.62	1.12	21	72%	2	7%	2	7%	4	14%
I can connect a data projector to a computer	1.52	1.02	22	76%	2	7%	2	7%	3	10%
I can connect a keyboard, mouse or monitor to a computer	2.31	1.26	11	38%	6	21%	4	14%	8	28%
I can create shortcuts on the computer	2.03	1.12	12	41%	9	31%	3	10%	5	17%
I can install software onto the computer	1.76	1.09	17	59%	6	21%	2	7%	4	14%
I can do troubleshooting on the computer	1.55	0.95	20	69%	4	14%	3	10%	2	7%
I can use the search tool to find files on my computer	2.07	1.09	10	36%	11	39%	2	7%	5	18%
I can copy & paste text	2.29	1.08	8	29%	9	32%	6	21%	5	18%
I can format text (bold, underline, change size, change fonts)	2.68	1.09	4	14%	10	36%	5	18%	9	32%
I can open documents	2.64	1.10	4	14%	11	39%	4	14%	9	32%
I can save documents	2.64	1.13	5	18%	9	32%	5	18%	9	32%

[46] The n-value has in all cases been calculated on the number of participants who has completed that specific statement on the questionnaire / data gathering tool

Table 6: Participants' general word processing skills (n=29, calculated on number completed on questionnaire)

Statement: Word processor Skills	Mean	SD	NON: You do not have the skill		BEGINNER: You can do it, but with some help		CONFIDENT: You are able		EXPERT: You are very capable & can even help other people	
			1		2		3		4	
I can insert pictures, images or diagrams into a document	2.04	1.04	10	36%	11	39%	3	11%	4	14%
I can save documents in other file formats e.g. html or txt format	1.86	1.08	14	50%	8	29%	2	7%	4	14%
I can insert tables into a document	1.96	1.17	14	50%	6	21%	3	11%	5	18%
I can insert hyperlinks into a document	1.68	0.98	17	61%	5	18%	4	14%	2	7%
I can create bullets & numbered text	2.32	1.22	10	36%	6	21%	5	18%	7	25%

Table 7: Participants' general spreadsheet skills (n=29)

Statement: Spreadsheet Skills	Mean	SD	NON: You do not have the skill		BEGINNER: You can do it, but with some help		CONFIDENT: You are able		EXPERT: You are very capable & can even help other people	
			1		2		3		4	
I can create formulas and do calculations	1.68	0.94	15	54%	10	36%	0	0%	3	11%
I can change column & row sizes	2.14	1.11	10	36%	9	32%	4	14%	5	18%
I can sort data in a spreadsheet alphabetically or according to values (numbers)	1.86	1.08	14	50%	8	29%	2	7%	4	14%

Table 8: Participants' general presentation skills (n=29)

Statement: Presentation Skills	Mean	SD	NON: You do not have the skill		BEGINNER: You can do it, but with some help		CONFIDENT: You are able		EXPERT: You are very capable & can even help other people	
			1		2		3		4	
I can create a slide show e.g. in PowerPoint	1.68	1.09	18	64%	5	18%	1	4%	4	14%
I can insert an audio or video clip into a presentation	1.50	1.00	21	75%	3	11%	1	4%	3	11%
I can insert a picture or photo into a presentation	1.57	0.96	19	68%	4	14%	3	11%	2	7%

Table 9: Participants' general email and internet skills (n=20, calculated on number completed on questionnaire)

Statement: Presentation Skills	Mean	SD	NON: You do not have the skill		BEGINNER: You can do it, but with some help		CONFIDENT: You are able		EXPERT: You are very capable & can even help other people	
			1		2		3		4	
I can send and receive email	1.68	1.16	19	68%	4	14%	0	0%	5	18%
I can use a browser e.g. Internet Explorer	1.82	1.16	16	57%	6	21%	1	4%	5	18%
I can do searches on the Internet to search for information	1.89	1.20	16	57%	4	14%	3	11%	5	18%
I can save a webpage	1.57	1.03	20	71%	3	11%	2	7%	3	11%
I can insert hyperlinks into a document	1.50	0.92	20	71%	4	14%	2	7%	2	7%

Table 10: Participants' general software usage (calculated on number completed on questionnaire)

Statement: Software Usage		Mean	SD	#	%	Other:	%	Do not use:	%	N
What word processor do you use?	Word	1.58	0.90	18	69%	1	4%	7	27%	26
What spreadsheet software do you use?	Excel	1.93	1.00	14	52%	1	4%	12	44%	27
What presentation software do you use?	Power-point	2.19	0.98	10	38%	1	4%	15	58%	26
What web browser do you use to search on the Internet?	Explorer	2.33	0.96	9	33%	0	0%	18	67%	26
What database software do you use?	Access	2.31	0.97	9	35%	0	0%	17	65%	26
What web creation software do you use?	Front-page	2.92	0.39	1	4%	0	0%	25	96%	26
What computer encyclopaedia do you use?	Encarta	2.54	0.84	6	21%	1	4%	21	75%	28

Table 11: Report template for participating schools

School's Vision for computers
Goals for 2009
What has happened last year: Report per grade
The plan of action for this year: What will happen PER TERM for EACH GRADE
Who will be doing it?
Timetable for computer room with persons/teacher allocated for which grade
Does the school have a computer committee who deals with computer related issues?
Who is on the committee?
How was the committee established?
How often does the committee meet?
When do they meet?
What do they discuss?
What problems do the school experience related to computers?
How are they going to try to solve these problems mentioned?
What is the principal's role in the process?
What is the computer driver's & staff's role in the process?
Staff development at school by school's computer driver

Table 12: Existing participation and consultation (Summary and items)[47]

Existing participation & consultation n = 30 ∝ = 0.84	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
Summary of items below	3.30	1.35	10	33%	18	60%	2	7%
The staff have been consulted regarding a computer integration plan for the school	5.30	2.20	5	17%	7	23%	18	60%
We share on a regular basis during staff development sessions what successes we have achieved within the ICT (computer) classroom	3.53	2.11	10	33%	15	50%	5	17%
We share on a regular basis during staff development sessions what challenges / problems we have experienced within the ICT (computer) classroom	3.67	2.11	10	33%	14	47%	6	20%
We share on a regular basis during staff development sessions how we have used computers within our classroom	2.60	1.87	17	56.6%	11	36.6%	2	6.6%
We share on a regular basis during staff development sessions how we have overcome challenges / problems we have experienced within the ICT (computer) classroom	2.47	1.70	18	60%	9	30%	3	10%
We have staff development sessions on a regular basis at our school	2.57	1.63	15	50%	14	47%	1	3%
We have regular staff development sessions at our school related to computers	2.63	1.65	16	53%	13	43%	1	3%
We share on a regular basis how we have overcome challenges / problems we have experienced within the ICT (computer) classroom	3.62	2.31	11	38%	11	38%	7	24%

[47] Please note that the percentages were rounded off. In some instances the total when adding disagree, uncertain or agree, might be less than 100% when the computer rounded e.g. 27.3% off to 27%. The same applies to e.g. 27.6 % which was rounded off to 28%. This resulted in that the total sometimes being more or less than 100%.

Table 13A: Importance of participation and consultation (Summary and items)

Importance of participation and consultation n = 30 ∝ = 0.67	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
Summary of items below	6.30	0.62	0	0%	1	3%	29	97%
I like to share ideas about my teaching with teachers at my own school	6.47	0.97	0	0%	6	20%	24	80%
I like to share ideas about my teaching with teachers from another school	6.57	0.68	0	0%	3	10%	27	90%
Regular meetings are important in order that we can learn from one another	6.60	0.89	0	0%	4	13%	26	87%
Regular meetings are important to assist us with our concerns / challenges	6.70	0.70	0	0%	2	7%	28	93%
The facilitator should provide feedback to my questions / concerns / problems	6.70	0.65	0	0%	1	3%	29	97%
Support in the form of an email user group can be valuable.	5.23	2.31	6	20%	5	17%	19	63%
I would use an electronic email support user group regularly if it is available	6.87	0.43	0	0%	1	3%	29	97%
The staff have to be consulted regarding a computer integration plan for the school	5.87	1.70	2	7%	6	20%	22	73%
The staff have to be consulted regarding their knowledge about computer integration	6.37	0.93	0	0%	5	17%	25	83%
The staff have to be consulted regarding their levels of computer use	5.63	1.69	2	7%	10	33%	18	60%

Table 13B: Vision and goal setting (Summary and items)

Vision & Goal setting n = 30 ∝ = 0.50	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
Summary of items below	4.51	1.19	4	13.3%	16	53.3%	10	33.3%
We have a computer technology plan with clear goals in place at our school	3.63	2.06	10	33%	15	50%	5	17%
Our school has set clear goals related to ICT / computer implementation and integration	3.93	2.07	9	30%	13	43%	8	27%
Our school has a clear vision in place related to computers	4.93	1.87	5	17%	13	43%	12	40%
We know what we want to do with computers should we get computers	5.53	1.50	1	3.3%	10	33.3%	19	63%

Table 14: Department of Education support and training (Summary and items)

Department of Education support and training n = 30 ∝ = 0.57	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
Summary of items below	2.02	1.20	25	83%	5	17%	0	0%
The Eastern Cape Education Department has the necessary leadership for ICT (computer) implementation and support.	1.87	1.68	23	77%	5	17%	2	7%
I/We can count on support from the Eastern Cape Education Department to successfully implement computers within our classroom / curriculum	2.70	2.12	18	60%	8	27%	4	13%
The Department of Education provide teachers with the necessary training on how to use computers at school	1.33	0.88	26	87%	4	13%	0	0%
The Department of Education provides schools with the necessary computer equipment in order that schools can use computers in teaching and learning	1.50	1.48	27	90%	1	3%	2	7%

Table 15: Importance of support for computer based teaching (Summary and items)

Importance of support for computer based teaching n = 30 ∝ = 0.79	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
Summary of items below	6.39	1.01	1	3%	1	3%	28	93%
I would like that a knowledgeable computer person visit my computer classroom on a regular basis in order that he/she can assess what I do well	6.47	0.94	0	0%	2	7%	28	93%
I would like that a knowledgeable computer person visit my computer classroom on a regular basis in order that he/she can assess in which areas I need assistance (help)	6.50	0.94	0	0%	4	13%	26	87%
I would like that a knowledgeable computer person visit my computer classroom on a regular basis in order that he/she can assist my with the cyberhunt process	6.20	1.61	2	7%	3	10%	25	83%

Table 16: Training

Training n = 30	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
There is a need for teachers to be trained in order that teachers will be able to learn how to implement computer integration in their classrooms	6.73	1.14	1	3%	1	3%	28	93%

Table 17: Colleagues with computer skills and positive attitude towards computers (Summary and items)

Colleagues with computer skills and positive attitude towards computers n = 30 ∝ = 0.77	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
Summary of items	3.46	0.89	12	40%	17	57%	1	3%
The teachers at our school are positive towards using computers for teaching and learning in their classes	5.47	2.03	5	17%	3	10%	22	73%
The staff at my school is computer literate	3.37	1.5	9	30%	19	63%	2	7%
Our staff has the knowledge of how to integrate computers within the curriculum	2.27	1.62	20	67%	9	30%	1	3%
Our staff is adequately trained to use computers	2.53	1.53	17	57%	13	43%	0	0%
Our school has the necessary people on staff that could provide one another with support related to computer problems / challenges	5.13	1.94	3	10%	12	40%	15	50%
My fellow staff members have the necessary skills to help me with computer related problems / issues	4	1.95	8	28%	14	48%	7	24%
At the moment there are members at my school who are computer technology leaders	3.87	2.29	10	33%	12	40%	8	27%
My principal is computer literate	3.03	2.27	14	47%	10	33%	6	20%
My principal regularly uses the Internet	1.73	1.39	23	77%	6	20%	1	3%
Staff in senior positions at my school, is computer literate	2.6	1.67	16	53%	12	40%	2	7%
Staff in senior positions at my school, know how to use the Internet	2.03	1.61	22	73%	7	23%	1	3%
Staff in junior positions at my school, is computer literate	3.07	2.24	15	50%	10	33%	5	17%

Staff in junior positions at my school, know how to use the Internet	2.23	1.59	18	60%	11	37%	1	3%
Our principal believes in computer technology	6.1	1.42	1	3%	7	23%	22	73%
I/We can count on support from our principal in order that we successfully implement computers within our classroom / curriculum	4.47	1.91	5	17%	15	50%	10	33%

Table 18: Teacher preference for computer integration

Teacher preference for computer integration	Own class		Whole grade group		More than one grade group		Whole school		One person for whole school	
n = 29	n	%	n	%	n	%	n	%	n	%
The school plans for computer integration and asked teachers who should take their learners to the computer room.	17	59%	3	10%	2	7%	6	21%	1	3%

Table 19: Rewards and incentives

Rewards and Incentives n = 30	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
I will learn more about computers if I am rewarded for it.	6.03	1.90	3	10%	3	10%	24	80%

Table 20: Rewards and incentives

Rewards and Incentives n = 30	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
Teachers are rewarded to influence teachers to undergo computer training for teaching and learning	1.73	1.62	25	83%	3	10%	2	7%

Table 21: Time Tabling

Time Tabling n = 30	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
The time table of my school provides adequate scheduled periods for my learners to visit the computer room	3.67	2.14	11	37%	13	43%	6	20%

Table 22: Access to the computer room

Access n = 30	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
I have enough access to the computer room	3.83	2.72	11	37%	10	33%	9	30%

Table 23: Time for planning and learning (Summary and items)

Time n = 30 ∝ = 0.69	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
Summary of items	3.51	1.59	12	40%	13	43%	5	17%
I would like to use the computer lab, but do not have enough time for planning	4.30	1.76	4	13%	18	60%	8	27%
I have enough time to prepare lessons that make use of computer integration	3.07	1.91	12	40%	15	50%	3	10%
I have enough time to learn how to use a computer for teaching and learning	3.77	2.33	10	33%	12	40%	8	27%

Table 24: Computers and related infrastructure (Summary and items)

Computers and related infrastructure n = 30 ∝ = 0.36	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
Summary of items	2.97	1.08	15	50%	15	50%	0	0%
We have a fast Internet connection at school	1.23	0.77	29	97%	1	3%	0	0%
Our school have an up to date computer room with up to date computers	4.50	2.18	7	23%	9	30%	14	47%
We have the latest/newest software in our computer room	4.34	2.50	10	34%	7	24%	12	41%

Table 25: Funding and money

Funding and Money n = 30	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
There is adequate money available for staff to attend computer training	2.0	1.51	21	70%	8	27%	1	3%

Table 26A: Confidence to participate

	Mean	SD	Low 1,3		Avg 3,5		High 5,7	
n = 29			1<=x<=3		3<x<=5		5<x<=7	
I feel a bit hesitant to participate in the training of the integration of computers for teaching and learning.	2.52	1.72	16	55%	12	41%	1	3%

Table 26B: Confidence, knowledge and skills to use the computer as a teaching tool (Summary and items)

Confidence, knowledge and skills to use the computer as a teaching tool n = 30 ∝ = 0.91	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
Summary of items	3.95	1.43	11	37%	12	40%	7	30%
I would rely on other persons who are computer literate to do my class's computer integration instruction rather than doing it myself	1.33	0.71	28	93%	2	7%	0	0%
I prefer that my learners go to the computer lab to be instructed by another teacher	1.70	1.32	26	87%	3	10%	1	3%
I feel confident that I understand how to use the computer in my classroom	4.43	2.30	9	30%	8	27%	13	43%
I feel confident that I can use computer technology effectively to teach subject matter in my classroom.	3.83	2.23	12	40%	9	30%	9	30%
I am confident that I have enough knowledge about how to use computers in my classroom for teaching and learning	3.57	2.11	11	37%	12	40%	7	23%
At this moment, I feel confident that I have the necessary computer / ICT skills to assist my learners within the computer classroom	3.60	2.16	12	40%	11	37%	7	23%
At this moment, I feel confident that I am able to assist my learners within the computer classroom	3.83	2.26	10	33%	11	37%	9	30%
I use computer technology effectively to integrate computer usage within my lessons.	2.43	2.05	20	67%	6	20%	4	13%
I have the knowledge of how to manage the computer / ICT classroom	3.37	2.04	11	37%	14	47%	5	17%
I have enough knowledge to provide appropriate feedback to my learners related to computer usage	3.77	2.31	12	40%	9	30%	9	30%
I feel confident that I can manage the computer / ICT classroom	3.87	2.39	11	37%	10	33%	9	30%
I need knowledge of how to manage the computer / ICT classroom	6.23	1.45	1	3%	4	13%	25	83%

Table 27: Positive attitude towards the use of computers as a teaching tool (Summary and items)

Positive attitude towards the use of computers as a teaching tool n = 30 ∝ = 0.49	Mean	SD	Low1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
Summary of items	6.26	1.07	1	3%	4	13%	25	83%
I would like to be trained in how to integrate computers into the teaching and learning in my classroom.	6.77	0.68	0	0%	2	7%	28	93%
I don't find the use of computers to be practical for my learners	2.20	1.95	21	70%	6	20%	3	10%
I do not find computers to be a necessary part of classroom instruction	1.80	1.65	25	83%	3	10%	2	7%

Table 28: Confidence to be able to learn computer skills

Confidence to be able to learn computer skills n = 30	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
I feel confident that I will be able to learn computer skills	5.63	1.56	1	3%	11	37%	18	60%

Table 29: Computer skills: How do the participants see themselves? (Summary and items)

Computer Skills: How do the participants see themselves? n = 30 ∝ = 0.94	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
Summary of items	4.13	2.00	10	33%	11	37%	9	30%
I have the skills to use the computer effectively at this moment	4.03	2.03	8	27%	14	47%	8	27%
I have the necessary computer skills to help my learners who have difficulty in using the computer	3.77	2.39	10	33%	11	37%	9	30%
I am computer literate	3.67	2.32	12	40%	10	33%	8	27%
I am comfortable using a computer	5.03	1.90	5	17%	12	40%	13	43%

Table 30: General pedagogy skills (Summary and items)

General Pedagogy Skills n = 30 ∝ = 0.72	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
Summary of items	3.38	1.49	14	47%	11	37%	5	17%
I know how to assess computer based projects	3.10	2.23	15	50%	10	33%	5	17%
I have enough knowledge on how to formulate questions for higher levels of thinking	3.27	1.95	13	43%	13	43%	4	13%
I am happy with the way that I teach at the moment	3.83	2.07	9	30%	14	47%	7	23%

Table 31: Cyberhunt Skills (Summary and items)

Cyberhunt Skills n = 30 ∝ = 0.86	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
Summary of items	2.84	1.52	17	57%	12	40%	1	3%
I use the Internet on a regular basis to search for information	2.73	2.20	18	60%	8	27%	4	13%
I know how to do searches on the Internet	3.50	2.29	13	43%	10	33%	7	23%
I feel confident in the way I use the Internet	3.33	2.12	14	47%	10	33%	6	20%
I can design a cyberhunt lesson	2.67	2.11	17	57%	8	27%	5	17%
At this moment, I have the necessary skills to implement cyberhunts within the classroom	2.63	1.88	16	53%	10	33%	4	13%
I am able to implement the different levels of questioning as suggested by the taxonomy of Bloom	2.41	1.86	17	59%	10	34%	2	7%
I know what the different levels are in the taxonomy of Bloom	2.53	2.01	18	60%	9	30%	3	10%

Table 32: Planning

Planning n = 30	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
It takes more time to prepare a lesson where computer integration is involved than to plan a lesson that do not make use of computer integration or computer activities.	3.37	1.43	9	30%	20	67%	1	3%

Table 33: Personal computer related goal setting

Personal Goal Setting n = 30	Mean	SD	Low 1,3 1<=x<=3		Avg 3,5 3<x<=5		High 5,7 5<x<=7	
I set goals related to computers for myself on a regular basis	5.30	1.44	1	3%	15	50%	14	47%

Table 34A: Decision making Skills (Summary and items)

Decision making skills Pre ∝ = 0.58 Post ∝ = 0.69	Mean		SD		Low 1,2 1<=x<=2		Avg 3 x=3		High 4,5 4<=x<=5	
(npre = 27, npost = 26)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
It is often hard for me to decide what the topic means when I have to do a project. (npre = 26, npost = 26)	2.58	3.12	1.33	1.31	54%	31%	27%	38%	19%	31%
It is often hard for me to decide what to do for an assignment or project (npre = 27, npost = 26)	2.85	2.88	1.29	1.34	48%	31%	26%	42%	26%	27%
I find doing projects difficult because I don't always know what to do right away. (npre = 25, npost = 25)	3.04	3.24	1.27	1.33	40%	32%	28%	20%	32%	48%
I find it easy to decide upon a topic for the creation of a project in a learning area (npre = 27, npost = 26)	2.19	4.12	0.92	1.03	70%	4%	19%	35%	11%	62%
I find it easy to create questions for the topics after I have read information about the topic (npre = 26, npost = 26)	3.04	4.42	1.40	0.70	50%	0%	15%	12%	35%	88%

Decision making (summary of items) Pre ∝ = 0.58 Post ∝ = 0.69	Mean		SD		Low 1,2 1<=x<2.6		Avg 3 2.6<=x=3.4		High 4,5 3.4<x<=5	
(npre = 27, npost = 26)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
Summary of items	2.73	0.76	3.57	0.77	41%	0%	41%	50%	19%	50%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 34B: Topic selection for cyberhunts

Topic	Mean	SD	Low 1, 2 1<=x<=2	Avg 3 x=3	High 4,5 4<=x<=5
	Post	Post	Post %	Post %	Post %
I find it easy to decide upon a topic for the creation of a cyberhunt (npre=23)	4.13	0.92	4%	9%	87%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 34C: Decision making skills: Statistical Significance and Practical Significance

		Mean			Diff.	Statistical Significance t-Test			Practical significance
Pre ∝ = 0.58 Post ∝ = 0.69	n	Pre	Post	Diff	Std. Dev.	t-value	df	p	Cohen's d
Decision making	26	2.71	3.57	0.86	0.91	4.83	25	.000	0.95

Statistical significance: p

.000 implies < .0005

Practical significance: Cohen’s d

0-0.19 Not significant	0.20-0.49 Small difference	0.50-0.79 Moderate difference	0.80+ Large difference

Table 35A: Searching and research for information (Summary and items)

Searching Pre ∝ = 0.89 Post ∝ = 0.93	Mean		SD		Low 1,2 1<=x<=2		Avg 3 x=3		High 4,5 4<=x<=5	
(npre = 27, npost = 26)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
I find it easy to create keywords to make searching for information easier	2.12	4.12	1.07	0.83	73%	4%	15%	16%	12%	80%
I create keywords to help me to make the search for information easier	2.78	4.19	1.50	0.85	52%	0%	22%	27%	26%	73%
I make notes about the content that I read when I do projects	3.37	4.38	1.36	0.90	33%	4%	19%	15%	48%	81%
I find it easy to create/compose/set questions about something that I have read	2.84	4.33	1.40	0.76	48%	0%	16%	17%	36%	83%
When I receive reading material and questions based upon the reading material, I find it easy to answer the questions correctly.	3.30	4.23	1.35	0.86	33%	4%	26%	15%	41%	81%
I find it easy to search for information on the Internet	2.46	4.16	1.50	0.94	58%	4%	15%	24%	27%	72%
I know where to find good information for my project.	2.31	4.08	1.16	0.84	62%	4%	27%	19%	12%	77%
It is easy for me to find good/relevant information on a topic on the Internet	2.19	3.88	1.10	0.77	77%	0%	12%	35%	12%	65%
I find it easy to find relevant information on the Internet	2.23	4.20	1.24	0.82	65%	0%	19%	24%	15%	76%
I go to great lengths to ensure that information for a project is reliable and truthful	3.26	4.12	1.38	0.99	41%	8%	22%	8%	37%	85%
I often think whether the information that I have gathered is accurate, reliable and truthful.	3.27	4.27	1.40	0.87	38%	4%	19%	15%	42%	81%
The information that I usually find has nothing to do with my topic.	2.65	2.50	1.50	1.58	50%	54%	23%	19%	27%	27%

Often I have to think a lot about exactly what information to take from a source.	3.04	3.65	1.26	1.16	37%	19%	26%	19%	37%	62%
I find it easy to group information together	2.96	4.23	1.37	0.91	54%	4%	12%	19%	35%	77%
I understand well what I read in English	4.15	4.50	1.10	0.76	11%	0%	19%	15%	70%	85%
I enjoy spending time reading about a wide range of topics related to a project	3.46	4.46	1.42	0.76	31%	0%	23%	15%	46%	85%
Searching (Summary of items)	Mean		SD		High 1,2		Avg 3		High 4,5	
Pre ∝ = 0.89 Post ∝ = 0.93					1<=x<2.6		2.6<=x=3.4		3.4<x<=5	
(npre = 27, npost = 26)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
Summary of items	2.91	0.86	4.09	0.63	41%	0%	33%	19%	26%	81%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 35B: Reading confidence and enjoyment (Summary and items)

Reading confidence / Enjoyment	Mean	SD	Low 1, 2	Avg 3	High 4,5
Post ∝ = 0.79			1<=x<=2	x=3	4<=x<=5
(npost = 23)	Post	Post	Post %	Post %	Post %
Summary of items	4.35	0.65	0%	9%	91%
I find that I feel more confident about reading when I am busy with cyberhunts (npre=23)	4.39	0.72	0%	13%	87%
I find that I feel reading is more interesting to me when I am busy with cyberhunts (npre=23)	4.30	0.70	0%	13%	87%

Table 35C: Search and research skills: Statistical Significance and Practical Significance

		Mean			Diff.	Statistical Significance t-Test			Practical significance
Pre ∝ = 0.89 Post ∝ = 0.93	n	Pre	Post	Diff	Std. Dev.	t-value	df	p	Cohen's d
Searching and research	26	2.88	4.09	1.21	0.68	9.07	25	.000	1.78

Statistical significance: p

.000 implies < .0005

Practical significance: Cohen's d

0-0.19 Not significant | 0.20-0.49 Small difference | 0.50-0.79 Moderate difference | 0.80+ Large difference

Table 36: Journal data indicating what participants found difficult

What do you find difficult today?	4 June 2008	18 June 2008	29 July 2008	13 August 2008
Accessing Internet	I want to know more or how to network through internet (Teacher 45) More knowledge on searching for information through an internet (Teacher 51) Accessing internet is still tricky for me. Posting internet address on the document I have typed. (Teacher 33) Log on or surfing the internet and cyberhunt (Teacher 50)	At the beginning, the search was too slow to open (Teacher 26) Yes, takes time to be opened but I was patient no to be in a hurry (Teacher 24)		
Searching for Information / Exploring information	I need more help in computer basics, because it is my first time to use computer. I am still struggling in searching information and getting pictures (Teacher 20) I found that it is difficult to get pictures, to search for information. I need help in computer basic as it is my first time to use computer (Teacher 19) I find difficult in Internet (Teacher 47) Using the internet to download information because I started late to attend this training only the two past days (Teacher 48) To search for something, to underline words, use bold words (Teacher 21) Log on or surfing the internet and cyberhunt (Teacher 50) To understand the programme of the computer. To search information on the internet (Teacher 23) To be able to enter in the internet (Teacher 22) I am still not sure how to surf to the computer looking for other information except the one that I was shown (Teacher 55)	Finding a site, kidsclick isn't too technical in its approach (Teacher 35) No problem with computer activities but struggle in getting information from kids click (Teacher 11) Yes, because kids click have limited resources (Teacher 22)	I did not understand the Wikihow (Teacher 20) I experienced problem in writing web address. The computer shows two addresses (Teacher 36) Struggling to search for water purification, moving from Internet to word (Teacher 14)	Choosing a website that relates to my lesson (Teacher 40) The computers are slow and I saved my document and it gets lost (Teacher 1) The internet was sometimes slow, unable to decide on time which site to use (look) for information (Teacher 33) Difficult to go to internet the computer was slow (Teacher 32)

Table 37: Participants who helped others: With what did they helped them?

Helping peers with the following during the project:	Response from semi-closed-open-ended questionnaire
Accessing Internet	They could not access Internet (Teacher 2)
	Get to Internet (Teacher 18)
Log on	Logging in, searching for information, googling (Teacher 37)
	With how to log on/off, select program, how to copy and paste (Teacher 19)
	To log on and google about a little knowledge I have (Teacher 1)
	Logging in. Typing (Teacher 34)
Searching for Information / Exploring information	Logging in, searching for information, googling (Teacher 37)
	On MS Word inserting a picture and the Internet (exploring and choosing links) (Teacher 28)
	I showed them how to copy and paste and how to search for information (Teacher 20)
	To log on and google about a little knowledge I have (Teacher 1)
	Browsing for info in the Internet. Open google. Do cyberhunt. Pasting. Copying (Teacher 11)
	Get information from the Internet, design cyberhunt and typing (Teacher 36)
	I showed her how to start from the website address and google for information (Teacher 3)

Table 38A: Questioning Skills (Summary and items)

Questioning Skills Pre ∝ = 0.86 Post ∝ = 0.69 (npre = 26, npost = 25)	Mean		SD		Low 1,2 1<=x<=2		Avg 3 x=3		High 4,5 4<=x<=5	
	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
I know what the different levels are in the taxonomy of Bloom (npre = 26, npost = 25)	2.65	3.64	1.50	1.41	50%	16%	23%	24%	27%	60%
I have enough knowledge on how to formulate questions for higher levels of thinking (npre = 27, npost = 26)	2.48	4.04	1.28	1.04	59%	12%	26%	15%	15%	73%
I am able to implement the different levels of questioning as suggested by the taxonomy of Bloom (npre = 23, npost = 22)	2.61	4.00	1.53	0.87	52%	0%	17%	36%	30%	64%
Questioning Skills (Summary of items) Pre ∝ = 0.86 Post ∝ = 0.69 (npre = 26, npost = 25)	Mean		SD		Low 1,2 1<=x<=2		Avg 3 x=3		High 4,5 4<=x<=5	
	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
Summary of items	2.56	1.26	3.87	0.98	54%	8%	23%	32%	23%	60%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 38B: Questioning skills: Statistical Significance and Practical Significance

		Mean			Diff.	Statistical Significance t-Test			Practical significance
Pre ∝ = 0.86 Post ∝ = 0.69	n	Pre	Post	Diff	Std. Dev.	t-value	df	p	Cohen's d
Questioning skills	25	2.53	3.87	1.34	1.07	6.24	24	.000	1.25

Statistical significance: p

.000 implies < .0005

Practical significance: Cohen's d

0-0.19 Not significant	0.20-0.49 Small difference	0.50-0.79 Moderate difference	0.80+ Large difference

Table 39: Learning new things

Knowledge construction / Exchange ideas	Mean	SD	Low 1, 2 1<=x<=2	Avg 3 x=3	High 4,5 4<=x<=5
	Post	Post	Post %	Post %	Post %
I do learn a lot of new things during cyberhunt projects (npost = 23)	4.35	1.03	4%	13%	83%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 40: Planning how to finish on time and their journals

How did you plan to finish on time?	
Saving regularly	[Saving work regularly]Yes we are saved before we were asked t save our work (Teacher 45)
	Log directly to the file where the information was saved (Teacher 50)
Working faster	By working faster (Teacher 19)
	By working faster (Teacher 27)
	Work quickly (Teacher 26)
	Be on time and work quickly (Teacher 25)
	To be able to grasp quickly what is being said, work faster and be able to use the computer (Teacher 33)
Work at extra times	Ask for more time/early start (Teacher 37)
	Overtime. Ask colleagues for help (Teacher 38)
Punctuality	Be on time and work quickly (Teacher 25)
	To use at least two computers trying to search different websites. Arrive early and catch on work not completed (Teacher 11)
	Punctuality, dedicated (Teacher 41)
	Be punctual (Teacher 56)
	Be punctual and practise makes perfect (Teacher 38)
Attend sessions regularly	Continuing to attend. If we can have computers at our homes (Teacher 47)
	Continue attending. Buy a computer for myself (Teacher 49)
	To attend lectures daily (Teacher 6)
	By attending regularly and try to work faster (Teacher 19)
	By understanding everything in the classroom and attend all lessons (Teacher 1)
	To sacrifice and be on class every Wednesdays (Teacher 33)
	By attending lectures (Teacher 37)
	By attending everyday (Teacher 47)
	By attending regularly (Teacher 57)
Practice more	Practice can help (Teacher 20)
	Frequent practice can change and working together as one (Teacher 23)
	Be punctual and practise makes perfect (Teacher 38)
	More practise (Teacher 40)
	By practising (Teacher 42)
	To practise (Teacher 6)
	Practise (Teacher 2)
Buying own computer	Continuing to attend. If we can have computers at our homes (Teacher 47)
	Continue attending. Buy a computer for myself (Teacher 49)
	If only I had internet at home I would have been done by now (Teacher 40)

Working cooperatively	By being co-operative when given task (Teacher 17)
	Co – operation (Teacher 18)
	Frequent practice can change and working together as one (Teacher 23)
	To use at least two computers trying to search different websites. Arrive early and catch on work not completed (Teacher 11)
	Trying to work together as a group be tolerant to each other (Teacher 55)
	Work with others in groups. To observe and discover new information (Teacher 36)
	By asking assistance from the facilitator and also working in groups (Teacher 3)
	Working in groups. Facilitators' assistance by getting notes with steps to follow (Teacher 5)
	By asking for help if I'm stuck (Teacher 3)
	Asking questions if do not understand (Teacher 29)
Asking for assistance	Ask for assistance if we are struggling (Teacher 12)
	By asking for assistance then I practise (Teacher 3)
	By listening to instructions and concentrate (Teacher 46)
	Listen and apply what I heard from my facilitator and ask where I have a problem (Teacher 42)
Come prepared and do some work at home / homework / extra time	I have to come to classes with prepared questions so that I cannot delay (Teacher 20)
	Homework (Teacher 35)
	Work every time and practise more (Teacher 38)
Planning for keywords and questions	Sometimes I manage to finish in time by using key words (Teacher 14)
	Have key words first (Teacher 49)
	Download and paste the information. Focus on the question at hand without interruption. Key words are expanded if necessary (Teacher 50)
	By preparing questions in advance (Teacher 20)
Listen attentively and follow instructions	To listen carefully to one who will be helping me (Teacher 32)
	Listen to instructions (Teacher 46)
	Listen carefully to the instructor, have straight forward questions (Teacher 39)
	By listening to instructions and concentrate. (Teacher 46)
	Listen and apply what I heard from my facilitator and ask where I have a problem (Teacher 42)
	Follow the instructions and do what is needed (Teacher 42)
	Being able to formulate the correct title that is relevant to the topic. Be attentive and listen to the instructions (Teacher 50)
Searching skills	By setting first the necessary information and decide on the topic. Being able to search and find info through the internet (Teacher 48)
Topic selection	To be fast on getting the topic (Teacher 45)
	Being able to formulate the correct title that is relevant to the topic. Be attentive and listen to the instructions (Teacher 50)
	By searching and being able to choose a topic for my lesson. To work hand in hand with my instructor (Teacher 43)
Using notes	Working in groups. Facilitators' assistance by getting notes with steps to follow (Teacher 5)

Use time effectively and focus	If we can arrive at start on time. Do not disturb so that we can finish on time (Teacher 39)
	Follow facilitator's instructions, focus on task at hand (Teacher 26)
	By concentrating listening to instructions that are given and be able to follow (Teacher 2)
	Download and paste the information. Focus on the question at hand without interruption. Key words are expanded if necessary (Teacher 50)
Use previous knowledge	By building on what I have already every day (Teacher 56)
Making notes	To write down whatever I learn (Teacher 26)

Table 41: What will I do differently next time? (According to journals)

What participants will do differently next time	Teacher responses 29 July 2008	Teacher responses 13 August 2008	Teacher responses 20 August 2008
Prepare questions in advance	I have to prepare my questions in advance (Teacher 20)		
Collaborating more	I will have more information with others. Search for more on the internet (Teacher 36)	Work quicker than today; help my fellow students (Teacher 26)	
To work faster	To be a little quicker / faster (Teacher 49) Work faster (Teacher 45) Work fast (Teacher 37)	To be fast (Teacher 56) Work faster (Teacher 33) Work quicker than today; help my fellow students (Teacher 26)	
Work on computer skills	Work on inserting the pictures (Teacher 33)		
Perseverance	I'll continue with the same so that I can master it (Teacher 3)		
Learn from mistakes	Confident and prepared to learn. Mistakes are a good experience (Teacher 50)		
Time management		Time management (Teacher 41)	
Work alone		Work on my own (Teacher 37) I want to continue all by myself what I have learnt today (Teacher 57)	To work on my own (Teacher 6)
Search differently for information		To be quicker in searching for the correct topic (Teacher 45) Find the best suitable site for my question or find more than one site (Teacher 38) To be able to search information from the internet and type quickly (Teacher 32)	
Work on typing skills		Try to improve typing skills (Teacher 5) I will try type as fast as I can (Teacher 36)	To improve my typing skills and listen carefully in class and write important info (Teacher 29)
Follow the steps		Take things slow and first go over the steps done today. Not to be afraid to ask for assistance (Teacher 2)	I took longer to know about the steps. In future I will be fast (Teacher 36)

What participants will do differently next time	Teacher responses 29 July 2008	Teacher responses 13 August 2008	Teacher responses 20 August 2008
Ask for assistance		Take tings slow and first go over the steps done today. Not to be afraid to ask for assistance (Teacher 2)	
Revise previously done work		Before starting a new lesson I will revise today's work (Teacher 42)	
Work on saving skills			Is to try and save my stuff in my computer (Teacher 43) Start by asking for assistance as to how to save before I start typing my information and save them and not loosing the work that I have done (Teacher 2) I will be careful I saving my work (Teacher 11) To work on my own saving with HTLM (Teacher 45) Save it in HTML so learners can not change it (Teacher 38)
Focus more			I think I will need to listen attentively, because our tutor can be a bit fast sometimes (Teacher 33) To improve my typing skills and listen carefully in class and write important info (Teacher 29)
Note taking of new skills			Taking notes of anything that is new (Teacher 40)

Table 42: What did you speak about or discuss while working in your groups? (semi-closed-open-ended questionnaire)

What did you speak about or discuss while working in your groups?	
Topic selection	Choosing or selecting the topics (Teacher 27) Things you do when getting this information and also talk about the topic (Teacher 9) We choose the topic that is suitable for the learners in primary and in high school. We then formulate questions and type (Teacher 19) Purification of water. Symptoms of diseases (Teacher 47) Decide on a topic browsing on Internet Explorer after finding it you read it asking question open word and write your question, copy and paste so that your learners can work on it then save your document (Teacher 11) The day's topic. How excellent this course is (Teacher 38) We discussed the topic (Teacher 45)
Developing questions	Type questions that can be asked to learners (Teacher 40) We choose the topic that is suitable for the learners in primary and in high school. We then formulate questions and type (Teacher 19) Decide on a topic browsing on Internet Explorer after finding it you read it asking question open word and write your question, copy and paste so that your learners can work on it then save your document (Teacher 11)
Strategies	The various strategies to use. Used the facilitator's instructions to construct the project (Teacher 26) Things you do when getting this information and also talk about the topic (Teacher 9)
Audience	How can we make it interesting and attractive at the same time informative to learners (Teacher 28)
Internet & Internet Addresses	It was Internet and saving email address of the important information (Teacher 29) Decide on a topic browsing on Internet Explorer after finding it you read it asking question open word and write your question, copy and paste so that your learners can work on it then save your document (Teacher 11)
Audience / Learners: Helping them	We discussed about helping our pupils to master what we learnt (Teacher 20)
Design skills & Lesson Planning	The steps when you do cyberhunt (Teacher 42) About the lesson and how am I going to plan this (Teacher 1) That if we could all learn how to construct the cyberhunt and teach the learners through it, teaching would be very interesting (Teacher 34) What's next (Teacher 6)
Usefulness of Project	About the usefulness of this project (Teacher 43)
How to assist each other	Helping with different skill for searching cyberhunt (Teacher 5)

Table 43A: Planning (Summary and items)

Planning Pre ∝ = 0.90 Post ∝ = 0.85	Mean		SD		Low 1,2 1<=x<=2		Avg 3 x=3		High 4,5 4<=x<=5	
(npre = 27, npost = 26)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
I spend a significant amount of time to set goals for a project (npre = 26, npost = 25)	2.96	3.56	1.46	1.33	42%	24%	23%	20%	35%	56%
I achieve the goals that I set for myself (npre = 26, npost = 26)	3.08	4.27	1.20	0.83	35%	0%	31%	23%	35%	77%
I am aware of the value (benefit) of goal setting for learning by learners (npre = 27, npost = 26)	3.11	4.46	1.25	0.58	30%	0%	37%	4%	33%	96%
I set goals for myself during projects (npre = 26, npost = 26)	3.00	4.46	1.33	0.71	42%	0%	23%	12%	35%	88%
I have the required planning skills for projects (npre = 26, npost = 25)	2.46	3.84	1.42	1.03	62%	12%	15%	24%	23%	64%
My planning for projects is very good (npre = 27, npost = 25)	2.44	4.04	1.09	0.93	63%	4%	22%	28%	15%	68%
I create a timeline to help me to plan my project in order to finish on time (npre = 26, npost = 26)	2.54	4.04	1.30	1.00	58%	4%	19%	35%	23%	62%
I often think about what I could do to finish on time with my projects. (npre = 26, npost = 25)	2.92	4.16	1.41	0.90	50%	0%	12%	32%	38%	68%
When there is a group project, we discuss a lot in our team what each person should do. (npre = 27, npost = 26)	3.37	4.19	1.21	0.75	30%	0%	22%	19%	48%	**81%**
When we have a group assignment/project, we do a lot of planning in our groups about what we should do. (npre = 26, npost = 26)	3.54	4.27	1.42	0.87	42%	0%	4%	27%	54%	**73%**

Planning (Summary of items) Pre ∝ = 0.90 Post ∝ = 0.85	Mean		SD		High 1,2 1<=x<2.6		Avg 3 2.6<=x=3.4		High 4,5 3.4<x<=5	
(npre = 27, npost = 26)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
Summary of items	2.94	0.95	4.13	0.62	33%	0%	44%	19%	22%	81%

Table 43B: Planning (Summary and items)

Planning Post ∝ = 0.61 (npost = 24)	Mean Post	SD Post	Low 1, 2 1<=x<=2 Post %	Avg 3 x=3 Post %	High 4,5 4<=x<=5 Post %
Summary of items	3.81	0.92	17%	13%	71%
I find it easy to pose questions of different levels of difficulty to be used in cyberhunts (npost = 24)	4.08	0.93	8%	13%	79%
I find it easy to plan cyberhunts (npost = 24)	3.54	1.22	21%	29%	50%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 43C: Planning and design (Summary and items)

Planning and Design Post ∝ = 0.42 (npost = 23)	Mean Post	SD Post	Low 1, 2 1<=x<=2 Post %	Avg 3 x=3 Post %	High 4,5 4<=x<=5 Post %
Summary of items	3.37	1.22	22%	30%	48%
I plan (compose) my cyberhunt questions on paper before I type them on the computer (npost = 23)	3.91	1.38	22%	4%	74%
I type my cyberhunt questions directly on the computer (I do not design them on paper first) (npost = 23)	2.83	1.67	52%	0%	48%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 43D: Planning skills: Statistical Significance and Practical Significance

		Mean			Diff.	Statistical Significance t-Test			Practical significance
Pre ∝ = 0.90 Post ∝ = 0.85	n	Pre	Post	Diff	Std. Dev.	t-value	df	p	Cohen's d
Planning	26	2.92	4.13	1.21	0.70	8.86	25	.000	1.74
Statistical significance: p .000 implies < .0005									
Practical significance: Cohen's d									
0-0.19 Not significant	0.20-0.49 Small difference				0.50-0.79 Moderate difference			0.80+ Large difference	

Table 44B: Goal setting: Aspects which received attention according to the journals

Goal setting: Aspects which received attention		
Empowerment of learners: Computer Literacy	Posing relevant questions	Collaboration with others
Empowerment of teachers: Computer Literacy	Level of learners / Audience	Catching up where I lost out
Helping others	Topic	Saving / Copying
Using the Internet	Where to obtain information / Internet / Searching for Information	Helping others to achieve their goals
Designing cyberhunt	Keywords	Opening documents, Saving & Typing
Motivating learners / Making it interesting to them	Finishing on time	Gaining more knowledge / Understanding
Implementation in classroom	Hyper linking	Tabbing between Word and Internet Explorer
Confidence building	Motivating learners / Making it interesting to them	Saving as HTML files
Staff Development	Designing cyberhunt	Writing the memorandum
Providing a service to the school and community	Copying and Pasting	Collaborating with others

Table 45A: Audience (Summary and items)

Audience Pre ∝ = 0.84 Post ∝ = 0.77 (npre = 27, npost = 26)	Mean Pre	 Post	SD Pre	 Post	Low 1,2 1<=x<=2 Pre %	 Post %	Avg 3 x=3 Pre %	 Post %	High 4,5 4<=x<=5 Pre %	 Post %
I often think about the people who will be using my project (npre = 27, npost = 26)	3.33	3.73	1.36	1.28	30%	19%	22%	15%	48%	65%
I find it easy to present my ideas to other people (npre = 26, npost = 25)	2.58	4.04	1.36	0.84	54%	0%	19%	32%	27%	68%
I insert relevant pictures into my projects to help my learners to understand the topic better (npre = 27, npost = 26)	2.52	3.62	1.55	1.3	59%	19%	11%	27%	30%	54%
Projects/Presentations should help people to make connections among ideas (npre = 27, npost = 26)	3.59	4.31	1.25	0.84	22%	4%	26%	12%	52%	85%
I try to present my information in such a way that the people who would look at my project would easily understand what my project is about (npre = 26, npost = 26)	3.27	4.38	1.22	0.94	35%	8%	31%	8%	35%	85%
I space my text in project assignments in such a way that my learners (users) will be able to read easily (or do not get easily lost) (npre = 26, npost = 26)	3.42	4.27	1.47	0.92	31%	4%	23%	19%	46%	77%

Audience (Summary of items) Pre ∝ = 0.84 Post ∝ = 0.77 (npre = 27, npost = 26)	Mean Pre	 Post	SD Pre	 Post	Low 1,2 1<=x<2.6 Pre %	 Post %	Avg 3 2.6<=x=3.4 Pre %	 Post %	High 4,5 3.4<x<=5 Pre %	 Post %
Summary of items	3.12	1.02	4.06	0.70	26%	0%	48%	19%	26%	81%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 45B: Thinking about their audience: Statistical Significance and Practical Significance

Pre ∝ = 0.84 Post ∝ = 0.77	n	Mean Pre	Post	Diff	Diff. Std. Dev.	Statistical Significance t-Test t-value	df	p	Practical significance Cohen's d
Audience	26	3.10	4.06	0.96	0.70	6.98	25	.000	1.37

Statistical significance: p

.000 implies < .0005

Practical significance: Cohen's d

0-0.19 Not significant	0.20-0.49 Small difference	0.50-0.79 Moderate difference	0.80+ Large difference

Table 46: Presentation

Presentation	Mean	SD	Low 1, 2 1<=x<=2	Avg 3 x=3	High 4,5 4<=x<=5
	Post	Post	Post %	Post %	Post %
I use consistent (same type) fonts and fontsizes throughout my cyberhunt design (npre=24)	3.25	1.57	33%	21%	46%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 47A: Computer and design skills (Summary and items)

Computer Skills	Mean		SD		Low 1,2		Avg 3		High 4,5	
Pre ∝ = 0.98 Post ∝ = 0.93					1<=x<=2		x=3		4<=x<=5	
(npre = 24, npost = 24)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
I am comfortable using a computer / I find it easy to work on the computer (npre = 24, npost = 24)	2.96	4.63	1.46	0.65	38%	0%	33%	8%	29%	92%
I have the skills to use the computer effectively (npre = 24, npost = 24)	2.46	4.08	1.47	1.06	54%	8%	13%	13%	33%	79%
I have the necessary computer skills to help my learners who have difficulty in using the computer (npre = 24, npost = 24)	2.67	4.17	1.46	0.82	46%	4%	21%	13%	33%	83%
Create folders (npre = 24, npost = 24)	2.33	3.83	1.49	1.13	58%	13%	17%	21%	25%	67%
Save documents (npre = 24, npost = 24)	3.58	4.83	1.72	0.38	29%	0%	8%	0%	63%	100 %
Save a webpage (npre = 24, npost = 24)	1.58	2.92	1.06	1.28	88%	29%	4%	42%	8%	29%
Save files in html or htm mode (npre = 23, npost = 23)	1.43	2.78	0.66	1.17	91%	39%	9%	30%	0%	30%
Find saved files (npre = 24, npost = 24)	2.88	4.54	1.54	0.78	42%	4%	21%	4%	38%	92%
Copy and paste text (npre = 24, npost = 24)	2.71	4.17	1.65	1.09	46%	8%	17%	13%	38%	79%
Insert hyperlinks into a document (npre = 24, npost = 24)	1.96	3.33	1.40	1.37	71%	29%	17%	21%	13%	**50%**
Open documents	3.04	4.42	1.63	1.10	46%	8%	8%	8%	46%	83%
Format text (bold, underline, change size, change fonts) (npre = 24, npost = 24)	3.17	4.50	1.71	0.83	42%	4%	4%	8%	54%	88%
Insert pictures, images or diagrams into a document (npre = 24, npost = 24)	2.50	3.46	1.59	1.50	50%	25%	21%	25%	29%	**50%**
Create bullets & numbered text (npre = 24, npost = 24)	2.88	4.21	1.73	1.22	46%	13%	13%	13%	42%	75%

Insert tables into a document (npre = 24, npost = 24)	2.42	3.54	1.67	1.61	58%	29%	13%	8%	29%	63%
Use a browser e.g. Internet Explorer (npre = 24, npost = 24)	1.88	3.79	1.39	1.22	75%	13%	13%	21%	13%	67%
Do searches on the Internet to search for information (npre = 24, npost = 24)	2.00	4.08	1.53	1.10	71%	8%	13%	17%	17%	75%
Computer Skills (Summary of items)	Mean		SD		High 1,2		Avg 3		High 4,5	
Pre ∝ = 0.98 Post ∝ = 0.93					1<=x<2.6		2.6<=x=3.4		3.4<x<=5	
(npre = 24, npost = 24)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
Summary of items	2.32	1.20	3.67	0.76	63%	13%	21%	17%	17%	71%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement. References to presentations (PowerPoint) were excluded as participants designed their cyberhunts in Word.

Table 47B: Computers skills: Statistical Significance and Practical Significance

		Mean			Diff.	Statistical Significance t-Test			Practical significance
Pre ∝ = 0.98 Post ∝ = 0.93	n	Pre	Post	Diff	Std. Dev.	t-value	df	p	Cohen's d
Computer skills and design	24	2.32	3.67	1.35	1.03	6.41	23	.000	1.31

Statistical significance: p

.000 implies < .0005

Practical significance: Cohen’s d

0-0.19 Not significant	0.20-0.49 Small difference	0.50-0.79 Moderate difference	0.80+ Large difference

Table 48: With what did you help these people? (semi-closed-open-ended questionnaire)

With what did you help these people?	
Accessing Internet	They could not access Internet (Teacher 2)
	Get to Internet (Teacher 18)
Searching for Information / Exploring information	Logging in, searching for information, googling (Teacher 37)
	On MS Word inserting a picture and the Internet (exploring and choosing links) (Teacher 28)
	I showed them how to copy and paste and how to search for information (Teacher 20)
	To log on and google about a little knowledge I have (Teacher 1)
	Browsing for info in the Internet. Open google. Do cyberhunt. Pasting. Copying (Teacher 11)
	Get information from the Internet, design cyberhunt and typing (Teacher 36)
	I showed her how to start from the website address and google for information (Teacher 3)
Tabbing between Internet Explorer & Word	Getting between Internet and Microsoft Word (Teacher 40)
Finding Pictures	To find pictures (Teacher 40)
	Formatting, Inserting pictures, Saving documents (Teacher 26)
	On MS Word inserting a picture and the Internet (exploring and choosing links) (Teacher 28)
General Computer Skills	By sharing and explaining things or aspects they did not understand (Teacher 27)
	To get into cyberhunt (Teacher 9)
Saving Documents	Formatting, Inserting pictures, Saving documents (Teacher 26)
	Opening and closing file and how to save it (Teacher 5)
Copy and Paste	Going through the Internet and saving information about something and paste it to another programme (Teacher 29)
	I showed them how to copy and paste and how to search for information (Teacher 20)
	With how to log on/off, select program, how to copy and paste (Teacher 19)
	How to log in, how to copy and paste the hyperlink, how to open the word document (Teacher 45)
	Browsing for info in the Internet. Open google. Do cyberhunt. Pasting. Copying (Teacher 11)
Hyperlinking	How to open it and when you want to go to the Internet you have to write the addres first or topic (Teacher 47)
	How to log in, how to copy and paste the hyperlink, how to open the word document (Teacher 45)
	I showed her how to start from the website address and google for information (Teacher 3)
Cyberhunt Design	How to set up a cyberhunt (Teacher 38)
	Get information from the Internet, design cyberhunt and typing (Teacher 36)

Table 49: With what did the participants need assistance? (semi-closed-open-ended questionnaire)

With what did you need help or assistance during the project?	
Saving	Saving my cyberhunhunt (Teacher 2) To save my work (Teacher 20) Logging in. Saving information. Designing a cyberhunt (Teacher 34) Then I also needed help in doing copuing and pasting was also helped in saving my document so as to be able to open it again (Teacher 11)
Pasting	Pasting files (Probably means text or hyperlinks) (Teacher 37) Copy and paste. To save my work (Teacher 20) Cut and paste (Teacher 6) Then I also needed help in doing copying and pasting was also helped in saving my document so as to be able to open it again (Teacher 11) How to edit, copy, minimize, open document, edit and paste (Teacher 3)
Copying	Copying the web address to microsoft word (Teacher 40) How to copy the web address to microsoft word (Teacher 40) With integration. With copy linking the two (Word and Internet) (Teacher 28) I was struggling to copy and paste the email [html] address (Teacher 29)
Finding Information	When checking for information on the computers (fiddling with it) (Teacher 9) How to search something I don't know what to go to (Teacher 47) Log on. Finding information (Teacher 43) To get to Internet and to search for other things in Internet (Teacher 18)
Basic Computer Skills	As it was my first time to use computer I asked almost evrything. I needed help in how to log on/off, in how to use capital letters, to do bullets, numbering, insert pictures, etc. (Teacher 19) My friends, colleagues and facilitator to log on, off, cyberhunt, Internet exploration and typing skill (Teacher 36) How to edit, copy, minimize, open document, edit and paste (Teacher 3)
Cyberhunt Design	Designing a cyberhunt (Teacher 34)

Table 50: With what did participants need assistance according to their journals?

What do you find difficult? Or with what do you need more help?	4 June 2008	29 July 2008	13 August 2008	20 August 2008
Basic computer skills	Finding a font, going back when I am lost highlighting and underlining. Making corrections when I made a mistake (Teacher 44) Accessing internet is still tricky for me. Pasting Internet address on the document I have typed (Teacher 33) Copying and pasting the address to a document created on word (Teacher 26) To search for something, to underline words, use bold words (Teacher 21)	Yes, to copy and paste to Microsoft word	Cut and paste seems to be a bit of a struggle (Teacher 37)	Cut and Paste (Teacher 6) Copying and pasting (Teacher 11)
Internet skills	I want to know more or how to network through internet (Teacher 45) More knowledge on searching for information through an Internet (Teacher 51) Using the Internet to download information because I started late to attend this training only the two past days (Teacher 48) To be able to enter in the Internet (Teacher 22) I am still not sure how to surf to the computer looking for other information except the one that I was shown (Teacher 55) Log on or surfing the internet and cyber hunt (Teacher 50) Nothing difficult so far in typing. I find difficult in Internet (Teacher 47)			
Typing skills	I would like to be clearer in implementing cyber hunt. Steps to follow when designing a cyber hunt. And if I could improve my typing skills as I am currently take too long to type the question (Teacher 12) I want to work on my typing skills i.e. key board skills. I will be pleased also if everything we do can be compiled in the form of a module because we are expected to go back to our schools and train our colleagues (Teacher 11)		Basic typing skills (Teacher 36) To be faster in typing speed (Teacher 48)	

What do you find difficult? Or with what do you need more help?	4 June 2008	29 July 2008	13 August 2008	20 August 2008
Cyberhunt design process	I would like to be clearer in implementing cyber hunt. Steps to follow when designing a cyber hunt. And if I could improve my typing skills as I am currently take too long to type the question (Teacher 12)			
Saving information & Finding saved information	Saving the information. Going back to the information (Teacher 32) I find it difficult to find saved document. Typing I'm little but bit behind i. e. I am struggling (Teacher 36) When the information disappears from the screen, I struggle to get it (Teacher 9)		Unable to search [find] for information that I have saved last time (Teacher 32)	I find it difficult to check from my previous document (Teacher 36) Sometimes work that I save it get lost. I want to be able to locate my work wherever it is saved (Teacher 33) Yes I have lost my file (Teacher 5) Yes saving on elf document (Teacher) Saving on the web page (Teacher 40) Saving the file as a web page (Teacher 40) Yes, of course creating an HTML file and saving it on the web page. But I was able to slowly grasp what it is all about (Teacher 33)
Finding pictures	I found that it is difficult to get pictures, to search for information. I need help in computer basic as it is my first time to use computer (Teacher 19) I need more help in computer basics, because it is my first time to use computer. I am still struggling in searching information and getting pictures (Teacher 20)		Taking a picture and paste it (Teacher 50)	

Table 51A: Confidence in using computer as a teaching and learning tool (Summary and items)

Confidence in using computer as a teaching & learning tool Pre ∝ = 0.95 Post ∝ = 0.95	Mean		SD		Low 1,2 1<=x<=2		Avg 3 x=3		High 4,5 4<=x<=5	
(npre = 24, npost = 24)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
I have adequate knowledge about how to use computers in my classroom for teaching and learning (npre = 24, npost = 24)	1.75	3.75	1.07	1.07	83%	13%	8%	21%	8%	67%
I have the necessary computer / ICT skills to assist my learners within the computer classroom (npre = 24, npost = 24)	2.25	3.88	1.29	0.90	63%	4%	21%	21%	17%	75%
I am able to assist my learners within the computer classroom (npre = 24, npost = 24)	2.25	4.13	1.33	0.95	67%	8%	13%	13%	21%	79%
I have the required knowledge to manage the computer / ICT classroom (npre = 24, npost = 24)	2.17	3.63	1.27	1.01	71%	17%	13%	25%	17%	58%
I have the required knowledge to provide appropriate feedback to my learners related to computer usage (npre = 24, npost = 24)	2.17	3.92	1.27	0.93	71%	8%	13%	21%	17%	71%

Confidence in using computer as a teaching & learning tool (Summary of items) Pre ∝ = 0.95 Post ∝ = 0.95	Mean		SD		High 1,2 1<=x<2.6		Avg 3 2.6<=x=3.4		High 4,5 3.4<x<=5	
(npre = 24, npost = 24)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
Summary of items	2.12	1.15	3.86	0.88	71%	8%	13%	17%	17%	75%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 51B: Confidence in using computer as a teaching and learning tool : Statistical Significance and Practical Significance

		Mean			Diff.	Statistical Significance t-Test			Practical significance
Pre ∝ = 0.95 Post ∝ = 0.95	n	Pre	Post	Diff	Std. Dev.	t-value	df	p	Cohen's d
Confidence in using computer as a teaching & learning tool	24	2.12	3.86	1.74	1.12	7.64	23	.000	1.56

Statistical significance: p

.000 implies < .0005

Practical significance: Cohen's d

0-0.19 Not significant	0.20-0.49 Small difference	0.50-0.79 Moderate difference	0.80+ Large difference

Table 51C: Computer knowledge to manage the teaching and learning (Summary and items)

Computer knowledge to manage the teaching and learning Post ∝ = 0.81	Mean	SD	Low 1, 2 1<=x<=2	Avg 3 x=3	High 4,5 4<=x<=5
(npost = 23)	Post	Post	Post %	Post %	Post %
Summary of items	3.77	0.99	13%	26%	61%
I find it easy to design cyberhunts (npost = 24)	3.83	1.20	13%	29%	58%
I have the necessary skills to implement cyberhunts within the classroom (npost = 23)	3.78	1.31	17%	17%	65%
I know how to use computer technology effectively to teach subject matter with cyberhunts in my classroom (npost = 23)	3.70	0.93	9%	35%	57%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 51D: Assessment

Assessment	Mean	SD	Low 1, 2 1<=x<=2	Avg 3 x=3	High 4,5 4<=x<=5
	Post	Post	Post %	Post %	Post %
I know how to assess cyberhunt projects (npost = 24)	3.54	1.18	21%	35%	54%

Note. The abbreviation npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 52A: Reflection (Summary and items)

Reflection Pre ∝ = 0.88 Post ∝ = 0.91	Mean		SD		Low 1,2 1<=x<=2		Avg 3 x=3		High 4,5 4<=x<=5	
(npre = 27, npost = 26)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
I think that it is important that other teachers look a t my project to give advice. (npre = 27, npost = 26)	3.56	4.35	1.40	0.89	26%	4%	15%	4%	59%	92%
I use feedback (hints and critique) from other teachers to improve my project (npre = 27, npost = 26)	3.15	4.04	1.29	1.11	37%	12%	26%	12%	37%	77%
I can provide useful feedback to my fellow teachers about the quality of their projects (npre = 25, npost = 25)	2.36	4.08	1.41	0.86	64%	0%	12%	32%	24%	68%
After I have completed a project, I think a lot how I could improve it in future. (npre = 26, npost = 26)	3.88	4.35	1.28	1.06	23%	4%	15%	19%	62%	77%
I continually strive to improve the quality of my project (npre = 27, npost = 26)	3.67	3.96	1.24	1.37	19%	15%	30%	12%	52%	73%
I often think how I could improve my project while I am busy working on it. (npre = 27, npost = 26)	3.52	4.19	1.40	0.90	30%	0%	19%	31%	52%	69%
I think a lot what the people will think about my project (npre = 26, npost = 25)	3.00	4.08	1.33	1.00	38%	4%	23%	20%	38%	76%
Knowing that others will be using my project motivates my to improve the quality of my project (npre = 26, npost = 26)	3.42	4.42	1.36	0.81	27%	0%	31%	19%	42%	81%

After I have completed a project, I read through my completed project to check for mistakes and to correct any mistakes. (npre = 27, npost = 26)	3.70	4.42	1.17	0.76	22%	0%	19%	15%	59%	85%
I make changes to how my project looks, after I have completed it in order that my readers will find it more attractive / appealing. (npre = 24, npost = 24)	2.96	4.33	1.27	0.82	42%	4%	33%	8%	25%	88%
After I have completed a project, I read through my completed project again to check whether I have answered all the questions (npre = 23, npost = 22)	3.35	4.27	1.43	1.03	26%	5%	22%	14%	52%	82%
I can recommend the regular use of reflection sheets in a project by learners (npre = 26, npost = 26)	3.54	4.19	1.30	0.94	23%	4%	35%	12%	42%	85%
I can recommend the regular use of reflection sheets in a project by teachers (npre = 27, npost = 26)	2.96	4.08	1.43	1.13	41%	8%	26%	12%	33%	81%

Reflection (Summary of items) Pre ∝ = 0.88 Post ∝ = 0.91	Mean		SD		High 1,2 1<=x<2.6		Avg 3 2.6<=x=3.4		High 4,5 3.4<x<=5	
(npre = 27, npost = 26)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
Summary of items	3.32	0.91	4.21	0.66	22%	4%	37%	12%	41%	85%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 52B: Reflection and evaluation: Statistical Significance and Practical Significance

		Mean			Diff.	Statistical Significance t-Test			Practical significance
Pre ∝ = 0.88 Post ∝ = 0.91	n	Pre	Post	Diff	Std. Dev.	t-value	df	p	Cohen's d
Reflect and evaluate	26	3.31	4.21	0.90	0.91	5.05	25	.000	0.99

Statistical significance: p

.000 implies < .0005

Practical significance: Cohen's d

0-0.19 Not significant	0.20-0.49 Small difference	0.50-0.79 Moderate difference	0.80+ Large difference

Table 52C: New skill: Reflection and Goal sheet (Summary and items)

New skill: Reflection and Goal sheet Post ∝ = 0.86	Mean	SD	Low 1, 2 1<=x<=2	Avg 3 x=3	High 4,5 4<=x<=5
(npost = 23)	Post	Post	Post %	Post %	Post %
Summary of items	4.13	0.92	9%	9%	83%
The reflection sheets that I complete during each session helped me with my planning for the next session (npost = 23)	4.00	1.17	4%	39%	57%
I will let learners define their goals for the different learning areas to help them to monitor their progress (npost = 24)	4.13	0.90	4%	21%	75%
I will use similar reflection sheets on a regular basis in my teaching and learning to help me to get a better understanding of how my learners experience my class (npost = 23)	4.13	1.06	4%	22%	74%
The reflection sheets that I complete during each session made it easy for me to express how I feel about issues and my progress (npost = 23)	4.26	1.21	9%	9%	83%

Table 52D: Mental effort (Summary and items)

Pre ∝ = 0.74 Post ∝ = 0.73	Mean		SD		Low 1,2 1<=x<=2		Avg 3 x=3		High 4,5 4<=x<=5	
(npre = 26, npost = 26)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
I concentrate a lot while busy with projects. (npre = 26, npost = 25)	3.46	4.44	1.14	0.82	27%	0%	23%	20%	50%	80%
I really have to think much when I develop a project. (npre = 26, npost = 27)	3.38	3.63	1.27	1.15	31%	19%	23%	22%	46%	59%
Projects are a lot of hard work. (npre = 27, npost = 26)	3.59	2.96	1.45	1.25	26%	31%	19%	42%	56%	27%
When I am busy with a project, I stay focused and my attention is not easily distracted. (npre = 26, npost = 25)	2.96	3.96	1.15	1.02	46%	4%	19%	28%	35%	68%
I think a lot about ideas when I do a project (npre = 25, npost = 24)	3.16	4.00	1.25	1.10	40%	4%	20%	33%	40%	63%
It is often hard for me to decide what to do for an assignment. (npre = 26, npost = 26)	2.54	3.54	1.27	1.39	62%	19%	15%	23%	23%	58%
It’s hard to know in what order to put my ideas. (npre = 26, npost = 26)	3.04	3.50	1.34	1.30	46%	23%	19%	27%	35%	50%
I often lose track of time when I am working on a project. (npre = 26, npost = 26)	2.96	3.38	1.28	1.36	42%	27%	23%	23%	35%	50%

Mental effort (Summary of items) Pre ∝ = 0.74 Post ∝ = 0.73	Mean		SD		Low 1,2 1<=x<2.6		Avg 3 2.6<=x=3.4		High 4,5 3.4<x<=5	
(npre = 26, npost = 26)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
Summary of items	3.08	3.68	0.78	0.69	31%	4%	38%	35%	31%	62%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 52E: Mental effort: Statistical Significance and Practical Significance

		Mean			Diff.	Statistical Significance t-Test			Practical significance
Pre ∝ = 0.74 Post ∝ = 0.73	n	Pre	Post	Diff	Std. Dev.	t-value	df	p	Cohen's d
Mental effort	26	3.08	3.68	0.60	0.85	3.59	25	.001	0.70
Statistical significance: p .000 implies < .0005									
Practical significance: Cohen's d									
0-0.19 Not significant	0.20-0.49 Small difference				0.50-0.79 Moderate difference			0.80+ Large difference	

Table 53A: Which cyberhunt activity did you like best?

Which cyberhunt activity did you like best? n = 21	Answering questions in a pre-designed cyberhunt?	Designing your own cyberhunt	I liked both equally
	n = 2	n = 12	n = 7
	10%	57%	33%

Table 53B: Do you enjoy this type of cyberhunt learning?

Do you enjoy this type of cyberhunt learning? Why or why not? n = 24	YES	NO
	n = 24	n = 0
	100%	0%

Table 54: Enjoying cyberhunts as new tool and Internet skills (Summary and items)

Enjoying: New tool and skills Post ∝ = 0.72 (npost = 24)	Mean Post	SD Post	Low 1, 2 1<=x<=2 Post %	Avg 3 x=3 Post %	High 4,5 4<=x<=5 Post %
Summary of items	4.63	0.54	0%	4%	96%
I enjoy cyberhunts as a teaching and learning strategy to introduce searching for information on the Internet to my learners (npost = 23)	4.52	0.67	0%	9%	91%
I enjoy cyberhunts as a teaching and learning strategy to introduce the Internet to my learners (npost = 24)	4.71	0.55	0%	4%	96%

Table 55: Teacher motivation during cyberhunts: What is causing it? (semi-closed-open-ended questionnaire)

MOTIVATIONAL ASPECT	TEACHERS RESPONSES
Feeling empowered	[I have learned a] skill that nobody will take from me. It's just like learning how to drive a car. I learn to work with others, move, help and discover information for myself (Teacher 36)
	It is developing me and also it is an opportunity to advance in technology (Teacher 2)
	Learn more about many things and search for certain things concerning a lesson (Teacher 18)
Realizing a goal	I learn more about [the] Internet that is what I wanted to know. The learners must be computer literate (Teacher 1)
	To learn the computer it was my dream and I didn't have money to do it so this is my time (Teacher 47)
Vision	The dream/vision of being able to use cyberhunt in my class in future (Teacher 2)
Learning new skills	I enjoy it because I've learnt how to use the Internet. I also got a lot of information that I did not know about (Teacher 27), I gained a lot of information (Teacher 27)
	Because it opens my understanding. I acquire different skills during cyberhunt learning as I've mentioned them above (Teacher 11)
	Learning something new everyday (Teacher 26)
New way of teaching and learning: Linking theory with practice	The fact that I want to show the kids how cyberhunts can improve our schooling (Teacher 38)
	The project taught me that gone are the days of giving learners all the information. They also have to wonder around (Teacher 26)
	The fact that I feel this info I can use it in my class, keeps me motivational (Teacher 28)
	It's more exploring, you search information on and you use it (Teacher 28)
	Because it give a chance to a learner to explore more information (Teacher 20)
	Learners are able to use the computer in more than one way (Teacher 45)

	Learners will be exposed to more information. [Thus she implies that the learners are limited to info to which they are exposed to currently, they don't have the resources such as a library] (Teacher 19)
Competence: becoming experts	I learned new things about it as I said before that I miss some classes but I managed to grasp information from the others and after that I was the one who was being asked about certain things (Teacher 29)
	Each and every time something is done I managed to grasp it and be able to it after some time (Teacher 29)
	It helped me to get information using Internet (Teacher 42)
	To think I am moving a step forward into being computer literate (Teacher 34)
Opens new possibilities and different thinking	It opened my scope (Teacher 26)
Different viewpoints and decision making	Opportunity to access different Internet requesting one topic and yet get different views on the same topic (Teacher 2)
	Internet usage. It provides you with a lot of information and you decide what is useful (Teacher 28)
	The variety of info available (Teacher 38)
	If you feel that the information is not what you expected, you have a chance to change your topic (Teacher 19)
Collaboration	Working with others and being able to access as much information as possible (Teacher 26)
	The group I worked with (Teacher 19)
Develops creativity	Allows you to be creative and informative (Teacher 28)
Learning new skills and finding interesting information	You maneuver a lot of information yourself when given instruction. It's interesting when you get it yourself / do it yourself (Teacher 9)
	All the stuff that is done it is interesting because at the end of the day you want the best (Teacher 29)
	Searching information (Teacher 20)
	Searching for information. Selecting text and the information of the questions (Teacher 43)
	Searching for a particular topic of a lesson. Know more information about it (Teacher 18)
Control	The fact that you are able to decide what you want to do (Teacher 11)
Presentation style / format	It is practical and well explained (Teacher 9)
	The facilitator's explanations and gives help when everyone even you need it. Prepared to teach or show when you get confused (Teacher 9)
	The way it is conducted it makes me want to be always in class as long as the session is still continuing (Teacher 11) and I never got bored during the sessions; instead I always wanted to know more (Teacher 11)
	Facilitator was wiling to help us to learn something from the project. Peers were also hands on and willing to learn (Teacher 36)

Table 56: Is the role of the teacher different in this cyberhunt activity than in normal classroom activities?

Is the role of the teacher different in this cyberhunt activity than in normal classroom activities? n = 21	YES	NO
	n = 17	n = 4
	81%	19%

Table 57: Role of the teacher in the cyberhunt teaching and learning strategy (semi-closed-open-ended questionnaire)

ROLE OF TEACHER	TEACHERS RESPONSES
Facilitator	You also facilitate, but here more info is to be discovered by learners. Sometimes in class you are forced to provide them with information because you lack resources since they have a problem going to the library. (Teacher 2)
	In this curriculum learner play vital role as participants and teacher facilitator computer literacy part of the curriculum (Teacher 5)
	To facilitate and give explanations on what they do not understand (Teacher 27)
Skills developer	Because you are helping them to develop skills in using computer (Teacher 20)
Supervisor	The teacher is not the sole source of information learners can check for themselves under the supervision of a teacher (Teacher 43)
Guide & Provide feedback	Guiding learners to follow instructions. (Teacher 2)
	To be there for those who are struggling and be patient, honest and faithful and treat the learners equally (Teacher 29)
	Guide the learners through out the session (Teacher 45)
	Guidance & helping (Teacher 5)
	Feedback. Helper. Assess problem and progress. Motivate (Teacher 36)
Mentor	The teacher should act as a facilitator, a mentor and helper (Teacher 26)
Mediator	To mediate between the learner and the text (Teacher 20)
Helper & Problem solver	To help where necessary (assist) (Teacher 46)
	To facilitate, help where problems arise (Teacher 38)
	Guidance & helping (Teacher 5)
	Feedback. Helper. Assess problem and progress. Motivate (Teacher 36)
Motivator	Feedback. Helper. Assess problem and progress. Motivate (Teacher 36)

Table 58: Is cyberhunt learning different than the learning in your normal class?

Is cyberhunt learning different than the learning in your normal class? n = 24	YES	NO
	n = 23	n = 1
	96%	4%

Table 59: Role of the learner in the cyberhunt teaching and learning strategy

ROLE OF LEARNER	TEACHERS RESPONSES
Discover & find knowledge	Self discovery. Problem solving. Thinking. Experimentation (Teacher 36)
	You also facilitate, but here more info is to be discovered by learners. Sometimes in class you are forced to provide them with information because you lack resources since they have a problem going to the library. (Teacher 2)
	Because they find the knowledge and learning activities on their own while in the normal class you are teaching them knowledge and prepare activities for them. But here all their interaction is with the computers (Teacher 11)
	To explore and answer the questions (Teacher 28)
	To see if they can find the answers (Teacher 38)
	It is to go through the information given and give answers on questions or manipulate the information has been given (Teacher 45)
Designer and skills implementer	Learners will be able to operate on a computer, find information on their own, rather than [the teacher] giving out info (Teacher 34)
	Learner use computer skill. Work in groups. Asses their own work (Teacher 36)
Reading	Read with understanding, applying what they already know. Answer questions (Teacher 2)
	The learner look for information. Read. (Teacher 11)
	It is to go through the information given and give answers on questions or manipulate the information has been given (Teacher 45)
Active: Hands-on	Learners are hands-on working on their own other than in the class when they are given the information (Teacher 45)
	Teacher becomes more (hands-on) involve. More time is spending doing [by learners] (Teacher 38)
	The teacher will not be the one to bring information or doing the talking, learners will when reporting their findings (Teacher 34)
	They should be active participants wanting to reach the outcomes of the lesson (Teacher 26)
Collaborate	Learner use computer skill. Work in groups. Asses their own work (Teacher 36)
Reporters	The teacher will not be the one to bring information or doing the talking, learners will when reporting their findings (Teacher 34)
Assessors	Learner use computer skill. Work in groups. Asses their own work (Teacher 36)

Table 60: Would your learners enjoy this type of activity (cyberhunts)?

Would your learners enjoy this type of activity (cyberhunts)? n = 22	YES	NO
	n = 21	n = 1
	95.5%	4.5%

Table 61: Would your learners enjoy cyberhunt learning more than your normal class?

Would your learners enjoy cyberhunt learning more than your normal class? n = 24	YES	NO
	n = 21	n = 3
	87.5%	12.5%

Table 62: What should the teacher do to keep the learners motivated?

WHAT SHOULD THE TEACHER DO?	TEACHERS RESPONSES
Topic selection: Relevant	By choosing a topic that was done in class so that they can search for information (Teacher 27) Use a topic that is used in class and needs more reinforcement (Teacher 26) Finding interesting topics (Teacher 45)
Simplicity: Keep learners level in mind	Give them simple things / tasks to do first (Teacher 9) By selecting questions that are at their level and interesting (Teacher 20)
Visual stimulation	By inserting pictures (Teacher 19)
Clear explanations	At the beginning, tell them the address to look for so that they may get more practice and be used to the cyberhunts (Teacher 26)
Praise	Be amongst them help where you can / let them finish their task / praise when finished task (Teacher 9)
Stimulate	Stimulate them with questions. Encourage them to read with understanding and encourage the use of skimming, scanning and skipping skill in class. They should apply what they know. (Teacher 2)
Start in group context	Start in group activity (Teacher 36)
Encourage exploration	By allowing them to browse and se what the Internet can give (Teacher 11)
Show confidence in them	By showing confidence to them. they really need be sure exactly where to start and end (Teacher 5)
Choice	Give them different topics (Teacher 36)

Table 63A: Motivation and interest (Summary and items)

Motivation and Interest Pre ∝ = 0.74 Post ∝ = 0.74 (npre = 26, npost = 26)	Mean		SD		High 1,2 1<=x<=2		Avg 3 x=3		High 4,5 4<=x<=5	
	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
Doing projects help me to learn in an interesting way (npre = 26, npost = 26)	3.62	4.46	1.27	0.81	23%	0%	23%	19%	54%	81%
I like to work on projects (npre = 26, npost = 25)	3.35	4.08	1.55	1.00	31%	4%	19%	20%	50%	76%
I really enjoy projects as a way of learning about a subject (npre = 26, npost = 26)	3.54	4.19	1.36	1.10	27%	8%	19%	15%	54%	77%
When I have designed and completed a project, I feel like it's mine (npre = 26, npost = 26)	3.65	4.31	1.35	1.12	27%	12%	8%	4%	65%	85%
I find myself working on projects during my free time (npre = 26, npost = 25)	2.54	3.44	1.30	1.42	58%	24%	19%	20%	23%	56%
Computer projects are similar to other projects in class (npre = 26, npost = 26)	1.62	2.81	0.75	1.27	85%	38%	15%	35%	0%	27%
I do learn lots of new things during projects (npre = 26, npost = 25)	4.12	4.52	0.95	0.65	4%	0%	27%	8%	69%	92%
I remember more about a topic when I have done a project (npre = 26, npost = 25)	3.54	4.32	1.21	0.75	23%	0%	23%	16%	54%	84%
I learn more when I do a project than with other types of learning (npre = 26, npost = 26)	2.54	3.42	1.17	1.17	54%	12%	27%	42%	19%	46%
I think projects are boring (npre = 26, npost = 26)	2.08	2.27	1.49	1.59	73%	62%	8%	12%	19%	27%
The projects that I do at school are all more or less the same (npre = 26, npost = 26)	2.27	3.19	1.22	1.50	65%	35%	19%	19%	15%	46%
I often think about other things not related to my project when I am busy with a project (npre = 26, npost = 26)	2.23	2.77	1.18	1.61	54%	46%	35%	19%	12%	35%
I am positive about my teaching and learning (npre = 26, npost = 26)	3.85	4.42	1.22	0.86	15%	4%	23%	12%	62%	85%

I enjoy teaching and learning (npre = 26, npost = 26)	4.12	4.58	0.95	0.64	4%	0%	27%	8%	69%	92%

Motivation and Interest (Summary of items)	Mean		SD		High 1,2		Avg 3		High 4,5	
Pre ∝ = 0.74 Post ∝ = 0.74					1<=x<2.6		2.6<=x=3.4		3.4<x<=5	
(npre = 26, npost = 26)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
Summary of items	3.07	0.59	3.78	0.56	35%	0%	27%	27%	38%	73%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 63B: Motivation and interest: Statistical Significance and Practical Significance

		Mean			Diff.	Statistical Significance t-Test			Practical significance
Pre ∝ = 0.74 Post ∝ = 0.74	n	Pre	Post	Diff	Std. Dev.	t-value	df	p	Cohen's d
Motivation and interest	26	3.07	3.78	0.70	0.54	6.67	25	.000	1.31

Statistical significance: p

.000 implies < .0005

Practical significance: Cohen’s d

0-0.19 Not significant	0.20-0.49 Small difference	0.50-0.79 Moderate difference	0.80+ Large difference

Table 64: Motivation and interest

Motivation and Interest	Mean	SD	Low 1, 2	Avg 3	High 4,5
			1<=x<=2	x=3	4<=x<=5
	Post	Post	Post %	Post %	Post %
Doing projects sure beats listening in class (npost = 24)	3.42	1.32	21%	29%	50%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 65A: Motivation and interest

Motivation and Interest	Mean	SD	Low 1, 2 1<=x<=2	Avg 3 x=3	High 4,5 4<=x<=5
	Post	Post	Post %	Post %	Post %
I like to work on projects where I am not allowed to use or work on the computer (npost = 24)	2.75	1.29	54%	21%	25%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 65B: Motivation and interest

Motivation and Interest	Mean	SD	Low 1, 2 1<=x<=2	Avg 3 x=3	High 4,5 4<=x<=5
	Post	Post	Post %	Post %	Post %
I would prefer to do projects in which we use the computer than projects in which we don't use computers (npost = 23)	4.26	0.86	4%	13%	83%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 66: Analogy

Analogy	Mean	SD	Low 1, 2 1<=x<=2	Avg 3 x=3	High 4,5 4<=x<=5
	Post	Post	Post %	Post %	Post %
This cyberhunt project is similar to other projects that I have done (npost = 23)	2.17	1.27	78%	9%	13%

Note. The abbreviation npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 67A: Benefits of computer projects: Computer as a new tool (Novelty / Preference)

Benefits of computer projects: Computer as a new tool: Novelty / Preference Post ∝ = 0.29	Mean	SD	Low 1, 2 1<=x<=2	Avg 3 x=3	High 4,5 4<=x<=5
	Post	Post	Post %	Post %	Post %
I can see the value and benefits of computer projects (npost = 24)	4.75	0.53	0%	4%	96%
Learners would enjoy cyberhunts as a teaching and learning strategy on the Internet for research more than normal non-Internet related research (npost = 22)	4.68	0.57	0%	5%	95%

Table 67B: Enjoying cyberhunts as new tool and Internet skills (Summary and items)

Enjoying: New tool and skills Post ∝ = 0.72	Mean	SD	Low 1, 2 1<=x<=2	Avg 3 x=3	High 4,5 4<=x<=5
(npost = 24)	Post	Post	Post %	Post %	Post %
Summary of items	4.63	0.54	0%	4%	96%
I enjoy cyberhunts as a teaching and learning strategy to introduce searching for information on the Internet to my learners (npost = 23)	4.52	0.67	0%	9%	91%
I enjoy cyberhunts as a teaching and learning strategy to introduce the Internet to my learners (npost = 24)	4.71	0.55	0%	4%	96%

Table 68: Do you think this project have benefited you in any way?

Do you think this project have benefited you in any way? n= 23	YES	NO
	n = 23	n = 1
	96%	4%

Table 69: The benefit that the cyberhunt project had on participating teachers (semi open closed questionnaire)

BENEFIT	RESPONSE
Could improve teaching	It is a good project. I think it can improve teaching in the entire country (Teacher 43)
	I feel they are good and will be of good use to learners (Teacher 34)
Introduce to new approaches	I like project because they keep one informed. You are always exposed to new approaches and gain more experience (Teacher 11)
	It is useful to me as an educator because I gained a lot of information (Teacher 27)
	Having lots of information to my disposal. Being more involved with my learners (Teacher 38)
Empowering	I feel empowered (Teacher 26)
	Now I can design my cyberhunt on my own (Teacher 20)
	I can do cyberhunt on my own (Teacher 42)
Prepare one for change	It has made me more prepared for changes that are taking place in education [pro-active]. (Teacher 2)
Becoming a facilitator to teach others how to design cyberhunts	I am very happy because I'll be helpful to my colleagues at my school (Teacher 19)
	Because today I can be able to explain it to new learners who don't understand it (Teacher 29)
	Plant the seed to my fellow teachers and learners (Teacher 36)
Creates interest	Excited, cannot wait to start (Anonymously)
Explore new horizons	Learners will be exposed to more information. [Thus she implies that the learners are limited to info to which they are exposed to currently, they don't have the resources such as a library] (Teacher 19)
Learn Internet skills	By learning to do a cyberhunt and to work on the Internet (Teacher 27)
	I have learnt to use the web to benefit the learners and myself (Teacher 26)
	Check for information. Do thing yourself. Gathering information is very interesting with the computer (Teacher 9)

Table 70A: Collaboration (Summary and items)

Collaboration Pre ∝ = 0.92 Post ∝ = 0.81 (npre = 26, npost = 26)	Mean		SD		Low 1,2 1<=x<=2		Avg 3 x=3		High 4,5 4<=x<=5	
	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
When I have a problem, I ask someone else to help me (npre = 26, npost = 26)	4.08	4.69	1.20	0.55	12%	0%	19%	4%	69%	96%
When I don't understand something, I would rather try and find out for myself than asking for help (npre = 25, npost = 26)	2.00	2.50	1.15	1.62	76%	58%	16%	13%	8%	29%
I find it easy to ask for help when I work in a group (npre = 26, npost = 26)	3.62	4.38	1.36	0.94	23%	4%	23%	19%	54%	77%
I find it easy to learn new things from group members (npre = 26, npost = 26)	3.85	4.58	1.32	0.76	15%	0%	23%	15%	62%	85%
When I do not understand something, I ask an expert in another group to help me (npre = 26, npost = 26)	4.08	4.73	1.13	0.45	12%	0%	23%	0%	65%	100%
When I do not understand something, I ask someone in my group that have knowledge about the area in which I need help (npre = 25, npost = 24)	4.08	4.67	1.15	0.48	12%	0%	24%	0%	64%	100%
When I do not understand something, I ask the expert in my group to help me (npre = 26, npost = 26)	4.15	4.69	0.97	0.55	8%	0%	15%	4%	77%	96%
When I do not understand something, I ask the facilitator or project leader to help me (npre = 26, npost = 25)	4.04	4.68	1.11	0.69	12%	4%	23%	0%	65%	96%
When I do not understand something, I ask someone from another group that have knowledge about the area in which I need help (npre = 26, npost = 26)	3.77	4.38	1.39	0.98	23%	4%	15%	12%	62%	85%
I find it easy to share my ideas with other group members (npre = 26, npost = 26)	4.08	4.62	1.16	0.70	12%	0%	15%	12%	73%	88%

I find it easy to raise my point of view when I work in a group to my group members (npre = 26, npost = 26)	3.92	4.38	1.09	0.85	12%	4%	27%	12%	62%	85%
I find it easy to express a different point of view about how to proceed with projects to other teachers (npre = 22, npost = 22)	2.95	3.95	1.05	0.84	32%	0%	50%	36%	18%	64%
I find it easy to show that I do not understand something about projects to teachers (npre = 26, npost = 26)	3.31	4.27	1.41	1.00	31%	4%	27%	15%	42%	81%
I find it easy to show that I do not understand something about projects to teachers from another group (npre = 26, npost = 25)	3.27	3.96	1.34	1.14	27%	16%	35%	16%	38%	68%
I find it easy to show that I do not understand something about projects to teachers from my group (npre = 26, npost = 25)	3.27	4.16	1.46	0.90	31%	4%	27%	20%	42%	76%
I find it easy to show to other group members that I do not understand something when I am working in a group (npre = 26, npost = 26)	3.73	4.42	1.22	0.76	15%	0%	31%	15%	54%	85%
I find it easy to collaborate (work together) with fellow teachers (npre = 26, npost = 26)	4.08	4.46	1.13	0.71	8%	0%	23%	12%	69%	88%
I prefer to work in a group with teachers from another school (npre = 26, npost = 25)	2.65	3.08	1.26	1.32	46%	28%	27%	28%	27%	44%
I prefer to work in a a group with teachers from my own school (npre = 26, npost = 25)	3.50	3.72	1.17	1.28	19%	20%	35%	12%	46%	68%
I prefer to work in a group on a project (npre = 26, npost = 25)	3.16	4.04	1.43	1.21	28%	8%	32%	20%	40%	72%
I find it more enjoyable to work in a group than as an individual (npre = 26, npost = 26)	2.96	4.15	1.48	1.08	50%	8%	15%	15%	35%	77%
Learning computer skills in groups are easier than learning it individually (npre = 26, npost = 26)	3.58	4.19	1.42	1.10	27%	8%	23%	15%	50%	77%

Overall I feel positive about working with others on a project (npre = 26, npost = 26)	3.73	4.50	1.40	0.76	23%	0%	19%	15%	58%	85%
Working in groups really makes projects better (npre = 26, npost = 25)	4.19	4.72	1.02	0.54	8%	0%	19%	4%	73%	96%
I prefer to work alone on a project (npre = 26, npost = 26)	3.96	3.23	1.25	1.63	19%	42%	8%	12%	73%	46%
I would rather work alone than working in a group (npre = 26, npost = 26)	2.12	2.64	1.34	1.58	73%	52%	12%	16%	15%	32%
I usually experience a lot of conflict in my group during group work (npre = 26, npost = 26)	1.85	2.04	1.29	1.59	81%	69%	4%	8%	15%	23%
When I work in a group, I often find that everyone keeps talking but very little really gets done. (npre = 26, npost = 26)	2.54	2.81	1.39	1.50	54%	42%	19%	19%	27%	38%
I feel confident that I can help my peers / fellow teachers when they do not know how to do something on the computer (npre = 26, npost = 25)	3.12	4.40	1.45	0.65	46%	0%	12%	8%	42%	92%

Collaboration (Summary of items) Pre ∝ = 0.92 Post ∝ = 0.81	Mean		SD		High 1,2 1<=x<2.6		Avg 3 2.6<=x=3.4		High 4,5 3.4<x<=5	
(npre = 26, npost = 26)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
Summary of items	3.44	0.70	4.05	0.42	15%	0%	35%	4%	50%	96%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 70B: Collaboration: Statistical Significance and Practical Significance

		Mean			Diff.	Statistical Significance t-Test			Practical significance
Pre $\propto = 0.92$ Post $\propto = 0.81$	n	Pre	Post	Diff	Std. Dev.	t-value	df	p	Cohen's d
Collaboration	26	3.44	4.05	0.61	0.62	5.00	25	.000	0.98
Statistical significance: p									
.000 implies < .0005									
Practical significance: Cohen’s d									
0-0.19 Not significant	0.20-0.49 Small difference				0.50-0.79 Moderate difference			0.80+ Large difference	

The over all picture of individualisation suggests that there was not a noticeable increase in the mean scores from their initial perceptions to their post perceptions. However, the Cronbach Alpha (□□) scores seem to indicate a very high level of reliability from the data generated. Yet, the the p value is not highly significant statistically and the Cohen’s d score was not applicable (See Table 4.31).

Table 70C: Individualisation: Statistical Significance and Practical Significance

		Mean			Diff.	Statistical Significance t-Test			Practical significance
Pre $\propto = 0.75$ Post $\propto = 0.60$	n	Pre	Post	Diff	Std. Dev.	t-value	df	p	Cohen's d
Individualisation	26	3.83	3.85	0.02	1.24	0.09	25	.928	n.a.
Statistical significance: p									
.000 implies < .0005									
Practical significance: Cohen’s d									
0-0.19 Not significant	0.20-0.49 Small difference				0.50-0.79 Moderate difference			0.80+ Large difference	

Table 70D: Collaboration: Helping others & Exchanging Ideas (Summary and items)

Collaboration: Helping others & Exchanging Ideas Post ∝ = 0.68 (npost = 24)	Mean Post	SD Post	Low 1, 2 1<=x<=2 Post %	Avg 3 x=3 Post %	High 4,5 4<=x<=5 Post %
Summary of items	4.52	0.56	0%	0%	100%
When I have a problem, I ask someone who is an expert in my class to assist or to help me (npost = 24)	4.67	0.56	0%	4%	96%
I really exchange ideas with the other members of the project team (npost = 23)	4.35	0.71	0%	13%	87%

Table 70E: Individualization (Summary and items)

Individualization Pre ∝ = 0.75 Post ∝ = 0.60	Mean		SD		Low 1,2 1<=x<=2		Avg 3 x=3		High 4,5 4<=x<=5	
(npre = 27, npost = 26)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
Doing projects give me a chance to develop my own point of view (npre = 27, npost = 26)	3.63	4.54	1.45	0.65	30%	0%	15%	8%	56%	92%
Group work in projects promotes personal growth (npre = 26, npost = 26)	4.00	4.62	1.10	0.64	12%	0%	23%	8%	65%	92%

Individualization (Summary of items) Pre ∝ = 0.75 Post ∝ = 0.60	Mean		SD		Low 1,2 1<=x<2.6		Avg 3 2.6<=x=3.4		High 4,5 3.4<x<=5	
(npre = 27, npost = 26)	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
Summary of items	3.80	1.15	3.85	0.58	22%	0%	19%	23%	59%	77%

Table 70F: The final product reflects the individual contributions

Individualization	Mean		SD		Low 1,2 1<=x<=2		Avg 3 x=3		High 4,5 4<=x<=5	
	Pre	Post	Pre	Post	Pre %	Post %	Pre %	Post %	Pre %	Post %
The output (product) of group work reflects the individual contributions of participants (npre = 25, npost = 25)	2.88	3.44	1.42	1.42	44%	20%	24%	20%	32%	60%

Table 70G: Confidence

Confidence	Mean	SD	Low 1, 2 1<=x<=2	Avg 3 x=3	High 4,5 4<=x<=5
	Post	Post	Post %	Post %	Post %
I find that working in groups made me feel more confident to learn about cyberhunts (npost= 24)	4.58	0.65	0%	8%	92%

Table 71: With whom did you feel more comfortable while searching for answers to your problems or questions? (semi-closed-open-ended questionnaire)

With whom did you feel more comfortable while searching for answers to your problems or questions?	Facilitator	Fellow teacher	By finding out on your own	Both facilitators and fellow teacher
n=25	9	9	2	5
	36%	36%	8%	20%

Table 72: Why feeling comfortable to ask the facilitator? (semi-closed-open-ended questionnaire)

Why feeling comfortable to ask the facilitator
Asked Facilitator
Facilitator has the necessary knowledge and skills
The facilitator had the knowhow. My fellow teachers happened to grasp faster at a particular point (Teacher 26)
He is the person responsible to teach us (Teacher 6)
He is the one who taught us that (Teacher 40)
He is an expert in computers (Teacher 43)
Facilitator very friendly & always willing to assist
The guy is very friendly and always willing to help (Teacher 28)
Facilitator is very helpful, friendly and know his work very well (Teacher 38)
Facilitator honest and active
Because he was more honest and active and fom the start he mentioned that ask if you don’t understand (Teacher 29)
Facilitator provide certainty
It is because I wanted to be sure with what I’m doing (Teacher 45)
To get a response and an understanding of what I wanted to know (Teacher 1)
Facilitator is patient
Andre’ is so patient. He listens to us all and always eager to assist (Teacher 11)
Facilitator listens to us
Andre’ is so patient. He listens to us all and always eager to assist (Teacher 11)

Table 73: Why feeling comfortable to ask group members or no-one? (semi-closed-open-ended questionnaire)

Why feeling comfortable to ask both the facilitator and group members
I feel comfortable with both. Facilitator can show me short cuts whereas teacher can also explain in our mother tongue (Teacher 36)
Why feeling comfortable to ask group members
Relating to friends
Because we relate more comfortably (Teacher 37)
Facilitator does not show how
Our facilitator usually just corrects what you have done wrongly instead of showing you what you have done wrong (Teacher 40)
She explains to me how to solve the problem whereas the facilitator will solve your problem himself and he is very fast (Teacher 19)
Clear explanations
They explained clearly to me (Teacher 27)
They understand me better (Xhosa home language)
Because they know or understand that I know nothing about the computer so they did all means to help me (Teacher 20)
Because we understand each other (Teacher 47)
My fellow teacher do understand me that I don't have much knowledge about computer (Teacher 42)
Asked no-one
Trial and Error
Learning through trial an error has helped me to know more about computer that being help by others (Teacher 2)
Want to do it on my own
Because I wanted to try on my own, so to do it for myself next time (Teacher 18)

Table 74: Why have you asked these people for help? (semi-closed-open-ended questionnaire)

Reasons for asking help from other people and the participants' responses	
Couldn't Log on	
I couldn't access the Internet after having tried twice to log in. I had a problem finding what I have saved the previous day so I wanted to be sure I've saved correctly (Teacher 2)	I was not sure about this project when I started it and sometimes I had a problem with my password (Teacher 42)
Lacking the Knowledge myself to design cyberhunts	
I have no knowledge about cyberhunt before (Teacher 46)	Everything was new to me (Teacher 19)
I was not sure how to go about pasting information and they seemed to be on the know how. (Teacher 37)	I did not know cut and paste (Teacher 6)
I did not understand how to do it (Teacher 27)	When I need assistance (Teacher 1)
To show me how its done (Teacher 28)	I needed to be onboard with what has been done (Teacher 34)
To show how to do it because each and every time I was trying it was a mistake. But I did it twice and then I understood it (Teacher 29)	Because sometimes I don't attend because of other commitments at schools (Teacher 18)
Because then I was not competent, I had difficulties (Teacher 20)	I need help to some computer skills (Teacher 36)
	I was not sure (Teacher 3)
They are Computer Experts / Knowledgeable	
There were the ones who knows computers better than me (Teacher 47)	Because they have understanding of the subject (Teacher 5)
Team work (Teacher 40)	The tutor was always available to help us all. The same of the colleagues who understood it first time while I was still uncertain (Teacher 11)
They are highly skilled than me (Teacher 43)	
Slow Learner	
Because I need it since I'm not that good in using it and there are too many learners who might be slow (Teacher 9)	
Setup of a Lesson Plan	
Setting up lesson-plan. Stuff that I did not grasp at first (Teacher 38)	

Table 75: Qualitative journal data analysis: Who do you ask for assistance?

Who do you ask for assistance?	**Dates**			
	4 June 2008	**29 July 2008**	**13 August 2008**	**20 August 2008**
Facilitator	8	8	8	8
By a group member	10	8	8	6
Fellow peer facilitator	2	2	1	2
By myself	1	0	1	0
Anybody	0	0	3	1
I helped others	0	0	1	0

Table 76: Participants: With what did you need help or assistance during the project?
(semi-closed-open-ended questionnaire)

With what did you need help or assistance during the project?	Response from
Saving	Saving my cyberhunt (Teacher 2)
	Copy and paste. To save my work (Teacher 20)
	Logging in. Saving information. Designing a cyberhunt (Teacher 34)
	I'm browsing for a topic when I was expected to do my cyberhunt lesson. Then I also needed help in doing copying and pasting was also helped in saving my document so as to be able to open it again (Teacher 11)
Pasting	Pasting files (Probably means text or hyperlinks) (Teacher 37)
	Copy and paste. To save my work (Teacher 20)
	Cut and paste (Teacher 6)
	I'm browsing for a topic when I was expected to do my cyberhunt lesson. Then I also needed help in doing copying and pasting was also helped in saving my document so as to be able to open it again (Teacher 11)
	How to edit, copy, minimize, open document, edit and paste (Teacher 3)
Copying / Hyper linking	Copying the web address to Microsoft Word (Teacher 40)
	With integration. With copy linking the two (Word and Internet) (Teacher 28)
	I was struggling to copy and paste the email address that contains the important information from the Internet (Teacher 29)
	To look for Internet address (Teacher 5)
Finding Information	To make a cyberhunt. Kidsclick (Teacher 27)
	When checking for information on the computers (fiddling with it) (Teacher 9)
	How to search something I don't know what to go to (Teacher 47)
	Log on. Finding information (Teacher 43)
	To get to Internet and to search for other things in Internet (Teacher 18)
Basic Computer Skills	As it was my first time to use computer I asked almost everything. I needed help in how to log on/off, in how to use capital letters, to do bullets, numbering, insert pictures, etc. (Teacher 19)
	My friends, colleagues and facilitator to log on, off, cyberhunt, Internet exploration and typing skill (Teacher 36)
	How to edit, copy, minimize, open document, edit and paste (Teacher 3)
Deciding on a Topic	To be able to open more topics (Teacher 46)
Log on	Log on when the password or username does not log on and when I did not hear or understand an instruction clearly (Teacher 1)
Cyberhunt Design	Logging in. Saving information. Designing a cyberhunt (Teacher 34)

Table 77: Participants who helped others: With what did they helped them? (semi-closed-open-ended questionnaire)

Helping peers with the following during the project:	Response)
Accessing Internet	They could not access Internet (Teacher 2)
	Get to Internet (Teacher 18)
Log on	Logging in, searching for information, googling (Teacher 37)
	With how to log on/off, select program, how to copy and paste (Teacher 19)
	To log on and google about a little knowledge I have (Teacher 1)
	Logging in. Typing (Teacher 34)
Searching for Information / Exploring information	Logging in, searching for information, googling (Teacher 37)
	On MS Word inserting a picture and the Internet (exploring and choosing links) (Teacher 28)
	I showed them how to copy and paste and how to search for information (Teacher 20)
	To log on and google about a little knowledge I have (Teacher 1)
	Browsing for info in the Internet. Open google. Do cyberhunt. Pasting. Copying (Teacher 11)
	Get information from the Internet, design cyberhunt and typing (Teacher 36)
	I showed her how to start from the website address and google for information (Teacher 3)
Tabbing between Internet Explorer & Word	Getting between Internet and Microsoft Word (Teacher 40)
Finding Pictures	To find pictures (Teacher 40)
	Formatting, Inserting pictures, Saving documents (Teacher 26)
	On MS Word inserting a picture and the Internet (exploring and choosing links) (Teacher 28)
General Computer Skills	By sharing and explaining things or aspects they did not understand (Teacher 27)
	To get into cyberhunt (Teacher 9)
Saving Documents	Formatting, Inserting pictures, Saving documents (Teacher 26)
	Opening and closing file and how to save it (Teacher 5)
Copy and Paste	Going through the Internet and saving information about something and paste it to another programme (Teacher 29)
	I showed them how to copy and paste and how to search for information (Teacher 20)
	With how to log on/off, select program, how to copy and paste (Teacher 19)
	How to log in, how to copy and paste the hyperlink, how to open the word document (Teacher 45)
	Browsing for info in the Internet. Open google. Do cyberhunt. Pasting. Copying (Teacher 11)

Starting the Program	How to open it and when you want to go to the Internet you have to write the address first or topic (Teacher 47) With how to log on/off, select program, how to copy and paste (Teacher 19) Browsing for info in the Internet. Open google. Do cyberhunt. Pasting. Copying (Teacher 11)
Hyper linking	How to open it and when you want to go to the Internet you have to write the address first or topic (Teacher 47) How to log in, how to copy and paste the hyperlink, how to open the word document (Teacher 45) I showed her how to start from the website address and google for information (Teacher 3)
Cyberhunt Design	How to set up a cyberhunt (Teacher 38) Get information from the Internet, design cyberhunt and typing (Teacher 36)
Typing	Get information from the Internet, design cyberhunt and typing (Teacher 36)

Table 77A: What participants find difficult or struggled with according to their journals?

What do you find difficult or struggled with?	4 June 2008	18 June 2008	29 July 2008	13 August 2008	20 August 2008
Accessing Internet	I want to know more or how to network through internet (Teacher 45) More knowledge on searching for information through an internet (Teacher 51) Accessing internet is still tricky for me. Posting internet address on the document I have typed. (Teacher 33) Log on or surfing the internet and cyberhunt (Teacher 50)	At the beginning, the search was too slow to open (Teacher 26) Yes, takes time to be opened but I was patient no to be in a hurry (Teacher 24)			
Log on	Log on or surfing the internet and cyberhunt (Teacher 50)				
Searching for Information / Exploring information	I need more help in computer basics, because it is my first time to use computer. I am still struggling in searching information and getting pictures (Teacher 20) I found that it is difficult to get pictures, to search for information. I need help in computer basic as it is my first time to use computer (Teacher 19) I find difficult in Internet (Teacher 47) Using the internet to download information because I started late to attend this training only the two past days (Teacher 48) To search for something, to underline words, use	Finding a site, kidsclick isn't too technical in its approach (Teacher 35) No problem with computer activities but struggle in getting information from kids click (Teacher 11) Yes, because kids click have limited resources (Teacher 22)	I did not understand the Wikihow (Teacher 20) I experienced problem in writing web address. The computer shows two addresses (Teacher 36) Struggling to search for water purification, moving from Internet to word (Teacher 14)	Choosing a website that relates to my lesson (Teacher 40) The computers are slow and I saved my document and it gets lost (Teacher 1) The internet was sometimes slow, unable to decide on time which site to use (look) for information (Teacher 33) Difficult to go to internet the computer was slow (Teacher 32)	

	bold words (Teacher 21) Log on or surfing the internet and cyberhunt (Teacher 50) To understand the programme of the computer. To search information on the internet (Teacher 23) To be able to enter in the internet (Teacher 22)			
	I am still not sure how to surf to the computer looking for other information except the one that I was shown (Teacher 55)			
Tabbing between Internet Explorer & Word			Struggling to search for water purification, moving from Internet to word (Teacher 14)	
Finding & Inserting Pictures	I found that it is difficult to get pictures, to search for information. I need help in computer basic as it is my first time to use computer (Teacher 19) I need more help in computer basics, because it is my first time to use computer. I am still struggling in searching information and getting pictures (Teacher 20)			Taking a picture [from the web] and paste it (Teacher 50)
General Computer Skills	Finding a font, going back when I am lost highlighting and underlining. Making corrections when I made a mistake (Teacher 44) To search for something, to underline words, use bold words (Teacher 21)	Yes, because this is new I have to ask for help from my tutor and my group members. When the time goes on I hope things will be alright (Teacher 15) I need more help in computer basics, because it is my first time to		

		use computer. I am still struggling in searching information and getting pictures (Teacher 20)			
Saving Documents & Opening saved info	Saving the information. Going back to the information (Teacher 32) I find it different to find saved document. Typing I'm little but bit behind i.e. I am struggling (Teacher 36) When the information disappears from the screen, I struggle to get it (Teacher 9)		Yes. Unable to search for information that I have saved last time (Teacher 32)	Yes saving on elf [server] document (Teacher 39)	Yes I have lost my file (Teacher 5) Yes. Saving the file as a web Page (Teacher 40) Yes, of course creating an HTML file and saving it on the web page. But I was able to slowly grasp what it is all about (Teacher 33) Saving on the web page (Teacher 40) Sometimes work that I save it get lost. I want to be able to locate my work wherever it is saved (Teacher 33) I find it difficult to check from my previous document (Teacher 36)
Copy and Paste	Accessing internet is still tricky for me. Posting internet address on the document I have typed. (Teacher 33)	Copying and pasting the address to a document created on word (Teacher 26) Yes, to copy and paste to Microsoft Word (Teacher 16)	Topic sometimes broad. Cut and paste seems to be abet of a struggle (Teacher 37)		
Hyper linking	Accessing internet is still tricky for me. Posting internet address on the document I have typed. (Teacher 33)				

	Copying and pasting the address to a document created on word (Teacher 26)				
Cyberhunt Design	I would like to be clearer in implementing cyber hunt. Steps to follow when designing a cyber hunt. And if I could improve my typing skills as I am currently take too long to type the question (Teacher 12)	Firstly I was struggling to understand the instructions (Teacher 55)	Sometimes it is difficult at the beginning since I do not practise at home. So I contemplate purchasing one (Teacher 50) I was a bit confused [Design & Search] (Teacher 3)	Design the cyberhunt (Teacher 36) Designing (Teacher 32) Yes I forgot my instructions (Teacher 57)	Like to go back see if I will be able to do easy things right [Design] (Teacher 38) Practise more with my cyberhunt [Design] (Teacher 3) To enter information in web page (Teacher 30)
Typing	I would like to be clearer in implementing cyber hunt. Steps to follow when designing a cyber hunt. And if I could improve my typing skills as I am currently take too long to type the question (Teacher 12) I want to work on my typing skills i.e. keyboard skills. I will be pleased also if everything we do can be compiled in the form of a module because we are expected to go back to our schools and train our colleagues (Teacher 11) I find it different to find saved document. Typing I'm little but bit behind i.e. I am struggling (Teacher 36)		Basic typing skills (Teacher 36) To be faster in typing speed (Teacher 48)	Improving typing skills (Teacher 5) Yes I sit in information not fast on typing (Teacher 36)	Cut and Paste (Teacher 6) Copying and pasting (Teacher 11)
Topic		Yes, to get the topic, but we chose another topic (Teacher 17) Yes, to get a topic. There was	Need something new [Topic] (Teacher 39) Topic sometimes broad. Cut and paste seems to be abet of a struggle		

	not much information until we decided to change to another topic (Teacher 18) First it was hard to find the relevant topic for the kids. But you struggle and eventually find one (Teacher 23)	(Teacher 37)		
Composing questions	Writing the questions while still on the site (Teacher 50)	I need same help in writing the questions (Teacher 51)		
Too much information			To change the site I have several because I saw one that was more interesting (Teacher 2) The internet was sometimes slow, unable to decide on time which site to use (look) for information (Teacher 33) Choosing a website that relates to my lesson (Teacher 40)	
Want to work alone			Need to be able to work alone without assistance (Teacher 3)	
Need more time & own computer		Sometimes it is difficult at the beginning since I do not practise at home. So I contemplate purchasing one (Teacher 50)		More time is needed I can work properly if I would have my personal comp. I need more practise (Teacher 43)
Need notes				Need to have notes also (Teacher 5)
Need confidence				Still need to be confident (Teacher 50)

				After consulting with the assistant everything went smoothly (Teacher 50)
YES, but did not mention on what they struggled)	Yes, because this is new I have to ask for help from my tutor and my group members. When the time goes on I hope things will be alright. Teacher 15 Not that much. (Teacher 47)	Yes, but later improve (Teacher 5) A little bit, but steady but surely getting there (Teacher 50) Like to go back see if I will be able to do easy things right (Teacher 38)	More practise (Teacher 41) At first (Teacher 22) Not much (Teacher 3) Need more help (Teacher 2) I need more assistance (Teacher 57)	Yes I did but I got a lot of assistance (Teacher 3) Yes, I did. I am lacking in the information of last week's lesson (Teacher 30) I was a bit lost but a friend helped me, because I missed the two classes earlier (Teacher 29)
Did not struggle	Firstly I did struggle but now I'm little bit confidant (Teacher 51) No, I did not, but I did help my colleagues in doing the cyberhunt (Teacher 45) No (Teacher 19) No (Teacher 27) Not that much (Teacher 47) There were few problems today because the part we were doing today was a repetition of what we were doing last week (Teacher 20) Not that much (Teacher 49)	Not really (Teacher 39) No (Teacher 38) No (Teacher 56) No (Teacher 45) No problems (Teacher 49) No (Teacher 33) None – really (Teacher 45) Not now, or I can say there was no problem (Teacher 56) I didn't struggle today. At least there is a progress (Teacher 51) No – except that the computer I was using was very slow (Teacher 48) Not too much, I open the website on my own (Teacher 6)	Nothing (Teacher 56) Nothing presently (Teacher 38) None at the moment (Teacher 51) Not that much (Teacher 41) No (Teacher 56) No (Teacher 40) No (Teacher 37) No (Teacher 26) No (Teacher 38) No (Teacher 45) Not really (Teacher 51) Not too much differ from last session (Teacher 5) No (Teacher 19) Today things were easy I am becoming competent now (Teacher 20) Nothing so far I am slowly getting there (Teacher 50)	Everything was fine for me (Teacher 42) Not as such (Teacher 11) No (Teacher 45) No (Teacher 38) Not at all at least everything was fine. I did not struggle that much as before (Teacher 43) No I did not (Teacher 47) None (Teacher 38)

Table 77B: What do participants find difficult? (A numerical summary of the journal data in Table 78A)

What do you find difficult?	4 June 2008	18 June 2008	29 July 2008	13 August 2008	20 August 2008
Accessing internet	4	2	0	0	0
Log on	1	0	0	0	0
Searching for Information / Exploring information	9	3	3	4	0
Tabbing between Internet Explorer & Word	0	0	1	0	0
Finding & inserting pictures	2	0	0	1	0
General computer skills	2	2	0	0	0
Saving Documents & Opening saved info	3	0	1	1	6
Copy and Paste	1	2	1	0	0
Starting the Program	0	0	0	0	0
Hyper linking	2	0	0	0	0
Cyberhunt design	1	1	2	3	3
Typing	3	0	2	2	3
Did not struggle	0	7	11	15	7
Topic	0	3	2	0	0
Composing questions	0	1	1	0	0
YES, but did not mention on what they struggled)	0	2	3	5	3
Too much information	0	0	0	3	0
Want to work alone!!!!!!!	0	0	0	1	0
Need more time & own computer	0	0	1	0	1
Need notes	0	0	0	0	1
Need confidence	0	0	0	0	1

Table 78: Have you helped any person during the cyberhunt project? (semi-closed-open-ended questionnaire)

Have you helped any person during the cyberhunt project?	I did not help anyone	I helped one person	I helped two persons	I helped three persons	I helped four persons	I helped more than four persons
n = 25	2	8	6	3	1	5
	8%	32%	24%	12%	4%	20%

Table 79: The number of people that the participants asked helped from

The number of people that the participants asked helped from	Asked nobody for help (worked on my own all the time)	One person	Two persons	Three persons	Four persons	More than four persons
n = 22	1	12	6	2	1	0
	4.5%	54.5%	27.3%	9.1%	4.5%	0%

Table 80: Were the problems you have experienced, solved?

Were the problems that you have experienced, solved?	YES	NO
n = 20	13	7
	65%	35%

Table 81: Would you like to participate in groups again? (semi-closed-open-ended questionnaire)

Would like to participate in groups again?	YES	NO
n=25	25	0
	100%	0%

Table 82: Enjoyment of working in groups. (semi-closed-open-ended questionnaire)

Did you enjoy working with others in the computer room during the cyberhunt project?	VERY MUCH	FAIRLY	NOT MUCH	NOT AT ALL
n=24	19 79%	5 21%	0 0%	0 0%

Table 83: Familiarity

Familiarity	Mean	SD	Low 1, 2 1<=x<=2	Avg 3 x=3	High 4,5 4<=x<=5
	Post	Post	Post %	Post %	Post %
I have chosen to be in the same group as my friends as I feel comfortable with them (npost = 24)	3.79	1.47	29%	4%	67%

Note. The abbreviation npre and npost refer to the number of participants who responded to the statement in the pre and post section of the same statement.

Table 84: What was negative working in a group? (semi-closed-open-ended questionnaire)

What was negative about working in a group?	
Disturbances	There is a lot of disturbance (Teacher 40)
Different speed at which people work. Age differences	Age counts a lot. Coz those who are very old forget a lot which deteriorates the process of those who have a know how (Teacher 40) To work in a fast pace some are very slow, but we managed to finish (Teacher 9) Others are faster than others. Some time this people become bored (Teacher 36)
Not all members stay focused	Others just want to finish and easily agree on everything just to get it finished (Teacher 28)
Late arrivals	Late coming. First time learners (Teacher 38)
Nothing	Nothing (Teacher 26) Nothing was negative because we agreed from the first time that each one teach one (Teacher 29) Nothing was negative (Teacher 20) Not at all (Teacher 19) None (Teacher 6) Nothing (Teacher 1) Nothing except that I was the slow one (Teacher 34) Nothing (Teacher 18)

Table 85A: Problems experienced in groups? (semi-closed-open-ended questionnaire)

What problems did you experience in your group?	
Too much talking	There is a lot of chatting taking place (Teacher 40)
Different abilities	We have different abilities i.e. slow learners and quick learners (Teacher 40)
Finding suitable information	Finding the most appropriate link/address to select as there are many of them (Teacher 26)
	We did not have problems as people because everyone was participating, it is just that we didn't get more information based on our sub-headings. There was little information from the computer (Teacher 9)
	That we are not sure of information do trial and error on searching.
Composing suitable questions	Choosing the right questions to ask in the cyberhunt (Teacher 28)
No Manual or Guide	No manual or notes to guide us (Teacher 6)
Late coming	Late coming. First time learners (Teacher 38)
Lack of computer skills	Due to the lack of computer skills (Teacher 45)
	Late coming. First time learners (Teacher 38)
	Most of us were not well acquainted and had to ask for help from others (Teacher 34)
	Time allocation. Feedback. Some others were faster than others. Others were bored because they already know something (Teacher 36)
Boredness: Pace of training	Time allocation. Feedback. Some others were faster than others. Otheres were bored because they already know something (Teacher 36)
No problems	We did not have problems as people because everyone was participating, it is just that we didn't get more information based on our sub-headings. There was little information from the computer (Teacher 9)
	Yes. Wasn't much problems because we were all sharing and making sure that everything and every member of the group must ensure that he/she understand it (Teacher 29)
	No problem (Teacher 20)
	No problem (Teacher 19)
	I didn't experience no problem (Teacher 47)
	No problems (Teacher 1)
	No problem, all group members were cooperative (Teacher 18)
	No problems at this stage (Teacher 11)

Table 85B: Did you disagree OR had different opinions about anything? (journals)

Did you disagree OR had different opinions about anything?				
	18 June 2008	**29 July 2008**	**13 August 2008**	**20 August 2008**
NO				
Helped each other	Not at all, because we worked together, helped each other (Teacher 51)			
	No, all of us are learning, we are trying to help each other (Teacher 15)			
Common understanding	No, we discussed everything we have decided on and come to a common understanding (Teacher 45)			
	No, because we both are language teachers we chose the topic suitable for both of us (Teacher 12)			
NO: NO REASON GIVEN				
	No (Teacher 19)	No (Teacher 20)	No (Teacher 39)	No (Teacher 5)
	No (Teacher 27)	None (Teacher 51)	No (Teacher 41)	No (Teacher 3)
	No (Teacher 47)	No (Teacher 33)	No (Teacher 56)	No (Teacher 6)
	No (Teacher 49)	No (Teacher 32)	No (Teacher 40)	No (Teacher 40)
	No (Teacher 17)	No (Teacher 3)	No (Teacher 37)	No (Teacher 11)
	No (Teacher 18)	No (Teacher 6)	No (Teacher 26)	No (Teacher 38)
	No (Teacher 14)	No (Teacher 39)	No. We shared ideas (Teacher 45)	No. So far so good (Teacher 36)
	No (Teacher 11)	No (Teacher 56)	No (Teacher 22)	No (Teacher 30)
	No (Teacher 35)	No (Teacher 38)	No (Teacher 3)	
	No (Teacher 22)		No (Teacher 20)	
	No, we are teaching each other (Teacher 55)		No (Teacher 51)	
			No necessary only offered help (Teacher 5)	

Table 85C: Did you disagree OR had different opinions about anything? (journals)

Did you disagree OR had different opinions about anything?				
	18 June 2008	**29 July 2008**	**13 August 2008**	**20 August 2008**
YES				
Some domination	The only thing I do not like is the person who is dominating because I want to have my chance too (Teacher 20)			
Choosing the topic	Yes, choosing the topic (Teacher 26) Yes, choosing a topic (Teacher 24) Yes, to choose topic (Teacher 23)			
Using google and not Kidsclick	Sometimes people want to go back to Google to explore even though given the new easier method (Teacher 50)			
A little bit			Not actually (Teacher 38)	
But reached consensus		Sometimes we disagree so that we can agree at the end of the day (Teacher 48)	Yes but ultimately reach consensus on how to paste and copy (Teacher 50)	

Table 86: How participants responded when asked for help? (semi-closed-open-ended questionnaire)

How did they respond when you asked them for help? (What did they say or how did they react?)	
Helpful	They were helpful and gave help willingly (Teacher 2)
	They were prepared to help at times (Teacher 37)
	They were willing to help me (Teacher 27)
	Willing (Teacher 9)
	Just helped me with pleasure (Teacher 28)
	They were very helpful (Teacher 20)
	They were nice. There was no funny faces, as a result I enjoy (Teacher 47)
	They were fine they show me how to open a computer (Teacher 42)
	They were always willing to help (Teacher 43)
	They helped me (Teacher 6)
	Eager (Teacher 38)
Helped Easily	They help me with ease (Teacher 40)
Positive	They were very positive they even left their computer and assisted me without any complain (Teacher 29)
Some became bored to help	Some reacted positively, some become bored (Teacher 19)

Table 87: What participants discussed while working in groups (semi-closed-open-ended questionnaire)

What did you speak about or discuss while working in your groups?	
Topic selection	Choosing or selecting the topics (Teacher 27)
	Things you do when getting this information and also talk about the topic (Teacher 9)
	We choose the topic that is suitable for the learners in primary and in high school. We then formulate questions and type (Teacher 19)
	Purification of water. Symptoms of diseases (Teacher 47)
	Decide on a topic browsing on Internet Explorer after finding it you read it asking question open word and write your question, copy and paste so that your learners can work on it then save your document (Teacher 11)
	The day's topic. How excellent this course is (Teacher 38)
	We discussed the topic (Teacher 45)
Developing questions	Type questions that can be asked to learners (Teacher 40)
	We choose the topic that is suitable for the learners in primary and in high school. We then formulate questions and type (Teacher 19)
	Decide on a topic browsing on Internet Explorer after finding it you read it asking question open word and write your question, copy and paste so that your learners can work on it then save your document (Teacher 11)
Deciding and developing strategies and procedures	The various strategies to use. Used the facilitator's instructions to construct the project (Teacher 26)
	Things you do when getting this information and also talk about the topic (Teacher 9)
Audience	How can we make it interesting and attractive at the same time informative to learners (Teacher 28)
Internet & Internet Addresses	It was Internet and saving email address of the important information (Teacher 29)
	Decide on a topic browsing on Internet Explorer after finding it you read it asking question open word and write your question, copy and paste so that your learners can work on it then save your document (Teacher 11)
Assisting learners	We discussed about helping our pupils to master what we learnt (Teacher 20)
Design skills & Lesson Planning	The steps when you do cyberhunt (Teacher 42)
	About the lesson and how am I going to plan this (Teacher 1)
	That if we could all learn how to construct the cyberhunt and teach the learners through it, teaching would be very interesting (Teacher 34)
	What's next (Teacher 6)
Usefulness of Project	About the usefulness of this project (Teacher 43)
How to assist each other	Helping with different skill for searching cyberhunt (Teacher 5)

Table 88: How participants experienced group work (journals)

How did you experience the group work today? How do you experience the group work (working together)?				
	18 June 2008	**29 July 2008**	**13 August 2008**	**20 August 2008**
Gain more knowledge / Share knowledge	I gain more knowledge from group work (Teacher 51) It's exciting because we share the knowledge (Teacher 45) It was enjoyable we gained a lot from working together (Teacher 27) Group work is helping me a lot because we differ in knowledge (Teacher 20) Was co – operating, given one another a chance to work with computer, share ideas (Teacher 14) Very informative as my partner is knowledgeable than I am (Teacher 12) It is very good because you share ideas (Teacher 11) Perfect, learning from each other (Teacher 22) It's easier because each and every body comes with information (Teacher 18)	To share information, help each other and explore information (Teacher 36) Great, we helped each other very (Teacher 49) We were helping each other (Teacher 33)		
Enjoyable & Interesting	Enjoyable (Teacher 19) It was enjoyable we gained a lot from working together (Teacher 27)	Enjoyable (Teacher 45) Super (Teacher 3) Excellent (Teacher 32) Good (Teacher 6) Good (Teacher 39) Very much interesting and really helping a lot (Teacher 5)	Marvelous It's good to work with groups (Teacher 39) Fine (Teacher 37) Enjoying (Teacher 26) Very helpful, it will ever be better of all of us can arrive on time (Teacher 38) Interesting (Teacher 45) Fantastic (Teacher 22) Fine (Teacher 3)	Very pleasant (Teacher 43) Fine because every body is co-operating (Teacher 50) Good (Teacher 11) Interesting (Teacher 45) Very nice (Teacher 38) It help me simple because recent information and skills that I did not know in the past. For instance

				simple skills to use a key board (Teacher 36) Very well (Teacher 30)
Simplify learning	It makes things easier (Teacher 49) Work became easier than being alone. You get help from the group (Teacher 15)	Much easier when working in groups (Teacher 38)		
Helpful	It is very helpful to help with one another (Teacher 26) It is helpful (Teacher 16) It is really helpful (Teacher 25)	Helpful (Teacher 20) Group work is very helpful because it is easy to learn from the others (Teacher 56)	Is so fruitfull to work as team (Teacher 41) Helpful (Teacher 2)	It was very helpful to work with the group (Teacher 3)
Time saver	It is easy everyone helps and reminds each other. It saves time (Teacher 17) Good and quick (Teacher 24)			
Assist to solve problems	Good and interaction solved the problems I had (Teacher 50) It is helping in putting down the right questions (Teacher 55)			
Members started to participate more		More participating (Teacher 48)	Work more easily with group (Teacher 51)	
Instils Confidence				Confidence (Teacher 6)
WORKED ALONE			I was working alone (Teacher 19)	I worked alone (Teacher 40)

Table 89: Positive aspects related to working in groups (semi-closed-open-ended questionnaire)

What was positive about working in a group?	
Meeting new & different people	Meeting different characters (Teacher 40)
	Dealing and meeting with colleagues who are always showing interest and faithful to one another (Teacher 29)
	I know other people whom I'm not working with (Teacher 42)
Getting assistance	Its nice coz it's easy to get help (Teacher 40)
	The sharing of information, you are a slow learner you feel accommodated too (Teacher 20)
	When you are not sure of how to do something, someone help you in your group and they make sure that you understand by letting you to do it (Teacher 19)
	To help each other (Teacher 6)
	They help you receive (Teacher 38)
Explanations from others / Learning from one another	Finishing up work in time and getting explanations from other (Teacher 27)
	Helping each other and being helped i.e. learning from each other (Teacher 26)
	You get the help you need (Teacher 43)
	Helping each other (Teacher 46)
	To help each other when there was a problem (Teacher 1)
	Getting more information from others (Teacher 34)
	Cooperation (Teacher 18)
Finishing in time	Finishing up work in time and getting explanations from other (Teacher 27)
Sharing different experiences	Different experiences come along and made sense (Teacher 9)
Discussion of ideas	Brainstorming and debating your ideas and get feedback on them (Teacher 28)
	Working in groups encouraged me. Will share ideas (Teacher 47)
Encouragement	Working in groups encouraged me. Will share ideas (Teacher 47)
Sharing workload	Sharing the working. Giving assistance to one another (Teacher 11)
Enthusiasm	Enthusiasm on having computers and work on projects (Teacher 45)
Sharing information	We help each other in group. We share information. We plan the problem in the level that I can understand. We support each other (Teacher 36)
Planning collectively	We help each other in group. We share information. We plan the problem in the level that I can understand. We support each other (Teacher 36)

Table 90: Would participants like to participate in groups again? (semi-closed-open-ended questionnaire)

Would like to participate in groups again? Please explain or tell us.	
Sharing knowledge: Your own & your group's	In a group there is always someone who would know things that you don't know (Teacher 37)
	You can easy get to know the concept from other group members. One contributes with what you know (Teacher 28)
	I a group you get a lot of information and short cuts of doing something and each others' ideas and opinions are accepted (Teacher 29)
	I would like to participate in groups because in groups we share information (Teacher 20)
	I like sharing information (Teacher 45)
	Because you learn more from groups, each and everyone comes with an idea (Teacher 18)
Team work	It is good to work as a team (Teacher 40)
Assistance provided: Simplicity / Making it simpler / easier and Quicker to learn	Working in groups helps a lot (Teacher 27)
	It is more easier and I get help where I stuck so I find it interesting and communicable (Teacher 9)
	You can get help if you're not sure about something (Teacher 34)
	I like working with people because you understand things faster (Teacher 19)
	At least you are able to ask something you don't understand as one is near to you (Teacher 3)
Trialability	Working in the groups gave me an understanding of what to expect when working with the learners at school (Teacher 26)
Can express yourself	Working in groups gives more chance of expressing your feelings (Teacher 47)
Creates confidence	I would participate because I will have more confidence about cyberhunt (Teacher 42)
	They are willing to assist and the groups are encouraging (Teacher 43)
Atmosphere more relaxed	We are usually more relaxed (Teacher 38)
More than one answer	More fruitful easy to get different answer to solutions (Teacher 5)
Language issues: Easier to understand	In groups we share information and solve problem. People were eager to help other to search and understand information. [Language Issue!!!!!] (Teacher 36)

Table 91: Suggestions for group work by participants (journals)

Suggestions for group work by participants to participants			
	18 June 2008	**29 July 2008**	**13 August 2008**
Keep on helping each other	Keep on helping each other (Teacher 51) The more we practice the better (Teacher 45) We must go forward with group work (Teacher 47) Continue working together (Teacher 49) We must carry on again with group work (Teacher 18) To work together (Teacher 25) Working together make us conquer what we thought (Teacher 23)		
Share information	Sharing information (Teacher 19) Sharing information that we have (Teacher 27)		Those who know more must help those who do not (Teacher 20)
Work as a team	We should all work as a team (Teacher 26)	To try as hard as they can (Teacher 45)	
Freedom to ask & to bring ideas	For all group members to bring ideas upfront and to obey one's ideas. Give one another a chance (Teacher 14)	We need to assist one another. Everybody must be free to ask if she/he does not understand something (Teacher 48)	
Divide tasks	Searches will be faster if we search different sites instead of both of us using one computer. We've solved that one (Teacher 35)		
Start working as groups, THEN as individuals	We must work together there after work as individuals (Teacher 16)		
Stay focused	Not to be play around when the work is given (Teacher 24)		
Patience with one another			To be patient eventually we will be alright (Teacher 43)
Cooperate & Compromise			Co-operation and compromise (Anonymous)

Table 92: Suggestions for groupings according to the participants (semi-closed-open-ended questionnaire)

Suggestions for groupings according to the participants
Group together from same school
Group from same school will be more appreciated than mixed schools (Teacher 2)
Group according to ability or understanding
Those who have a better understanding should be grouped together to alleviate boredom (Teacher 37)
Group to assist those who struggle or who are new with capable ones
There should be one in each group that is well acquainted to help others (Teacher 34)
In our groups there must be always one who understands so as to lead others and help them (Teacher 11)
Nothing at the moment or you can just mix those with the background knowledge with the new students (Teacher 9)
Groups must be paired with someone who knows, with those who do not (Teacher 38)
Groups should not be too big
When a group is too big, less work is done (Xolisa Stamper)
Same people should not stay together in a group for too long
People should not stay in one group for long all the groups must be mixed after a certain period of time (Teacher 29)
Longer sessions
Time allocation for group activities not enough. No feedback to show our understanding (Teacher 36)

Table 93A: Planning with facilitator

Planning with facilitator n = 30	Mean	SD	LOW1,3 1<=x<3		AVG3,5 3<=x<=5		HIGH5,7 5<x<=7	
I should have the opportunity to see how the facilitator / project leader plan cyberhunts	6.50	1.04	0	0%	3	10%	27	90%

Table 93B: Observation of action in practice or real time

Observation of action in practice or real time n = 30	Mean	SD	LOW1,3 1<=x<3		AVG3,5 3<=x<=5		HIGH5,7 5<x<=7	
I should have the opportunity to see how the facilitator / project leader implement cyberhunts within a classroom context	6.87	0.35	0	0%	0	0%	30	100%

Table 93C: Regular classroom visitations (Summary and items)

Importance of support for computer based teaching n = 30 ∝ = 0.79	Mean	SD	LOW1,3 1<=x<3		AVG3,5 3<=x<=5		HIGH5,7 5<x<=7	
Summuray of items	6.39	1.01	1	3%	1	3%	28	93%
I would like that a knowledgeable computer person visit my computer classroom on a regular basis in order that he/she can assess what I do well	6.47	0.94	0	0%	2	7%	28	93%
I would like that a knowledgeable computer person visit my computer classroom on a regular basis in order that he/she can assist my with the cyberhunt process	6.20	1.61	2	7%	3	10%	25	83%
I would like that a knowledgeable computer person visit my computer classroom on a regular basis in order that he/she can assess in which areas I need assistance (help)	6.50	0.94	0	0%	4	13%	26	87%

Table 94A: How often should the training for the cyberhunt programme be? (semi-closed-open questionnaire)

How often should the training for the cyberhunt programme be? n = 22	Once a week	Twice a week	Every second week	Once a month	Once a term	Other:
	n = 8	n = 12	n = 0	n = 0	n = 1	n = 1
	36%	55%	0%	0%	4.5%	4.5%

Table 94B: When should the training for the cyberhunt programme be? (semi-closed-open questionnaire)

When should the training for the cyberhunt programme be? n = 22	After school	During school time	Every weekend on a Saturday	Every second weekend on a Saturday	During school holidays
	n = 13	n = 4	n = 1	n = 0	n = 4
	59%	18%	5%	0%	18%

Table 95: How long should each training session be? (semi-closed-open questionnaire)

How long should each training session be? n = 21	1 Hour	1 ½ hours	2 hours	Half a day	Whole day
	n = 7	n = 3	n = 8	n = 3	n = 0
	33.3%	14.3%	38.1%	14.3%	0.0%

Table 96: Number of facilitators during training (semi-closed-open questionnaire)

Should this cyberhunt project be facilitated by one person or more than one? n = 22	One person	Two persons	Three persons	Four persons	More than four persons
	n = 5	n = 8	n = 4	n = 0	n = 5
	23%	36%	18%	0%	23%

Table 97: Changes and suggestions for group work (semi-closed-open questionnaire)

Grouping: What changes and suggestions are there for grouping?

Suggestions from participants	**Responses of participants**				
Groups from same school	Group from same school will be more appreciated than mixed schools (Teacher 2)				
Group according to ability	Those who have a better understanding should be grouped together to alleviate boredom (Teacher 37)				
Group with mixed ability	Nothing at the moment or you can just mix those with a background knowledge with the new students (Teacher 9)	Groups must be paired with someone who knows, with those who do not (Teacher 38)	To grasp those who understand and those who do not understand (Teacher 1)	There should be one in each group that is well acquainted to help others (Teacher 34)	In our groups there must be always one who understands so as to lead others and help them (Teacher 11)
Group size important	When a group is too big, less work is done (Teacher 40)				
Rotate group members	People should not stay in one group for long all the groups must be mixed after a certain period of time (Teacher 29)				
No changes	Nothing to be changed because in groups we help each other (Teacher 20)	No changes should be made (Teacher 19)	None (Teacher 6)	Nothing really (Teacher 45)	None (Teacher 18)

APPENDIX B

PROJECT OVERVIEW

THE PROJECT

This study focused on a teacher development project primarily in six disadvantaged schools that were provided with 20 computers each by the Dell Foundation through Investec. The project ran from March to the end of October in 2008 at the Missionvale campus of the Nelson Mandela Metropolitan University. The Missionvale campus was selected as venue for teacher training as the campus is located in the disadvantaged community, hence it is very close to the participating teachers' schools, and because the campus has the necessary computer and Internet infrastructure from which the teacher training could be conducted. This value of this section is that it provides an overview of the steps of the project to enable the reader to obtain a picture of how the project was implemented, but also to provide an audit trail of the project. Furthermore, it provides an explanation of what happened in each phase and stage as well as the dates of the various sessions and the data gathering tools used at which specific point. Figure 3.1 provides a short overview of the process (For the full process, see Appendix B). The participating schools had no Internet connection yet. It is also interesting to note that for the majority of participating teachers, it was their first Internet experience. To assist the teachers, a cyberhunt guide manual was compiled (See Appendix 25) as well as a website www.nmmu.ac.za/cyberhunt. (See Figure 3.2)

Figure 3.1: Overview of the project

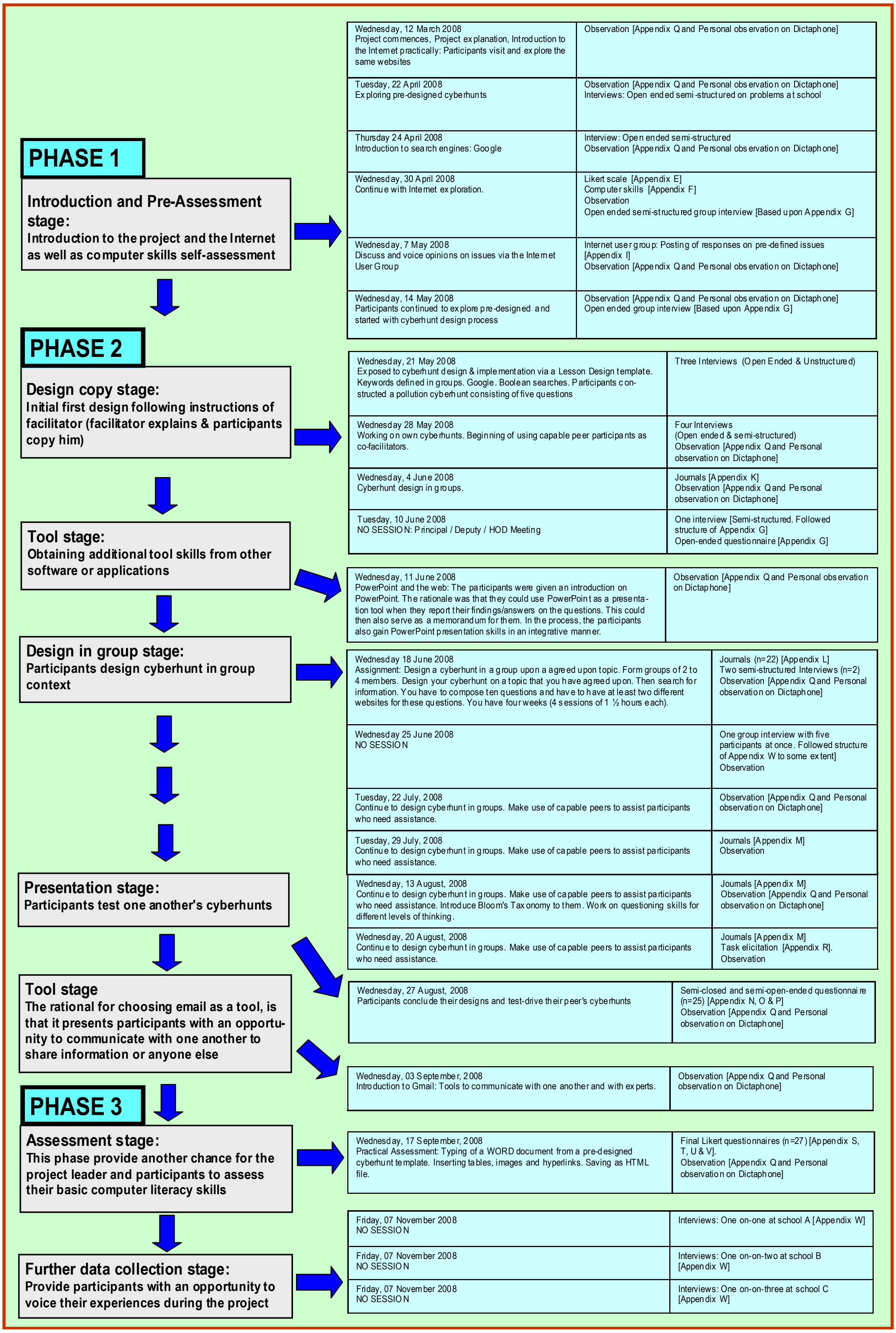
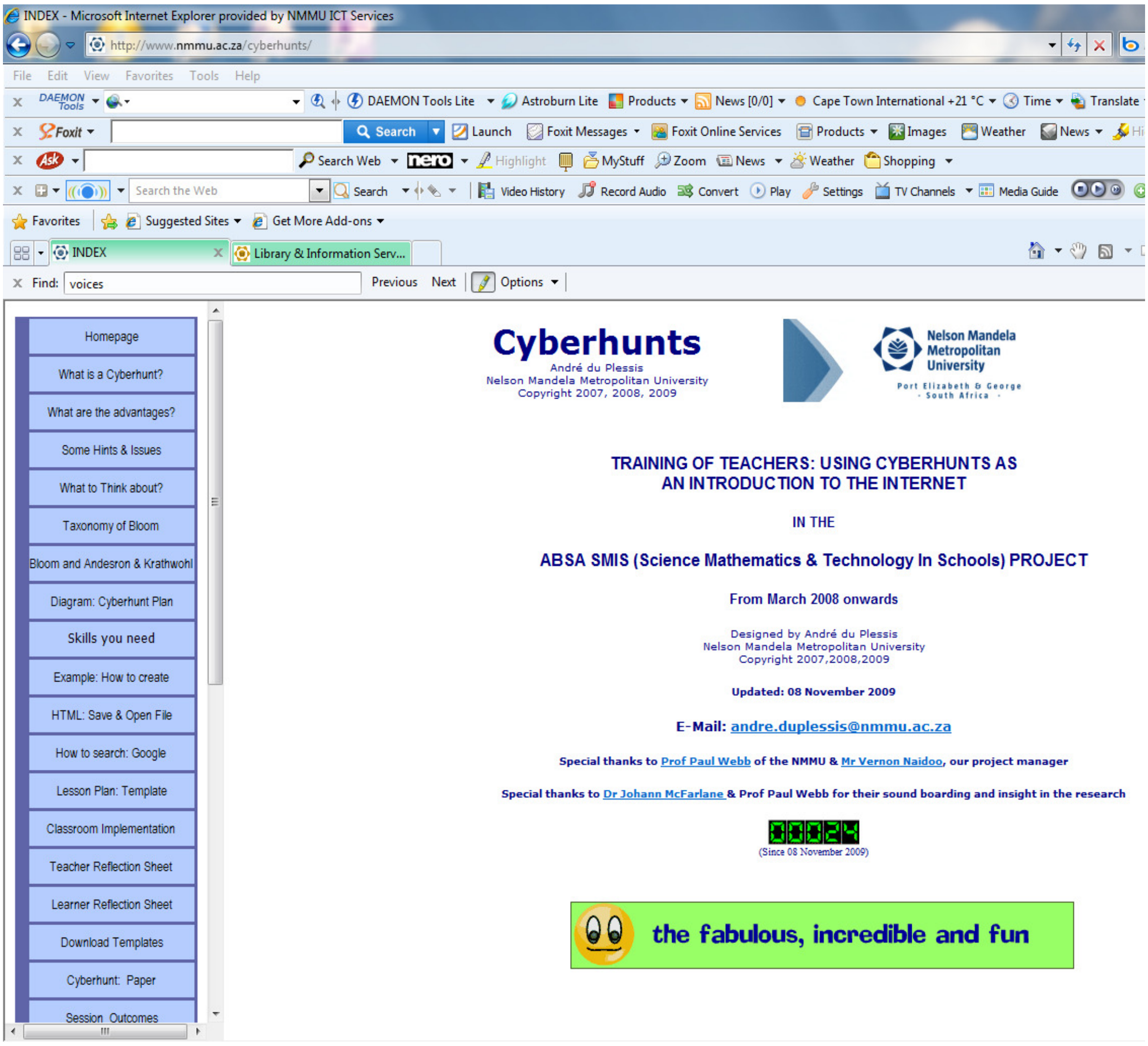


Figure 3.2: Website for the project www.nmmu.ac.za/cyberhunts



1. **Introduction and assessment stage: Introduction to the project and the Internet as well as computer skills self-assessment (Phase 1)**

It was decided to keep an attendance register for each session in order to provide the researcher with numbers for attendance. It is important to note that every session was not necessarily attended by every participant as work-, family- and personal responsibilities had an impact on attendance. The register was made available through-out each session and participants had to sign on arrival. However, some participants sometimes forgot to sign the register and hence the number of participants indicated for each session on the register and the number of data tools returned may differ.

In some instances it will be noted that fewer completed data gathering tools were returned than the number on the register. This was caused by participants who had to leave earlier of who did not complete and return the data gathering tool. In other cases more data tools were returned than the number of participants indicated on the attendance sheet. This happened as the data gathering tool were distributed during the previous week or the data tool was taken by someone and given to those not present in order that they could return it at the next session. In some instances participants that could not attend a session, returned the data tool via a friend or co-participant.

The project commenced on 12 March 2008 with 38 participants from 7 schools. Six of the seven schools received twenty computers each that were donated by the Dell Foundation. After the first session, the participants of the school that did not receive computers, decided to not attend. Thus, six schools remained. However, from the second week of the project (22 April 2008) one person from another school who also did not receive computers, started to attend. She attended every subsequent session. This resulted in 31 participants remaining. The data collected from the start of the project until the 30th of April 2008, reflect thus only the responses of the six Dell Schools (Three secondary and three primary schools) and from the one person of another school. Attendance varied, but the average attendance per session during was 27 participants.

From the 21st of May 2008, eight participants from two more schools joined and 7 initial participants decided not to continue. This resulted in approximately 32 participants. During the project, some more participants discontinued participation. However, on 25 June 2008 a few more participants joined in again. Again it is important to note that not each session was always attended by every participant. Attendance varied, but the average attendance per session from 21 May onwards was again 27 participants.

The following tables introduce the various phases of the project, the dates of the sessions, the focus in brief, data tools used (if any) during the session, and the number of data tools returned, the number of participants who signed the attendance register and a descriptor. Phase 1 is the first phase in which participants were introduced to the project and Internet in a practical manner (See Table 1 below). During this phase the Internet was explored in a guided manner by providing web addresses (URL's) to participants that they could type into Internet Explorer's address bar and then explore and navigate the website. Furthermore, participants were introduced to pre-designed cyberhunts. These cyberhunts were explored and completed in order that they could get a feel for cyberhunts. In addition, participants were also introduced to searching the Internet by means of Google as well as Boolean searches.

Table 1: Introduction and assessment phase

	Date of session and Focus of session	Data tool used and # returned	Number of people signing register	Descriptors
1	Wednesday, 12 March 2008 Logon, Project explanation, Introduction to the Internet practically: Participants visit and explore the same websites	Observation	38	Project commences
2	Tuesday, 22 April 2008 Participants logged onto the website www.nmmu.ac.za/cyberhunts. This website was created for the project by the facilitator and contains examples of pre-designed cyberhunts. Participants explored these cyberhunts individually and tried to answer the questions based on each cyberhunt. Returned Open Ended Questionnaire	Observation Interview: Open ended unstructured on problems at school	28	Exploring pre-designed cyberhunts
3	Thursday 24 April 2008 Introduction to search engines: Google	One interview (n=1) Open ended unstructured Observation	20	Introduction to search engines. Data collection.
4	Wednesday, 30 April 2008 Continue to explore the Internet using Google. Participants complete a General Skills and Competencies Questionnaire as well as a Likert Questionnaire based upon their school's readiness for ICT and their confidence, concerns and on issues related to teacher ICT development. Completed discussion based on Appendix 10A regarding issues / problems at school.	Computer skills (n=30) [Appendix F] Likert scale (n=31) [Appendix E] Observation Open ended group discussion [based upon Appendix G]	31	Continue with Internet exploration. Data collection
5	Wednesday, 7 May 2008 An Internet user group was created on the web. Participants logged on to the web address and were able to respond to questions related to the project, based upon Appendix 10B. They could post their replies to the respective questions. The questions were related to the cyberhunt research project.	Internet user group: Posting of responses on pre-defined issues (n=20) [Appendix I] Some struggled and needed assistance. Observation	29	Discuss and voice opinions on issues via the Internet User Group. Data collection
6	Wednesday, 14 May 2008 Participants continued to explore pre-designed cyberhunts. Discussed cyberhunt design issues based upon Appendix 11.	Observation Open ended group discussion [Based upon Appendix G]	28	Cyberhunt design process

2. Design copy stage: Initial first design following instructions of facilitator (facilitator explains & participants copy him) (Phase 2)

During this phase the project leader models the cyberhunt design process and the participants follow the instructions. As a result the project leader is drawing from his/her tacit knowledge (See Nonaka, 1995) and by articulating this tacit knowledge, he/she is converting the tacit knowledge to explicit knowledge. Being part of the process, afforded the participants with an opportunity to learn from the modeling process and to improve their self-efficacy through personal mastery, vicarious experience and verbal persuasion (Bandura, 1997; Schunk, 2004).

Equally important during this phase is use of peer-facilitators to assist the project leader. These peer-facilitators have to decide for themselves whether they feel capable to assist fellow participants (peers) during the training session on a full-time basis. As a result they become project leaders. In addition their self-efficacy is raised through sharing their tacit knowledge as they make it explicit by assisting and demonstrating to their peers what to do.

Table 2: Design copy phase

	Date of session and Focus of session	Data tool used and # returned	Number of people signing register	Descriptors
7	Wednesday, 21 May 2008 Participants are exposed to the cyberhunt design and implementation process via a Lesson Design template on the data projector. Pollution was defined as topic. In groups, the participants defined their keywords related to pollution. The keywords were then shared with the other groups. The keywords were then googled. Participants were also shown the value of searching in different ways for pollution including Boolean searches. Participants then all accessed the same website and constructed a pollution cyberhunt consisted of five questions on this one website as reference.	Three interviews (n=3) (Open ended & unstructured)	39	Exposed to cyberhunt design Increase in numbers: More teachers join project. Data collection

8	Wednesday 28 May 2008 Participants worked individually on the Internet. A typed Cyberhunt template was given to them. They had to type it in Word in exactly the same format and layout. This template consisted of a title heading, some motivational and enticing sentence to attract learner attention, questions and a web address. Participants were asked who felt confident that the will be able to assist others when they needed assistance. Four indicated that they were willing to assist. These four members were then instructed to move through the computer lab and to assist those who needed help. The other participants were instructed to make use of their peer experts for assistance and to only consult me as project leader/facilitator when their peer experts were unable to assist.	Four interviews (n=4) (Open ended & unstructured) Observation	43	Working on own cyberhunts. Beginning of using capable peer participants as co-facilitators. Data collection
9	Wednesday, 4 June 2008 Participants were also divided into groups of 3 to 4 members and had to decide upon a topic, define keywords related to the topic that could be used to search for on the Internet using Internet Explorer as web browser. Furthermore, they had then to search in www.google.com for information related to the topic and keywords. They have to explore the "hits" (search results of google), read it and then set questions related to the content. These questions have to be typed in Microsoft Word.	Journals (n=21) [Appendix K] Observation	26	Cyberhunt design in groups. Decrease in numbers: Some of the teachers who started initially, does not continue further. Data collection
	Tuesday, 10 June 2008 NO SESSION: Principal / Deputy / HOD Meeting	One interview (n=1) [Semi-Structured. Followed structure of Appendix G] Open-ended questionnaire (n=7) [Appendix G]	NO SESSION	Data collection

3. Tool stage (Phase 2)

In this phase the focus is on obtaining additional tool skills from other software or applications that can be utilized as part of the cyberhunt planning, design and/or presentation phases. For example, PowerPoint can be used as presentation tool of the answers to the Cyberhunt or as presentation tool for deeper explored aspects related to the topic at another time.

Table 3: Design copy phase

	Date of session and Focus of session	Data tool used and # returned	Number of people signing register	Descriptors
10	Wednesday, 11 June 2008 PowerPoint and the web: The participants were given an introduction on PowerPoint. The rationale was that they could use PowerPoint as a presentation tool when they report their findings/answers on the questions. This could then also serve as a memorandum for them. In the process, the participants also gain PowerPoint presentation skills in an integrative manner.	Observation	25	PowerPoint and cyberhunts. Provided with handouts.

4. Design in group stage: Participants design cyberhunt in group context (Phase 2)

Participants are yet again afforded an opportunity to share their tacit knowledge with one another through articulation by means of discussion and peer assistance. As a result the tacit knowledge becomes explicit and participants have an opportunity to try to link the new knowledge to their existing knowledge structure. The newly acquired explicit knowledge becomes tacit knowledge when it is linked to the existing knowledge structure.

Table 4A: Design in group phase

	Date of session and Focus of session	Data tool used and # returned	Number of people signing register	Descriptors
11	Wednesday 18 June 2008 Participants were given the following assignment/project: Design a cyberhunt in a group. Form groups of 2 to 4 members. Mix and do not select friends. Design your cyberhunt on a topic that you have agreed upon. Then search for information. You have to compose ten questions and have to have at least two different websites for these questions. You have four weeks (4 sessions of 1 ½ hours each). Each week each participant will complete the Journal form on which participants set their goals for each session, report back on what they have achieved, what they struggled with, what they found easy, group work related issues, etc. This will help them as well as the facilitator to become aware of their progress and concerns.	Journals (n=22) [Appendix L] Two unstructured interviews (n=2) Observation	22	Data collection
	Wednesday 25 June 2008 NO SESSION	One group interview with five participants at once (n=1, but 5 participants). Followed structure of Appendix W to some extent] Observation	5	Data collection
12	Tuesday, 22 July, 2008 Continue to design cyberhunt in groups. Make use of capable peers to assist participants who need assistance.	Observation	27	
13	Tuesday, 29 July, 2008 Continue to design cyberhunt in groups. Make use of capable peers to assist participants who need assistance.	Journals (n=19) [Appendix M]. Fewer data tools were returned as some participants left earlier or did not complete the data tool. Observation	24	Difference in number of Journals received as a result of some participants that had to leave early and as a result did not hand in their Journals (Data collection)

Table 4B: Design in group phase (Continue from previous page)

	Date of session and Focus of session	Data tool used and # returned	Number of people signing register	Descriptors
14	Wednesday, 13 August, 2008 Continue to design cyberhunt in groups. Make use of capable peers to assist participants who need assistance. Introduce Bloom's Taxonomy to them. Work on questioning skills for different levels of thinking.	Journals (n=23) [Appendix M] Fewer data tools were returned as some participants left earlier or did not complete the data tool. Observation	24	Difference in number of Journals received as a result of some participants that had to leave early and as a result did not hand in their Journals (Data collection)
15	Wednesday, 20 August, 2008 Continue to design cyberhunt in groups. Make use of capable peers to assist participants who need assistance.	Journals (n=26) [Appendix M] Task Elicitation (n=22) [Appendix R]. Fewer data tools were returned as some participants left earlier or did not complete the data tool. Observation	29	Difference in number of Journals received as a result of some participants that had to leave early and as a result did not hand in their Journals (Data collection)

5. Presentation stage: Participants test one another's cyberhunts (Phase 2)

During this phase participants received an opportunity to showcase their finished cyberhunt products and to obtain feedback from their peers, a kind of alpha testing. The feedback serves as informal assessment with a view to indicate where improvements can be made and to acquire feedback on how the tester is experiencing the completed product. Those who have not completed their product yet, also receive an opportunity to obtain further assistance from more capable peers in order to complete their product. For the project leader an opportunity is afforded to assess the competence of the individual or group’s final design and computer skills.

Table 5: Presentation Phase

	Date of session and Focus of session	Data tool used and # returned	Number of people signing register	Descriptors
16	Wednesday, 27 August, 2008 Participants conclude their designs and test-drive their peer's	Semi-closed and Semi-open-ended questionnaire (n=25) [Appendix N, O & P] Observation	22 (# that should have signed should be 25. See column to the left)	Difference in number of Questionnaires returned as a result of some participants not signing the register (Data collection)

6. Tool stage (Phase 2)

The same applies here as discussed in the previous tool phase. The rationale for choosing email as a tool, is that it presents participants with an opportunity to communicate with one another to share information, but also to see the value of this tool to be able to communicate with any other person who could assist one with educational assistance.

Table 6: Tool Phase

	Date of session and Focus of session	Data tool used and # returned	Number of people signing register	Descriptors
17	Wednesday, 03 September, 2008 Introduction to Gmail: Tools to communicate with one another and with experts.	Observation	Approx 30 (No register)	No records / No attendance register

7. Assessment stage (Phase 3)

As Microsoft Word was used as the design tool of the Cyberhunt, this phase provide another chance for the project leader and participants to assess their basic computer literacy skills. For example, during the design of the Cyberhunt, the participants were taught how to use various computer skills in Microsoft Word such as formatting text, inserting tables and images, etc. During this phase the project leader can thus observe whether these skills can be transferred to do something else in Microsoft Word.

Table 7: Assessment Phase

	Date of session and Focus of session	Data tool used and # returned	Number of people signing register	Descriptors
18	Wednesday, 17 September, 2008 Practical Assessment: Typing of a WORD document from a pre-designed template. Inserting tables, images and hyperlinks. Saving as HTML file.	Final Likert questionnaires (n=27) [Appendix S, T, U & V]. Three questionnaires were not returned. Observation	30	Project ends. Not all participants returned the Likert Questionnaires handed to them the previous week (Data collection)

8. Further data collection stage (Phase 3)

In order to provide participants with an opportunity to voice their experiences during the project, three additional interviews were conducted. The rationale to have these interviews a month and a half after the project ended, was to verify aspects and issues related to the design process (including the design process, computer skills, planning, interest, collaboration, etc.) and how the project was experienced and recommendations that can be made.

Table 8: Further data collection

Date of session and Focus of session	Data tool used and # returned	Number of people signing register	Descriptors
Friday, 07 November 2008 NO SESSION	Interviews: One one-on-one at school A [Appendix W]	NO SESSION	Data collection
Friday, 07 November 2008 NO SESSION	Interviews: One one-on-two at school B [Appendix W]	NO SESSION	Data collection
Friday, 07 November 2008 NO SESSION	Interviews: One one-on-three at school C [Appendix W]	NO SESSION	Data collection

To try to ensure reliability and validity/credibility, the data collection tools were designed, fine-tuned, implemented and analyzed in phases by following the following steps (See Table 9) [48]:

To practically enhance reliability, participant member checking and feedback from other sources can be implemented to ensure credibility (Silverman, 2000). As a result, a colleague was asked to do spot checks. In addition, the quantitative data collection tools were examined by a statistician at the Nelson Mandela Metropolitan University prior to the research to establish whether the statements and questions conform to the requirements for statistical data analysis. The results of the completed quantitative data instruments were captured into Excel and an independent person selected at random a number of completed quantitative data instruments to establish the accurateness of the entered data. The quantitative data were analyzed by the same statistician who examined the data tools.

[48] The reader will note that the dates overlap among the phases. This occurred as not all the data collection instruments were designed before the research project commenced. For example, after the initial Likert Scale Questionnaire and Computer Skills Questionnaire, interview questions were determined to explore and clarify certain responses and perceptions of the participants. However, these interviews were semi-structured in nature. During Phase 1, the Journal-Reflection data gathering tool was developed, but changed towards the end of Phase 1 and adapted again during the initial stages of Phase 1. During Phase 2, the Journal-Reflection data gathering tool was for example, altered after the first time it was distributed and analyzed in order to improve its usability. The Semi-Closed-Open Ended Questionnaire was designed in June and July 2008 after it was noticed that the additional semi-structured interviews that were designed towards the end of Phase 1 and the beginning of Phase 2, did not provide enough quality data and that it was also very time consuming. Thus, it was decided to design the Semi-Closed-Open Ended Questionnaire which provided quantitative and qualitative data simultaneously. A draft of the final pre- and post perceptions Likert Scale Questionnaire were designed during Phase 1, but it was redesigned towards the middle of Phase 2 because observations during Phase 1 seems to necessitate it, further literature reviewing prompted me to add and reword aspects and a discussion with the statistician served to reword and to regroup certain items in order to improve the quality of date gathering tool.

Table 3.9: Data gathering design tool process

PHASE 1: Data for subsidiary research questions 1 and 5 (January to May 2008)

Step 1: Data tools were designed after the research questions had been defined. The data gathering tools were designed based upon the requirements of the research questions and related aspects from the literature. These data tools were the initial Likert scale questionnaire, Computer skills questionnaire and interview questions.

Step 2: These designed data tools were then discussed with the two promoters of this study as well as a statistician from the Nelson Mandela Metropolitan University. Changes were made where it was deemed necessary after consultation with the two promoters and statistician.

Step 3: The data gathering tools were printed and used in the phases on the dates indicated.

Step 4: Data gathering tools were collected and read.

Step 5: Data gathering tools were converted to electronic format on computer in Microsoft Word and Excel.

Step 6: Electronic data were compared with original completed data gathering tools, with the original digital recorded interview data and with the original digital recorded observational notes.

Step 7: Changes were made where needed.

Step 8: Follow up interviews were conducted to establish clarity on certain aspects and to explore certain aspects on a deeper level.

Step 9: Statistician was visited. He analysed all the quantitative data and we discussed the findings together. These findings were prepared and presented in tabular format.

Step 10: Follow up interviews were conducted again to establish clarity on certain aspects and to explore certain aspects on a deeper level.

Step 11: Codes were determined for the qualitative data by taking the quantitative data into consideration.

Step 12: Electronic data were coded using the pre-determined codes and new codes were created when required.

Step 13: Data belonging to the same categories from the different data gathering tools were grouped together.

Step 14: The grouped data were allocated to the different research questions.

Step 15: The headings and sub-headings were determined and altered when deemed necessary.

Step 14: Draft chapters for each subsidiary question were compiled and presented to the two promoters. Quantitative raw data was examined deeper to check whether any specific patterns could be established from participants from the same school's responses. This was then indicated in the discussion whenever a certain pattern was observed.

Step 15: Changes were made by using the feedback from the promoters.

PHASE 2: Data for subsidiary research questions 2, 3, 4 and 5 (April 2008 to January 2009)

The same steps were followed more or less as for PHASE 1

The data tools developed were interviews, the three separate pre- post Likert Scale Questionnaire, a post Likert Scale Questionnaire These data tools were altered after a discussion with the statistician as his recommendations were included and the necessary deletions he suggested were made. The semi-closed-open-ended questionnaire was designed after it was noticed that the additional semi-structured interviews that were designed towards the end of Phase 1 and the beginning of Phase 2, did not provide sufficient data and that it was also very time consuming.

PHASE 3: Data from all the different data gathering tools were re-read and re-examined and second draft copies of the findings were written by taking into account what was learned through the re-examination of the data (January 2009 to March 2009).

Third draft copies were prepared after the suggestions were received from the supervisors related to the second draft copies.

PHASE 4: The fourth and final copies of the results and interpretation chapters were compiled and handed to the promoters for final assessment (April 2009 to June 2009).

To practically enhance reliability, participant member checking and feedback from other sources can be implemented to ensure credibility (Silverman, 2000). As a result, a colleague was asked to do spot checks. In addition, the quantitative data collection tools were examined by a statistician at the Nelson Mandela Metropolitan University prior to the research to establish whether the statements and questions conform to the requirements for statistical data analysis. The results of the completed quantitative data instruments were captured into Excel and an independent person selected at random a number of completed quantitative data instruments to establish the accurateness of the entered data. The quantitative data were analysed by the same statistician who examined the data tools.

APPENDIX C1

Table C1: Marc Prensky‟s Essential 21st Century Skills (Prensky, 2009)

The Essential 21st Century Skills	
Knowing the right thing to do	Behaving ethically
	Thinking critically
	Setting goals
	Having good judgment
	Making good decisions
Getting it done	Planning
	Solving problems
	Self-directing
	Self-assessing
	Iterating
Doing it with others	Taking leadership
	Communicating/interacting with individuals and groups (especially using technology)
	Communicating/interacting with machines (= "programming")
	Communicating/interacting with a world audience
	Communicating/interacting across cultures
Doing it creatively	Adapting
	Thinking creatively
	Tinkering and designing
	Playing
	Finding your voice
Constantly doing it better	Reflecting
	Being proactive
	Taking prudent risks
	Thinking long-term
	Continually improving through learning

APPENDIX C2

Figure C2: Example, volcanoes cyberhunt that provides space for learners to write or type their answers below the questions.

Volcanoes

Instructions

- Fill in your name and student number
- You will find several questions that are related to various websites. To answer each question you will need to click on the blue highlighted web address which will take you to the website that will offer the information needed to answer the questions.
- Answer all questions on the page.
- Once you have completed your work, save it under your name and surname in the folder named VolcanoesGrade6A.
-

Name and Surname	
Question 1 (Comprehension)	What would you do if a volcano erupts? http://vulcan.wr.usgs.gov/Hazards/Safety/what_to_do.html
Answer	
Question 2 (Knowledge)	List all the Volcanoes in Tanzania. http://volcano.und.edu/vwdocs/volc_images/africa/africa.html
Answer	
Question 3 (Knowledge/ Analysis	By looking at the map and information related to the dispersal of volcanoes, identify the area which is most dense. Roughly how many volcanoes would you say there are? http://www.geo.mtu.edu/volcanoes/world.html
Answer	

APPENDIX C3

Figure C3: Example, a visit to Addo Elephant Park cyberhunt that does not provide space for learners to write or type their answers below the questions.

A VISIT TO ADDO ELEPHANT PARK

Answer the questions on your printed worksheets. Click on the blue links to go to a website which has the information you need to answer the questions listed below it.

What to see and do in Addo http://www.nature-reserve.co.za/cape-eastern-addo-elephant-park.html

1. (Know) How many elephants are there in the Addo Elephant Park?
2. (Know) How far away from Port Elizabeth is the Addo Elephant Park?
3. (Know) Name three other kinds of large animals you could expect to see in Addo.
4. (Comp) What is another name for a suricate? Describe one in a sentence.
5. (Comp) What do you think is the main thing visitors to Addo, do? (
6. (Comp) What other activities are there? (Name at least 3).

Accommodation at Addo http://www.sanparks.org/parks/addo/

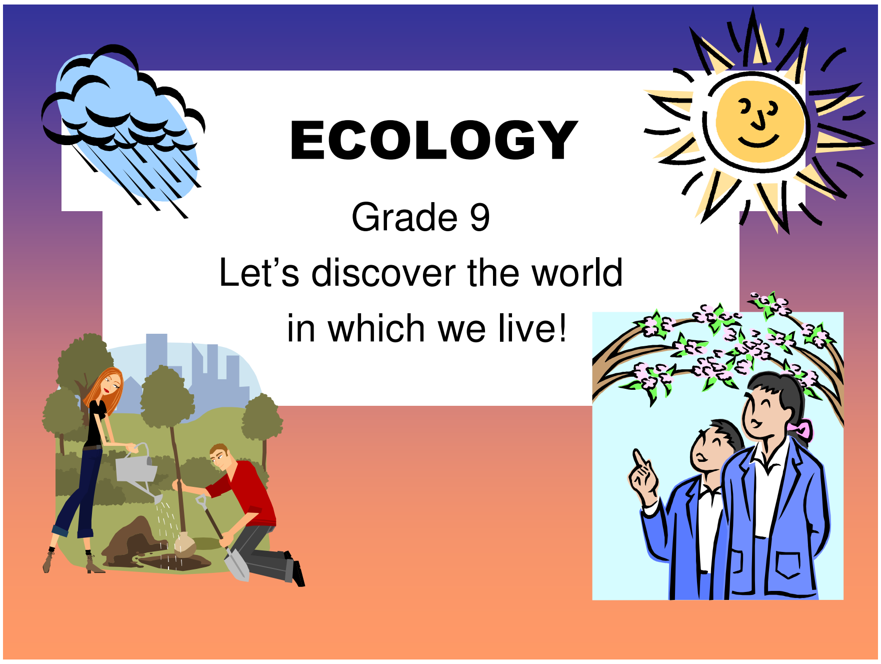
7. (Know) What are the main kinds of different accommodation at Addo? Name at least five kinds.
8. (Appl) How many safari tents are available for the night of 1 September 2006?
9. (Know) How many people can sleep in each tent?
10. (Comp) Describe a safari tent in your own words (Hint: find some pictures).
11. (Appl) How much would it cost for a family of 2 adults and 2 children to share a Forest Cabin on the night of 1 September 2006?
12. (Comp) Which number would you phone to book your reservation?

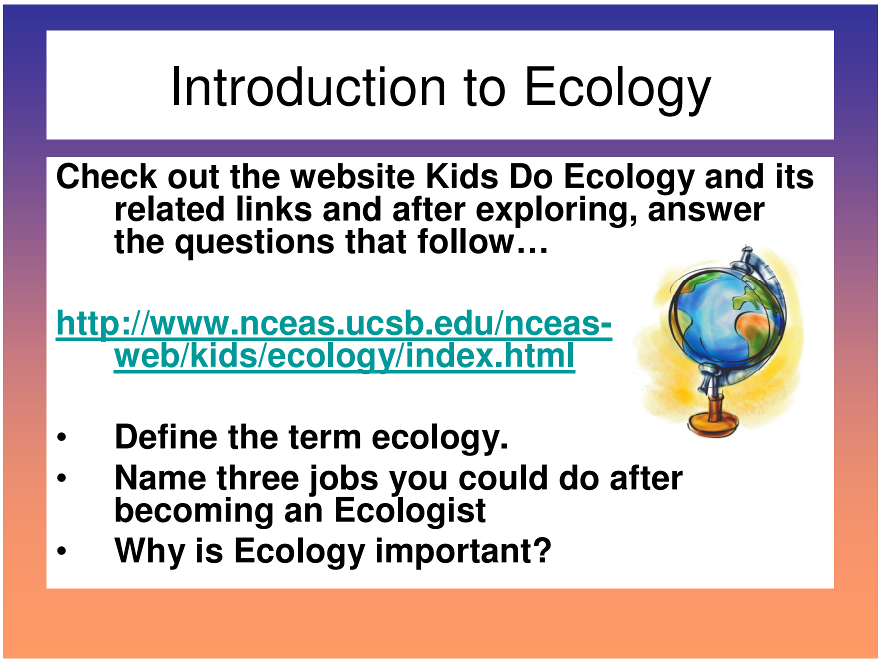
Getting there http://www.sanparks.org/parks/addo/

13. (Anal) If you were going to drive to Addo from Port Elizabeth, which route would you take? (Give the route numbers of the major roads you would take).

APPENDIX C4

Figure C4: Example, cyberhunt created in PowerPoint. Answers need to be typed in a word processor or on paper.





Biomes

http://www.nceas.ucsb.edu/nceas-web/kids/biomes/what_biomes_are.htm

4. Explain what a biome is in your own words.

5. The biomes are separated into two general classifications. Name them

6. List the 12 Biomes of the World

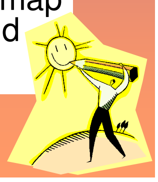
7. Reflect on South Africa, which biomes do you think we have?

South African Biomes

Now that you've discovered a bit about world conservation – let's turn our focus closer to home…

http://www.environment.gov.za/enviro-info/nat/biome.htm

8. What are the 7 biomes that scientists have identified in South Africa?
9. On a separate sheet of paper, design a map of South Africa showing where you would find the various biomes.



APPENDIX C5

Table C5: Taxonomies of the cognitive domain: Bloom vs. Anderson & Krathwohl (Wilson, 2005).

Bloom's Taxonomy 1956	Anderson and Krathwohl's Taxonomy 2000
1. Knowledge: Remembering or retrieving previously learned material. Examples of verbs that relate to this function are: know, define, record identify, recall, name relate, memorize, recognize list, repeat, acquire	**1. Remembering: Retrieving, recalling, or recognizing** knowledge from memory. Remembering is when memory is used to produce definitions, facts, or lists, or recite or retrieve material.
2. Comprehension: The ability to grasp or construct meaning from material. Examples of verbs that relate to this function are: restate, identify, illustrate locate, discuss, interpret report, describe, draw recognize, discuss, represent explain, review, differentiate express, infer, conclude	**2. Understanding:** Constructing meaning from different types of functions be they written or graphic messages activities like i**nterpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.**
3. Application: The ability to use learned material, or to implement material in new and concrete situations. Examples of verbs that relate to this function are: apply, organize, practice relate, employ, calculate develop, restructure, show translate, interpret, exhibit use, demonstrate, dramatize operate, illustrate	**3. Applying:** Carrying out or using a procedure through **executing, or implementing**. Applying refers to situations where learned material is used through products like models, presentations, interviews or simulations.
4. Analysis: The ability to break down or distinguish the parts of material into its components so that its organizational structure may be better understood. Examples of verbs that relate to this function are: analyze, differentiate, experiment compare, contrast, scrutinize probe, investigate, discover inquire, detect, inspect examine, survey, dissect contrast, classify, discriminate categorize, deduce, separate	**4. Analyzing:** Breaking material or concepts into parts, determining how the parts relate or interrelate to one another or to an overall structure or purpose. Mental actions included in this function are **differentiating, organizing, and attributing**, as well as **being able to distinguish between** the components or parts. When one is analyzing he/she can illustrate this mental function by creating spreadsheets, surveys, charts, or diagrams, or graphic representations.
5. Synthesis: The ability to put parts together to form a coherent or unique new whole. Examples of verbs that relate to this function are: compose, plan, propose produce, invent, develop design, formulate, arrange assemble, collect, construct create, set up, organize prepare, generalize, originate predict, document, derive modify, combine, write tell, relate, propose	**5. Evaluating:** Making judgments based on criteria and standards through **checking and critiquing**. Critiques, recommendations, and reports are some of the products that can be created to demonstrate the processes of evaluation. In the newer taxonomy evaluation comes before creating as it is often a necessary part of the precursory behavior before creating something. **Remember this one has now changed places with the last one on the other side.**
6. Evaluation: The ability to judge, check, and even critique the value of material for a given purpose. Examples of verbs that relate to this function are: judge, argue, validate assess, decide, consider compare, choose, appraise evaluate, rate, value conclude, select, criticize measure, estimate, infer deduce	**6. Creating:** Putting elements together to form a coherent or functional whole; **reorganizing** elements into a new pattern or structure through **generating, planning, or producing**. Creating requires users to put parts together in a new way or synthesize parts into something new and different a new form or product. This process is the most difficult mental function in the new taxonomy. **This one used to be #5 in Bloom's known as synthesis.**

APPENDIX C6

Figure C6: The initial cyberhunt planning and implementation model of 2008

APPENDIX C7

Table C7: Critical outcomes in relation to design skills

Critical outcomes and related issues	Design skills: Ask: What actions must be evident in the skills to indicate that the critical outcome has been addressed?
Identify and solve problems in which responses display that responsible decisions using critical and creative thinking have been made.	Research Skills Project management and Time management Reflection Skills Design Skills
Work effectively with others as a member of a team, group, organisation, community	Decision Making Skills Research Skills Project management and Time management Design Skills Reflection Skills
Organise and manage oneself and one's activities responsibly and effectively	Project management and Time management Design Skills Reflection Skills
Collect, analyse, organise and critically evaluate information	Decision Making Skills Research Skills Design Skills Reflection Skills
Communicate effectively using visual, mathematical and/or language skills in the modes of oral and/or written presentation	Design Skills Reflection Skills
Use science and technology effectively;	Research Skills Design Skills
Employ effective learning strategies;	Decision Making Skills Research Skills
Become responsible citizens;	Time management
Be culturally and aesthetically sensitive;	Project management

APPENDIX D1

LETTER TO PRINCIPALS OF PARTICIPATING SCHOOLS

Nelson Mandela Metropolitan University

for tomorrow

Faculty of Education

Department of Science, Mathematics and Technology Education

PO Box 77000 • Nelson Mandela Metropolitan University

Port Elizabeth • 6031 · South Africa • www.nmmu.ac.za

19 November 2007

Dear Principal, Teachers, Staff, Governing Body, Parents and Learners

SMIS PROJECT: COMPUTERS

You are being asked to participate in a research study. We will provide you with the necessary information to assist you to understand the study and explain what would be expected of you (participant) at the end of this letter. These guidelines would include the risks, benefits, and your rights as a study subject. Please feel free to ask the researcher to clarify anything that is not clear to you.

To participate, it will be required of you to provide a written consent that will include your signature, date and initials to verify that you understand and agree to the conditions.

You have the right to query concerns regarding the study at any time. Immediately report any new problems during the study, to the researcher. Telephone numbers of the researcher are provided. Please feel free to call these numbers.

Furthermore, it is important that you are aware of the fact that the study has to be approved by the Research Ethics Committee (Human) of the university. The RECH consist of a group of independent experts that has the responsibility to ensure that the rights and welfare of participants, in research are protected and that studies are conducted in an ethical manner. Studies cannot be conducted without RECH's approval. Queries with regard to your rights as a research subject can be directed to the Research Ethics Committee (Human) you can call the Director: Research Management at (041) 504-4536.

If no one could assist you, you may write to: The Chairperson of the Research, Technology and Innovation Committee, PO Box 77000, Nelson Mandela Metropolitan University, Port Elizabeth, 6031.

Participation in research is completely voluntary. You are not obliged to take part in any research. If you choose not to participate in medically related research, your present and/or future medical care will not be affected in any way and you will incur no penalty and/or loss of benefits to which you may otherwise be entitled.

If you do partake, you have the right to withdraw at any given time, during the study without penalty or loss of benefits. However, if you do withdraw from the study, you should return for a final discussion or examination in order to terminate the research in an orderly manner.

The study may be terminated at any time by the researcher, the sponsor or the Research Ethics Committee (Human) that initially approved the study.

Although your identity will, at all times remain confidential the results of the research study may be presented at scientific conferences or in specialist publications without any names being used.

This informed consent statement has been prepared in compliance with current statutory guidelines.

ABOUT THE RESEARCH PROJECT AND PREVIOUS DISCUSSIONS

The SMIS project would like to assist schools to become Learning Organizations which have a passion to develop and improve teaching and learning. You have all attended meetings already where you have been informed about this project and you have indicated that you want to participate.

The Computer Training will focus on using Cyberhunts as a strategy for teaching and learning. Cyberhunts are linked to topics in the RNCS Outcomes Based Curriculum. Teachers will be trained how to use existing cyberhunts, how to design their own Cyberhunts and how to assist learners to eventually design Cyberhunts. Cyberhunts would require that teachers and learners are trained in how to use the Internet for searching by making use of Internet Explorer as well as how to use Microsoft Word and PowerPoint to create Cyberhunts. Through the training, teachers will be able to empower themselves to become computer literate in Word, PowerPoint and Internet Explorer. Participants will also be taught how to use Email and how to implement it as a learning tool via Cyberhunts. Support will be provided through site visits, training sessions and *via* email

To indicate that you agree to participation and the terms associated, you have to sign the attached letter of consent as certification of your commitment and agreement to these terms.

TRAINING AND IMPLEMENTATION ASPECTS

- Allow the SMIS research team into the school to assist and monitor
- Allow for suitable time tabling during the school week in order that the SMIS research team can visit the school
- Participation and Training: We require that a minimum of 6 teachers from grade 5 to 7 in the primary school and grade 8 to 9 in the high school, participates. This number will be expanded in the second year.
- Participate in the scheduled training / staff development sessions at the Missionvale Campus or at designated schools in the surrounding area in the afternoons and occasional weekends
- Complete questionnaires for data gathering purposes before the project start, during the project and at the end of the project
- Implement the newly acquired knowledge/techniques into their classrooms and complete reflection journals/sheets/questionnaires

RESEARCH ASPECTS

- Support the SMIS research team
- Allow that the principal, staff, learners and parents may be interviewed to gather data
- Allow entrance into the school and classes by the SMIS research team
- Complete questionnaires for data gathering purposes before the project start, during the project and at the end of the project
- Implement the newly acquired knowledge/techniques into their classrooms and complete reflection journals/sheets/questionnaires

Yours sincerely

André du Plessis

APPENDIX D2

APPLICATION LETTER TO EDUCATION DEPARTMENT

Nelson Mandela Metropolitan University

for tomorrow

Faculty of Education

Department of Science, Mathematics and Technology Education

PO Box 77000

Nelson Mandela Metropolitan University

Port Elizabeth

6031

0835655560

041-5041633 (FAX)

5 February 2008

Dear Mrs Mbopa

<u>RESEARCH PROJECT: COMPUTERS IN SCHOOLS</u>

The SMIS project would like to assist schools to become Learning Organizations which have a passion to develop and improve teaching and learning. This will be in line with the Draft White Paper on e-Education which was gazetted in 2004.

We have received sponsorship from the DELL foundation in the form of 20 computers for each of the participating schools. Principals of the following schools have been consulted and are very excited about the possibility, as this will be an additional aspect to the ABSA SMIS project. The following schools will form part of the project (Another one might be added after we have consulted with them):

- School A
- School B
- School C
- School D
- School E
- School F

The Computer Training will focus on using Cyberhunts as a strategy for teaching and learning. Cyberhunts are linked to topics in the RNCS Outcomes Based Curriculum. Teachers will be trained how to use existing cyberhunts, how to design their own Cyberhunts and how to assist learners to eventually design Cyberhunts. Cyberhunts would require that teachers and learners are trained in how to use the Internet for searching by making use of Internet Explorer as well as how to use Microsoft Word and PowerPoint to create Cyberhunts. Through the training, teachers will be able to empower themselves to become computer literate in Word, PowerPoint and Internet Explorer. Participants will also be taught how to use Email and how to implement it as a learning tool via Cyberhunts. Support will be provided through site visits, training sessions and *via* email

WHAT IS REQUIRED BY SCHOOLS: TRAINING AND IMPLEMENTATION ASPECTS

- Allow the SMIS research team into the school to assist and monitor
- Allow for suitable time tabling during the school week in order that the SMIS research team can visit the school
- Participation and Training: We require that a minimum of 6 teachers from grade 5 to 7 in the primary school and grade 8 to 9 in the high school, participates. This number will be expanded in the second year.
- Participate in the scheduled training / staff development sessions at the Missionvale Campus or at designated schools in the surrounding area in the afternoons and occasional weekends
- Complete questionnaires for data gathering purposes before the project start, during the project and at the end of the project
- Implement the newly acquired knowledge/techniques into their classrooms and complete reflection journals/sheets/questionnaires

RESEARCH ASPECTS

- Support the SMIS research team
- Allow that the principal, staff, learners and parents may be interviewed to gather data
- Allow entrance into the school and classes by the SMIS research team
- Complete questionnaires for data gathering purposes before the project start, during the project and at the end of the project
- Implement the newly acquired knowledge/techniques into their classrooms and complete reflection journals/sheets/questionnaires

We hope that this research project will receive your favourable consideration.

Yours sincerely

André du Plessis

0835655560

041-5041633 (FAX)

APPENDIX D3

LETTER FROM EDUCATION DEPARTMENT

Fax sent by : 0414510193 district office 21/02/08 10:04 Pg: 1/1

Province of the
EASTERN CAPE
DEPARTMENT OF EDUCATION

Ethel Valentine Building * Sutton Road * Sidwell * Private Bag X3931 * North End * Port Elizabeth * 6056 *
REPUBLIC OF SOUTH AFRICA * Tel: 0414034420 * Fax: 0414510193 *
Website: ecprov.gov.za * e-mail: tandeka.mbopa@edu.ecprov.gov.za

Mr André du Plessis
Nelson Mandela Metropolitan University
(Fax: 041 5041633)

Dear Mr du Plessis

RESEARCH PROJECT: COMPUTERS IN SCHOOLS

I refer to your letter dated 05 February 2008 and our telephonic conversation of today.

Permission is hereby granted for you to conduct your research on the following conditions:

1. your research must be conducted on a voluntary basis;
2. all ethnical issues relating to research must be honoured;
3. your research is subject to the internal rules of the school, including its curricular programme and its code of conduct and must not interfere in the day-to-day routine of the school.

Kindly present a copy of this letter to the principal as proof of permission.

I wish you good luck in your research.

Yours faithfully

dLMbopa

L.M.T. MBOPA
ACTING DISTRICT DIRECTOR: PORT ELIZABETH
/ab

21 February 2008

APPENDIX D4&5

ETHICS REQUEST

Nelson Mandela Metropolitan University

for tomorrow

REF NO: **For office use**

APPLICATION FOR APPROVAL: NMMU RESEARCH ETHICS COMMITTEE (HUMAN)

1. Any project in which humans are the subjects of research, hereafter called a study, requires completion of this form and submission for approval to the RESEARCH ETHICS COMMITTEE (HUMAN) (REC-H).
2. The faculty through the Faculty RTI Committee and Head of Department (or other intra-faculty academic unit) should approve research proposals before submission to the Ethics Committee.
3. Each faculty has the primary responsibility for ensuring that human subjects used in research in their faculties are protected adequately by the application of the appropriate code applicable to the relevant profession.
4. How to proceed: i) Read the Code of Conduct for Researchers at the Nelson Mandela Metropolitan University, available on the Intranet (Official Stuff|Policies|Official NMMU Policies|RTI|Research Ethics). ii) Open a copy of the application form (this file "REC-H Human Ethics Application Form.doc") from the Intranet, and "**Save as**" the file with a filename **containing your name (e.g. "J Smith** REC-H Human Ethics Application Form.doc"**)**. iii) Complete Sections 1 to 8 in **typescript** (Tab between fields, select from pull-downs, information may be pasted from existing Word® documents), and save (**ensuring the filename contains your name**). iv) Append the necessary information, e.g. an Informed Consent form (use Document D/497/05 "REC-H Informed Consent Pro-forma" as a basis, and modify to suit your requirements) v) Email the files to Visha.Coopasamy@nmmu.ac.za.
5. **Print the document**, get each page initialled on the lower right hand corner and get Sections 9 and 10 signed by the relevant parties.
6. **Hand the signed hardcopy and attachments in** at the Department of Research Capacity Developement.

1. GENERAL PARTICULARS
a) Concise descriptive title of study (must contain key words that best describe the study): The implementation of an approach for guiding participants in the integration of computer technology in teaching and learning through cyberhunts as a teaching and learning strategy
b) Name of primary responsible person (PRP) (must be member of permanent staff): Andre du Plessis SMATE, MISSIONVALE CAMPUS, ROOM425

c) Contact number/s of PRP: 0835655560

d) Affiliation of PRP: Faculty Education; Department (or equivalent):SMATE

e) Name and affiliation of principal investigator (PI) / researcher (may be same as PRP):
ANDRE (Lecturer) Gender: Male

f) Name(s) and affiliation(s) of all co workers (e.g. co-investigator / assistant researchers / supervisor / co-supervisor / promoter / co-promoter):
Vernon Naidoo (SMIS Project Manager)

g) Scope of study: Local | h) If for degree purposes: Doctoral

i) Funding : Privately funded
Additional information (e.g. source of funds or how combined funding is split)

j) Are there any restrictions or conditions attached to publication and/or presentation of the study results? NO
If YES, elaborate: (Any restrictions or conditions contained in contracts must be made available to the Committee)

k) Date of commencement of study: MARCH 2008 Anticipated duration of study: 6-9 months

l) Objectives of the study (the major objective(s) / Grand Tour questions are to be stated briefly and clearly):
To design and develop a model for guiding participants in the integration of computer technology in teaching and learning through Cyberhunts as a teaching and learning strategy.

m) Background information: briefly (300 words or less) describe the scientific or field observations which have prompted the work. A few (no more than 5) key scientific references may be included:
In some fortunate South African schools, learners have been exposed to computers for a number of years. According to the DOE (2002) the main focus in many schools is computer literacy and basic computer skills rather than using the computer as a tool for learning with. A seminar that I have presented in 2004 at the then PE Technicon, teachers indicated that there is a great need for direction regarding computer integration and how to achieve this as inn many cases one person is responsible for teaching computer literacy to the whole school. The problems that teachers experience are:

n)

o) 1.There is not a great deal of contact between them and the computer facilitator to liaise and

p) 2.What happens in the computer room is not directly linked to what happen within the classroom.

q) 3.If teachers are responsible for their own class's computer integration, they do not know what to do or are unsure. The attending teachers voiced that there is a need to establish the integration of computers within learning areas, but that they are uncertain and unfamiliar with how to implement integration. They need assistance.

r) 4.The need to get personally involved with computer integration and to play an active part in the establishment and implementation of computer integration at their schools, were of great concern to many.

s) Briefly state the methodology (specifically the procedure in which human subjects will be participating) (the full protocol is to be included as *Appendix 1*):
MIXED METHOD, ONTOLOGICALLY CRITICAL REALIST, EPISTEMOLOGICALLY SOCIAL CULTURAL AND METHODOLOGICALLY THE INTERPRETIVE APPROACH. Participants will complete Likert Scale questionnaires and will be interviewed. They will attend workshops in which they will be trained. The will implement the newly

acquired strategy in the school and will meet on a two to three weekly basis where they will report back on problems and success areas. Learners will also complete Likert Scale questionnaires in which they will comment on their attitudes and learning experiences. Learners will also be interviewed and asked questions such as how they experience the learning, what they enjoy, dislike, problems they encounter, etc. The learners will also keep a journal where they note their perceptions and experiences of the cyberhunt learning. At the end of the project, participants will again complete the same Likert Scale questionnares to check whether their have been changes in their attitudes and learning experiences.

t) State the minimum and maximum number of participants involved (Minimum number should reflect the number of participants necessary to make the study viable) Min: 20 Max: 300

2. Risks and Benefits of this Study

a) Is there any risk of harm, embarrassment or offence, however slight or temporary, to the participant, third parties or to the community at large.? NO
If YES, state each risk, and for each risk state i) whether the risk is reversible, ii) whether there are alternative procedures available and iii) whether there are remedial measures available.
NOT APPLICABLE

b) Has the person administering the project previous experience with the particular risk factors involved? YES
If YES, please specify: Have been involved with training people in computer use

c) Are any benefits expected to accrue to the participant (e.g. improved health, mental state, financial etc.)? YES
If YES, please specify the benefits: NEW COMPUTER AND INTERNET SKILLS

d) Will you be using equipment of any sort? YES If YES, please specify: Computers and the Internet

e) Will any article of property, personal or cultural be collected in the course of the project? YES
If YES, please specify: Examples of teachers planning, writing and learner journals about their feelings related to this type of learning and their computer created products

3. Target Participant Group

a) If particular characteristics of any kind are required in the target group (e.g. age, cultural derivation, background, physical characteristics, disease status etc.) please specify:

b) Are participants drawn from NMMU students? NO

c) If participants are drawn from specific groups of NMMU students, please specify:

d) Are participants drawn from a school population? YES If YES, please specify: 6 Disadvantaged schools in the Missionvale area

e) If participants are drawn from an institutional population (e.g. hospital, prison, mental institution) , please specify: NOT APPLICABLE

f) If any records will be consulted for information, please specify the source of records:

g) Will each individual participant know his/her records are being consulted? YES
If YES, state how these records will be obtained:

h) Are all participants over 21 years of age? NO If NO, state justification for inclusion of minors in study: Learners need to tell us how they experience this learning through computers and what they have learned, etc.

4. CONSENT OF PARTICIPANTS
a) Is consent to be given in writing? YES If YES, include the consent form with this application. (A pro-forma file "REC-H Informed Consent Pro-forma" is available for your convenience. Modify it to suit your requirements, and attach as "Appendix 2"). If NO, state reasons why written consent is not appropriate in this study.
b) Are any participant(s) subject to legal restrictions preventing them from giving effective informed consent? NO If YES, please justify:
c) Do any participant(s) operate in an institutional environment, which may cast doubt on the voluntary aspect of consent? NO If YES, state what special precautions will be taken to obtain a legally effective informed consent:
d) Will participants receive remuneration for their participation? NO If YES, justify and state on what basis the remuneration is calculated, and how the veracity of the information can be guaranteed.
e) Do you require consent of an institutional authority for this study? YES If YES, specify: DISTRICT MANAGER, The principal of the school (They are all part of the SMIS project and have agreed to participate)

5. INFORMATION TO PARTICIPANTS
a) What information will be offered to the participant before he / she consents to participate? (A pro-forma file "REC-H Preamble Letter Pro-forma.doc" is available for your convenience. Modify it to suit your requirements, and attach as [*Appendix 2*]. Attach any oral [*Appendix 3*] information given)
b) Who will provide this information to the participant? (Give name and role) ANDRE DU PLESSIS Other If "Other", please specify: TEACHERS AT SCHOOL
c) Will the information provided be complete and accurate? YES If NO, describe the nature and extent of the deception involved and explain the rationale for the necessity of this deception below:
6. PRIVACY, ANONYMITY AND CONFIDENTIALITY OF DATA
a) Will the participant be identified by name in your research? NO If YES, justify:
b) Are provisions made to protect participant's rights to privacy and anonymity and to preserve confidentiality with respect to data? YES If NO, justify If YES, specify: Names won't be used
c) If mechanical methods of observation be are to be used (e.g. one-way mirrors, recordings, videos etc.), will participant's consent to such methods be obtained? YES If NO, justify: Asked to whether he/she agrees to be recorded during the interview
d) Will data collected be stored in any way? YES If YES, please specify: (i) By whom? (ii) How many copies? (iii) For how long? (iv) For what reasons? (v) How will participant's anonymity be protected? (i) Researcher (ii) all the collected data (iii) for the duration of the study and the analysis of the data (12 months) (iv) data analysis (v) stored in a safe place in my office. The data are not data that will discredited a person, as it will provide evidence of their teaching and learning experiences
e) Will stored data be made available for re-use? NO If YES, how will participant's consent be obtained for such re-usage?
f) Will any part of the project be conducted on private property (including shopping centres)? NO If YES, specify and state

how consent of property owner is to be obtained:
g) Are there any contractual secrecy or confidentiality constraints on this data? NO If YES, specify:

7. FEEDBACK
a) Will feedback be given to participants? YES If YES, specify whether feedback will be written, oral or by other means and describe how this is to be given (e.g. to each individual immediately after participation, to each participant after the entire project is completed, to all participants in a group setting, etc.) : During and after the project. Participants will be involved all the time and will be giving their feedback to me as researcher. There are no secrets as all participants will be actively involved all the time
b) If you are working in a school or other institutional setting, will you be providing teachers, school authorities or equivalent a copy of your results? YES If YES, specify, if NO, motivate: They will all get a copy of the final thesis

8. ETHICAL AND LEGAL ASPECTS
a) The Declaration of Helsinki (2000) will be included in the references : YES If NO, motivate:
b) I would like the REC-H to take note of the following additional information:
9. DECLARATION
If any changes are made to the above arrangements or procedures, I will bring these to the attention of the Research Ethics Committee (Human). I have read, understood and will comply with the *Guidelines for Ethical Conduct in Research and Education at the Nelson Mandela Metropolitan University* and have taken cognisance of the availability (on-line) of the Medical Research Council Guidelines on Ethics for Research. All participants are aware of any potential health hazards or risks associated with this study. I **AM NOT** **aware of potential conflict(s) of interest which should be considered by the Committee.** If affirmative, specify:
12 Mar SIGNATURE: Andre du Plessis (Primary Responsible Person) Date
12 Marc SIGNATURE: ANDRE (Lecturer) (Pricipal Investigator/Researcher) Date

10. SCRUTINY BY FACULTY AND INTRA-FACULTY ACADEMIC UNIT

This study has been discussed, and is supported, at Faculty and Departmental (or equivalent) level. This is attested to by the signature below of a Faculty (e.g. RTI) and Departmental (e.g. HoD) representative, neither of whom may be a previous signator.

NAME and CAPACITY (e.g. HoD)	SIGNATURE
NAME and CAPACITY (e.g. Chair:FacRTI)	SIGNATURE

11. APPENDICES

In order to expedite the processing of this application, please ensure that all the required information, as specified below, is attached to your application.

APPENDIX 1: RESEARCH METHODOLOGY

Attach the full protocol and methodology to this application, as "Appendix 1".

APPENDIX 2: INFORMED CONSENT FORM

A pro-forma file "REC-H Informed Consent Pro-forma" is available for your convenience. Modify it to suit your requirements, and attach as "Appendix 2". If no written consent is required, motivate at 4a)

APPENDIX 3: WRITTEN INFORMATION GIVEN TO PARTICIPANT PRIOR TO PARTICIPATION

A pro-forma file "REC-H Preamble Letter Pro-forma.doc" is available for your convenience. Modify it to suit your requirements, and attach as "Appendix 3"

APPENDIX 4: ORAL INFORMATION GIVEN TO PARTICIPANT PRIOR TO PARTICIPATION

If applicable, attach the required information to your application, as "Appendix 4".

In order to facilitate improvements in efficacy/ease of use, feedback via a REC-H committee member will be appreciated.

APPENDIX D6

ETHICS REQUEST OUTCOME

Nelson Mandela Metropolitan University

for tomorrow

FACULTY OF EDUCATION

Tel . +27 (0)41 504 4310   Fax. +27 (0)504 1610

Ref: [H08-EDU-SMT-001/Approval]

Contact person: Carol Poisat

03 March 2008

Mr A du Plessis

SMATE

NMMU

Dear Mr du Plessis

THE IMPLEMENTATION OF AN APPROACH FOR GUIDING PARTICIPANTS IN THE INTEGRATION OF COMPUTER TECHNOLOGY IN TEACHING AND LEARNING THROUGH CYBERHUNTS AS A TEACHING AND LEARNING STRATEGY

Your above-entitled application for ethics approval served at the **February 2008** meeting of the Faculty Research, Technology and Innovation Committee (Education).

We take pleasure in informing you that the application was approved by the Committee.

The ethics clearance reference number is **H08-EDU-SMT-001**.

We wish you well with the project. Please inform your co-investigators of the outcome, and convey our best wishes.

Yours sincerely

Prof M M Botha

Chairperson: ERTIC

APPENDIX E

LIKERT SCALE QUESTIONNAIRE

BEFORE PROJECT STARTED

This is a confidential questionnaire. Your name and surname will not be made public. Put the questionnaire in the SEALED box at the secretary's office. The box has been sealed and signed to show that it was not tampered with. It is important for the researcher to know who has completed the questionnaire should the researcher need to clarify something. However, if you do not want to state your name and surname, you may use a nickname or any other name. This will help the researcher to try and locate that person should he want to speak to him/her without making that person's real name public. This will be done by asking that identified person make contact with the researcher telephonically to clarify a certain aspect, should there be a need to do so. Confidentially is ensured at all times. Should you not want to write your name or nick name, it is also fine

The questions are posed to obtain information in order to assist the researcher with future planning. Please answer the question as truthfully and objectively as possible. There are no wrong answers.

Why would we like to clarify something? Look at the following example: I have enough knowledge to use computers in my classroom. Lets assume that only 20% of the teachers respond that they do have enough knowledge, we could then interview some teachers in a group and ask them what knowledge would they view as important to use computers in their classrooms. Alternatively, if 85% of the teachers responded to the statement, I do not feel confident to learn how to use computers; interviews could be useful to clarify why this is the case. Thus, the idea is to clarify perceptions and feelings and not to portray anyone in a negative light.

DATE WHEN THIS QUESTIONNAIRE WAS COMPLETED:						
IF YOU DO NOT WANT TO GIVE YOUR REAL NAME, WRITE ANY NICK NAME:						
NAME AND SURNAME:						
ARE YOU A PARTICIPANT THAT HAS BEEN SELECTED TO PARTICIPATE WITH A CLASS IN THE ICT PROJECT? (Make an X in the block)	**YES**	**NO**				
AGE: (Make an X in the block)	**18-19**	**20-29**	**30-39**	**40-49**	**50-59**	**60+**
GENDER: (Make an X in the block)	**MALE**	**FEMALE**				
HIGHEST QUALIFICATION: (Make an X in the block)	**Standard 8 (Grade 10)**	**Matric (Grade 12)**	**2 Year diploma**	**3 Year diploma**	**4 Year diploma**	
	Degree (BA, BCom, BEd, Bsc)	**Honours degree**	**Masters Degree**	**Doctorate Degree**	**OTHER**	
YEAR WHEN HIGHEST QUALIFICATION WAS OBTAINED:						
NUMBER OF YEARS IN EDUCATION/TEACHING? (Make an X in the block)	**0-3**	**4-9**	**10-15**	**16-21**	**22-27**	**28+**
NAME OF SCHOOL WHERE YOU ARE TEACHING AT PRESENT:						
NUMBER OF YEARS AT CURRENT SCHOOL: (Make an X in the block)	**0-3**	**4-9**	**10-15**	**16-21**	**22-27**	**28+**

		STRONGLY DISAGREE						STRONGLY AGREE
Show your level of agreement with each of the following statements. You can position yourself at any point on the scale. Remember that a 1 means that you totally disagree and that a 7 means that you totally agree. A 2 or 3 will indicate that you disagree, but not so strongly. A 6 or 5 will mean that you agree, but not so strongly. Circle your level of agreement for each statement.								
1	We share on a regular basis how we have overcome challenges / problems we have experienced within the ICT (computer) classroom	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	We share on a regular basis during staff development sessions what successes we have achieved within the ICT (computer) classroom	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	We share on a regular basis during staff development sessions what challenges / problems we have experienced within the ICT (computer) classroom	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	We share on a regular basis during staff development sessions how we have used computers within our classroom	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5	We share on a regular basis during staff development sessions how we have overcome challenges / problems we have experienced within the ICT (computer) classroom	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6	We know what we want to do with computers should we get computers	**1**	**2**	**3**	**4**	**5**	**6**	**7**
7	We have the latest/newest software in our computer room	**1**	**2**	**3**	**4**	**5**	**6**	**7**
8	We have staff development sessions on a regular basis at our school	**1**	**2**	**3**	**4**	**5**	**6**	**7**
9	We have regular staff development sessions at our school related to computers	**1**	**2**	**3**	**4**	**5**	**6**	**7**
10	We have a fast Internet connection at school	**1**	**2**	**3**	**4**	**5**	**6**	**7**
11	We have a computer technology plan with clear goals in place at our school	**1**	**2**	**3**	**4**	**5**	**6**	**7**
12	There is adequate money available for staff to attend computer training	**1**	**2**	**3**	**4**	**5**	**6**	**7**
13	There is a need for teachers to be trained in order that teachers will be able to learn how to implement computer integration in their classrooms	**1**	**2**	**3**	**4**	**5**	**6**	**7**
14	The time table of my school provides adequate scheduled periods for my learners to visit the computer room	**1**	**2**	**3**	**4**	**5**	**6**	**7**

		STRONGLY DISAGREE						STRONGLY AGREE
15	The teachers at our school are positive towards using computers for teaching and learning in their classes	1	2	3	4	5	6	7
16	The staff have to be consulted regarding their knowledge about computer integration	1	2	3	4	5	6	7
17	Staff in senior positions at my school, is computer literate	1	2	3	4	5	6	7
18	My principal regularly uses the Internet	1	2	3	4	5	6	7
19	The staff have to be consulted regarding their levels of computer use	1	2	3	4	5	6	7
20	The staff at my school is computer literate	1	2	3	4	5	6	7
21	The project leader / facilitator should teach me individually how to plan and implement cyberhunts	1	2	3	4	5	6	7
22	The facilitator should provide feedback to my questions / concerns / problems	1	2	3	4	5	6	7
23	The Eastern Cape Education Department has the necessary leadership for ICT (computer) implementation and support.	1	2	3	4	5	6	7
24	Regular meetings are important in order that we can learn from one another	1	2	3	4	5	6	7
25	The Department of Education provide teachers with the necessary training on how to use computers at school	1	2	3	4	5	6	7
26	Teachers are rewarded to influence teachers to undergo computer training for teaching and learning	1	2	3	4	5	6	7
27	Support in the form of an email user group can be valuable.	1	2	3	4	5	6	7
28	Staff in senior positions at my school, know how to use the Internet	1	2	3	4	5	6	7
29	The staff have to be consulted regarding a computer integration plan for the school	1	2	3	4	5	6	7
30	Staff in junior positions at my school, know how to use the Internet	1	2	3	4	5	6	7

		STRONGLY DISAGREE						STRONGLY AGREE
31	The staff have been consulted regarding a computer integration plan for the school	1	2	3	4	5	6	7
32	Regular meetings are important to assist us with our concerns / challenges	1	2	3	4	5	6	7
33	The Department of Education provides schools with the necessary computer equipment in order that schools can use computers in teaching and learning	1	2	3	4	5	6	7
34	Our staff is adequately trained to use computers	1	2	3	4	5	6	7
35	Our staff has the knowledge of how to integrate computers within the curriculum	1	2	3	4	5	6	7
36	Our school have an up to date computer room with up to date computers	1	2	3	4	5	6	7
37	Our school has the necessary people on staff that could provide one another with support related to computer problems / challenges	1	2	3	4	5	6	7
38	Our school has set clear goals related to ICT / computer implementation and integration	1	2	3	4	5	6	7
39	Our school has a clear vision in place related to computers	1	2	3	4	5	6	7
40	Our principal believes in computer technology	1	2	3	4	5	6	7
41	Staff in junior positions at my school, is computer literate	1	2	3	4	5	6	7
42	My principal is computer literate	1	2	3	4	5	6	7
43	My fellow staff members have the necessary skills to help me with computer related problems / issues	1	2	3	4	5	6	7
44	It takes more time to prepare a lesson where computer integration is involved than to plan a lesson that do not make use of computer integration or computer activities.	1	2	3	4	5	6	7
45	In prefer to be taught in a group how to plan cyberhunts	1	2	3	4	5	6	7
46	I/We can count on support from the Eastern Cape Education Department to successfully implement computers within our classroom / curriculum	1	2	3	4	5	6	7

		STRONGLY DISAGREE						STRONGLY AGREE
47	I/We can count on support from our principal in order that we successfully implement computers within our classroom / curriculum	1	2	3	4	5	6	7
48	I would use an electronic email support user group regularly if it is available	1	2	3	4	5	6	7
49	I would rely on other persons who are computer literate to do my class's computer integration instruction rather than doing it myself	1	2	3	4	5	6	7
50	I would like to use the computer lab, but do not have enough time for planning	1	2	3	4	5	6	7
51	I would like to be trained in how to integrate computers into the teaching and learning in my classroom.	1	2	3	4	5	6	7
52	I would like that a knowledgeable computer person visit my computer classroom on a regular basis in order that he/she can assist my with the cyberhunt process	1	2	3	4	5	6	7
53	I set goals related to computers for myself on a regular basis	1	2	3	4	5	6	7
54	I would like that a knowledgeable computer person visit my computer classroom on a regular basis in order that he/she can assess in which areas I need assistance (help)	1	2	3	4	5	6	7
55	I will learn more about computers if I am rewarded for it.	1	2	3	4	5	6	7
56	I use the Internet on a regular basis to search for information	1	2	3	4	5	6	7
57	I use computer technology effectively to integrate computer usage within my lessons.	1	2	3	4	5	6	7
58	I should have the opportunity to see how the facilitator / project leader plan cyberhunts	1	2	3	4	5	6	7
59	I should have the opportunity to see how the facilitator / project leader implement cyberhunts within a classroom context	1	2	3	4	5	6	7
60	I would like that a knowledgeable computer person visit my computer classroom on a regular basis in order that he/she can assess what I do well	1	2	3	4	5	6	7
61	I prefer that my learners go to the computer lab to be instructed by another teacher	1	2	3	4	5	6	7

		STRONGLY DISAGREE						STRONGLY AGREE
62	I need knowledge of how to manage the computer / ICT classroom	1	2	3	4	5	6	7
63	I like to share ideas about my teaching with teachers from another school	1	2	3	4	5	6	7
64	I know what the different levels are in the taxonomy of Bloom	1	2	3	4	5	6	7
65	I like to share ideas about my teaching with teachers at my own school	1	2	3	4	5	6	7
66	I know how to do searches on the Internet	1	2	3	4	5	6	7
67	I know how to assess computer based projects	1	2	3	4	5	6	7
68	I have the skills to use the computer effectively at this moment	1	2	3	4	5	6	7
69	I have the necessary computer skills to help my learners who have difficulty in using the computer	1	2	3	4	5	6	7
70	I have the knowledge of how to manage the computer / ICT classroom	1	2	3	4	5	6	7
71	I have enough time to prepare lessons that make use of computer integration	1	2	3	4	5	6	7
72	I have enough time to learn how to use a computer for teaching and learning	1	2	3	4	5	6	7
73	I have enough knowledge to provide appropriate feedback to my learners related to computer usage	1	2	3	4	5	6	7
74	I have enough knowledge on how to formulate questions for higher levels of thinking	1	2	3	4	5	6	7
75	I have enough knowledge on how to formulate questions for higher levels of thinking	1	2	3	4	5	6	7
76	I have enough access to the computer room	1	2	3	4	5	6	7
77	I feel confident that I will be able to learn computer skills	1	2	3	4	5	6	7
78	I feel confident that I understand how to use the computer in my classroom	1	2	3	4	5	6	7

		STRONGLY DISAGREE						STRONGLY AGREE
79	I feel confident that I can use computer technology effectively to teach subject matter in my classroom.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
80	I feel confident that I can manage the computer / ICT classroom	**1**	**2**	**3**	**4**	**5**	**6**	**7**
81	I feel confident in the way I use the Internet	**1**	**2**	**3**	**4**	**5**	**6**	**7**
82	I feel a bit hesitant to participate in the training of the integration of computers for teaching and learning.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
83	I don't find the use of computers to be practical for my learners	**1**	**2**	**3**	**4**	**5**	**6**	**7**
84	I do not find computers to be a necessary part of classroom instruction	**1**	**2**	**3**	**4**	**5**	**6**	**7**
85	I can design a cyberhunt lesson	**1**	**2**	**3**	**4**	**5**	**6**	**7**
86	I am comfortable using a computer	**1**	**2**	**3**	**4**	**5**	**6**	**7**
87	I am happy with the way that I teach at the moment	**1**	**2**	**3**	**4**	**5**	**6**	**7**
88	I am confident that I have enough knowledge about how to use computers in my classroom for teaching and learning	**1**	**2**	**3**	**4**	**5**	**6**	**7**
89	I am computer literate	**1**	**2**	**3**	**4**	**5**	**6**	**7**
90	I am able to implement the different levels of questioning as suggested by the taxonomy of Bloom	**1**	**2**	**3**	**4**	**5**	**6**	**7**
91	At this moment, I have the necessary skills to implement cyberhunts within the classroom	**1**	**2**	**3**	**4**	**5**	**6**	**7**
92	At this moment, I feel confident that I have the necessary computer / ICT skills to assist my learners within the computer classroom	**1**	**2**	**3**	**4**	**5**	**6**	**7**
93	At this moment, I feel confident that I am able to assist my learners within the computer classroom	**1**	**2**	**3**	**4**	**5**	**6**	**7**
94	At the moment there are members at my school who are computer technology leaders	**1**	**2**	**3**	**4**	**5**	**6**	**7**

APPENDIX F

GENERAL COMPUTER SKILLS AND COMPETENCIES BEFORE PROJECT STARTED

This is a confidential questionnaire. Your name and surname will not be made public. Put the questionnaire in the SEALED box at the secretary's office. The box has been sealed and signed to show that it was not tampered with.

It is important for the researcher to know who has completed the questionnaire should the researcher need to clarify something. However, if you do not want to state your name and surname, you may use a nickname or any other name. This will help the researcher to try and locate that person should he want to speak to him/her without making that person's real name public. This will be done by asking that identified person make contact with the researcher telephonically to clarify a certain aspect, should there be a need to do so. Confidentially is ensured at all times. Should you not want to write your name or nick name, it is also fine

The questions are posed to obtain information in order to assist the researcher with future planning. Please answer the question as truthfully and objectively as possible. There are no wrong answers.

DATE WHEN THIS QUESTIONNAIRE WAS COMPLETED:						
IF YOU DO NOT WANT TO GIVE YOUR REAL NAME, WRITE ANY NICK NAME:						
NAME AND SURNAME:						
ARE YOU A PARTICIPANT THAT HAS BEEN SELECTED TO PARTICIPATE WITH A CLASS IN THE ICT PROJECT? (Make an X in the block)	**YES**	**NO**				
AGE: (Make an X in the block)	**18-19**	**20-29**	**30-39**	**40-49**	**50-59**	**60+**
GENDER: **(Make an X in the block)**	**MALE**	**FEMALE**				
HIGHEST QUALIFICATION: **(Make an X in the block)**	**Standard 8** **(Grade 10)**	**Matric** **(Grade 12)**	**2 Year diploma**	**3 Year diploma**	**4 Year diploma**	
	Degree **(BA, BCom, BEd, Bsc)**	**Honours degree**	**Masters Degree**	**Doctorate** **Degree**	**OTHER**	
YEAR WHEN HIGHEST QUALIFICATION WAS OBTAINED:						
NUMBER OF YEARS IN EDUCATION/TEACHING? (Make an X in the block)	**0-3**	**4-9**	**10-15**	**16-21**	**22-27**	**28+**
NAME OF SCHOOL WHERE YOU ARE TEACHING AT PRESENT:						
NUMBER OF YEARS AT CURRENT SCHOOL: (Make an X in the block)	**0-3**	**4-9**	**10-15**	**16-21**	**22-27**	**28+**

DO YOU HAVE YOUR OWN COMPUTER? (Make an X in the block)	YES		NO		
IF YOU DO HAVE YOUR OWN COMPUTER, WHAT KIND? (Make an X in the block)	DESKTOP (SEPARATE KEYBOARD, SCREEN AND CPU BOX		LAPTOP		
IF YOU DO NOT HAVE YOUR OWN COMPUTER, DO YOU USE A COMPUTER? (Make an X in the block)	YES		NO		
IF YOU ANSWERED YES ABOVE, WHERE DO YOU HAVE ACCESS TO A COMPUTER? <u>You may select more than one block.</u>	SCHOOL	POST NET	AT A FRIEND	LIBRARY	OTHER PLACE
IF YOU HAVE ACCESS TO A COMPUTER AT ANY OTHER PLACE, PLEASE TELL US WHERE. YOU HAVE ACCESS.					
DO YOU HAVE ACCESS TO THE INTERNET? PLEASE SELCT WHERE YOU HAVE ACCESS. ? Mark an X in the block. <u>You may select more than one block.</u>	HOME	SCHOOL	LIBRARY	POST NET	OTHER PLACE
IF YOU HAVE ACCESS TO THE INTERNET AT ANY OTHER PLACE, PLEASE TELL US WHERE.					
HAVE YOU RECEIVED ANY COMPUTER TRAINING? Mark an X in the block. <u>You may select more than one block.</u>	NOT AT ALL	THROUGH MY OWN STUDIES	TRAINING ARRANGED BY THE SCHOOL	TRAINING BY THE EDUCATION DEPARTMENT	FROM FAMILY AND FRIENDS
WHAT TRAINING HAVE YOU RECEIVED TO HELP YOU WITH HOW TO INTEGRATE COMPUTERS WITHIN THE CURRICULUM? (Mark an X in the block. <u>You may select more than one block.</u>	NOT AT ALL	THROUGH MY OWN STUDIES	TRAINING ARRANGED BY THE SCHOOL	TRAINING BY THE EDUCATION DEPARTMENT	FROM FAMILY AND FRIENDS

PLEASE TURN OVER

1. **Please read the statements below and then CIRCLE the description which fits your computer use the best for each statement.**

		NEVER	RARELY	SOMETIM ES	FAIRLY OFTEN	VERY OFTEN
1.1	I use the computer to type worksheets	1	2	3	4	5
1.2	I use the computer to type my tests or examination papers	1	2	3	4	5
1.3	I use the computer to record the marks of my learners on a mark sheet	1	2	3	4	5
1.4	I use the computer to report to my parents about the learners' progress	1	2	3	4	5
1.5	I use the computer to make posters or flashcards for my classroom	1	2	3	4	5
1.6	I use the computer to store my learners' test results, assignment marks or exam marks	1	2	3	4	5
1.7	I use my computer to write letters to parents, the principal or the Education Department	1	2	3	4	5
1.8	I use the computer to search for Information on the Internet	1	2	3	4	5
1.9	I use the computer to search for information on CD ROM or DVD based encyclopedias	1	2	3	4	5
1.10	I use the computer to communicate by using E-mail	1	2	3	4	5
1.11	I use the Internet for teaching and learning	1	2	3	4	5
1.12	I use the computer to make a flyer, poster or presentation to market my school	1	2	3	4	5

2. **Anything else you want to tell us about how you use the computer or for what purpose you use it for? Write it in the space provided below.**

____

____

3. **Please read the statements below and then CIRCLE the description which best fits your computer use for teaching and learning. If you choose a 2, 3, 4 or 5, please tell us HOW you use it in the space provided.**

		NEVER	RARELY	SOMETIME S	FAIRLY OFTEN	VERY OFTEN
3.1	I use drill and practice software for teaching and learning **HOW?** ____________ ____________ ____________	1	2	3	4	5
3.2	I use simulation software for teaching and learning **HOW?** ____________ ____________ ____________	1	2	3	4	5
3.3	I use tutorial software for teaching and learning **HOW?** ____________ ____________ ____________	1	2	3	4	5
3.4	I use hypermedia for teaching and learning **HOW?** ____________ ____________ ____________	1	2	3	4	5
3.5	I use hypermedia for teaching and learning **HOW?** ____________ ____________ ____________	1	2	3	4	5

		NEVER	RARELY	SOMETIMES	FAIRLY OFTEN	VERY OFTEN
3.6	I use a multimedia encyclopedia for example Encarta for teaching and learning **HOW?** ________________________________ ________________________________ ________________________________	1	2	3	4	5
3.7	I use a word processor, for example Microsoft Word, for teaching and learning **HOW?** ________________________________ ________________________________ ________________________________	1	2	3	4	5
3.8	I use presentation software, for example PowerPoint, for teaching and learning **HOW?** ________________________________ ________________________________ ________________________________	1	2	3	4	5
3.9	I use web design software, for example FrontPage, for teaching and learning **HOW?** ________________________________ ________________________________ ________________________________	1	2	3	4	5
3.10	I use the Internet for teaching and learning. **HOW?** ________________________________ ________________________________ ________________________________	1	2	3	4	5

4. If you use the computer for any other purposes, please tell us about it.

5. **Please read the statements below and then CIRCLE the description which fits your computer skill level the best for each statement.**

1	2	3	4
NON: You do not have the skill	**BEGINNER:** You can do it, but with some help	**CONFIDENT:** You are able	**EXPERT:** You are very capable & can even help other people

		NON	BEGINNER	CONFIDENT	EXPERT
GENERAL SKILLS					
5.1	I can use Explore to find files on my computer	1	2	3	4
5.2	I can find saved files	1	2	3	4
5.3	I can create folders	1	2	3	4
5.4	I can rename folders	1	2	3	4
5.5	I can scan for viruses	1	2	3	4
5.6	I can connect a digital camera to the computer	1	2	3	4
5.7	I can connect a data projector to a computer	1	2	3	4
5.8	I can connect a keyboard, mouse or monitor to a computer	1	2	3	4
5.9	I can create shortcuts on the computer	1	2	3	4
5.10	I can install software onto the computer	1	2	3	4
5.11	I can do troubleshooting on the computer	1	2	3	4
5.12	I can use the search tool to find files on my computer	1	2	3	4
5.13	I can copy & paste text	1	2	3	4
5.14	I can format text (bold, underline, change size, change fonts)	1	2	3	4
5.15	I can open documents	1	2	3	4
5.16	I can save documents	1	2	3	4
WORD PROCESSING					
5.17	I can insert pictures, images or diagrams into a document	1	2	3	4
5.18	I can save documents in other file formats e.g. html or txt format	1	2	3	4

		NON	BEGINNER	CONFIDENT	EXPERT
5.19	I can insert tables into a document	1	2	3	4
5.20	I can insert hyperlinks into a document	1	2	3	4
5.21	I can create bullets & numbered text	1	2	3	4
SPREADSHEETS					
5.22	I can create formulas and do calculations	1	2	3	4
5.23	I can change column & row sizes	1	2	3	4
5.24	I can sort data in a spreadsheet alphabetically or according to values (numbers)	1	2	3	4
PRESENTATION SKILLS					
5.25	I can create a slide show e.g. in PowerPoint	1	2	3	4
5.26	I can insert an audio or video clip into a presentation	1	2	3	4
5.27	I can insert a picture or photo into a presentation	1	2	3	4
INTERNET SKILLS					
5.28	I can send and receive email	1	2	3	4
5.29	I can use a browser e.g. Internet Explorer	1	2	3	4
5.30	I can do searches on the Internet to search for information	1	2	3	4
5.31	I can save a webpage	1	2	3	4
5.32	I can insert hyperlinks into a document	1	2	3	4

PLEASE TURN OVER

6. **Please read the statements below and indicate your choice. SELECT YOUR CHOICE (put an X in the appropriate box). If you select OTHER BRAND, please write the name of the software that you use, if you know its name..**

STATEMENT ABOUT SOFTWARE USE		**SELECT YOUR CHOICE (put an X in the appropriate box). If you select OTHER BRAND, please write the name of the software that you use.**		
6.1	What word processor do you use?	**MICROSOFT WORD**	**OTHER BRAND** ________________	**I DO NOT USE A WORD PROCESSOR**
6.2	What spreadsheet software do you use?	**MICROSOFT EXCEL**	**OTHER BRAND** ________________	**I DO NOT USE A SPREADSHEET**
6.3	What presentation software do you use?	**MICROSOFT POWERPOINT**	**OTHER BRAND** ________________	**I DO NOT USE A PRESENTATION TOOL**
6.4	What web browser do you use to search on the Internet?	**MICROSOFT INTERNET EXPLORER**	**OTHER BRAND** ________________	**I DO NOT USE THE INTERNET**
6.5	What database software do you use?	**MICROSOFT ACCESS**	**OTHER BRAND** ________________	**I DO NOT USE A DATABASE**
6.6	What web creation software do you use?	**MICROSOFT FRONTPAGE**	**OTHER BRAND** ________________	**I DO NOT USE WEB CREATION SOFTWARE**
6.7	What computer encyclopedia do you use?	**MICROSOFT ENCARTA**	**OTHER BRAND** ________________	**I DO NOT USE A COMPUTER CD ROM BASED ENCYCLOPEDIA**

7. ANY OTHER SOFTWARE THAT YOU USE? PLEASE TELL US ABOUT IT. TELL US ALSO WHAT DO YOU USE THE SOFTWARE FOR.

8. Please read each of the six descriptions below. Choose <u>ONE DESCRIPTION</u> that best describes where you are in the adoption of technology, by circling <u>the DESCRIPTION NUMBER in the left column</u>. Please describe then what you are doing or using the computer for the description that you have circled. Write only at the description that you have circled.

1	**DESCRIPTION 1: Awareness, but do not really use it** I am aware that technology exists, but have not used it - perhaps I'm even avoiding it. I am anxious / nervous about the prospect of using computers. I do not use it in my school work. ____ ____
2	**DESCRIPTION 2: Start to Learn and use computers** I am currently trying to learn the basics. I am sometimes frustrated when using computers. I lack confidence when using computers. ____ ____
3	**DESCRIPTION 3: Understanding and application of the process** I am beginning to understand the process of using technology and can think of specific tasks in which it might be useful. I use it in my school work on a regular basis. ____ ____
4	**DESCRIPTION 4: Confident and regular use** I am gaining a sense of confidence in using the computer for specific tasks. I am starting to feel comfortable using the computer. I use it in my school work on a regular basis. ____ ____
5	**DESCRIPTION 5: Adaptation to other contexts** I think about the computer as a tool to help me and am no longer concerned about it as technology. I can use it in many applications and as an instructional aid in my classroom. ____ ____
6	**DESCRIPTION 6: Creative application to new contexts** I am able to use it as an instructional tool in my teaching in interesting and new ways. ____ ____

9. **The school plans for computer integration and asked teachers the following questions. Please indicate your choice by making an X next to it AND provide also a reason in the space provided for your choice. <u>PLEASE select only ONE choice</u>.**

CHOICE: SELECT ONE ONLY	STATEMENT
	I am prepared to be responsible for computer integration for my own class
	I am prepared to be responsible for computer ingeneration for a whole grade group
	I am prepared to be responsible for computer integration for more than one grade group
	I am prepared to be responsible for computer integration for the whole school
	The school have to appoint one person who are responsible for computer integration for the whole school

My reason for my choice above, is:

____

____

____

10. **IF YOU ARE NOT USING THE COMPUTER IN ANY OF THE WAYS THAT YOU CAME ACROSS IN THIS QUESTIONNAIRE, PLEASE TELL US HOW YOU USE THE COMPUTER OR FOR WHAT YOU USE THE COMPUTER FOR.**

____

____

____

____

THANK YOU FOR YOUR TIME AND HONESTY. YOUR HELP IS HIGHLY APPRECIATED.

END

APPENDIX G

TEACHER & PRINCIPAL OPEN ENDED QUESTIONNAIRE DURING PROJECT

NAME AND SURNAME: ____

POSITION: _____________________________

SCHOOL: _______________________________ DATE: __________________

1. Do your school have a vision for computers? If YES, please tell us what the vision is.

2. If your school do have a vision for computers, how did you arrive at this vision?

3. Do you have regular staff meetings to discuss computer issues?

(a) If yes, how often?

(b) What are discussed during these meetings?

4. Are you computer literate? If yes, what do you do on the computer?

5. How computer literate is the staff? Why do you say so?

6. What problems do you foresee for computer integration at your school?

7. Do you think that your staff will be able to manage computer integration well? Tell us why or why not.

8. What support can you provide to the staff regarding computers? Tell us.

9. If staff have problems with computer integration, who will assist them?

10. What can be done to motivate or to encourage staff to become involved with computers?

THANK YOU

APPENDIX H

TEACHER GROUP WORKSESSIONS OPEN ENDED QUESTIONNAIRE

DATE: ______________________________

	SURNAME	NAME	SCHOOL
1			
2			
3			
4			
5			
6			

1. What do you understand under the term "computer integration"?

2. What skills or aspects would you like your learners to improve in? Why? OR What things do your learners struggle with at school? (Which areas do they need help with and with what in these areas?)

3. What issues or aspects or things or factors would you say are important for establishing computer integration?

4. What problems do you experience at school related to computers?

5. What problems/challenges do you foresee/anticipate when computer integration are implemented in your school? (What have to be done?)

APPENDIX I

INTERNET USER GROUP QUESTIONS

1. Why could teachers at your school be negative towards computer integration?

2. What problems/challenges do you foresee/anticipate when computer integration are implemented in your school?

3. What goals do you want to set related to your learners regarding cyberhunt-based learning?

4. What goals do you want to set for yourself regarding cyberhunt-based learning?

5. Any positive or negative comments about the project leader (facilitator)?

6. When and how often should the teacher training program for computer integration be conducted AND Why in this way? Provide reasons for your answer?

7. What characteristics should the project leader (facilitator) keep in mind while training the participating teachers? Why? Explain

8. What should the project leader (facilitator) keep in mind (think about) during the preparation process?

9. What was negative about the development program / process so far? Make suggestions on what to change or how to improve, please

10. What was positive about the development program / process so far? (What did you like?)

11. What have you learned so far?

12. What do you find difficult? Or with what do you need more help?

13. What did you find easy so far?

14. Which elements / aspects should a teacher training program for computer integration, contain? Why?

15. How would you manage the cyberhunt classroom? (What will the role of the learners be and what will the role of the teacher be?

16. What benefits could cyberhunt learning have for you as a teacher?

17. What benefits could cyberhunt learning have for your learners?

18. How would you implement this in your class?

APPENDIX J

TEACHER GROUP WORKSESSIONS OPEN ENDED QUESTIONNAIRE

DATE: ______________________________

	SURNAME	NAME	SCHOOL
1			
2			
3			
4			
5			
6			

1. What would you need to do to design a cyberhunt? Discuss in your groups and write it down below.

2. What skills would you need to be able to design a cyberhunt?

3. How would you plan a cyberhunt?

4. How would you implement this in your class?

5. What benefits could cyberhunt learning have for your learners?

6. What benefits could cyberhunt learning have for you as a teacher?

7. How would you manage the cyberhunt classroom? (What will the role of the learners be and what will the role of the teacher be?

8. What goals do you want to set for yourself regarding cyberhunt-based learning?

9. What goals do you want to set related to your learners regarding cyberhunt-based learning?

10. What goals do you want to set related to your school regarding cyberhunt-based learning?

APPENDIX K

TEACHER JOURNALS

AT END OF FIRST SESSION

NAME AND SURNAME: ________________________________

DATE: _____________________ **SCHOOL:** ________________________

1. What goals do you want to set for yourself for this project?

2. What have you learned so far?

3. What do you find easy so far?

4. What do you find difficult? Or with what do you need more help?

5. If you have a problem during a session, who do you ask for help? Why do you ask that person for help?

6. What was positive about the development program / process so far? (What did you like?)

7. Make suggestions on what to change or how to improve, please.

8. What problems do you foresee or anticipate when you have to implement Cyberhunts at your school?

9. What things or aspects have to be in place at school to successfully implement Cyberhunts?

APPENDIX L

TEACHER JOURNALS

AT END OF EACH SESSION AFTER THE FIRST SESSION

NAME AND SURNAME: ____

SCHOOL: ______________________________ DATE: _________________

<u>AT BEGINNING OF THE SESSION</u>

1. What are your goals for today?

<u>AT THE END OF THE SESSION</u>

2. Did you reach your goals today? What did you do today?

3. What do you think about when you are busy to design your cyberhunt?

4. Have you experienced any problems today? Did you struggle with anything? With what did you struggle? Tell us.

5. **Were these problems solved? How? Tell us.**

6. **What did you find easy today?**

7. **How do you experience the group work (working together)?**

8. **Did you disagree about anything in your groups? Tell us about what you disagreed about?**

9. **Is there anything negative about the group work (working together)?**

10. **What suggestions do you have for your group OR group work?**

11. **How do you plan to finish your cyberhunt group project on time?**

APPENDIX M

TEACHER JOURNALS

AT END OF EACH SESSION AFTER THE FIRST SESSION

NAME AND SURNAME: ________________________________

DATE: _____________________ SCHOOL: ________________________

<u>AT BEGINNING OF THE SESSION</u>

1. What are your goals for today?

2. How do you plan to finish your cyberhunt project on time?

<u>AT END OF THE SESSION</u>

3. Did you reach all your goals today? What did you do today?

If NO, tell us why you did not reach all your goals?

4. What will I do differently next time?

5. What do you think about when you are busy to design your cyberhunt?

6. Have you experienced any problems today? Did you struggle with anything or find anything difficult? With what did you struggle? Please tell us.

7. Were these problems solved? HOW?

8. If you have a problem during a session, who do you ask for help? Why do you ask that person for help?

9. What do you find easy today?

10. What did you enjoy today?

11. What do you find difficult? Or with what do you need more help?

12. Have you learned anything new today? What?

13. How did you experience the group work today?

14. Did you disagree OR had different opinions about anything? Please tell us.

15. What suggestions do you have for your group OR group work in general?

APPENDIX N

QUESTIONNAIRE 1A

COLLABORATION

TEACHER NAME AND SURNAME:	
GRADE:	
SCHOOL:	
DATE:	

Please select one of the options by making a X in the block which represents your response or feeling, when appropriate.

1. Did you enjoy working with others in the computer room during the cyberhunt project?

VERY MUCH	
FAIRLY	
NOT MUCH	
NOT AT ALL	

2. Do you think that you could do this kind of project (cyberhunts) in your normal classroom?

YES	
NO	

Please explain or tell us:

___

3a. Please tick the number of people that **helped you** (that you have asked for help) during the cyberhunt activity:

Asked nobody for help (worked on my own all the time)	
One person	
Two persons	
Three persons	
Four persons	
More than four persons	

3b If you have selected more than four persons, can you give us an indication of how many people you have asked for help or assistance?

____

3c With what did you need help or assistance during the project?

____

____

____

____

____

____

3d Why have you asked these people for help?

____

____

3e How did they respond when you asked them for help? (What did they say or how did they react?)

____

____

____

4a. Have you helped any person during the cyberhunt project? Please tick the number of people that **YOU have helped**:

I did not help anyone	
I helped one person	
I helped two persons	
I helped three persons	
I helped four persons	
I helped more than four persons	

4b If you did not help anyone, please tell us why.

____

____

____

____

4c If you have selected that you have helped more than four persons, can you give us an indication of how many people you have helped?

____

4d Why have you helped these people?

4e With what did you help these people?

4f How did they respond to your help (when you helped them?). (What did they say or how did they react?)

4g Give a specific example of something new that you learned during the course of this project from your fellow students and explain how you learned this new thing

---

5a. When did you feel more comfortable while searching for answers to your problems or questions? While asking the:

Facilitator	
Fellow teacher	
By finding out on your own	

5b Please tell us why you felt more comfortable asking that specific person that you have indicated above.

____

____

____

____

____

____

6. Would like to participate in groups again?

YES	
NO	

Please explain or tell us.

____

____

____

7. What changes should be made to the groups?

8. Was it possible to construct the same cyberhunt all by yourself? Please explain.

YES	
NO	

Please explain or tell us.

9. Will it be possible to construct the same cyberhunt all by yourself in the future? Please explain.

YES	
NO	

Please explain or tell us.

10. What did you speak about or discuss while working in your groups?

____

____

____

____

11. Any things related to planning that you discussed. Please tell us what.

____

____

____

____

12. What problems did you experience in your group?

____

____

____

____

13. How did you plan to finish on time?

____

____

____

14. Were the problems that you experience, solved?

YES	
NO	

Explain how the problems were solved?

15. What was negative about working in a group?

16. What was positive about working in a group?

APPENDIX O

QUESTIONNAIRE 1B

MOTIVATION, INTEREST AND SKILLS

TEACHER NAME AND SURNAME:	
GRADE:	
SCHOOL:	
DATE:	

Please select one of the options by making a X in the block which represents your response or feeling, when appropriate.

1A. How do you teach in your normal class? Describe.

____

____

1B. Will you teach differently from a normal class when you use cyberhunts in your classroom? Why or why not?

____

____

2. Have you ever designed a cyberhunt before this project started? If yes, tell us when and where.

YES	
NO	

____

____

3. Have you used the Internet before the project started to search for information? If YES, please tell us for what you have used or searched the Internet.

YES	
NO	

4. Did you learn anything more than you already knew about the Internet and Cyberhunts during the project? Please tell us:

YES	
NO	

Please explain or tell us.

5. What do you think about when you are busy with the cyberhunt project? Name all the things that you do think about.

6. What keeps you motivated during this project? Please tell us.

7. How do you feel about projects in general? Please tell us.

8. How do you feel about this cyberhunt project? Please tell us.

9. Do you enjoy this type of cyberhunt learning? Why or why not?

YES	
NO	

Why? Please tell us.

10. Is cyberhunt learning different than the learning in your normal class?

YES	
NO	

Why? Please tell us.

11. Would your learners enjoy cyberhunt learning more than your normal class?

YES	
NO	

Why? Please tell us.

12. What seemed to be interesting in the cyberhunt activity for you? Why?

13. Would your learners enjoy this type of activity (cyberhunts)? What could be interesting for your learners about this type of learning?

YES	
NO	

14. How can you keep your learners interested or motivated in the beginning when they have to start to design their own cyberhunts?

____

____

____

15. How can or could you keep your learners interested when they are busy with a cyberhunt activity?

____

____

____

16. What is the role of the learner (pupils) during this activity (or this type of learning)?

____

____

____

17. What is the role of the teacher during this activity (or this type of learning)?

____

____

18. Is the role of the teacher different in this cyberhunt activity than in normal classroom activities?

YES	
NO	

Why do you say so? Please tell us.

19. Do you think this project have benefited you in any way? Why? Why not?

YES	
NO	

Why do you say so? Please tell us.

20. Will readers/users like using your program? Why or why not?

YES	
NO	

Why do you say so? Please tell us.

APPENDIX P

QUESTIONNAIRE 1C

TEACHER PREPARATION

TEACHER NAME AND SURNAME:	
GRADE:	
SCHOOL:	
DATE:	

Please select one of the options by making a X in the block which represents your response or feeling, when appropriate.

1. According to your opinion, what seems to be the most important things while designing a cyberhunt?

____

____

____

____

2. What did you learn while busy to answer and to complete a **pre-designed cyberhunt** (one where you only had to answer the questions)?

____

____

____

____

3. What did you learn while being busy with the **<u>design of their own cyberhunts</u>** (one where they have to design their own)?

____

____

____

4. Which cyberhunt activity did you like best? (Select one only)

Answering questions in a pre-designed cyberhunt?	
Designing your own cyberhunt	
I liked both equally	

Please tell us why you have made this selection?

____

____

____

5. What did you learn when you were busy to answer or to complete a pre-designed cyberhunt? Please tell us.

____

____

____

6. What did you learn when you were busy to design your own cyberhunt? Please tell us.

____

____

7. Do you think that you can create your own cyberhunt now?

YES	
NO	
UNCERTAIN	

Please tell us why you say so.

____

____

____

8. Did you enjoy this type of activity (designing cyberhunts)?

YES	
NO	
UNCERTAIN	

Please tell us why you say so.

____

____

____

____

9. Is the training or preparation that you receive here the same of different to the training programmes that you have been involved with? Explain.

____

____

10. What was interesting about the training you have received?

11. How should a facilitator or coach of this project become more knowledgeable about how to assist or coach the participants?

12. What skills does a good facilitator or coach need to be successful in the cyberhunt project?

13. What factors are necessary to be successful in this cyberhunt project?

14. Should this cyberhunt project be facilitated by one person or more than one?

One person	
Two persons	
Three persons	
Four persons	
More than four persons	

Please tell us why you have answered in this manner as you have above?

15. How often should the training for the cyberhunt programme be? Mark your first preference with a 1, your second preference with a 2, your third preference with a 3, etc.

Once a week	
Twice a week	
Every second week	
Once a month	
Once a term	
Other: (If you select other, please tell us how often)	

Why? Please tell us.

16. When should the training for the cyberhunt programme be? Mark your first preference with a 1, your second preference with a 2, your third preference with a 3, etc.

After school	
During school time	
Every weekend on a Saturday	
Every second weekend on a Saturday	
During school holidays	

Why? Please tell us.

____

____

____

____

17. How long should each training session be? Mark your first preference with a 1, your second preference with a 2, your third preference with a 3, etc.

1 Hour	
1 ½ hours	
2 hours	
Half a day	
Whole day	

Why? Please tell us.

____

____

18. How can the facilitator or coach of this cyberhunt project ensure that this cyberhunt project is a successful project?

19. How can the participants in this cyberhunt project ensure that this cyberhunt project is a successful project?

20. At the moment, can you count on support from the Eastern Cape Education Department or District Office to help with computer integration?

YES	
NO	

Why? Please tell us why you say so.

21. What does or should the Eastern Cape Education Department or District Office do to help schools with computer integration. List the things they should do or get in place.

END

APPENDIX Q

OBSERVATION SCHEDULE

FACILITATOR OR TEACHER NAME AND SURNAME:	
DATE:	

CYBERHUNT DESIGN AND DEVELOP SKILLS

OBSERVATIONS AND EXPERIENCES		○ Observed Frequently (OF), ○ Observed (O), ○ Observed Rarely (OR), ○ Never observed (NO)			
GENERAL SKILLS & OBSERVATIONS: Struggling Aspects		**OF**	**O**	**OR**	**NO**
1	Struggle with language (English): Do not understand what to do or how to follow				
2	Listening: Do not listen well in class				
3	Reading: Does not understand what they have read				
4	Ask a lot of questions to the teacher or facilitator o project leader				
5	Struggle to define topic				
6	Struggle to define keywords				
7	Struggle with computer skills				
8	Struggle to find relevant information				
9	Struggle with planning / goal setting				
10	Struggle to express themselves				
11	Struggle to pose or compose questions				
12	Struggle with group work				
13	Struggle to pose relevant questions				

PROJECT MANAGEMENT SKILLS		OF	O	OR	NO
1	Creating a timeline for the completion of the				
2	Plan how to finish on time				
3	Assigning roles to team members				
4	Personal goal setting				
5	Group goal setting				
6	Sharing of personal goals with one another				
RESEARCH SKILLS		**OF**	**O**	**OR**	**NO**
1	Brainstorming				
2	Deciding on a topic				
3	Generate keywords				
4	Searching for information				
5	Finding useful websites				
6	Evaluate quality of information found:				
7	Book marking useful websites				
8	Book marking useful websites				
9	Note taking or Summarising information in				
10	Reading or scanning information found				
11	Compose or Develop questions through				

ORGANIZATION AND PRESENTATION SKILLS		OF	O	OR	NO
1	Deciding or discussing what questions to				
2	Deciding or discussing how the questions				
3	Deciding or discussing in what order to put				
DESIGN AND PRESENTATION SKILLS		**OF**	**O**	**OR**	**NO**
1	Copy hyperlinks to Word or PowerPoint				
2	Designing screen and questions on paper or				
3	Deciding on how the cyberhunt questions				
4	Discussing how the cyberhunt will attracting				
5	Write questions on paper first				
6	Type questions directly on computer				
7	Create a memorandum				
8	Discuss or mention importance of audience				
9	Write instructions for users how to use				
10	Add pictures to make cyberhunt more				
11	Add colour or change fonts to make				

REFLECTION AND EVALUATION SKILLS		OF	O	OR	NO
1	Identify which goals have been achieved during the session				
2	Discuss what can be done to improve cyberhunt (Getting feedback from fellow group members to make changes)				
3	Test cyberhunt (Do the hyperlinks work?)				
4	Identify what went well and what did not				

COLLABORATION

INTERDEPENDENCE		OF	O	OR	NO
1	Giving and receiving help and assistance				
2	Exchanges resources and information				
3	Challenging each other's reasoning				
4	Co-construction of ideas or questions				
5	Influencing each other				
6	Sharing of answers				
FACE-TO-FACE PROMOTIVE INTERACTION		**OF**	**O**	**OR**	**NO**
1	Discussions of what has to be done				
2	Differences of opinions in group				

SOCIAL SKILLS, DIVISION OF LABOUR AND INTERACTIONS		OF	O	OR	NO
1	Project leader-Learner Interaction				
2	Teacher-Teacher Interaction				
3	Teachers become Facilitators to other				
4	Teacher-Material/Internet Interaction				
5	Lot of talk but little gets done				
6	Conflict management: Can deal or handle				
7	Abiding by rules				
8	Listens to other group members				
9	Criticizing ideas, not people				

APPENDIX R

TASK ELICITATION PROCEDURE FOR TEACHERS

(END of project)

NAME & SURNAME:		AGE:		GENDE R:	MALE	FEMAL E
NAME OF SCHOOL:						
DATE:						

A. When we do something like this integration project, we really do a number of things, like for instance to plan differently or to do searches on the Internet. Please think about all the different things, tasks and thinking that were important for you to do so that you could make the integration project successful. These tasks or things should be what YOU DID, not what you think you should have done. List now these things below

B. For each task or thing that you have listed, please write the strategies or things that have HELPED you to accomplish or complete each task AND what things have HINDERED you.

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

TASK 1 or THING 1
HELPED:

HINDERED

TASK 2 or THING 2
HELPED:

HINDERED

TASK 3 or THING 3
HELPED:

HINDERED

TASK 4 or THING 4

HELPED:

HINDERED

TASK 5 or THING 5

HELPED:

HINDERED

TASK 6 or THING 6

HELPED:

HINDERED

TASK 7 or THING 7

HELPED:

HINDERED

TASK 8 or THING 8

HELPED:

HINDERED

TASK 9 or THING 9

HELPED:

HINDERED

THANK YOU

END

APPENDIX S

LIKERT SCALE PROJECT ASSESSMENT SKILLS QUESTIONNAIRE

AT END OF PROJECT

This is a confidential questionnaire. Your name and surname will not be made public. It is important for the researcher to know who has completed the questionnaire should the researcher need to clarify something. Confidentially is ensured at all times.

Please answer the question as truthfully and objectively as possible. There are no wrong answers.

NB: You will have to reflect (think back) how you felt about each statement BEFORE the project and how you felt about the same statement AFTER you have been through the training.

DATE WHEN THIS QUESTIONNAIRE WAS COMPLETED:						
IF YOU DO NOT WANT TO GIVE YOUR REAL NAME, WRITE ANY NICK NAME:						
NAME AND SURNAME:						
ARE YOU A PARTICIPANT THAT HAS BEEN SELECTED TO PARTICIPATE WITH A CLASS IN THE ICT PROJECT? (Make an X in the block)	YES	NO				
AGE: (Make an X in the block)	18-19	20-29	30-39	40-49	50-59	60+
GENDER: (Make an X in the block)	MALE	FEMALE				
HIGHEST QUALIFICATION: (Make an X in the block)	Standard 8 (Grade 10)	Matric (Grade 12)	2 Year diploma	3 Year diploma	4 Year diploma	
	Degree (BA, BCom, BEd, Bsc)	Honours degree	Masters Degree	Doctorate Degree	OTHER	
YEAR WHEN HIGHEST QUALIFICATION WAS OBTAINED:						
NUMBER OF YEARS IN EDUCATION/TEACHING? (Make an X in the block)	0-3	4-9	10-15	16-21	22-27	28+
NAME OF SCHOOL WHERE YOU ARE TEACHING AT PRESENT:						
NUMBER OF YEARS AT CURRENT SCHOOL: (Make an X in the block)	0-3	4-9	10-15	16-21	22-27	28+

	Show your level of agreement with each of the following statements. You can position yourself at any point on the scale. Remember that a 1 means that you strongly disagree and that a 5 means that you strongly agree.	**BEFORE THE PROJECT STARTED: HOW DID YOU FEEL OR THINK** (Your thinking, perceptions, skills, attitudes BEFORE the project started) Strongly disagree				Strongly agree	**AT THE END OF THE PROJECT: HOW DO YOU FEEL OR THINK** (Your thinking, perceptions, skills, attitudes at the END of the project started) Strongly disagree				Strongly agree
1	After I have completed a project, I read through my completed project again to check whether I have answered all the questions	1	2	3	4	5	1	2	3	4	5
2	I am able to implement the different levels of questioning as suggested by the taxonomy of Bloom	1	2	3	4	5	1	2	3	4	5
3	I can provide useful feedback to my fellow teachers about the quality of their projects	1	2	3	4	5	1	2	3	4	5
4	I concentrate a lot while busy with projects.	1	2	3	4	5	1	2	3	4	5
5	I find it easy to present my ideas to other people	1	2	3	4	5	1	2	3	4	5
6	I find it easy to search for information on the Internet	1	2	3	4	5	1	2	3	4	5
7	I often think about what I could do to finish on time with my projects.	1	2	3	4	5	1	2	3	4	5
8	I think a lot about ideas when I do a project	1	2	3	4	5	1	2	3	4	5
9	I think a lot what the people will think about my project	1	2	3	4	5	1	2	3	4	5
10	It is often hard for me to decide what the topic means when I have to do a project.	1	2	3	4	5	1	2	3	4	5
11	The information that I usually find has nothing to do with my topic.	1	2	3	4	5	1	2	3	4	5
12	I find it easy to create keywords to make searching for information easier	1	2	3	4	5	1	2	3	4	5
13	I find it easy to create/compose/set questions about something that I have read	1	2	3	4	5	1	2	3	4	5
14	I have the required planning skills for projects	1	2	3	4	5	1	2	3	4	5

		BEFORE THE PROJECT STARTED: HOW DID YOU FEEL OR THINK (Your thinking, perceptions, skills, attitudes BEFORE the project started)					AT THE END OF THE PROJECT: HOW DO YOU FEEL OR THINK (Your thinking, perceptions, skills, attitudes at the END of the project started)				
		Strongly disagree				Strongly agree	Strongly disagree				Strongly agree
15	I know what the different levels are in the taxonomy of Bloom	1	2	3	4	5	1	2	3	4	5
16	I often lose track of time when I am working on a project.	1	2	3	4	5	1	2	3	4	5
17	I often think about the people who will be using my project	1	2	3	4	5	1	2	3	4	5
18	I often think how I could improve my project while I am busy working on it.	1	2	3	4	5	1	2	3	4	5
19	I think that it is important that other teachers look at my project to give advice.	1	2	3	4	5	1	2	3	4	5
20	It is often hard for me to decide what to do for an assignment or project	1	2	3	4	5	1	2	3	4	5
21	Often I have to think a lot about exactly what information to take from a source.	1	2	3	4	5	1	2	3	4	5
22	Projects are a lot of hard work.	1	2	3	4	5	1	2	3	4	5
23	Doing projects give me a chance to develop my own point of view	1	2	3	4	5	1	2	3	4	5
24	I am aware of the value (benefit) of goal setting for learning by learners	1	2	3	4	5	1	2	3	4	5
25	I can recommend the regular use of reflection sheets in a project by teachers	1	2	3	4	5	1	2	3	4	5
26	I create keywords to help me to make the search for information easier	1	2	3	4	5	1	2	3	4	5
27	I go to great lengths to ensure that information for a project is reliable and truthful	1	2	3	4	5	1	2	3	4	5
28	I have enough knowledge on how to formulate questions for higher levels of thinking	1	2	3	4	5	1	2	3	4	5
29	I really have to think much when I develop a project	1	2	3	4	5	1	2	3	4	5

		BEFORE THE PROJECT STARTED: HOW DID YOU FEEL OR THINK (Your thinking, perceptions, skills, attitudes BEFORE the project started)					AT THE END OF THE PROJECT: HOW DO YOU FEEL OR THINK (Your thinking, perceptions, skills, attitudes at the END of the project started)				
		Strongly disagree				Strongly agree	Strongly disagree				Strongly agree
30	I understand well what I read in English	1	2	3	4	5	1	2	3	4	5
31	I use feedback (hints and critique) from other teachers to improve my project	1	2	3	4	5	1	2	3	4	5
32	My planning for projects is very good	1	2	3	4	5	1	2	3	4	5
33	Projects/Presentations should help people to make connections among ideas	1	2	3	4	5	1	2	3	4	5
34	work in projects promotes personal growth	1	2	3	4	5	1	2	3	4	5
35	I can recommend the regular use of reflection sheets in a project by learners	1	2	3	4	5	1	2	3	4	5
36	I continually strive to improve the quality of my project	1	2	3	4	5	1	2	3	4	5
37	I find it east to find relevant information on the Internet	1	2	3	4	5	1	2	3	4	5
38	I find it easy to decide upon a topic for the creation of a project in a learning area	1	2	3	4	5	1	2	3	4	5
39	I insert relevant pictures into my projects to help my learners to understand the topic better	1	2	3	4	5	1	2	3	4	5
40	I make notes about the content that I read when I do projects	1	2	3	4	5	1	2	3	4	5
41	I spend a significant amount of time to set goals for a project	1	2	3	4	5	1	2	3	4	5
42	When I am busy with a project, I stay focused and my attention is not easily distracted.	1	2	3	4	5	1	2	3	4	5
43	When I receive reading material and questions based upon the reading material, I find it easy to answer the questions correctly.	1	2	3	4	5	1	2	3	4	5
44	When there is a group project, we discuss a lot in our team what each person should do.	1	2	3	4	5	1	2	3	4	5

		BEFORE THE PROJECT STARTED: HOW DID YOU FEEL OR THINK (Your thinking, perceptions, skills, attitudes BEFORE the project started)					AT THE END OF THE PROJECT: HOW DO YOU FEEL OR THINK (Your thinking, perceptions, skills, attitudes at the END of the project started)				
		Strongly disagree				Strongly agree	Strongly disagree				Strongly agree
45	After I have completed a project, I read through my completed project to check for mistakes and to correct any mistakes.	1	2	3	4	5	1	2	3	4	5
46	Group work inhibits my individual creativity and ideas	1	2	3	4	5	1	2	3	4	5
47	I enjoy spending time reading about a wide range of topics related to a project	1	2	3	4	5	1	2	3	4	5
48	I find it easy to create questions for the topics after I have read information about the topic	1	2	3	4	5	1	2	3	4	5
49	I find it easy to group information together	1	2	3	4	5	1	2	3	4	5
50	I know where to find good information for my project.	1	2	3	4	5	1	2	3	4	5
51	I set goals for myself during projects	1	2	3	4	5	1	2	3	4	5
52	I try to present my information in such a way that the people who would look at my project would easily understand what my project is about	1	2	3	4	5	1	2	3	4	5
53	It is often hard for me to decide what to do for an assignment.	1	2	3	4	5	1	2	3	4	5
54	Knowing that others will be using my project motivates my to improve the quality of my project	1	2	3	4	5	1	2	3	4	5
55	When we have a group assignment/project, we do a lot of planning in our groups about what we should do.	1	2	3	4	5	1	2	3	4	5
56	After I have completed a project, I think a lot how I could improve it in future.	1	2	3	4	5	1	2	3	4	5
57	I achieve the goals that I set for myself	1	2	3	4	5	1	2	3	4	5
58	I create a timeline to help me to plan my project in order to finish on time	1	2	3	4	5	1	2	3	4	5

		BEFORE THE PROJECT STARTED: HOW DID YOU FEEL OR THINK (Your thinking, perceptions, skills, attitudes BEFORE the project started)						AT THE END OF THE PROJECT: HOW DO YOU FEEL OR THINK (Your thinking, perceptions, skills, attitudes at the END of the project started)				
		Strongly disagree				Strongly agree		Strongly disagree				Strongly agree
59	I find doing projects difficult because I don't always know what to do right away.	1	2	3	4	5		1	2	3	4	5
60	I make changes to how my project looks, after I have completed it in order that my readers will find it more attractive / appealing.	1	2	3	4	5		1	2	3	4	5
61	I often think whether the information that I have gathered is accurate, reliable and truthful.	1	2	3	4	5		1	2	3	4	5
62	I space my text in project assignments in such a way that my learners (users) will be able to read easily (or do not get easily lost)	1	2	3	4	5		1	2	3	4	5
63	It is easy for me to find good/relevant information on a topic on the Internet	1	2	3	4	5		1	2	3	4	5
64	It's hard to know in what order to put my ideas.	1	2	3	4	5		1	2	3	4	5
65	The output (product) of group work reflects the individual contributions of participants	1	2	3	4	5		1	2	3	4	5

END

APPENDIX T

LIKERT SCALE PROJECT ASSESSMENT MOTIVATION, INTEREST &COLLABORATION QUESTIONNAIRE

AT END OF PROJECT

This is a confidential questionnaire. Your name and surname will not be made public. It is important for the researcher to know who has completed the questionnaire should the researcher need to clarify something. Confidentially is ensured at all times.

Please answer the question as truthfully and objectively as possible. There are no wrong answers.

NB: You will have to reflect (think back) how you felt about each statement BEFORE the project and how you felt about the same statement AFTER you have been through the training.

<table>
<tr><td>DATE WHEN THIS QUESTIONNAIRE WAS COMPLETED:</td><td colspan="6"></td></tr>
<tr><td>IF YOU DO NOT WANT TO GIVE YOUR REAL NAME, WRITE ANY NICK NAME:</td><td colspan="6"></td></tr>
<tr><td>NAME AND SURNAME:</td><td colspan="6"></td></tr>
<tr><td>ARE YOU A PARTICIPANT THAT HAS BEEN SELECTED TO PARTICIPATE WITH A CLASS IN THE ICT PROJECT? (Make an X in the block)</td><td>YES</td><td>NO</td><td colspan="4"></td></tr>
<tr><td>AGE: (Make an X in the block)</td><td>18-19</td><td>20-29</td><td>30-39</td><td>40-49</td><td>50-59</td><td>60+</td></tr>
<tr><td>GENDER:
(Make an X in the block)</td><td>MALE</td><td>FEMALE</td><td colspan="4"></td></tr>
<tr><td rowspan="2">HIGHEST QUALIFICATION:
(Make an X in the block)</td><td>Standard 8 (Grade 10)</td><td>Matric (Grade 12)</td><td>2 Year diploma</td><td>3 Year diploma</td><td>4 Year diploma</td><td></td></tr>
<tr><td>Degree (BA, BCom, BEd, Bsc)</td><td>Honours degree</td><td>Masters Degree</td><td>Doctorate Degree</td><td>OTHER</td><td></td></tr>
<tr><td>YEAR WHEN HIGHEST QUALIFICATION WAS OBTAINED:</td><td colspan="6"></td></tr>
<tr><td>NUMBER OF YEARS IN EDUCATION/TEACHING? (Make an X in the block)</td><td>0-3</td><td>4-9</td><td>10-15</td><td>16-21</td><td>22-27</td><td>28+</td></tr>
<tr><td>NAME OF SCHOOL WHERE YOU ARE TEACHING AT PRESENT:</td><td colspan="6"></td></tr>
<tr><td>NUMBER OF YEARS AT CURRENT SCHOOL:
(Make an X in the block)</td><td>0-3</td><td>4-9</td><td>10-15</td><td>16-21</td><td>22-27</td><td>28+</td></tr>
</table>

	Show your level of agreement with each of the following statements. You can position yourself at any point on the scale. Remember that a 1 means that you strongly disagree and that a 5 means that you strongly agree.	**BEFORE THE PROJECT STARTED: HOW DID YOU FEEL OR THINK** (Your thinking, perceptions, skills, attitudes BEFORE the project started) Strongly disagree				Strongly agree		**AT THE END OF THE PROJECT: HOW DO YOU FEEL OR THINK** (Your thinking, perceptions, skills, attitudes at the END of the project started) Strongly disagree				Strongly agree
1	Computer projects are similar to other projects in class	1	2	3	4	5		1	2	3	4	5
2	Doing projects help me to learn in an interesting way.	1	2	3	4	5		1	2	3	4	5
3	I find it easy to ask for help when I work in a group	1	2	3	4	5		1	2	3	4	5
4	I find it easy to learn new things from group members	1	2	3	4	5		1	2	3	4	5
5	I find it easy to show that I do not understand something about projects to teachers	1	2	3	4	5		1	2	3	4	5
6	I find it more enjoyable to work in a group than as an individual	1	2	3	4	5		1	2	3	4	5
7	I learn more when I do a project than with other types of learning.	1	2	3	4	5		1	2	3	4	5
8	Overall I feel positive about working with others on a project	1	2	3	4	5		1	2	3	4	5
9	When I do not understand something, I ask someone from another group that have knowledge about the area in which I need help	1	2	3	4	5		1	2	3	4	5
10	I find it easy to share my ideas with other group members	1	2	3	4	5		1	2	3	4	5
11	I often think about other things not related to my project when I am busy with a project.	1	2	3	4	5		1	2	3	4	5
12	I prefer to work in a group on a project	1	2	3	4	5		1	2	3	4	5
13	I really enjoy projects as a way of learning about a subject.	1	2	3	4	5		1	2	3	4	5
14	Learning computer skills in groups are easier than learning it individually	1	2	3	4	5		1	2	3	4	5

		BEFORE THE PROJECT STARTED: HOW DID YOU FEEL OR THINK (Your thinking, perceptions, skills, attitudes BEFORE the project started)						**AT THE END OF THE PROJECT: HOW DO YOU FEEL OR THINK** (Your thinking, perceptions, skills, attitudes at the END of the project started)				
		Strongly disagree				**Strongly agree**		**Strongly disagree**				**Strongly agree**
15	The projects that I do at school are all more or less the same.	1	2	3	4	5		1	2	3	4	5
16	When I do not understand something, I ask an expert in another group to help me	1	2	3	4	5		1	2	3	4	5
17	When I have a problem, I ask someone else to help me	1	2	3	4	5		1	2	3	4	5
18	When I work in a group, I often find that everyone keeps talking but very little really gets done.	1	2	3	4	5		1	2	3	4	5
19	I enjoy teaching and learning	1	2	3	4	5		1	2	3	4	5
20	I find it easy to collaborate (work together) with fellow teachers	1	2	3	4	5		1	2	3	4	5
21	I find it easy to raise my point of view when I work in a group to my group members	1	2	3	4	5		1	2	3	4	5
22	I find it easy to show to other group members that I do not understand something when I am working in a group	1	2	3	4	5		1	2	3	4	5
23	I prefer to work alone on a project	1	2	3	4	5		1	2	3	4	5
24	I think projects are boring.	1	2	3	4	5		1	2	3	4	5
25	I usually experience a lot of conflict in my group during group work.	1	2	3	4	5		1	2	3	4	5
26	When I do not understand something, I ask the expert in my group to help me	1	2	3	4	5		1	2	3	4	5
27	When I have designed and completed a project, I feel like it's mine	1	2	3	4	5		1	2	3	4	5
28	I am positive about my teaching and learning	1	2	3	4	5		1	2	3	4	5

		BEFORE THE PROJECT STARTED: HOW DID YOU FEEL OR THINK (Your thinking, perceptions, skills, attitudes BEFORE the project started)						**AT THE END OF THE PROJECT: HOW DO YOU FEEL OR THINK** (Your thinking, perceptions, skills, attitudes at the END of the project started)				
		Strongly disagree				**Strongly agree**		**Strongly disagree**				**Strongly agree**
29	I feel confident that I can help my peers / fellow teachers when they do not know how to do something on the computer	1	2	3	4	5		1	2	3	4	5
30	I find it easy to express a different point of view about how to proceed with projects to other teachers	1	2	3	4	5		1	2	3	4	5
31	I find it easy to show that I do not understand something about projects to teachers from my group	1	2	3	4	5		1	2	3	4	5
32	I find myself working on projects during my free time	1	2	3	4	5		1	2	3	4	5
33	I prefer to work in a a group with teachers from another school	1	2	3	4	5		1	2	3	4	5
34	I remember more about a topic when I have done a project.	1	2	3	4	5		1	2	3	4	5
35	When I do not understand something, I ask the facilitator or project leader to hlp me	1	2	3	4	5		1	2	3	4	5
36	Working in groups really makes projects better.	1	2	3	4	5		1	2	3	4	5
37	I do learn lots of new things during projects.	1	2	3	4	5		1	2	3	4	5
38	I find it easy to show that I do not understand something about projects to teachers from another group	1	2	3	4	5		1	2	3	4	5
39	I like to work on projects.	1	2	3	4	5		1	2	3	4	5
40	I prefer to work in a a group with teachers from my own school	1	2	3	4	5		1	2	3	4	5
41	I would rather work alone than working in a group	1	2	3	4	5		1	2	3	4	5

		BEFORE THE PROJECT STARTED: HOW DID YOU FEEL OR THINK (Your thinking, perceptions, skills, attitudes BEFORE the project started)						AT THE END OF THE PROJECT: HOW DO YOU FEEL OR THINK (Your thinking, perceptions, skills, attitudes at the END of the project started)				
		Strongly disagree				Strongly agree		Strongly disagree				Strongly agree
42	When I do not understand something, I ask someone in my group that have knowledge about the area in which I need help	1	2	3	4	5		1	2	3	4	5
43	When I don't understand something, I would rather try and find out for myself than asking for help	1	2	3	4	5		1	2	3	4	5

END

APPENDIX U

LIKERT SCALE PROJECT ASSESSMENT COMPUTER SKILLS QUESTIONNAIRE

AT END OF PROJECT

This is a confidential questionnaire. Your name and surname will not be made public. It is important for the researcher to know who has completed the questionnaire should the researcher need to clarify something. Confidentially is ensured at all times.

Please answer the question as truthfully and objectively as possible. There are no wrong answers.

NB: You will have to reflect (think back) how you felt about each statement BEFORE the project and how you felt about the same statement AFTER you have been through the training.

DATE WHEN THIS QUESTIONNAIRE WAS COMPLETED:						
IF YOU DO NOT WANT TO GIVE YOUR REAL NAME, WRITE ANY NICK NAME:						
NAME AND SURNAME:						
ARE YOU A PARTICIPANT THAT HAS BEEN SELECTED TO PARTICIPATE WITH A CLASS IN THE ICT PROJECT? (Make an X in the block)	YES	NO				
AGE: (Make an X in the block)	18-19	20-29	30-39	40-49	50-59	60+
GENDER: (Make an X in the block)	MALE	FEMALE				
HIGHEST QUALIFICATION: (Make an X in the block)	Standard 8 (Grade 10)	Matric (Grade 12)	2 Year diploma	3 Year diploma	4 Year diploma	
	Degree (BA, BCom, BEd, Bsc)	Honours degree	Masters Degree	Doctorate Degree	OTHER	
YEAR WHEN HIGHEST QUALIFICATION WAS OBTAINED:						
NUMBER OF YEARS IN EDUCATION/TEACHING? (Make an X in the block)	0-3	4-9	10-15	16-21	22-27	28+
NAME OF SCHOOL WHERE YOU ARE TEACHING AT PRESENT:						
NUMBER OF YEARS AT CURRENT SCHOOL: (Make an X in the block)	0-3	4-9	10-15	16-21	22-27	28+

	Show your level of agreement with each of the following statements. You can position yourself at any point on the scale. Remember that a 1 means that you strongly disagree and that a 5 means that you strongly agree.	**BEFORE THE PROJECT STARTED: HOW DID YOU FEEL OR THINK** (Your thinking, perceptions, skills, attitudes BEFORE the project started) Strongly disagree				Strongly agree		**AT THE END OF THE PROJECT: HOW DO YOU FEEL OR THINK** (Your thinking, perceptions, skills, attitudes at the END of the project started) Strongly disagree				Strongly agree
1	I am comfortable using a computer / I find it easy to work on the computer	1	2	3	4	5		1	2	3	4	5
2	I have the skills to use the computer effectively	1	2	3	4	5		1	2	3	4	5
3	I have the necessary computer skills to help my learners who have difficulty in using the computer	1	2	3	4	5		1	2	3	4	5

Working on a computer, I find it easy to do the following:

4	Find saved files	1	2	3	4	5		1	2	3	4	5
5	Create folders	1	2	3	4	5		1	2	3	4	5
66	Copy and paste text	1	2	3	4	5		1	2	3	4	5
7	Format text (bold, underline, change size, change fonts)	1	2	3	4	5		1	2	3	4	5
8	Open documents	1	2	3	4	5		1	2	3	4	5
9	Save documents	1	2	3	4	5		1	2	3	4	5
10	Insert pictures, images or diagrams into a document	1	2	3	4	5		1	2	3	4	5
11	Save documents in other file formats e.g. html or txt format	1	2	3	4	5		1	2	3	4	5
12	Insert tables into a document	1	2	3	4	5		1	2	3	4	5
13	Insert hyperlinks into a document	1	2	3	4	5		1	2	3	4	5
14	Create bullets & numbered text	1	2	3	4	5		1	2	3	4	5

		BEFORE THE PROJECT STARTED: HOW DID YOU FEEL OR THINK (Your thinking, perceptions, skills, attitudes BEFORE the project started)						AT THE END OF THE PROJECT: HOW DO YOU FEEL OR THINK (Your thinking, perceptions, skills, attitudes at the END of the project started)				
		Strongly disagree				Strongly agree		Strongly disagree				Strongly agree
	Working on a computer, I find it easy to do the following:											
15	Create a slide show in PowerPoint	1	2	3	4	5		1	2	3	4	5
16	Insert an audio or video clip into a presentation	1	2	3	4	5		1	2	3	4	5
17	Insert a picture or photo into a presentation	1	2	3	4	5		1	2	3	4	5
18	Use a browser e.g. Internet Explorer	1	2	3	4	5		1	2	3	4	5
19	Do searches on the Internet to search for information	1	2	3	4	5		1	2	3	4	5
20	Save a webpage	1	2	3	4	5		1	2	3	4	5
21	Save files in html or htm mode	1	2	3	4	5		1	2	3	4	5
22	Insert hyperlinks into documents	1	2	3	4	5		1	2	3	4	5
23	Use tables to make my presentation (screen designs) on computer more interesting	1	2	3	4	5		1	2	3	4	5
24	I have adequate knowledge about how to use computers in my classroom for teaching and learning	1	2	3	4	5		1	2	3	4	5
25	I have the necessary computer / ICT skills to assist my learners within the computer classroom	1	2	3	4	5		1	2	3	4	5
26	I am able to assist my learners within the computer classroom	1	2	3	4	5		1	2	3	4	5
27	I have the required knowledge to manage the computer / ICT classroom	1	2	3	4	5		1	2	3	4	5
28	I have the required knowledge to provide appropriate feedback to my learners related to computer usage	1	2	3	4	5		1	2	3	4	5

END

APPENDIX V

LIKERT SCALE PROJECT ASSESSMENT CYBERHUNT KNOWLEGE QUESTIONNAIRE

AT END OF PROJECT

This is a confidential questionnaire. Your name and surname will not be made public. It is important for the researcher to know who has completed the questionnaire should the researcher need to clarify something. Confidentially is ensured at all times.

Please answer the question as truthfully and objectively as possible. There are no wrong answers.

DATE WHEN THIS QUESTIONNAIRE WAS COMPLETED:						
IF YOU DO NOT WANT TO GIVE YOUR REAL NAME, WRITE ANY NICK NAME:						
NAME AND SURNAME:						
ARE YOU A PARTICIPANT THAT HAS BEEN SELECTED TO PARTICIPATE WITH A CLASS IN THE ICT PROJECT? (Make an X in the block)	**YES**	**NO**				
AGE: (Make an X in the block)	**18-19**	**20-29**	**30-39**	**40-49**	**50-59**	**60+**
GENDER: (Make an X in the block)	**MALE**	**FEMALE**				
HIGHEST QUALIFICATION: (Make an X in the block)	**Standard 8 (Grade 10)**	**Matric (Grade 12)**	**2 Year diploma**	**3 Year diploma**	**4 Year diploma**	
	Degree (BA, BCom, BEd, Bsc)	**Honours degree**	**Masters Degree**	**Doctorate Degree**	**OTHER**	
YEAR WHEN HIGHEST QUALIFICATION WAS OBTAINED:						
NUMBER OF YEARS IN EDUCATION/TEACHING? (Make an X in the block)	**0-3**	**4-9**	**10-15**	**16-21**	**22-27**	**28+**
NAME OF SCHOOL WHERE YOU ARE TEACHING AT PRESENT:						
NUMBER OF YEARS AT CURRENT SCHOOL: (Make an X in the block)	**0-3**	**4-9**	**10-15**	**16-21**	**22-27**	**28+**

<u>AT THE END OF THE PROJECT:</u> HOW DO YOU FEEL OR THINK
(Your thinking, perceptions, skills, attitudes at the END of the project started)

	Show your level of agreement with each of the following statements. You can position yourself at any point on the scale. Remember that a 1 means that you strongly disagree and that a 5 means that you strongly agree.	**Strongly disagree**				**Strongly agree**
1	I can see the value and benefits of computer projects	1	2	3	4	5
2	I find it easy to pose questions of different levels of difficulty to be used in cyberhunts	1	2	3	4	5
3	I find the setting of goals for myself for each cyberhunt design session has helped me to be able to finish my cyberhunt design on time	1	2	3	4	5
4	I know how to assess cyberhunt projects	1	2	3	4	5
5	I like to work on projects where I am not allowed to use or work on the computer.	1	2	3	4	5
6	I use consistent (same type) fonts and fontsizes throughout my cyberhunt design	1	2	3	4	5
7	I will let learners define their goals for the different learning areas to help them to monitor their progress	1	2	3	4	5
8	When I have a problem, I ask someone who is an expert in my class to assist or to help me	1	2	3	4	5
9	Doing projects sure beats listening in class.	1	2	3	4	5
10	I enjoy cyberhunts as a teaching and learning strategy to introduce the Internet to my learners	1	2	3	4	5
11	I find it easy to decide upon a topic for the creation of a cyberhunt	1	2	3	4	5
12	I find it easy to design cyberhunts	1	2	3	4	5
13	I find it easy to plan cyberhunts	1	2	3	4	5
14	I find that working in groups made me feel more confident to learn about cyberhunts	1	2	3	4	5
15	I have chosen to be in the same group as my friends as I feel comfortable with them	1	2	3	4	5

AT THE END OF THE PROJECT: HOW DO YOU FEEL OR THINK
(Your thinking, perceptions, skills, attitudes at the END of the project started)

		Strongly disagree				Strongly agree
16	The reflection sheets that I complete during each session helped me with my planning for the next session	1	2	3	4	5
17	I enjoy cyberhunts as a teaching and learning strategy to introduce searching for information on the Internet to my learners	1	2	3	4	5
18	I find that I feel more confident about reading when I am busy with cyberhunts	1	2	3	4	5
19	I have the necessary skills to implement cyberhunts within the classroom	1	2	3	4	5
20	I plan (compose) my cyberhunt questions on paper before I type them on the computer	1	2	3	4	5
21	I really exchange ideas with the other members of the project team	1	2	3	4	5
22	I would prefer to do projects in which we use the computer than projects in which we don't use computers	1	2	3	4	5
23	The reflection sheets that I complete during each session made it easy for me to express how I feel about issues and my progress	1	2	3	4	5
24	This cyberhunt project is similar to other projects that I have done	1	2	3	4	5
25	I do learn a lot of new things during cyberhunt projects	1	2	3	4	5
26	I find that I feel reading is more interesting to me when I am busy with cyberhunts	1	2	3	4	5
27	I know how to use computer technology effectively to teach subject matter with cyberhunts in my classroom.	1	2	3	4	5
28	I think it is important to use illustrations, pictures, photos or graphs in projects.	1	2	3	4	5
29	I type my cyberhunt questions directly on the computer (I do not design them on paper first)	1	2	3	4	5
30	I will use similar reflection sheets on a regular basis in my teaching and learning to help me to get a better understanding of how my learners experience my class	1	2	3	4	5
31	Learners would enjoy cyberhunts as a teaching and learning strategy on the Internet for research more than normal non-Internet related research	1	2	3	4	5

END

APPENDIX W

INDIVIDUAL OR FOCUSED GROUP TEACHER INTERVIEWS

AT END OF PROJECT

PROJECT PREPARATION

1. What was interesting about the training you have received?
2. Is the training or preparation that you receive here the same of different to the training programmes that you have been involved with? Explain.
3. What were the advantages (positive aspects) of participating in the project?
4. What were the disadvantages (negative aspects) of participating in the project?
5. What worked well in the teacher development program? Why?
6. What did not work well in the teacher development program Why?
7. What changes should be made to the teacher development program? How can it be improved?
8. What did the facilitator (project leader) do well?
9. What can the facilitator (project leader) improve on?
10. Do you have any other suggestions for the future to improve similar computer projects?
    - Venue?
    - Facilitation? How?
    - Material?
    - Follow up projects?
11. What support should be given to participants after they completed the training? What support is needed at school? What help would you like? Why?
12. How can the facilitator or coach of this cyberhunt project ensure that this cyberhunt project is a successful project?
13. How can the participants in this cyberhunt project ensure that this cyberhunt project is a successful project?
14. How should a facilitator or coach of this project become more knowledgeable about how to assist or coach the participants?
15. What skills does a good facilitator or coach need to be successful in the cyberhunt project?
16. Should this cyberhunt project be facilitated by one person or more than one? Why or why not?
17. How often should the training for the cyberhunt programme be?
18. When should the training for the cyberhunt programme be?
19. How long should each training session be?
20. At the moment, can you count on support from the Eastern Cape Education Department or District Office to help with computer integration? Should the DOE become involved? How? Why?

LINK WITH SKILLS AS DESIGNERS	PROCESS of CYBERHUNT MODEL WHERE APPLICABLE	MAJOR THINKING SKILLS AS DESIGNERS
Selection & Planning	**DECIDE & PLAN**	**Decision Making & Planning Skills**

21. Why or How have you decided on this topic?
    - Was it difficult to decide on a topic? What was difficult to decide on the topic?
22. How did you go about to decide what you have or needed to do? What gave you trouble regarding this?
    - Any keyword problems? Why?
    - Were it solved? How?
23. What planning did you do for your cyberhunt project? Explain?
24. What did you learn during the planning phase?
25. What did you find difficult during your planning? Why?
26. What do you discuss in your groups? Why?
27. How did you experience reading on the Internet / the computer?
28. Is it different from a book? Why or why not?

- What skills do learners need to read on the computer screen?

Searching / Project Management / Time Management / Collaboration	**DEVELOP / DESIGN**	**Organization & Representation Skills Project Management Skills & Decision Making Skills**

29. What problems have you experienced while searching on the Internet?
    - What have you find difficult when you were searching for information? Why?
    - Do you get the information that you want? Why or Why not?
30. What will you do differently next time? Easy
31. What do you do with the information that you locate? (Do you make summaries of your located information? How do you go about to do it?)
32. How do you decide whether your information is accurate, truthful and relevant?
33. How did you decide what to put into your cyberhunt? (What questions to ask)
34. What kind of questions do or did you pose? BLOOM?
    - Are all these questions on the same difficulty level? How do you ensure that you have questions on different levels of difficulty? (When do you know that a question that you set/compose is difficult or easy?)
35. .How do you know whether your answers are correct?

36. Were the journals of any value (the sheets that you completed before and after every design session)? Explain?

- How do you feel about the goal setting in the weekly journals? Explain.
    - Does it have any value? What? Why or why not?
    - Would you use it in your own class? Why or why not?
- How do you feel about the completion of reflection in the weekly journals? Explain.
    - Does it have any value? What? Why or why not?
    - Would you use weekly journals in your classroom? Why or why not?

37. Did you experience any time problems? Explain why/why not?

38. How did you plan to finish on time? Would you be able to finish this project in time? Why, why not?
    - Have you created a time line to finish your project? Why or why not?
    - Did you allocate any times to certain parts? What times did you allocate and why?
    - Did you divide the tasks in your group? (Assign roles?) How did you go about dividing your tasks?

Design / Arguments / Purpose	**DEVELOP / DESIGN**	**Organization & Representation Skills**

39. Where do you do your planning for your cyberhunt?
    - Why in this way? Why not on paper first?
    - Why do you do it on the computer first / from the start?

40. What is important when you design your screens for you cyberhunt?
    - Why do you design your screens in such a way? (fonts, backgrounds, pictures, etc.)
    - How else could you have done it?

41. Any problems experienced while designing? Explain.

42. How did you find/experience the design process?

Audience / Organization / Interest / Focused	**DEVELOP / DESIGN**	**Reflection Skills**

43. Do you think about anyone or anything while designing your project? If yes, who or what do you think of and why? OR Why don't you think about anyone or anything?
    - When I have designed and completed a project, I feel like it's mine

44. What do you think about when you are busy with projects OR while you are busy with the cyberhunt project?
    - I often think about other things not related to my project when I am busy with the project?
    - When I am busy with a project, I stay focused and my attention is not easily distracted.
45. How did you try to maintain the interest of your readers/viewers/audience?
46. Will readers/users like using your program? Why or why not?
    - Will someone else (like your fellow teachers here with you) be able to learn from your presentation? Why? Explain please.
    - What makes you think so (that someone will learn something)? Not think so? (Have you tried to make the work on this project more understandable? I yes why and how, if no, why not?)

Analogy	**REFLECT**	**Reflection Skills**

47. To what/with what can you compare this project?

Interest & Roles & Problems	**MOTIVATIONAL ASPECTS AND ROLES**	**Reflection Skills**
Interest	**COLLABORATION**	**Social Skills**

48. Is cyberhunt learning different from normal class? Why or Why not?
49. Is this project important to you? Why or why not? / Have you been committed? Why or why not?
50. What is the role of the teacher during this activity (or this type of learning)?
    - I like the way in which my teacher work with us more in the normal classroom than in the computer classroom
51. Would the cyberhunt classroom be different from your normal classroom? Is it the same or different? Explain why you say so. Is this experience the same as or different than learning in the regular classroom? Explain.
52. What do you like about this project? Tell me.
53. What do you dislike about this project? Why?
54. What do you find hard? (Problems experienced). What problems have you experienced
55. What do you find easy?
56. Do you think this project have benefited you in any way? Why? Why not? (Future????)
57. How do you feel about projects? Why? How do you feel about this project?

58. How did you feel after you have completed this cyberhunt project?
59. How did you keep interest in the project?

Project Management / Collaboration	DESIGN	Organization & Representation Skills Project Management Skills & Decision Making Skills

60. What do you discuss with other people during the project?
61. What problems did your group experience? (Conflict? Why? How was it solved)
62. What do you do when you don't understand something or don't know how to do it? Why do you do that?
63. Would you rather work alone in such a project or in a group? Why?
64. Who did you ask for assistance? Why him/her?
65. What have you learned about working with each other?
66. How big should a team or group be according to you? Why?
67. Do you concentrate a lot? Anything that hindered your concentration?
68. Have you revised OR change anything in your project at anytime? Why? Why not?
69. When did you make changes? Why did you make changes? What influence you to make changes?

Reflection Skills	PRESENT / ASSESS / REFLECT	Reflection Skills

70. How did you evaluate the quality of your project? Any feedback? From whom? Why?
71. Do you make any changes to your project at any time?
72. What influence you to make changes to your project?
73. Would you do this project the same way next time? Why / Why not? What would you change? Why?
74. How do you feel about your design?
75. Did you develop any new knowledge through interaction with group members?
76. Have you learned a lot of new content? Why/Why not? How do you learn the new content?
77. Have you thought about anything while designing? Have you thought about your audience? Why/why not?

Quality Assessment Skills	PRESENT / ASSESS / REFLECT	All Skills

78. How can this type of project be assessed?

79. In what different ways can the teachers assess (test) you to see whether you have gained more knowledge? How would you like that the teachers assess you? (In what different ways can the teachers assess (test) you to see whether you have gained more or new skills?)

Design Skills	PRESENT / ASSESS / REFLECT	Reflection Skills

80. If you have to design a similar cyberhunt activity, what do you think you would have to do to design one?

END

APPENDIX X

CYBERHUNT GUIDE

CYBERHUNT GUIDE

2008

By

A. du Plessis

CONTENTS

OUTCOMES

OF THE

CYBERHUNT PROJECT

CYBERHUNTS OR SCAVENGER HUNTS: THEORY, DISCUSSION & PRACTICAL

By André du Plessis

Nelson Mandela Metropolitan University

2008

OUTCOMES

At the end of this session you should be able to:

- Identify Bloom's Taxonomy and name the different categories
- Provide examples of the keywords related to each of the categories
- Identify the difference between convergent and divergent questions
- Relate convergent and divergent questions to Bloom's Taxonomy
- Explain what a Cyberhunt is
- Explain the difference between horizontal and vertical Cyberhunts
- Define the critical attributes or components of a Cyber Hunt
- Identify what thinking skills are involved in a Cyberhunt
- Explain what is meant under each thinking skill
- Name the Design Steps of a Cyberhunt and explain each step
- Use the Cyberhunt Lesson Plan Template to plan a Cyberhunt
- Name and discuss the Pedagogical principles which underpin Cyberhunts
- Search for websites about Cyberhunts on the Internet: On finding websites, students should then examine the Cyberhunt with a view to obtain greater understanding of this lesson type.
- Design and plan Cyberhunts in groups and individually Word in a Web-Based online context
- Discuss the advantages and disadvantages of a Web-Based online Cyberhunt
- Design your own Cyberhunt Activity (Lesson) using PowerPoint or Word in an on-line Web-Based context
- Discuss the advantages and disadvantages of on-line non-Web-Based Cyberhunt
- Able to implement Cyberhunts as a learning activity in their classroom

	**SOURCES**	**INT**	Internet: Visit sites and explore

1 Search for cyberhunts, cyber hunts or scavenger hunts on www.google.com **INT**

Possible websites [Accessed: 18 June 2007]

http://www.woodlands-junior.kent.sch.uk/cyberhunts/Index.html

http://www.spa3.k12.sc.us/Scavenger.html

http://webtech.kennesaw.edu/jcheek3/shunts.htm

http://www.oswego.org/staff/cchamber/webdesign/scavenger.htm

http://homepage.mac.com/cohora/ext/internethunts.html

	**PREPARTION & DISCUSSION**	

- Introduction and organization of class
- Practical experience: web browsing and off-line browsing of Cyberhunts (If problematic, an alternative will be in place)
- Class discussion: Advantages and disadvantages of On-Line Cyberhunts
- Class discussion: Advantages and disadvantages of Off-Line Cyberhunts
- Presentation: Theory behind Cyberhunts
- Practical Presentation: How to create a Cyberhunt in Word
- Practical assignment in groups and individually: Create Cyberhunts
- Designing Lesson in groups and on your own

ASSIGNMENT 1: CYBERHUNT LESSON (ON-LINE)

Name and Surname:	
Student number:	

ASSIGNMENT 1

- Design your own Cyberhunt Activity (Lesson) using FrontPage, PowerPoint or Word
- Hand it in on disk OR your lecturer will evaluate you while in class.
- Remember that it must be web based (On-Line based)
- Obtain ideas by searching on the Internet in for example www.google.com for the term cyber hunt or cyberhunt or scavenger hunt. Use the examples that you find as a starting point to generate ideas.
- Your Cyberhunt must contain 10-15 questions.
- Indicate Bloom's Category next to each question.
- Your learners need to find the answers to these questions on websites on the Internet.
- You have to use at least 3 websites on which you base your questions.
- The key is that all the questions must cover the same theme or topic.
- Remember to indicate next to each question its relation to the Bloom taxonomy.
- Supply a memo.

Criteria	Max mark	Excellent	Adequate	Developing	Inadequate
Web links under each question for learners to explore	**8**	Most of the web links are working (leads to website on which answers to questions can be found)	Some of the web links are working (leads to website on which answers to questions can be found). Needs some work.	Web links need work. Only a few of the links work (leads to website on which answers to questions can be found)	Not handed in
		7-8 marks	4-6 marks	1-3 marks	0 marks
Questions related to a theme	**15**	10-15 questions. Well formulated. Focus on higher order thinking skills: Knowledge, comprehension, application, analyses (See Bloom). Focus on one theme or topic.	8-9 questions. Focus on knowledge and comprehension only. Focus on one theme or topic.	7 or less questions. Not very clear. Does not focus on one theme or topic.	Not handed in
		11-15 marks	8-10 marks	1-7 marks	0 marks
Creativity of page	**5**	Very inviting to learners. Spacing is excellent and colours used with great effect. Pictures have been inserted that match the theme or topic and are well positioned.	Creativity evident. Spacing and colours on web page capture attention and interest.	Need more attention towards creativity. Spacing and colour do not capture attention and interest.	Not handed in
		4-5 marks	3 marks	1-2 marks	0 marks
Memo	**2**	Memo included	Memo partially completed (more than 70%)		No Memo
		2 marks	1 marks		0 marks
				TOTAL: 30	

SOME READING MATERIAL ABOUT CYBERHUNTS

INTRODUCTION: WHAT IS A CYBERHUNT?

The term Cyberhunt would probably not be found in a dictionary of the 1990's or in a contemporary one. This could possibly be attributed to the fast development of the Information Society and ICT area. Cyberspace is a term that we can attribute to ICT and the Internet. The term "hunt" refers to finding or searching for something. Therefore a cyberhunt refers to an online activity where learners are using the Internet as a tool to find answers to questions (Rechtfertig, 2002) based upon a certain theme or topic that has been composed by someone else. Teachers may use cyberhunts as an introduction to a theme in a pre-activity or as a review for an upcoming test or other form of authentic assessment (Slayden, 2000).

ADVANTAGES OF CYBERHUNTS FOR TEACHERS AND LEARNERS

The advantage for teachers is twofold:

- They learn valuable ICT skills while designing cyberhunts and
- They start to use ICT in an integrative manner (Rechtfertig, 2002:IS) within their learning area.

These skills include searching the Internet by making use of search engines, the identification and evaluation of the level and appropriateness of websites to be included for their cyberhunts, the use of different levels of questioning techniques (See Taxonomy of questions in Table 1), the deployment of their cyberhunts either on the local server or online and how to manage the classroom within a cyberhunt context (Starr, 1999; Slayden, 2000; Rechtfertig, 2002). In addition, cyberhunts can be used to encourage cooperation through group work and cooperative learning, but it can also be used individually on a one-to-one basis (Star, 1999; Slayden, 2000).

Learners can also benefit from using cyberhunts (Rechtfertig, 2002) as they:

- Learn the basics of web navigation,
- Are introduced to online reading for information gathering for meaning,
- Learn how to respond to comprehension questions either by typing the answers online or by writing it in pencil and
- Being prepared for more complex online internet based activities for the future such as designing their own cyberhunts.

REFERENCES

Rechtfertig, M.A. (2002). Internet CyberHunts. Dixie School District Staff Development Day, January 16, 2002, 1:45 pm - 3:30pm. Presenter: Mary Ann Rechtfertig. Available:

http://dixiesd.marin.k12.ca.us/dixieschool/Classrooms/Rechfertig/cyberhunts/ [Accessed: 18 June 2007]

Slayden, B. (2000). Scavenger Hunt for Knowledge. Available:

http://www.suite101.com/article.cfm/english_education_k12/33709 [Accessed: 18 June 2007].

Starr L. (1999). Scavenger Hunts: Searching for Treasure on the Internet! Educational World. Available: http://www.education-world.com/a_curr/curr113.shtml [Accessed: 18 June 2007].

SOME INTERNET HINTS & ISSUES

BOOKMARKS

This means that you store the address of a website in Internet Explorer.

HOW DO YOU BOOKMARK A SITE?

- Select FAVORITES
- Click on ADD TO FAVORITES

CRITERIA FOR EVALUATING WEB PAGE CONTENT

- Content
- Respectable author (But can we know all respectable authors?)
- Contact information of author (Email address? Test by corresponding to see whether he/she replies)
- Frequent or regular updates of the website (What is the last date displayed on the website?)
- References or links to other well-established websites (Test these links. However, links to well established websites are no guarantee of good and accurate information)

TYPES OF PROBLEMS[49]

- Accessing sites with inappropriate material
    - Use Firewalls
    - Use Filter software
        - Cyber Patrol www.cyberpatrol.com
        - Cyber Sitter www.cybersitter.com/
        - Net Nanny www.netnanny.com
        - Cybersnoop www.pearlsw.com
        - Watchdog www.sarna.net/watchdog
- See also www.getnetwise.org for more information on Internet safety issues.

You could also search in www.google.com for: freeware and internet security software

SAFETY ISSUES

- Online predators: Don't give your personal information to anyone!!!
- Fraud
- Computer viruses
- Copyright

[49] These sites were tested on 14 August 2007 and were all working at that point in time.

EXAMPLES OF CYBERHUNTS

Example 1: Volcanoes cyberhunt that provides space for learners to write or type their answers below the questions.

CYBERHUNT CREATED IN MICROSOFT WORD

Volcanoes

BY [50]

Instructions

- Fill in your name and student number
- You will find several questions that are related to various websites. To answer each question you will need to click on the blue highlighted web address which will take you to the website that will offer the information needed to answer the questions.
- Answer all questions on the page.
- **Once you have completed your work, save it under your name and surname in the folder named VolcanoesGrade6A**.

Name and Surname	
Grade	
Date	

Question 1 (Comprehension)	What would you do if a volcano erupts? http://vulcan.wr.usgs.gov/Hazards/Safety/what_to_do.html
Answer	
Question 2 (Knowledge)	List all the Volcanoes in Tanzania. http://volcano.und.edu/vwdocs/volc_images/africa/africa.html
Answer	
Question 3 (Knowledge/ Analysis	By looking at the map and information related to the dispersal of volcanoes, identify the area which is most dense. Roughly how many volcanoes would you say there are? http://www.geo.mtu.edu/volcanoes/world.html
Answer	

[50] Student at the NMMU

Question 4 (Evaluation)	Read the differences between shield and strato volcanoes and explain the differences between each volcano. http://volcano.und.edu/vwdocs/vwlessons/volcano_types/index.html
Answer	
Question 5 (Synthesis)	Explain a Volcanologist's occupation. http://volcano.und.edu/vwdocs/how_to.html
Answer	
Question 6 (Application)	What are ophiolites? http://volcano.und.edu/vwdocs/vw_hyperexchange/ophiolites.html
Answer	
Question 7 (Evaluation)	Compare and contrast the largest eruptions in 10,000 years in Europe with that of South America. http://volcano.und.edu/vwdocs/vw_hyperexchange/veiTables/s_america.html
Answer	
Question 8 (Knowledge)	How many times has Mount St Helens erupted in the past 10, 000 years? http://volcano.und.edu/vwdocs/vw_hyperexchange/veiTables/usa.html
Answer	
Question 9 (Synthesis)	Identify the various parts of a volcano. http://volcano.und.edu/vwdocs/vw_hyperexchange/parts.html
Answer	
Question 10 (Analysis)	Give examples of colossal, super-colossal and mega-colossal volcanoes. http://volcano.und.edu/vwdocs/eruption_scale.html
Answer	
Question 11 (Knowledge)	How often do explosive volcanoes erupt? http://volcano.und.edu/vwdocs/eruption_scale.html
Answer	
Question 12 (Evaluation)	Compare the differences between a cow-pie bomb and a bread crust bomb. http://www.gc.maricopa.edu/earthsci/imagearchive/bombs.htm
Answer	
Question 13 (Analysis)	List the ten deadliest eruptions. http://volcano.und.edu/vwdocs/vw_hyperexchange/deadly_volcs.html
Answer	
Question 14 (Analysis)	Identify the different sectors that are affected in volcanic eruptions. Which are most affected? http://volcano.und.edu/vwdocs/vw_hyperexchange/CostVolc.html
Answer	
Question 15 (Application)	Show how the various gases involved in volcanic eruptions can affect our lives. http://volcano.und.edu/vwdocs/Gases/man.html
Answer	

Example 2: A visit to Addo Elephant Park cyberhunt that does not provide space for learners to write or type their answers below the questions.

CYBERHUNT CREATED IN MICROSOFT WORD
A VISIT TO ADDO ELEPHANT PARK

Answer the questions on your printed worksheets. Click on the blue links to go to a website which has the information you need to answer the questions listed below it.

<u>What to see and do in Addo</u>

http://www.nature-reserve.co.za/cape-eastern-addo-elephant-park.html

1. (Know) How many elephants are there in the Addo Elephant Park? (350)

2. (Know) How far away from Port Elizabeth is the Addo Elephant Park? (72 km)

3. (Know) Name three other kinds of large animals you could expect to see in Addo. (Rhino, Buffalo, Eland, Kudu, Bush Pig, Red Hartebeest, Jackal)

4. (Comp) What is another name for a suricate? Describe one in a sentence.(Meerkat or mongoose, small grey/brown animal with dark-ringed eyes, sits up on hindlegs)

5. (Comp) What do you think is the main thing visitors to Addo, do? (i.e. what is the most popular activity) (Game drives)

6. (Comp) What other activities are there? (Name at least 3). (Hiking, horse-trails, swimming, 4X4 trails, bird-watching)

<u>Accommodation at Addo</u> http://www.sanparks.org/parks/addo/

1. (Know) What are the main kinds of different accommodation at Addo? Name at least five kinds. (Chalets, rondawels, camping, safari tents, forest cabins, guest houses)

2. (Appl) How many safari tents are available for the night of 1 September 2006?

3. (Know) How many people can sleep in each tent? (2)

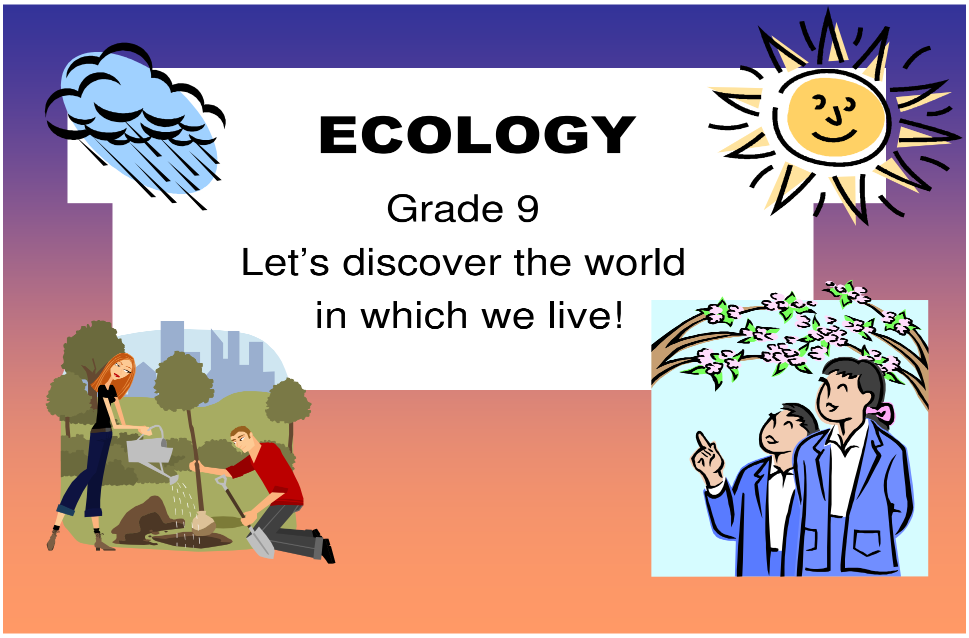
4. (Comp) Describe a safari tent in your own words (Hint: find some pictures). (Luxury tent with beds and balcony area).

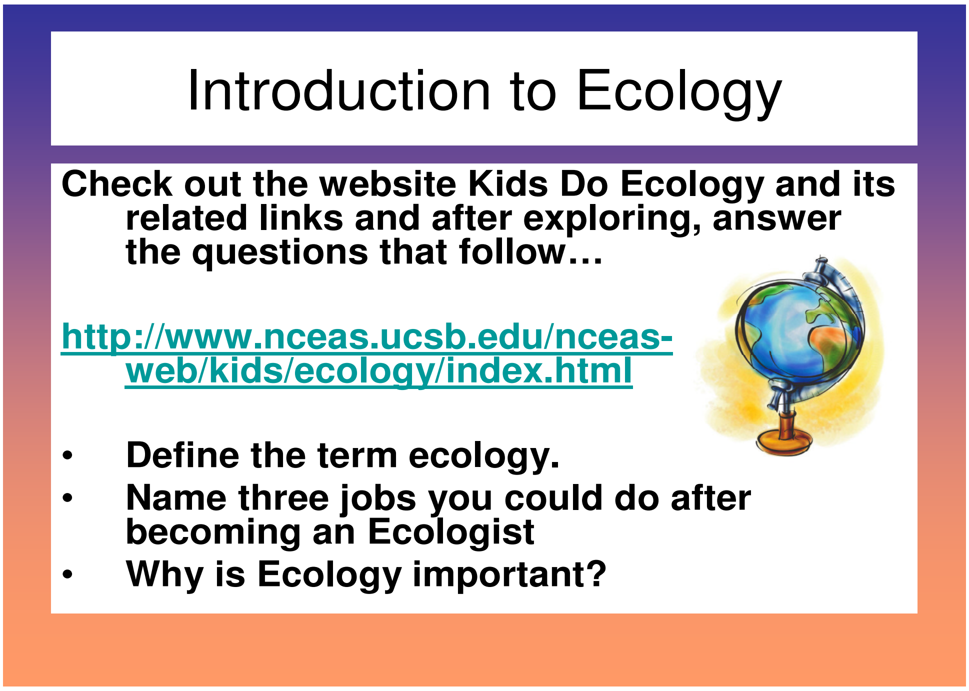
5. (Appl) How much would it cost for a family of 2 adults and 2 children to share a Forest Cabin on the night of 1 September 2006? (R350 + R104 + R52 = R511)

6. (Comp) Which number would you phone to book your reservation? (012 428 9111)

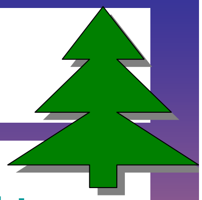
Example 3: Cyberhunt created in PowerPoint. Answers need to be typed in a word processor or written on paper.

CYBERHUNT CREATED IN POWERPOINT





Biomes



http://www.nceas.ucsb.edu/nceas-web/kids/biomes/what_biomes_are.htm

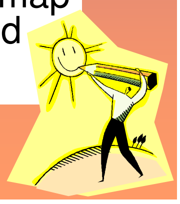
4. **Explain what a biome is in your own words.**
5. **The biomes are separated into two general classifications. Name them**
6. **List the 12 Biomes of the World**
7. **Reflect on South Africa, which biomes do you think we have?**

South African Biomes

Now that you've discovered a bit about world conservation – let's turn our focus closer to home…

http://www.environment.gov.za/enviro-info/nat/biome.htm

8. What are the 7 biomes that scientists have identified in South Africa?
9. On a separate sheet of paper, design a map of South Africa showing where you would find the various biomes.



SOME QUESTIONS TO THINK ABOUT WHEN DESIGNING A CYBERHUNT

AUDIENCE

- For whom am I designing this cyberhunt?
- Will they understand my questions? Have I posed my questions well? Are my questions clear and easy to understand?
- Will my readers or users be able to answer my questions easily? Have I provided clear instructions to my readers in my Cyberhunt? (Do my readers know what to do?)
- Will the people who use my cyberhunt find my topic and questions about the topic interesting?
- Have I inserted any pictures or other visual material that will enhance the topic or the interest of my users?
- Is my layout of my Cyberhunt good? (Not cramped, spaces between questions, bold headings, use of colour in headings, etc.)

BLOOM'S TAXONOMY

- Have I composed questions on the different levels of Bloom's Taxonomy?
- Is there a variety of the level of difficulty of my questions?
- Have I asked a variety of questions?

READING ABILITY

- Have I selected websites where the English is on the level of my learners?
- Is the information on the websites reliable and truthful?
- Do the websites contain pictures to enhance interest and/or to explain the topic better?

BLOOM'S TAXONOMY AND THE DIFFERENT LEVELS OF QUESTIONS

THE TAXONOMY OF BLOOM

As teachers and as people part of the world, we ask questions to our learners and people everyday. Not all questions are on the same level. Some questions are easy to answer where other questions may require a great deal of thinking.

Bloom (1956) has provided us with his taxonomy to assist us to compose questions on different levels of thinking. This taxonomy ranges from lower to higher levels of cognitive thinking. These levels are (I will shortly provide more detail of each level):

(1) Knowledge
(2) Comprehension
(3) Application
(4) Analysis
(5) Synthesis
(6) Evaluation

EXAMPLES OF QUESTIONS IN THE TAXONOMY

Dalton and Smith[51] (1986) provide us with the following examples:

KNOWLEDGE		
USEFUL VERBS	**SAMPLE QUESTIONS**	**POTENTIAL ACTIVITIES AND PRODUCTS**
• Tell • List • Describe • Relate • Locate • Write • Find • State • Name	• What happened after...? • How many...? • Who was it that...? • Can you name the...? • Describe what happened at...? • Who spoke to...? • Can you tell why...? • Find the meaning of...? • What is...? • Which is true or false...?	• Make a list of the main events.. • Make a timeline of events. • Make a facts chart. • Write a list of any pieces of information you can remember. • List all the .... in the story/article/reading piece. • Make a chart showing...

[51] Dalton, J. & Smith, D., (1986). Extending Children's Special Abilities: Strategies for primary classrooms (pp. 36-37).

COMPREHENSION		
USEFUL VERBS	**SAMPLE QUESTIONS**	**POTENTIAL ACTIVITIES AND PRODUCTS**
• Explain • Interpret • Outline • Discuss • Distinguish • Predict • Restate • Translate • Compare • Describe	• Can you write in your own words...? • Can you write a brief outline...? • What do you think could of happened next...? • Who do you think...? • What was the main idea...? • Who was the key character...? • Can you distinguish between...? • What differences exist between...? • Can you provide an example of what you mean...? • Can you provide a definition for...?	• Cut out or draw pictures to show a particular event. • Illustrate what you think the main idea was. • Make a cartoon strip showing the sequence of events. • Write and perform a play based on the story. • Retell the story in your words. Paint a picture of some aspect you like. • Write a summary report of an event. • Prepare a flow chart to illustrate the sequence of events. • Make a colouring book.

APPLICATION		
USEFUL VERBS	**SAMPLE QUESTIONS**	**POTENTIAL ACTIVITIES AND PRODUCTS**
• Solve • Show • Use • Illustrate • Construct • Complete • Examine • Classify	• Do you know another instance where...? • Could this have happened in...? • Can you group by characteristics such as...? What factors would you change if...? • Can you apply the method used to some experience of your own...? • What questions would you ask of...? • From the information given, can you develop a set of instructions about...? • Would this information be useful if you had a ...?	• Construct a model to demonstrate how it will work. • Make a scrapbook about the areas of study. • Take a collection of photographs to demonstrate a particular point. • Make up a puzzle game suing the ideas from the study area. • Make a clay model of an item in the material. • Design a market strategy for your product using a known strategy as a model. • Paint a mural using the same materials. • Write a textbook about... for others.

ANALYSIS		
USEFUL VERBS	**SAMPLE QUESTIONS**	**POTENTIAL ACTIVITIES AND PRODUCTS**
• Analyse • Distinguish • Examine • Compare • Contrast • Investigate • Categorise • Identify • Explain • Separate • Advertise	• Which events could have happened...? • I ... happened, what might the ending have been? • How was this similar to...? • What was the underlying theme of...? • What do you see as other possible outcomes? • Why did ... changes occur? • Can you compare your ... with that presented in...? • Can you explain what must have happened when...? • How is ... similar to ...? • What are some of the problems of...? • Can you distinguish between...? • What were some of the motives behind...? • What was the turning point in the game? • What was the problem with...?	• Design a questionnaire to gather information. • Write a commercial to sell a new product. • Conduct an investigation to produce information to support a view. • Make a flow chart to show the critical stages. • Construct a graph to illustrate selected information. • Make a family tree showing relationships. • Put on a play about the study area. • Write a biography of the study person. • Prepare a report about the area of study. • Arrange a party. Make all the arrangements and record the steps needed. • Review a work of art in terms of form, colour and texture. • Review a film

SYNTHESIS		
USEFUL VERBS	**SAMPLE QUESTIONS**	**POTENTIAL ACTIVITIES AND PRODUCTS**
• Create • Invent • Compose • Predict • Plan • Construct • Design • Imagine • Propose • Devise • Formulate	• Can you design a ... to ...? • Why not compose a song about...? • Can you see a possible solution to...? • If you had access to all resources how would you deal with...? • Why don't you devise your own way • to deal with...? • What would happen if...? • How many ways can you...? • Can you create new and unusual uses for...? • Can you write a new recipe for a tasty dish? • Can you develop a proposal which would...	• Invent a machine to do a specific task. • Design a building to house your study. • Create a new product. Give it a name and plan a marketing campaign. • Write about your feelings in relation to... • Write a TV show, play, puppet show, role play, song or pantomime about...? • Design a record, book, or magazine cover for...? • Make up a new language code and write material suing it. • Sell an idea. • Devise a way to... • Compose a rhythm or put new words to a known melody.

EVALUATION		
USEFUL VERBS	**SAMPLE QUESTIONS**	**POTENTIAL ACTIVITIES AND PRODUCTS**
• Judge • Select • Choose • Decide • Justify • Debate • Verify • Argue • Recommend • Assess • Discuss • Rate • Prioritise • Determine	• Is there a better solution to... • Judge the value of... • Can you defend your position about...? • Do you think ... is a good or a bad thing? • How would you have handled...? • What changes to ... would you recommend? • Do you believe? • Are you a ... person? • How would you feel if...? • How effective are...? • What do you think about...?	• Prepare a list of criteria to judge a ... show. Indicate priority and ratings. • Conduct a debate about an issue of special interest. • Make a booklet about 5 rules you see as important. Convince others. • Form a panel to discuss views, e.g. "Learning at School.". • Write a letter to ... advising on changes needed at... • Write a report. • Prepare a case to present your view about...

HOW TO SETUP AND PLAN A CYBERHUNT (STEPS)

<u>PHASE 1 STARTS:</u> DECIDE & PLAN

- Topic / problem / theme: what do we want to learn about?
- Pre-knowledge: what do I know already?
- Outcomes / goals
- Duration / timeframe / timeline
- Keywords & key phrases
- Group or individual
- Assessment
- Pre-activities / additional activities
- Results presentation
- Computer skills to be taught

TOOL: TEACHER PLAN SHEET

DEVELOP: SET & FIND

- Goal setting: for today, weekly (duration)
- Search internet: use keywords
- Bookmark sites
- Find & email experts
- Read / scan / navigate
- Note taking / summarise
- Evaluate sites & info
- Compose questions & memo

TOOL: JOURNAL & TEACHER PLAN SHEET

DESIGN, CREATE & TEST

- Type questions
- Answers: memo
- Hyperlink to sites
- Insert enhancing visual material
- Format text
- Screen design & layout
- Test if links work
- Assess screen layout

TOOL: COMPUTER

REFLECT & SHARE ON PHASE 1 (AT END OF EACH SESSION)

- Reflect on all aspects
- Revise (change & edit)
- Learning
- What have I learned?
- Positives:
- What went well?
- What do I feel proud about?
- What did I enjoy?
- Negatives:
- What did not go well?
- Where do I need help or with what do I need help?
- What problems have I experienced? Solved? How? Not? Why not?
- What changes will I make in future? How & why?
- Share with one another

TOOL: JOURNAL

DEPLOY & TEST (FINAL VERSION)

- Upload to server or internet
- Check if it works & revise if necessary

TOOL: COMPUTER

<u>PHASE 2 STARTS:</u> DO (LEARNERS COMPLETE PRE-DESIGNED)

- Read questions
- Navigate
- Think
- Search & find
- Discuss answer(s)
- Note taking / summarise
- Write or type answers
- Discuss: Is the answer correct
- Why or why not?

TOOL: COMPUTER

PRESENTATION OF ARTIFACTS (ICT or NON-ICT BASED)

One or a combination of the following:

- Paper-based (written)

- Orally / Verbally
- Poster
- PowerPoint presentation
- Word document
- Physical created artefact / poster

TOOL: COMPUTER AND/OR NON-COMPUTER BASED

REFLECT & SHARE ON PHASE 2 (AT END OF EACH SESSION)

- Self-reflection
- Peer-reflection
- Teacher-reflection
- Learning
- What have I learned?
- Positives:
- What went well?
- What do I feel proud about?
- What did I enjoy?
- Negatives:
- What did not go well?
- Where do I need help or with what do I need help?
- What problems have I experienced? Solved? How? Not? Why not?
- What changes will I make in future? How? Why?
- Share with one another (teacher & learners)

TOOL: JOURNAL

ASSESSMENT & FEEDBACK

- Assess presentation / product

TOOL: RUBRIC, CHECKLIST

CYBERHUNT MODEL

TEACHER DESIGN & LEARNERS DO | OR | LEARNERS DESIGN & LEARNERS DO

PHASE 1 STARTS: DECIDE & PLAN

TOPIC / PROBLEM / THEME: WHAT DO WE WANT TO LEARN ABOUT?
PRE-KNOWLEDGE: WHAT DO I KNOW ALREADY?
OUTCOMES / GOALS
DURATION / TIMEFRAME / TIMELINE
KEYWORDS & KEYPHRASES
GROUP OR INDIVIDUAL
ASSESSMENT
PRE-ACTIVITIES / ADDITIONAL ACTIVITIES
RESULTS PRESENTATION
COMPUTER SKILLS TO BE TAUGHT

TOOL: TEACHER PLAN SHEET

ASSESSMENT & FEEDBACK

ASSESS PRESENTATION / PRODUCT

TOOL: RUBRIC, CHECKLIST

REFLECT & SHARE ON PHASE 2 (AT END OF EACH SESSION)

SELF-REFLECTION
PEER-REFLECTION
TEACHER-REFLECTION
LEARNING
- WHAT HAVE I LEARNED?

POSITIVES:
- WHAT WENT WELL?
- WHAT DO I FEEL PROUD OF?
- WHAT DID I ENJOY?

NEGATIVES:
- WHAT DID NOT GO WELL?
- WHERE DO I NEED HELP OR WITH WHAT DO I NEED HELP?
- WHAT PROBLEMS DID I EXPERIENCE? WERE THEY SOLVED? HOW? NOT? WHY NOT?
- WHAT CHANGES WILL I MAKE IN FUTURE? HOW? WHY?

SHARE WITH ONE ANOTHER (TEACHER & LEARNERS)

TOOL: JOURNAL

PRESENT ARTIFACTS (ICT or NON-ICT BASED)

ONE OR A COMBINATION OF:
- PAPER-BASED (WRITTEN)
- ORALLY / VERBALLY
- POSTER
- POWERPOINT PRESENTATION
- PUBLISHER PRESENTATION
- WORD DOCUMENT
- HYPERMEDIA PRESENTATION
- PHYSICAL CREATED ARTEFACT

TOOL: COMPUTER AND/OR NON-COMPUTER BASED

SKILLS, ATTITUDES & PERCEPTIONS DEVELOPED & ENCOURAGED

SKILLS, ATTITUDES & PERCEPTIONS DEVELOPED & ENCOURAGED
DECISION-MAKING
PROJECT MANAGEMENT & PLANNING
TIME MANAGEMENT
SEARCH
RESEARCH
DESIGN & AUDIENCE
COMPUTER / ICT / NAVI-GATION
REFLECTION & REVISION
EVALUATION / ASSESSMENT
READING
MENTAL EFFORT
COLLABORATION & TEAMWORK
SOCIAL SKILLS
INTEREST
MOTIVATION, ENJOYMENT & ON-TASK
COMMUNICATION / DIS-CUSSION
CONNECTING IDEAS
PROBLEM SOLVING

DEVELOP: SET & FIND

GOAL SETTING: FOR TODAY, WEEKLY (DURATION)
SEARCH INTERNET: USE KEYWORDS
BOOKMARK SITES
FIND & EMAIL EXPERTS
READ / SCAN / NAVIGATE
NOTETAKING / SUMMARISE
EVALUATE SITES & INFO
COMPOSE QUESTIONS & MEMO

TOOL: JOURNAL & TEACHER PLAN SHEET

DESIGN, CREATE & TEST

TYPE QUESTIONS
ANSWERS: MEMO
HYPERLINK TO SITES
INSERT ENHANCING VISUAL MATERIAL
FORMAT TEXT
SCREEN DESIGN & LAYOUT
TEST IF LINKS WORK
ASSESS SCREEN LAYOUT

TOOL: COMPUTER

REFLECT & SHARE ON PHASE 1 (AT END OF EACH SESSION)

REFLECT ON ALL ASPECTS
REVISE (CHANGE & EDIT)
LEARNING
- WHAT HAVE I LEARNED?

POSITIVES:
- WHAT WENT WELL?
- WHAT DO I FEEL PROUD OF?
- WHAT DID I ENJOY?

NEGATIVES:
- WHAT DID NOT GO WELL?
- WHERE DO I NEED HELP OR WITH WHAT DO I NEED HELP?
- WHAT PROBLEMS DID I EXPERIENCE? SOLVED? HOW? NOT? WHY NOT?
- WHAT CHANGES WILL I MAKE IN FUTURE? HOW & WHY?

SHARE WITH ONE ANOTHER

TOOL: JOURNAL

DEPLOY & TEST (FINAL VERSION)

UPLOAD TO SERVER OR INTERNET
CHECK IF IT WORKS & REVISE IF NECESSARY

TOOL: COMPUTER

PHASE 2 STARTS: DO (LEARNERS COMPLETE PRE-DESIGNED)

READ QUESTIONS
NAVIGATE
THINK
SEARCH & FIND
DISCUSS ANSWER(S)
NOTETAKING / SUMMARISE
WRITE OR TYPE ANSWERS
DISCUSS: IS THE ANSWER CORRECT?
- WHY OR WHY NOT?

TOOL: COMPUTER

STEPS FOR CREATING A CYBERHUNT

The following steps are merely suggestions and are not prescriptive. Feel free to add or delete where you feel it is appropriate.

A. SELECT A TOPIC OR THEME

1. Select a Learning Area and decide on a topic or theme that can be linked to the National Curriculum Statement (NCS). This can be done in consultation with your learners, as learner input might lead to greater motivation and a feeling of ownership among learners.

B. COMPUTER WORK

2. Generate keywords or phrases that could be linked to the topic. (This can be done with the assistance of your learners during Step 1).
3. Open Microsoft Word or your preferred word processor. Here you are going to type your questions related to the topic as well as the web address (URL) of the website to which this question refers. (This will obviously depend on the level of the cyberhunt that you want to create).
4. Open Internet Explorer (Your Web Browser)
5. Decide on the search engine that you want to use for example www.google.com or www.askjeeves.com, etc. Type in the search engine's address in the toolbar box, e.g. www.google.com

   You could also go to www.wikipedia.org or wikipedia.com

   The wiki's are online encyclopedias

   Alternatively, you could go to www.wikihow.com and search there for information.
6. When your search engine appears in the Web Browser, type the generated keywords or phrases into the search box of your search engine. Remember that you can still generate keywords or phrases as you are searching. Write them down on paper.
7. Explore the generated results produced by your search engine. Not all the results will be useful. You have to decide whether the information accessed is valuable, truthful and on your learners' reading level.
8. Copy the web address to the word document by highlighting it in the Web Browser's address toolbar and then selecting copy from the edit menu (CTRL-C is the shortcut). Remember to bookmark sites, or to write the web addresses down. Bookmarking websites (Favourites button and Add to Favourites in your web browser) allow you to refer or revisit a previously visited web site with ease by selecting the web site from the Favourites option in your web browser.
9. If your word processor is open, switch to it by pressing the ALT-TAB keys. Press the ALT key first, keep it down and press the TAB key. While keeping the ALT key pressed, press the TAB key to move to the programme you want to be opened. Should your word processor not be open, open it by clicking on the START button and then select your word processor. Remember the ALT TAB function to move among opened programmes.

C. QUESTION WORKSHEET GENERATION

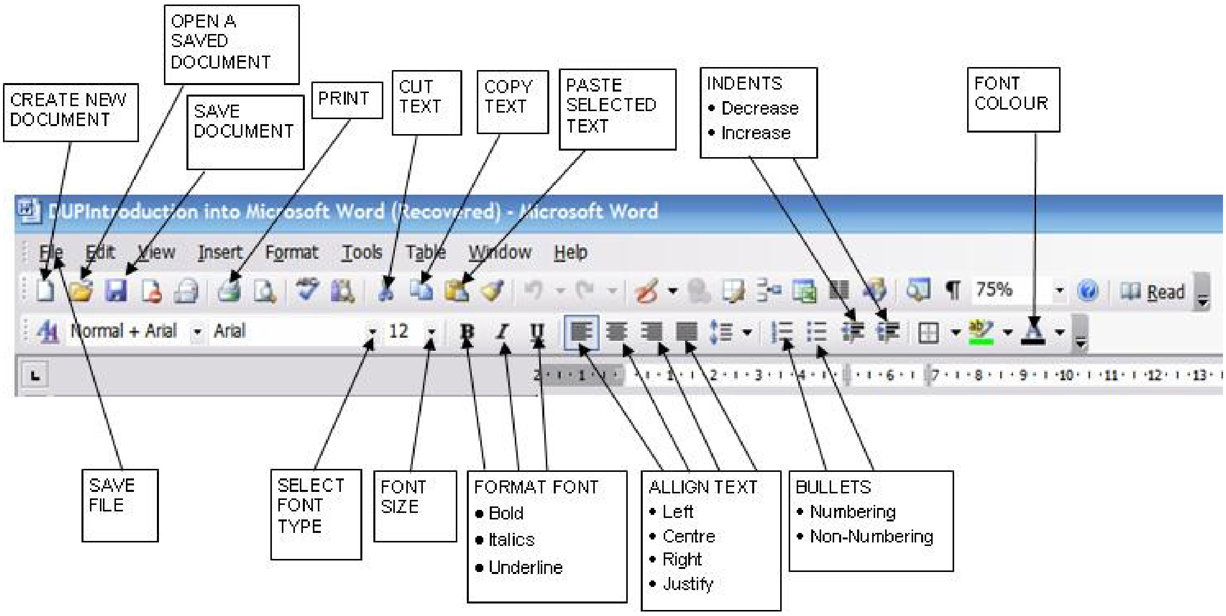
10. Decide what type of question you want to ask. Normally, one starts with simple or easy questions and then move on to a higher level of questioning. Refer to the different levels of questioning as suggested by Bloom. Type the question related to your topic. (It is important to include more and more questions on the higher levels of thinking as you get more confident in searching on the web and with the creation of your cyberhunts)
11. Copy your selected URL (the web address) underneath your typed question by selecting the Edit menu and the Copy option from the dropdown menu box. Alternatively you could use the shortcut option by pressing CTRL-V (Keep in mind that this will only work if you have highlighted the text to be copied previously. See Step 8).
12. Should you want to compose more questions pertaining to the open website, type these questions and paste the URL or indicate to your learners that they have to visit the same website to answer the questions.
13. Should you want to explore the open website deeper (vertically), do the following: Depending on the level of the cyberhunt that you want to design, you will then have to decide whether you will provide the new URL to your learners or whether they will have to explore the website deeper (vertically). If you decide to provide the web address, then copy and paste it as indicated previously. (Note: You do not have to use the address as the link. Instead you can use the question and use the question as a hyperlink. The disadvantage is that learners do not see the way in which a web address is structured. However, this could be useful, especially with young learners.)
14. If you have decided that you want to compose more questions, you could press the BACK button/option on your web browser to take you back to the previous screen in your web browser. Keep on selecting the BACK button until you are where you want to be. For example, if you want to return to the search engine in your web browser where you started initially, keep clicking on the BACK button until that screen appears. You could also start afresh by selecting and opening your web browser. Then follow the sequence as indicated by Step 5 and onwards.
15. To make your cyberhunt more attractive, you could insert applicable pictures that will enhance your topic. Do not insert pictures merely for the sake of having pictures.
16. HINT: You could create tables with two columns and several rows in which you provide space for your learners to type their answers on the computer (PC). In this way learners also learn how to move with the cursor keys and the mouse to the different sections on your page. This can then be printed. Alternatively, you could make a print-out of the questions and the learners can then write the answers in the provided space.

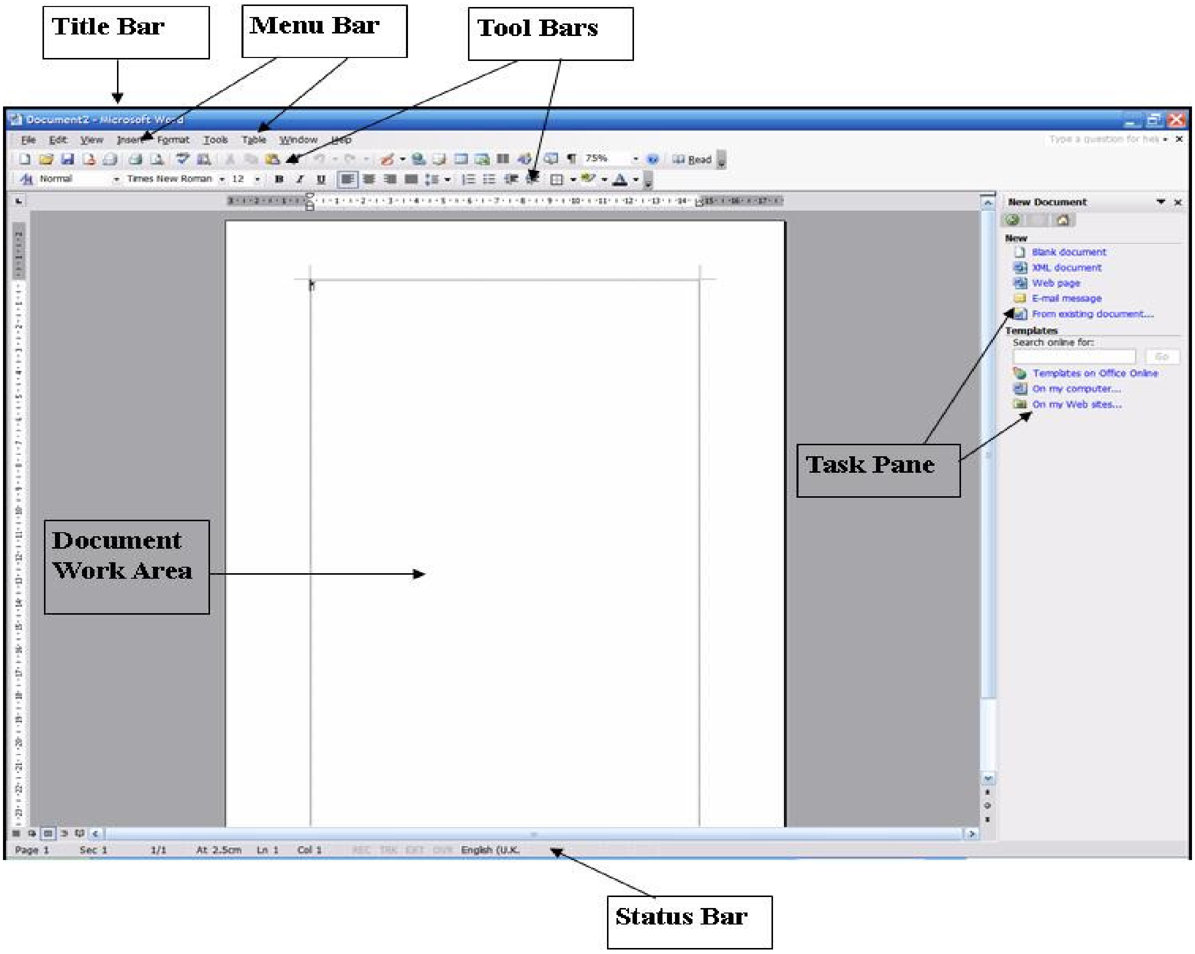
1.	How many elephants are there in the Addo Elephant Park? (Remembering) http://www.nature-reserve.co.za/cape-eastern-addo-elephant-park.html
ANSWER	
2.	What is a sanctuary? Describe one in a sentence (Comprehension) http://www.nature-reserve.co.za/cape-eastern-addo-elephant-park.html
ANSWER	

17. Memo: Remember to set up a memo while you are busy. Type the answers below the questions and print the memo. SAVE the memo and questions. Remember to DELETE the answers before you make another print out for your learners to work on. Should you want to save your cyberhunt in order that your learners can complete it on the computer, the answers have also to be deleted. (Save the questions for example as CyberhuntAddo1 and the memo as CyberhuntAddo1Memo).
18. If your learners are going to type the answers on the computer, remember to save the Cyberhunt on the server where they can all gain access to the specific file. Learners must be informed that they need to SAVE their answers regularly while they are busy working on the Cyberhunt.
19. Be sure to save your page (file) on your hard drive on a regular basis (after every question).
20. Add a title and directions in order that your users will know what to do in your Cyberhunt. They may be in different sizes, fonts, etc.
21. Upload the page onto the web or web server. Alternatively, you could save the page on your network server's hard drive.

THE COMPUTER SKILLS YOU NEED TO CREATE A CYBERHUNT

THE BASIC MENU SHORTCUTS IN WORD





STATUS BAR

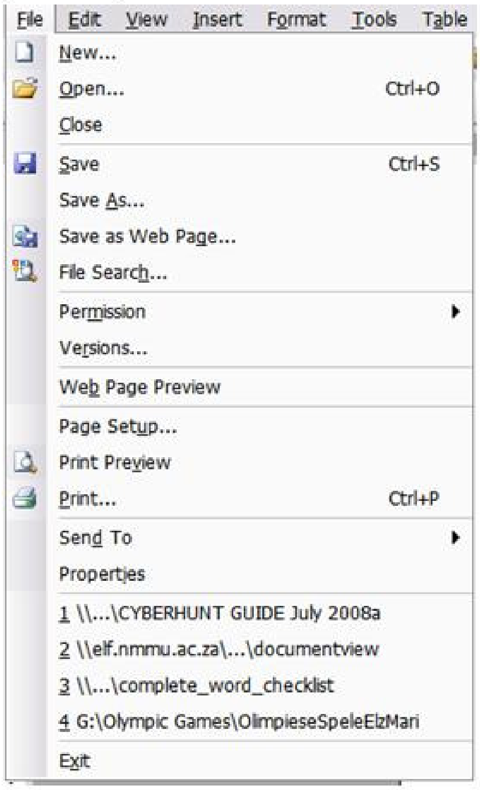
The status bar is a horizontal area in Word below the document window. It provides information about the current page and positioning of the cursor and additional contextual information.

Information on the Status bar reading from left to right tells you:

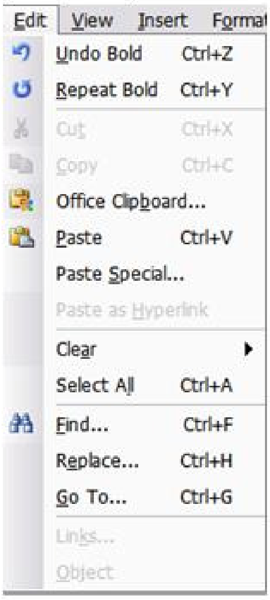
- The page you are currently positioned on
- The section you are currently positioned in
- The total number of pages
- The cursor position in relation to the top edge of your page
- The line position (horizontal) and the column position (vertical) of the cursor

THE MENU STRUCTURE

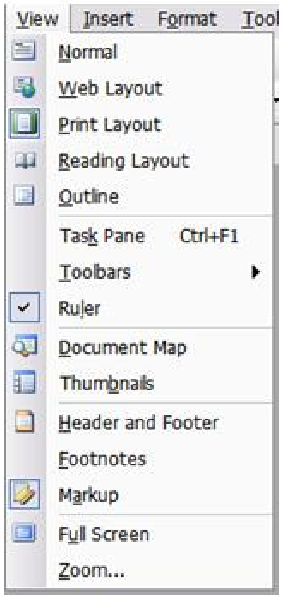
FILE



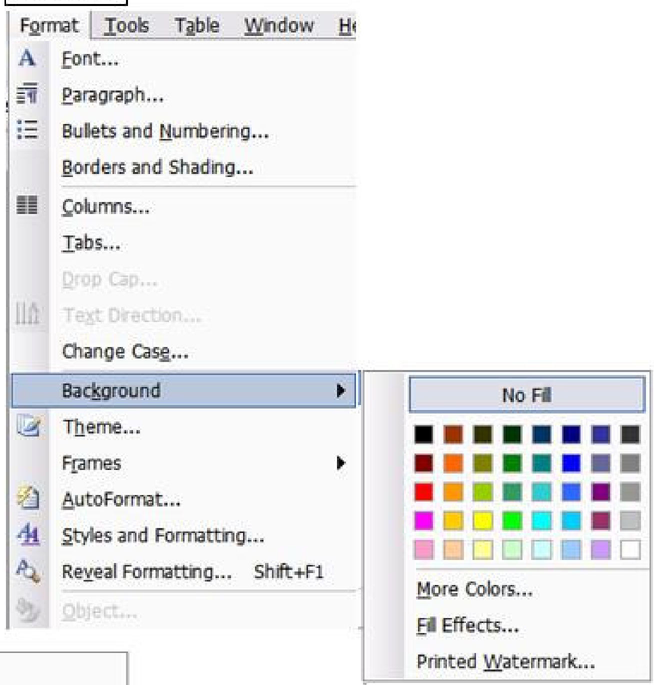
EDIT



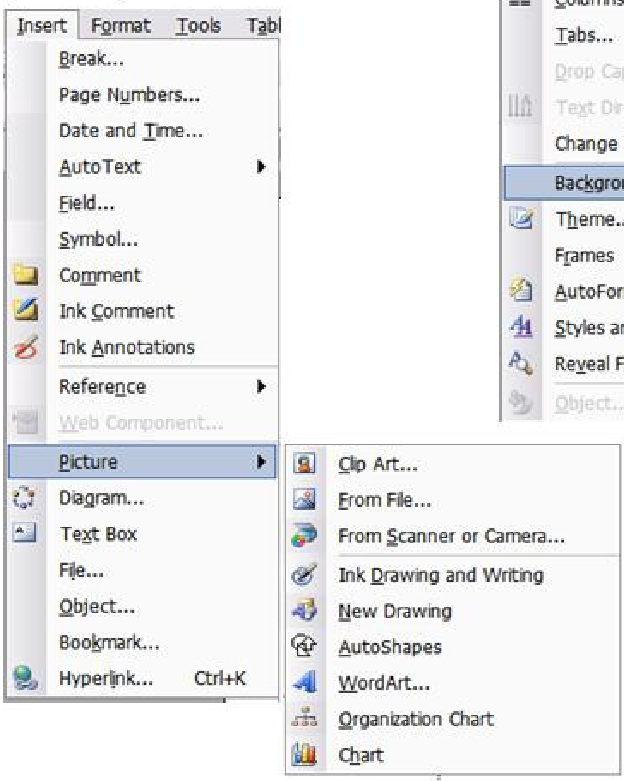
VIEW



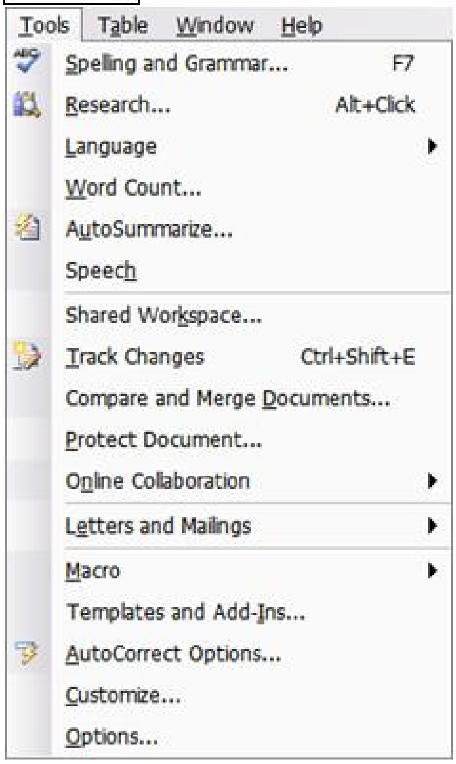
FORMAT



INSERT



TOOLS


Tools Table Window Help
Spelling and Grammar... F7
Research... Alt+Click
Language
Word Count...
AutoSummarize...
Speech
Shared Workspace...
Track Changes Ctrl+Shift+E
Compare and Merge Documents...
Protect Document...
Online Collaboration
Letters and Mailings
Macro
Templates and Add-Ins...
AutoCorrect Options...
Customize...
Options...

TABLE

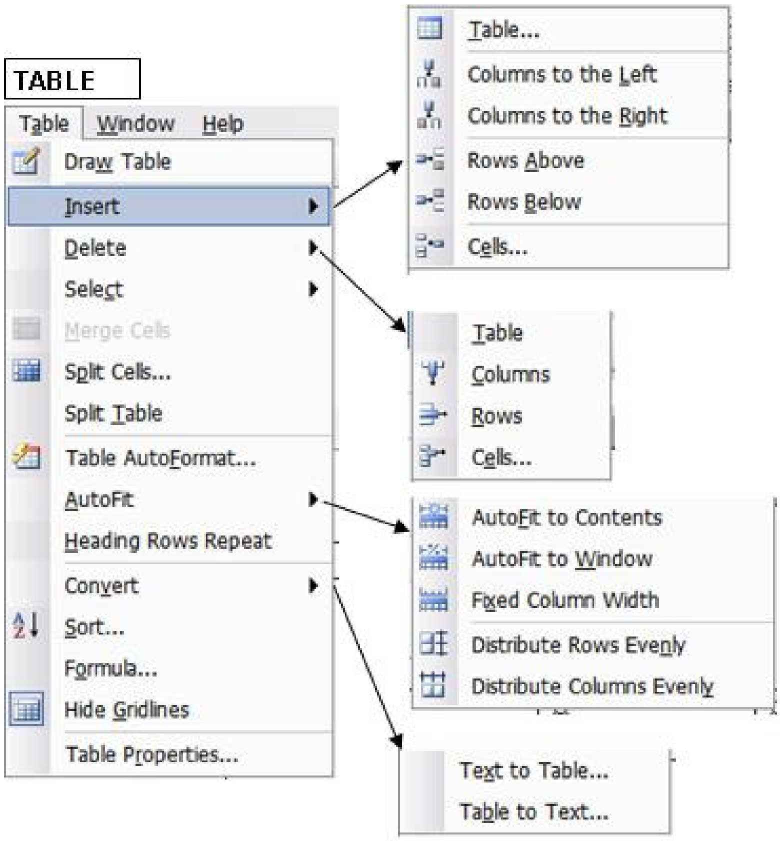
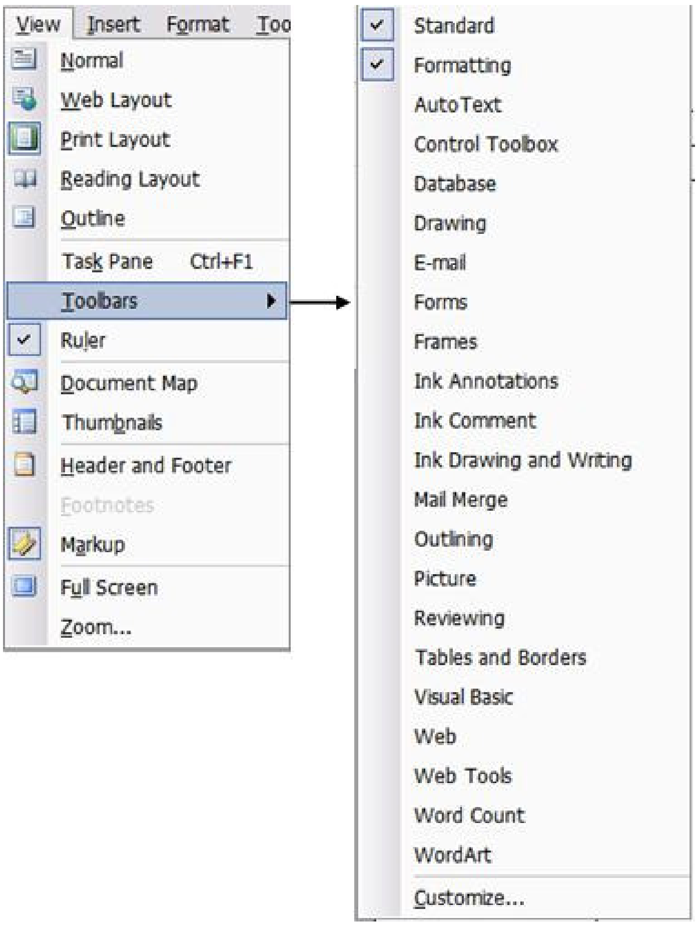


Table Window Help
Draw Table
Insert
Delete
Select
Merge Cells
Split Cells...
Split Table
Table AutoFormat...
AutoFit
Heading Rows Repeat
Convert
Sort...
Formula...
Hide Gridlines
Table Properties...
Table...
Columns to the Left
Columns to the Right
Rows Above
Rows Below
Cells...
Table
Columns
Rows
Cells...
AutoFit to Contents
AutoFit to Window
Fixed Column Width
Distribute Rows Evenly
Distribute Columns Evenly
Text to Table...
Table to Text...

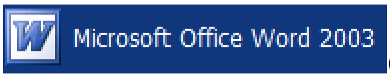

View Insert Format Too
Normal
Web Layout
Print Layout
Reading Layout
Outline
Task Pane Ctrl+F1
Toolbars
Ruler
Document Map
Thumbnails
Header and Footer
Footnotes
Markup
Full Screen
Zoom...
Standard
Formatting
AutoText
Control Toolbox
Database
Drawing
E-mail
Forms
Frames
Ink Annotations
Ink Comment
Ink Drawing and Writing
Mail Merge
Outlining
Picture
Reviewing
Tables and Borders
Visual Basic
Web
Web Tools
Word Count
WordArt
Customize...

SOME BASIC SKILLS

Starting Microsoft Word

There are two ways how you can start WORD

- Double click on the Microsoft Word icon on the desktop.



OR

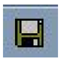
- Click on Start → Programs → Microsoft Office → Microsoft Word (Look until you find them)

Viewing the toolbars

The toolbars in Microsoft Word provide easy access and functionality to the user. There are many shortcuts that can be taken by using the toolbar. First, make sure that the proper toolbars are visible on the screen.

- Click **View**
- Select **Toolbars**
- Select **Standard, Formatting, and Drawing**
- Other toolbars can be selected if you wish

SOME MORE DESCRIPTORS THAT YOU'LL FIND ON THE TOOLBAR

Name	Icon (See Tool Bar)	Description
• New Blank Document		• Creates a new clean or blank file
• Open (File menu)		• Opens a pre-created or saved file (you use this to find a file).
• Save (File menu)		• Saves the active file with its current file name, location, and file format.
• Print (File menu)		• Prints the active file or selected items. To select print options, on the File menu, click Print.
• Cut (Edit menu)		• Removes the selection from the active document and places it on the Clipboard.
• Copy (Edit menu)		• Copies the highlighted selection to the Clipboard to enable you to paste the highlighted selection
• Paste (Edit menu)		• Inserts (paste the copied or highlighted section) on the Clipboard at the insertion point (place where your cursor is flashing). This command option is highlighted (available) if you have selected text or graphics. However, you have to copy the selected area first.
• Undo (Edit menu)		• Undo OR reverses the last command. In other words, it deletes the last entry that you have typed or inserted.
• Redo (Edit menu)		• The opposite of the Undo command (Reverse)
• Hyperlink		• Enable you to insert a new hyperlink or to edit the selected hyperlink.
• Zoom		• Magnifies or enlarge the page. You can enter different sizes between 10 and 400 percent.

MICROSOFT WORD KEYBOARD SHORTCUTS

• Bold	**CTRL+B**
• Change case	**SHIFT+F3**
• Copy	**CTRL+C**
• Delete a word	**CTRL+BACKSPACE**
• Find and replace	**CTRL+F**
• Go to page, section, line, etc.	**CTRL+G**
• Go to the beginning of the document	**CTRL+HOME**
• Go to the end of the document	**CTRL+END**
• Insert a hyperlink	**CTRL+K**
• Italicize	**CTRL+I**
• Open	**CTRL+O**
• Open the thesaurus	**SHIFT+F7**
• Paste	**CTRL+V**
• Print	**CTRL+P**
• Repeat your last action	**F4 or CTRL+Y**
• Save	**CTRL+S**
• Select all	**CTRL+A**
• Select to the beginning of the document	**CTRL+SHIFT+HOME**
• Select to the end of the document	**CTRL+SHIFT+END**
• Undo	**CTRL+Z**

CREATING A NEW DOCUMENT

- Click on **File**
- Select **New**
  - To create a blank document, simply select **New Blank Document**. (You may also use ready made templates. See left of the screen after you have selected FILE → NEW. The TEMPLATES selection should be visible. Select ON MY COMPUTER

FORMATTING TEXT

- Highlight the text that you want to format by dragging your mouse over the text (while holding down the left mouse button)
- Change the text to the size, font type, colour, etc. that you want

INSERTING A TABLE

- Click where you want to place your table
- Click **Table** at top of screen
- Select **Insert**
- Select Table
- Type your table dimensions

INSERTING A PICTURE

- Click where you want your picture to go
- Click **Insert** at top of screen
- Select **Picture**
- Select **Clip Art** (search for the picture you want) OR **From File** (depending what you want to insert)
- Select picture and click **Insert**

INSERTING A SYMBOL

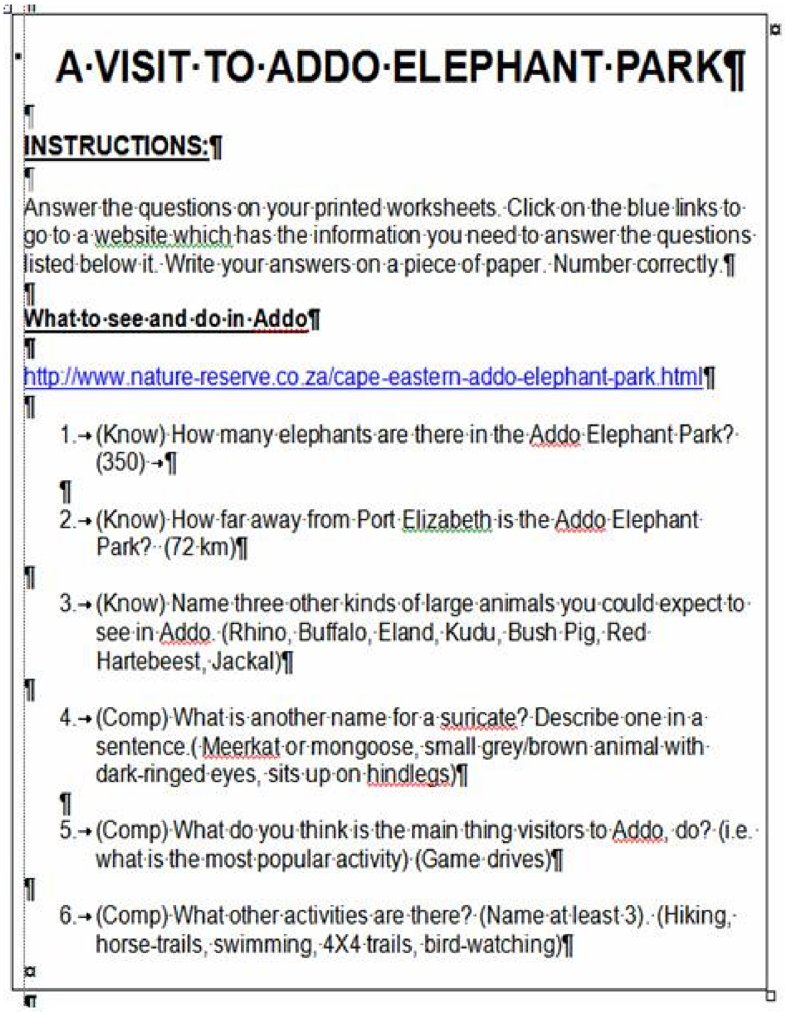
- Click where you want to insert the symbol
- Click **Insert** at top of screen
- Select **Symbol**
- Choose the symbol that you need to insert

INSERTING PAGE NUMBERS

- Click **Insert** at top of screen
- Select **Position** or/and **Alignment** or explore further

HOW TO DESIGN A CYBERHUNT ON COMPUTER: STEP-BY-STEP

Look at the Cyberhunt below. Step-by-step instructions will follow in a table next to it on how to create each section:



A VISIT TO ADDO ELEPHANT PARK

INSTRUCTIONS:

Answer the questions on your printed worksheets. Click on the blue links to go to a website which has the information you need to answer the questions listed below it. Write your answers on a piece of paper. Number correctly.

What to see and do in Addo

http://www.nature-reserve.co.za/cape-eastern-addo-elephant-park.html

1. (Know) How many elephants are there in the Addo Elephant Park? (350)
2. (Know) How far away from Port Elizabeth is the Addo Elephant Park? (72 km)
3. (Know) Name three other kinds of large animals you could expect to see in Addo. (Rhino, Buffalo, Eland, Kudu, Bush Pig, Red Hartebeest, Jackal)
4. (Comp) What is another name for a suricate? Describe one in a sentence.(Meerkat or mongoose, small grey/brown animal with dark-ringed eyes, sits up on hindlegs)
5. (Comp) What do you think is the main thing visitors to Addo, do? (i.e. what is the most popular activity) (Game drives)
6. (Comp) What other activities are there? (Name at least 3). (Hiking, horse-trails, swimming, 4X4 trails, bird-watching)

Type the HEADING

SELECT the heading by marking it with your mouse

Select the FONT SIZE and FONT TYPE that you want

Press ENTER to move one line down

Type the word INSTRUCTIONS

Select it by marking it with your mouse. Select BOLD and UNDERLINE

Press ENTER to move one line down

Do the same for WHAT TO SEE AND DO IN ADDO

Go to INTERNET EXPLORER

SELECT the HYPERLINK in the ADDRESS BAR

Select COPY

Come back to WORD and PASTE the hyperlink into word

Press the ENTER button. The hyperlink will turn BLUE. It must be blue to be active

Press ENTER to move one line down

Number your questions by typing the number 1 on the keyboard.

Type your question. Then press ENTER to move one line down.

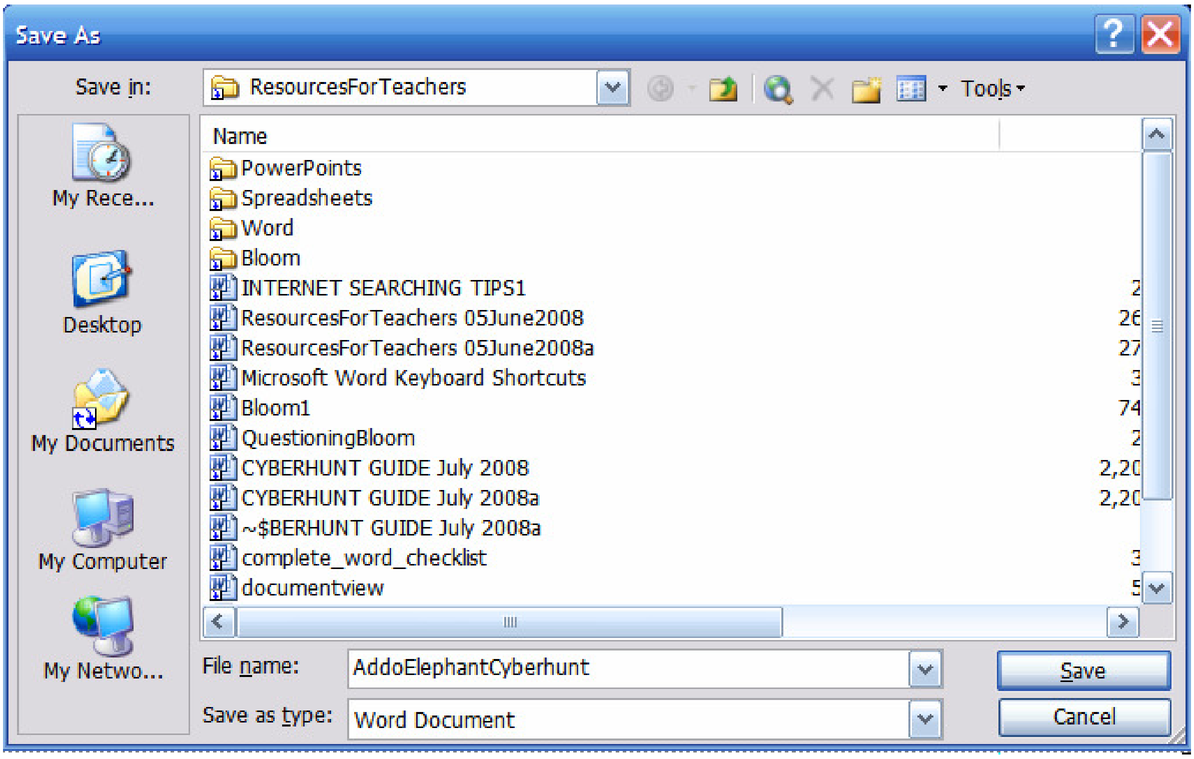
If the next line is not numbered 2, press the 2 and start to type your next question.

Should you want to insert any pictures, first insert a table AND then insert the picture inside the table columns.

WHAT DO YOU DO AFTER YOU HAVE CREATED IT?

SAVE it as a WORD and as an HTM (Web) file. How do you do it?

- Click FILE.
- Select SAVE AS from the menu the appears
- Type your filename (the one that you want to name your cyberhunt) in the FILE NAME box
- Select SAVE AS TYPE (arrow on the right) and select WEB PAGE
- Select SAVE (Remember to SAVE it on the correct FOLDER where you want it)



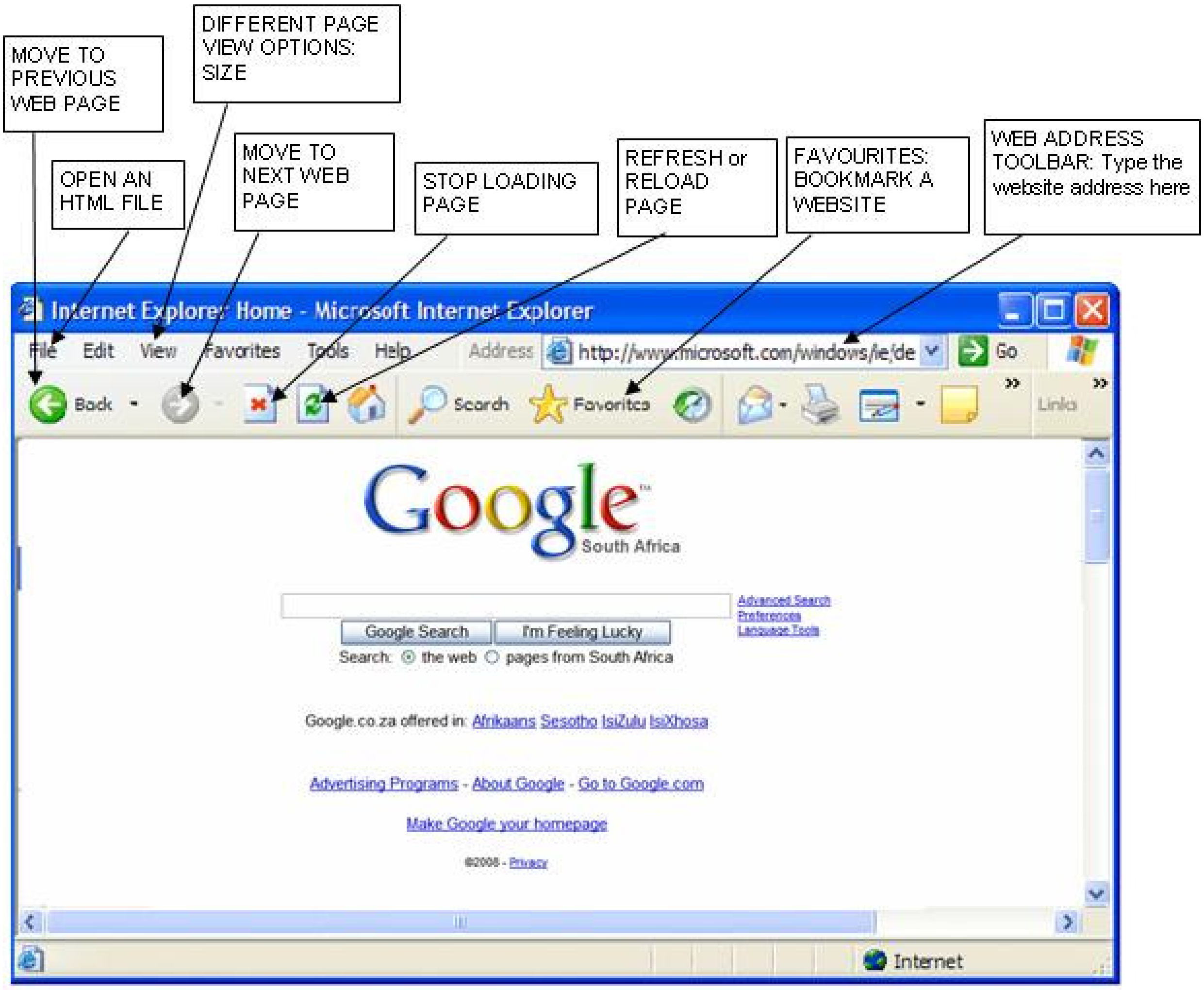
HOW DO THE LEARNERS ACCESS OR OPEN THIS FILE?

- Learners open INTERNET EXPLORER
- Select FILE
- Click OPEN then BROWSE
- Navigate and look until you find the file (LOOK IN box) and scroll down to the folder where the file is placed

INTERNET EXPLORER

SEARCHING IN GOOGLE FOR INFORMATION

INTERNET EXPLORER



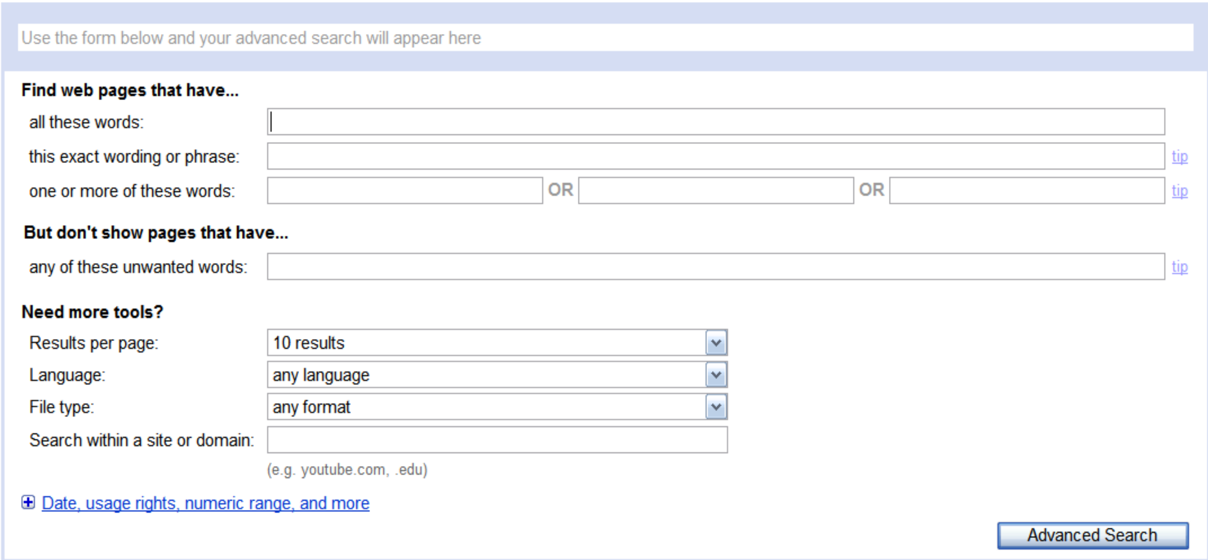
SEARCHING OPTIONS

Lets take the following example: If you want to search for the topic WATER PURIFICATION on www.google.com you could type the following search options in the www.google.com search toolbar:

water purification	water purification methods	**These example or phrases will get different results**
water purification strategies	Water purification strategies for kids	
Water purification models		
water purification AND methods	"water purification" AND "methods"	**Having words or phrases within inverted commas will yield different results**
water purification AND strategies	"water purification" AND "strategies"	
water purification OR water purification methods	"water purification" OR "water purification methods"	**The OR will provide results with the beginning part of the phrase or the end part**
Water purification NOT water purification methods	"water purification" NOT "water purification methods"	**Will provide results only for the first part and NOT words or phrases contained in the second part**

ADVANCED SEARCH OPTIONS

By clicking on the hyperlink ADVANCED SEARCH OPTIONS (see previous page), the following screen appears to assist people to be more accurate with their searching.



SOME SEARCH TIPS AND DIFFERENT SEARCH ENGINES

Don't just "Google" searches as you will probably retrieve useless sites and information. Different search engines and directories give varying results, depending on how the search is created and how each search engine catalogues the Web sites. TRY OTHER SEARCH ENGINES:

www.altavista.com

www.yahoo.com

www.yahooligans.com

www.askjeevs.com

www.dogpile.com

www.hotbot.com

www.metacrawler.com

SEARCH SITES FOR KIDS

www.wikipedia.com

www.wikihow.com

www.kidsclick.org

http://www.kidcyber.com.au/

http://www.teachthechildrenwell.com/

WEBSITE CONTAINING MANY SEARCH ENGINES FOR KIDS

Try this one below:

http://www.ivyjoy.com/rayne/kidssearch.html

SEARCH TECHNIQUES

Decide what information you need to know about regarding your topic.

- KEYWORDS: Choose specific words or phases regarding your topic. Have alternative words (Synonyms) in mind to search with (See lesson plan model at the end).
- STOP WORDS: Do not include the articles (certain words) such as *a, an, of, is, the, and, for* in the search. The reason is that these words are so often used in articles that you won't get the results that you are looking for. This is not to say that you may never use them. Just be careful when you use them.
- Use the following PUNCTUATION in the search line with your words or phrase for more efficient or flexibility in searches:

  "water purification" (quotes around the phrase tells the search engine to find these exact words as they appear in articles)

  +methods (a plus sign in front of the word tells the search engine that the word must appear on the page)

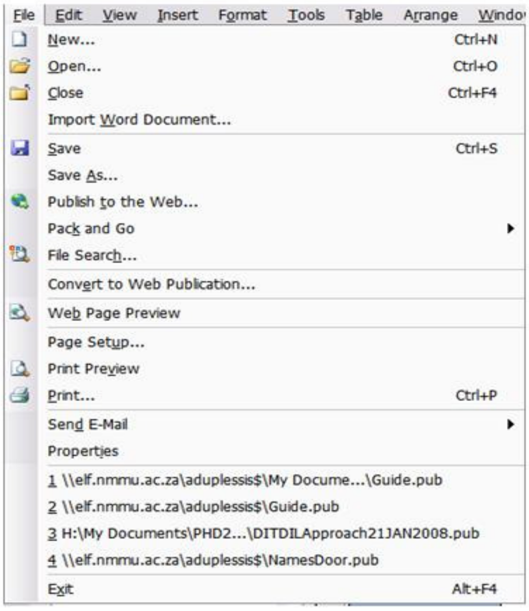
  -models (a minus sign in front of the word tells the search engine to ignore the page if the word appears in the article.

- BOOLEAN searching uses the following words or operators: AND, OR, NOT
  - This assists to help one to narrow down one's searched (see advanced search options on **www.google.com** for more help)
- Use AND:
  - To find documents/data/files containing more than one term occurring together; both terms must be present (Example: water AND purification)
- Use OR:
  - To find either the one term or word OR the other term (Example: water model OR "water purification"
- Use NOT or AND NOT:
  - To exclude a word, term or phrase from the search. This will lead to the inclusion of the one term, but not the other term/word or phrase (Example: "water purification" AND NOT methods)

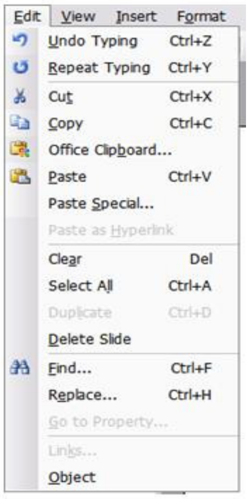
PRESENTATIONS IN POWERPOINT TO REPORT BACK ON QUESTIONS

THE MENU STRUCTURE

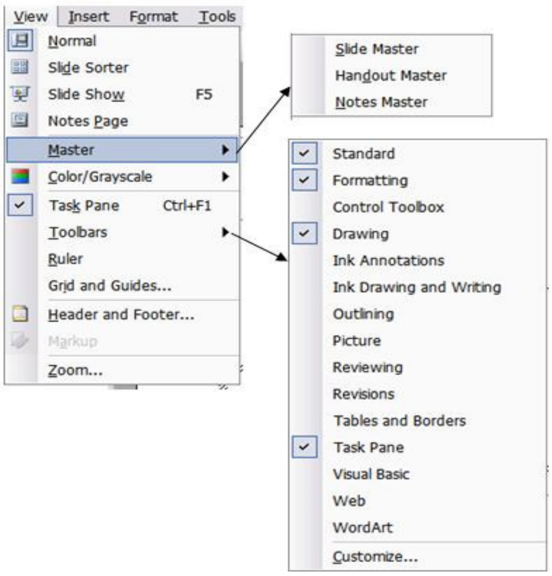
FILE



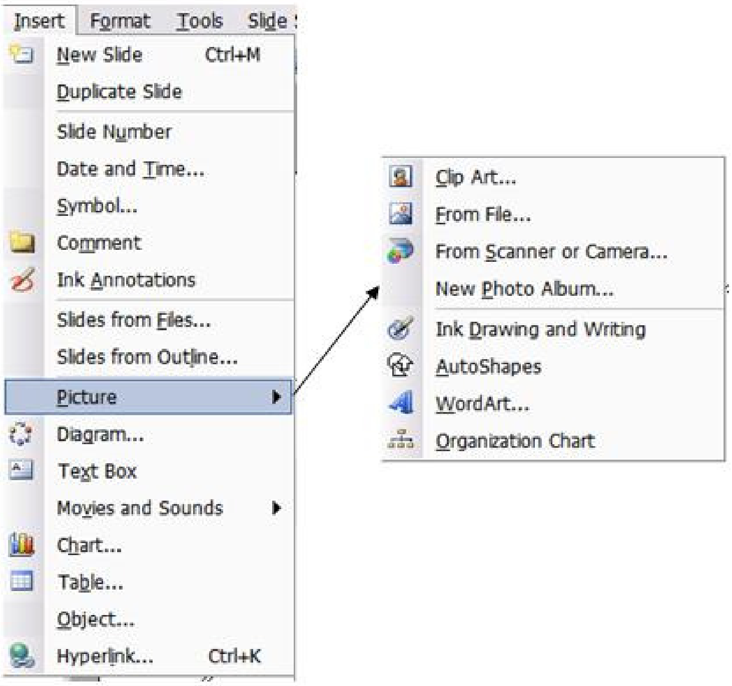
EDIT



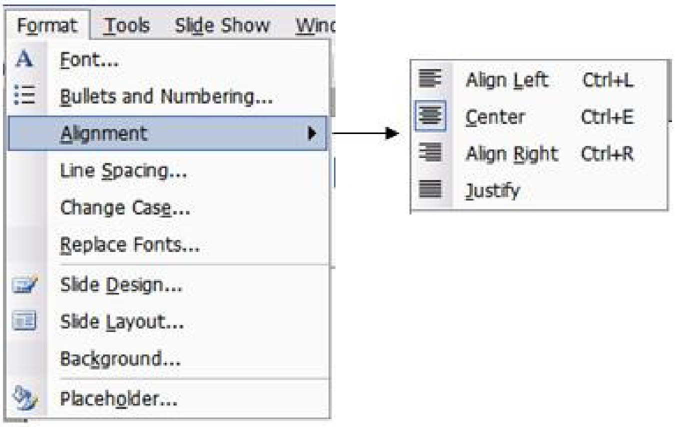
VIEW



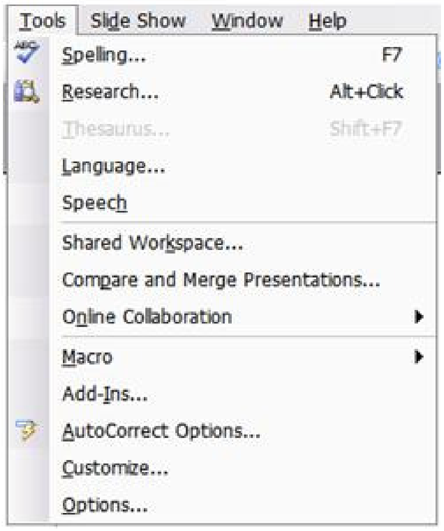
INSERT



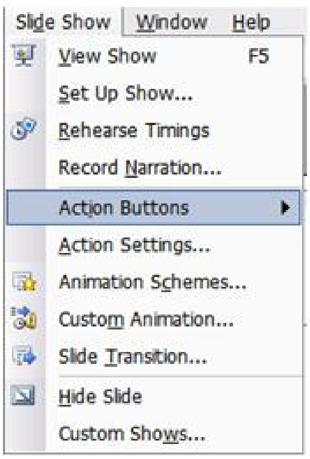
FORMAT



TOOLS



SLIDE SHOW



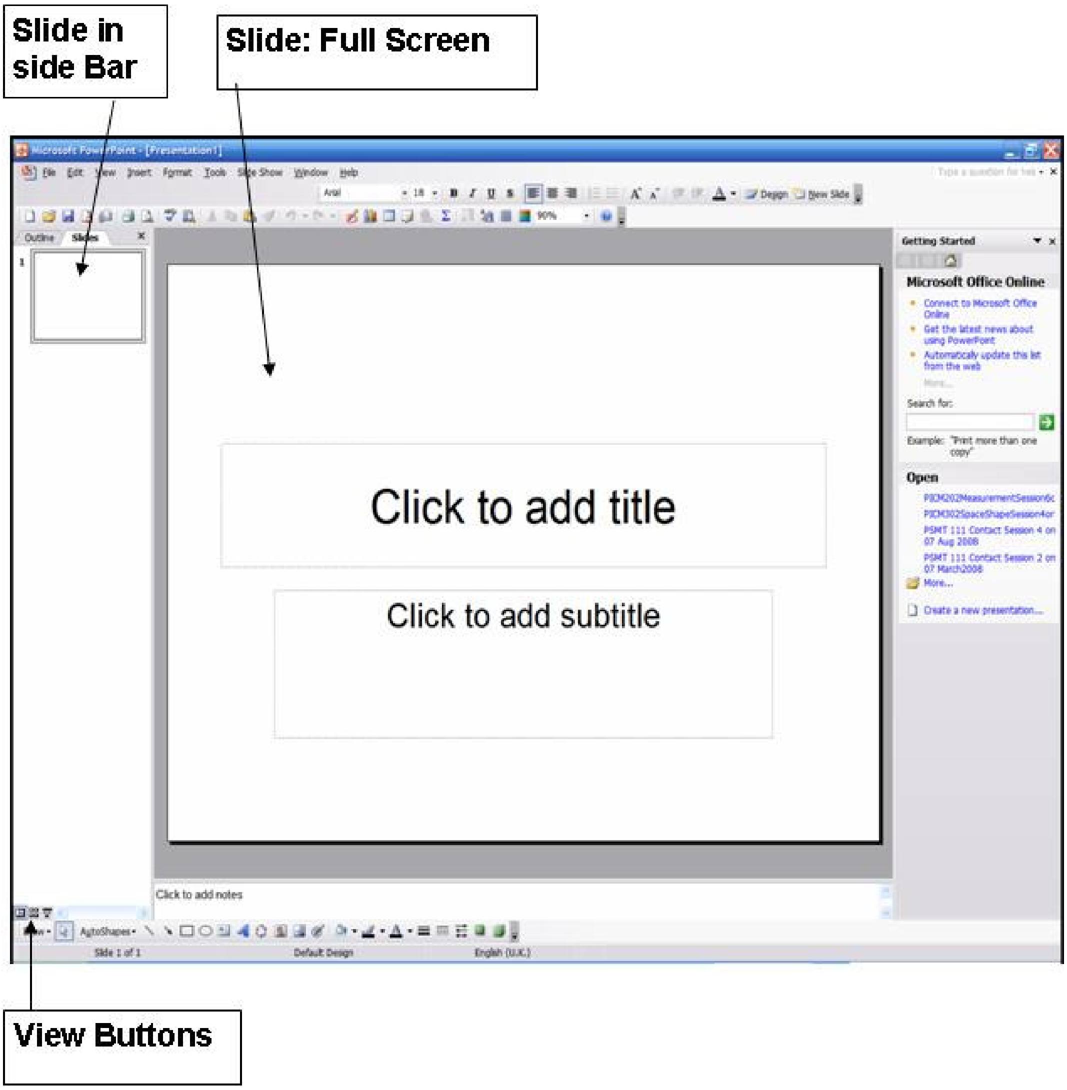
STARTING MICROSOFT POWERPOINT

There are two ways how you can start PowerPoint

- Double click on the Microsoft PowerPoint icon on the desktop.

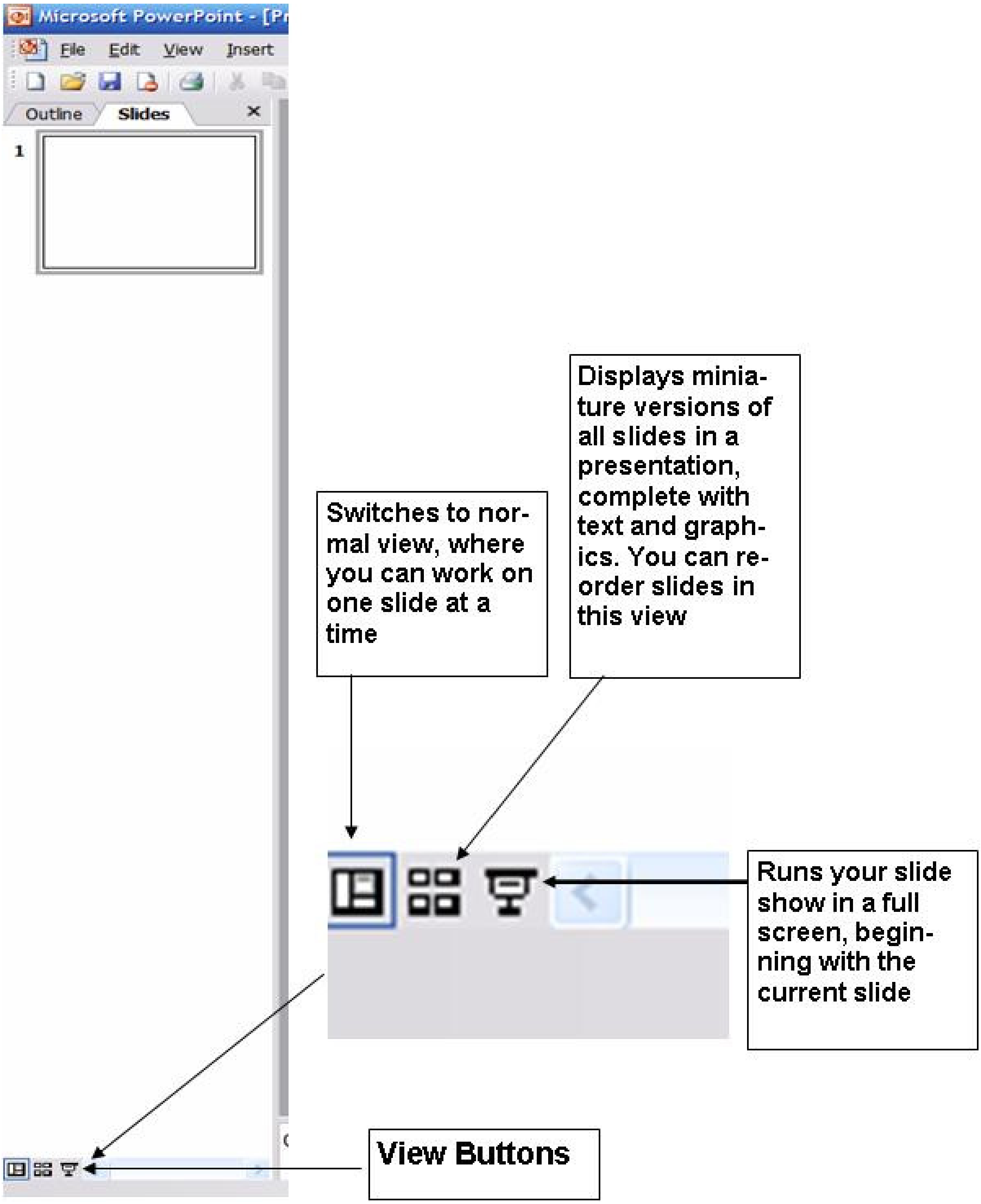
OR

- Click on Start → Programs → Microsoft Office →Microsoft PowerPoint (Look until you find them)

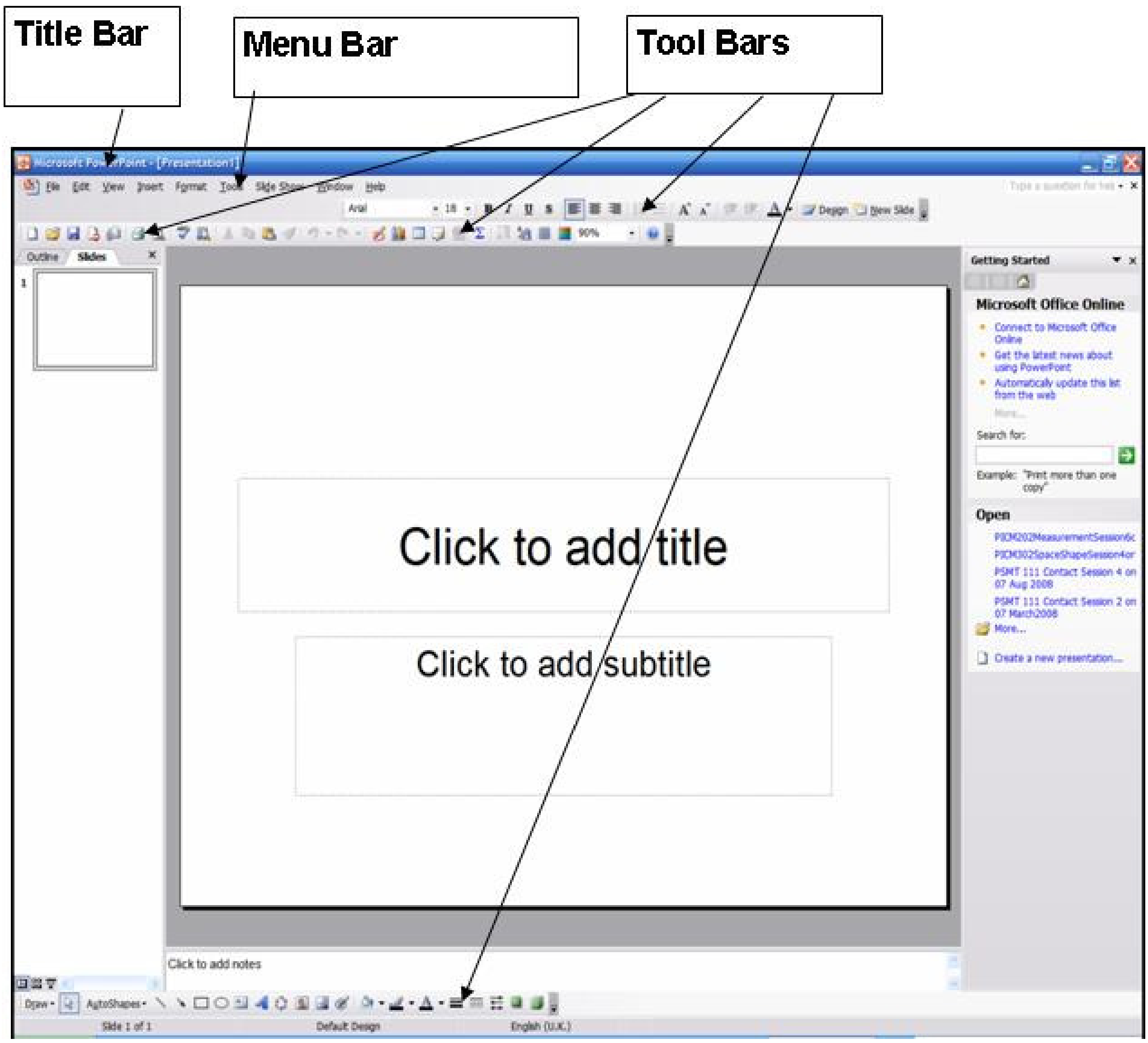


THE VIEW BUTTONS

See the BUTTONS circled on the next page. Explanation of each follows:

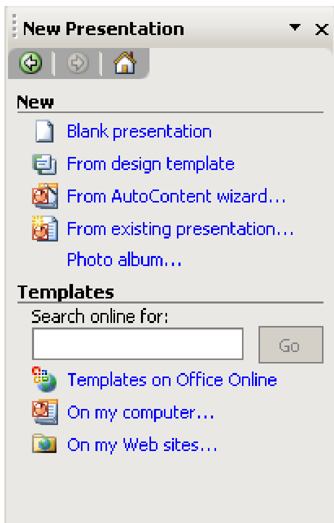


THE MENUS



TASK PANE

A task pane is a window that collects commonly used actions in one place. The task pane enables you to quickly create or modify a file, perform a search, or view the clipboard.



TEMPLATES

PowerPoint comes with two types of templates:

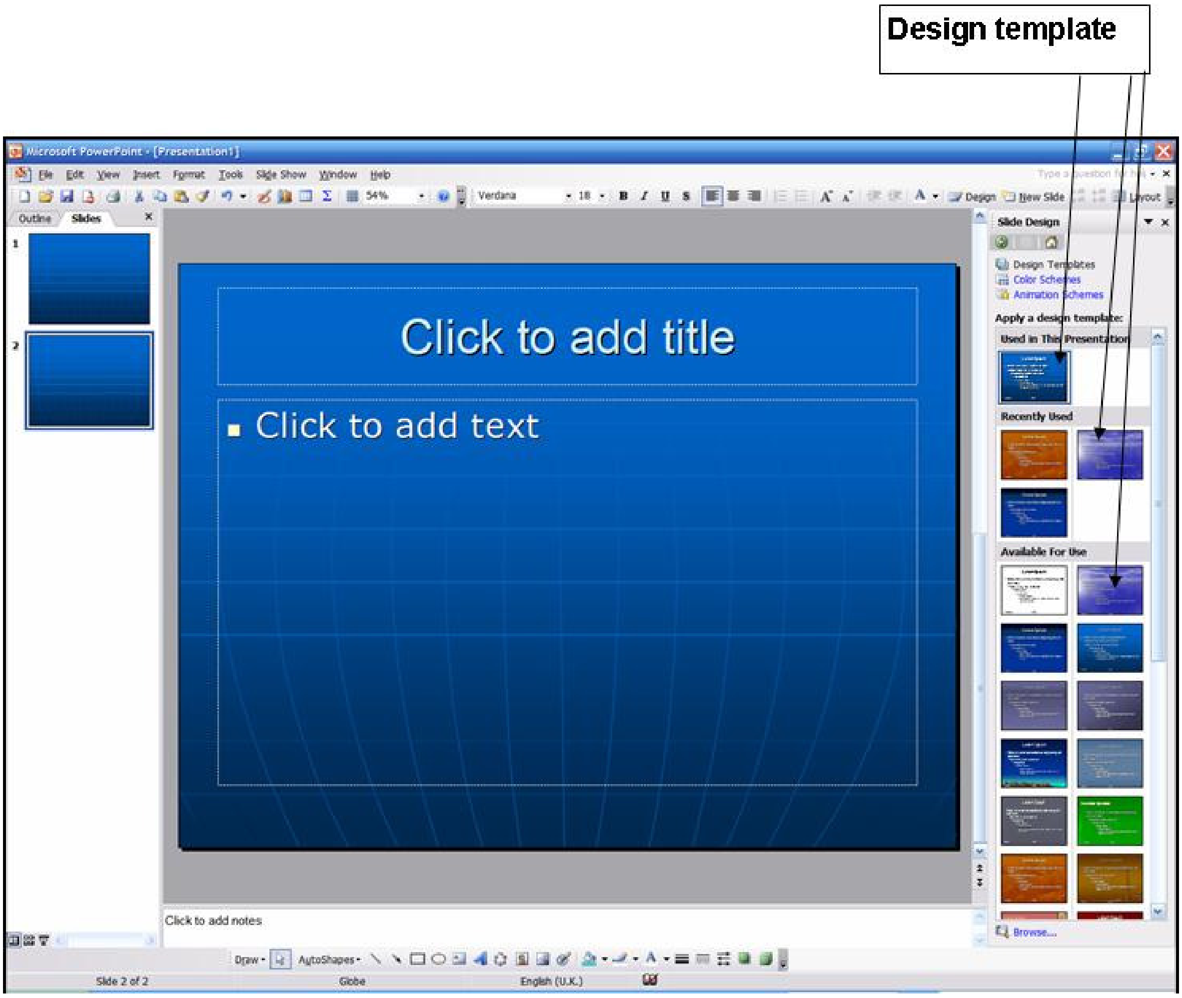
- Design templates and
- Content templates.

Design Templates are used to give your slide presentations a consistent and stylish appearance: colour schemes, slide and title masters with custom formatting. Some may also include background graphics. Applying a Design Template to your presentation will lead to the replacement of the previous slide master and colour scheme.

Content templates contain formats like the design templates, but also provide suggestions.

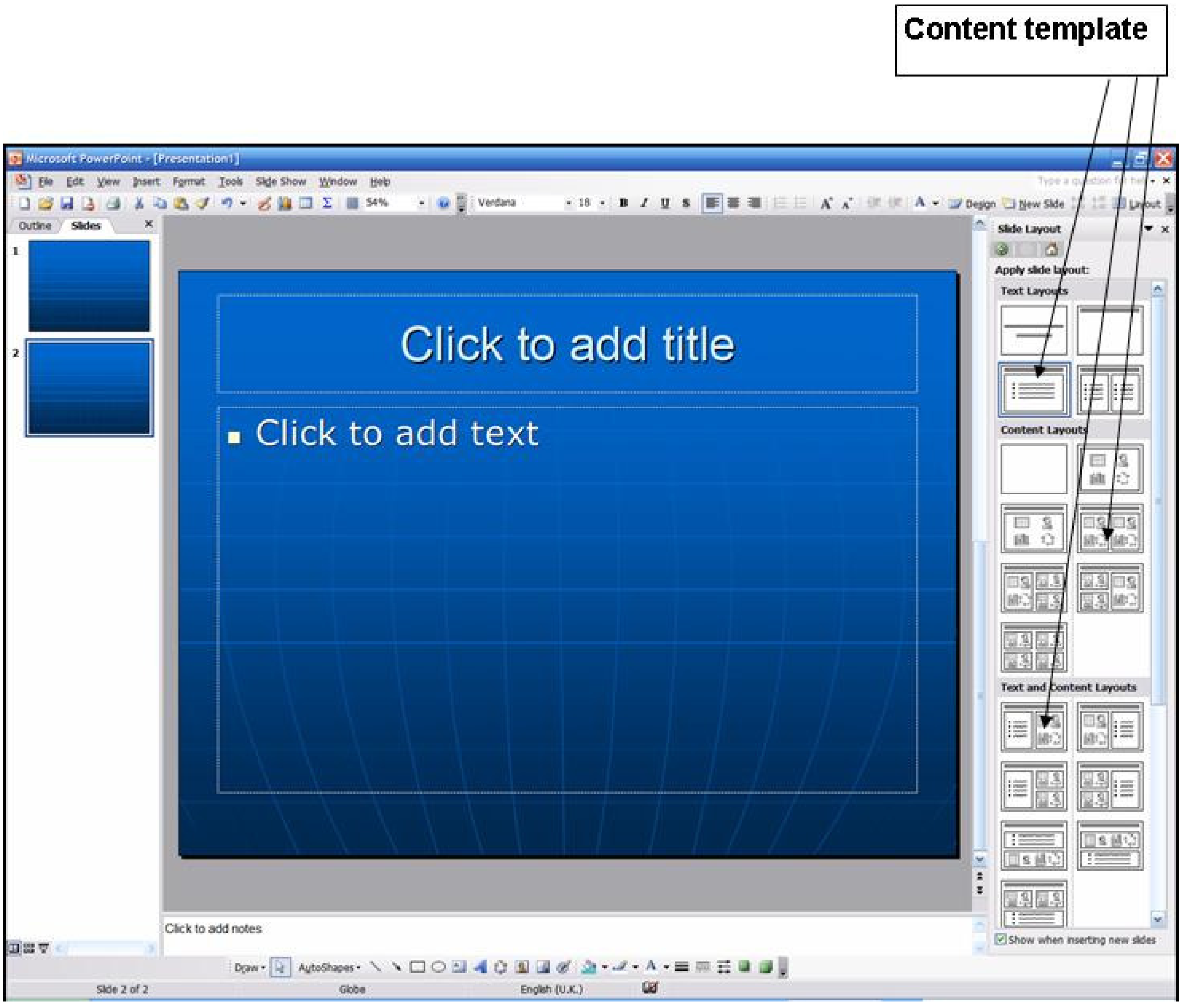
DESIGN TEMPLATE

- Click **Format**
- Select **Slide Design**
- Select the Slide Design that you like (All the slides will change to this layout)
- Click **Insert**
- Select **New Slide (Ctrl-m)** and add as many slides as you want



CONTENT TEMPLATE

- Select Click **Format**
- Select **Slide Layout**
- Select the Layout that you want



CREATING & OPENING A PRESENTATION

- Click **FILE** on the menu bar
- Select **NEW**
- On the right hand side you will see a MENU
- Click **FROM DESIGN TEMPLATE**
- Select a design from **AVAILABLE FOR USE** (Scroll down to see more)
- Click on your selection

SETUP THE SLIDE MASTER AND ANIMATIONS FOR THE SLIDE SHOW

(If you setup the SLIDE MASTER at the start, then all the following slides will use the same style and colours)

- Click **VIEW** on the menu bar
- Menu box pops up
- Select **SLIDE MASTER**
- Click on **TEXT BOX** with the BULLETS on the slide
- Select **SLIDE SHOW** menu
- Menu box pops up
- Select **CUSTOM ANIMATION**
- Click on **ADD EFFECT** (Right side of screen)
- Select **ENTRANCE**
- Select an effect on the next menu box
- Click on the option **TEXT 2: CLICK TO EDIT**
- Select **START ON CLICK**
- Close **SLIDE MASTER VIEW**

HOW TO INSERT SLIDES

- Click **INSERT** menu
- Select **NEW SLIDE** (Short cut is CTRL-M)
- A new slide appears
- You can add as many as you want at any time

HOW TO MOVE A SLIDE

- Click on the slide you want to move
- Drag it up OR down with your mouse while keep pressing the left mouse button
- If you have moved it where you wanted it, stop pressing the mouse button

HOW TO VIEW YOUR SLIDE SHOW

- Click **SLIDESHOW**
- Select **VIEW SLIDE SHOW** (Shortcut is F5)

HOW TO IMPLEMENT THE CYBERHUNT IN THE CLASSROOM & CLASSROOM MANAGEMENT IDEAS

HOW TO IMPLEMENT THE CYBERHUNT IN THE CLASSROOM & CLASSROOM MANAGEMENT IDEAS

PROPOSED UNFOLDING OF LESSON IN CLASSROOM CONTEXT

Each session has more or less the same format, which comprises the following:

1. Teacher: Explanation of what needs to be done. What learners should be aware of and be careful of. (3 minutes)
    - Also see activities prior to computer use
    - Materials needed
    - Learning Outcomes and Assessment Criteria to be made available to learners
    - Results presentation to be discussed
    - Assessment method to be made public
    - Assessment Rubric: Discuss and Hand-out to learners
2. Teacher: Explanation and discussion about any aspects regarding computer related skills (3-8 minutes)
3. Learners: Planning and Goal Setting
    - Completion of the first part of their Journals regarding goal setting (5 minutes)
4. Learners: Work either in the classroom, library and/or computer centre individually or in collaboration with members of their group or even with learners of another group. (40 or more minutes, depending on availability or access to computers)

    (If not enough computers are available, the individuals or groups can be rotated: learners can be divided into two groups. The one group work for 20 or more minutes and then they rotate. The others not working on the computer, could be doing the following:

    - Involved with activities prior to using the computer
    - Supporting activities
    - Activities while at the computer
    - Planning of Results Presentation in rough

- Assisting a peer at the computer who might ask for assistance (Teacher: Facilitates where necessary and checks on-task behaviour and keep learners on-task AND makes observational notes regarding learners and learning process and problems / problem areas noted)
- Activities after using the computer
- NB: If there are enough computers available for all learners OR all groups to have access to the computers simultaneously, then Activities after using the computer will follow next.

5. Learners: Completion of Journals for the day concerning what they found easy, difficult, problems experienced, whether problems were resolved or not and by whom they were resolved, and any other comments that they may want to make. (5 minutes)
6. Teacher: Read Journals (after lesson at home) to gain insight in the:
    - Learning process,
    - Problems experienced by learners,
    - Whether solutions were found or not,
    - Who assisted them,
    - How they went about solving the problems they experienced, etc.
    - To assist with future planning for next session
7. Learners share: Learners could also share what they have written in their journals with the rest of the class by reading it out aloud. By voicing their problems, solutions and who assisted them, they assist other learners to realize that they are not alone as learners can identify with them if they experience the same problems. They could also gain insight in where to find possible assistance. Problems that were not solved are heard by their peers and this could start some valuable thinking in other learners who might be able to come forward with a solution.

NB: Teachers should remember to:

- Provide the hand-out to learners in order that they know what to do.
- Hand-out journal sheets to learners at the start of each session and collect it at the end of each session (or alternatively, provide a photocopied journal with many template pages for learners in which they can write. The teacher can collect these journal booklets at the end of each lesson and return them to the learners at the start of each session of subsequent lessons, until the project is completed.)

TEACHER REFLECTION SHEETS TO HELP WITH IMPLEMENTATION AND TO ANALYSE LEARNERS' NEEDS

TEACHER JOURNAL TEMPLATE

NAME & SURNAME:		**GENDER:**	MALE	FEMAL E
LEARNING AREA:		**TOPIC:**		
NAME OF SCHOOL:		**GRADE:**		
DATE:				

BEFORE YOU START TODAY …

1. What are my goals for this session?

AT THE END OF TODAY'S SESSION …

2. What are my concerns at the moment at the end of this session?

3. Why am I concerned about this?

4. What problems do I experience at the moment?

5. Why am I concerned about these problems?

6. What problems do the learners experience?

7. How can I solve (or assist with the solving) the problems that the learners experience?

8. Who helped or assisted me and how? [Learners, Staff at school, User Group Message Board, Who else?]

9. What have I learned from this session OR how do I feel after this session?

10. What the learners have enjoyed and why

11. What the learners did not enjoy and why

12. What skills have the learners been exposed to / practiced / used / learned ….

13. How do I feel or how do I experience this kind of learning (The cyberhunt project) and why?

14. What will I do differently next time?

LEARNER REFLECTION SHEET TO ASSIST TEACHERS TO IDENTIFY LEARNERS’ NEEDS

LEARNERS

JOURNAL TEMPLATE

NAME & SURNAME:		**AGE:**		**GENDER :**	MALE	FEMALE
LEARNING AREA:		**TOPIC:**				
NAME OF SCHOOL:		**GRADE :**				
NAME OF TEACHER:						
DATE:						

BEFORE YOU START TODAY …

1. What are my goals for this session?

AT THE END OF TODAY’S SESSION …

2. What have I done during the session? Write below and also tick what you have achieved by marking with a √ next to the goal written.

3. What have I learned during this session?

4. What was difficult for me today and why?

5. What have I enjoyed today and why?

6. What did I not enjoy today and why?

7. What problems did I experience?

8. If I did experience problems, were the problems solved and by whom?

9. How was the problem solved?

10. Why did you ask this person(s) to help you to solve your problem(s)?

11. What will I do differently next time?

12. Any other comments that you wanted to make about the project? Write it down. (It can be positive, negative, what you are thinking about, etc.)

LESSON PLAN TEMPLATE TO DESIGN A CYBERHUNT

LESSON PLAN TEMPLATE TO DESIGN AND PLAN A CYBERHUNT

LEARNING AREA		**GRADE:**		**GROUP WORK?**	
LESSON TITLE:		**TIME ALLOCATION:**		**INDIVIDUAL?**	

TOPIC OR PROBLEM: WHAT DO I WANT TO LEARN ABOUT? (WHAT DO I WANT TO FIND OUT / DISCOVER)	**WHAT DO I KNOW ALREADY ABOUT THE TOPIC?**	**KEYWORDS & KEY PHRASE TO BE USED FOR SEARCHING ON WWW**

CRITICAL OUTCOMES TO BE ADDRESSED:
(Tick)

	Identify and solve problems by means of critical and creative thinking		Communicate effectively		Become responsible citizens
	Work together in teams		Use science and technology effectively		Be culturally and aesthetically sensitive
	Manage themselves responsibly		See the world as set of related contexts		Explore education and career opportunities
	Collect and analyze information		Employ effective learning strategies		Develop entrepreneurial abilities.

	#	LEARNING OUTCOMES (LO's):		#	ASSESSMENT CRITERIA (AC's): Rephrase Assessment Criteria in such a manner that it states what you require what the learner should be able to do.
LO			**AC**		
LO			**AC**		
LO			**AC**		
LO			**AC**		
LO			**AC**		

ASSESSMENT TOOLS: WRITE CRITERIA & CREATE
WRITE CRITERIA HERE:

RESULTS PRESENTATION: WHAT WILL THE FINAL PRODUCT(S) BE?
WRITE HERE:

ANY PRE-ACTIVITIES OR ADDITIONAL ACTIVITIES?
WRITE HERE IF APPLICABLE:

COMPUTER SKILLS THAT NEED TO BE ADDRESSED?
WRITE HERE:

DEVELOP CYBERHUNT: SET & FIND

SUMMARISE MAIN POINTS OF INFO FOUND USING KEYWORDS
WRITE HERE:

COMPOSE QUESTIONS & MEMO/ANSWERS:
WRITE HERE:

EVALUATE SITES & INFO
WRITE HERE ANY COMENTS:

BOOKMARK RELEVANT SITES
WRITE HERE:

DESIGN, CREATE & TEST

DESIGN, CREATE & TEST ON COMPUTER
TAKE NOTE OF: • Create a title page: Names & Surnames of creators/designers, Grade, Title • Type instructions • Type questions & create a memo on a separate sheet • Copy & Paste/Insert Hyperlinks • Headings • Screen design, Fonts, Size • Test links • Add any other applicable info if required • Anything else? Write below:

REFLECT & SHARE

REFLECT & SHARE
WRITE IN JOURNAL

DEPLOY & TEST

DO: IMPLEMENT ACTIVITY IN CLASS

DEPLOY & TEST
TAKE NOTE OF: • Create a title page: Names & Surnames of creators/designers, Grade, Title • Type instructions • Type questions & create a memo on a separate sheet • Copy & Paste/Insert Hyperlinks • Headings • Screen design, Fonts, Size • Test links • Add any other applicable info if required • Anything else? Write below:

DO: LEARNERS DO AND PRESENT THEIR RESULTS / FINDINGS
Learners make use of Cyberhunt

TEACHER NOTES / OBSERVATION WHILE LEARNERS ARE BUSY **DO: LEARNERS DO**
WRITE HERE: \

END