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Nelson Mandela  
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Can I improve my  
mathematics  
teaching? Teacher  
Action Research  
holds the key to how!

By Dr André du Plessis

# WHO AM I?

- Dr André du Plessis from the NMMU
- Primary school teacher and HOD for 15 years until 2007
- Joined SMATE (Science, Mathematics and Technology Education) unit at the NMMU in May 2007
- Responsible for ...
  - ❖ Intermediate (Gr 4-6) & Senior (Gr 7-9) Phase Mathematics method
  - ❖ ICT in Education and Mathematics
  - ❖ Assisting in-service & pre-service teachers with Research in Mathematics and Science Education through examining their own practice
  - ❖ Developing ICT integration Teaching & Learning Strategies

# MATHEMATICS IN A CRISES IN SA (PRIMARY) SCHOOLS? (#1 of 2)

- **Fleisch, B. (2008).** Primary Education in Crises: Why South African schoolchildren underachieve in reading and mathematics and **Du Plessis, A. (2010).** Quality of matric passes needs to be examined with overall results.

## ❖ What are the problems?

- Two Nations and bimodal achievement in SA
- Health
- Poverty
- Expenditure
- Language and learning
- Unions
- Teaching and knowing (Teachers' capacity, Content knowledge & Pedagogic knowledge)
- Teacher Attitudes (TA) & Teacher Perceptions (TP)
- Mediocrity (Being an average teacher is OK)
- Playing the Blame Game: 'It is the DOE's fault' OR 'It is apartheid's fault'  
[What did President Zuma said a while ago: 'Can we still blame the past or continue to blame it? ]

# MATHEMATICS IN A CRISES IN SA (PRIMARY) SCHOOLS? (#2 of 2)

- TAKE NOTE: I do not say for one moment that APARTHEID did not play a role OR is not currently playing a role

❖ What I am saying is:

➤ We need to ask ourselves 'What can I as a teacher do at this moment (now) in my classroom to change the current situation and the damage that our political past has caused and is still causing?'

- QUESTION TO THINK ABOUT: Why is Zimbabwe's learners mathematically outperforming our South African learners?
- QUESTION TO THINK ABOUT: Why is Zimbabwe's teachers viewed as mathematically outperforming our South African teachers?

# WHO ARE THE CHANGE MAKERS?

- The Government?
- The DOE?
- The Principal?
- Teachers?

# WHO IS THE REAL CHANGE MAKER?

- Think about this question above
- Who can start the change?
  - ❖ **The TEACHER!! YOU!! & Your Colleagues**
- THUS, what has to be done? Teachers need to bring about change
  - ❖ ***“It is teachers who, in the end, will change the world of the school by understanding it.”***  
**Inscription on Lawrence Stenhouse’s memorial plaque at University of East Anglia.**

# HOW CAN A TEACHER BRING ABOUT CHANGE?

- Content knowledge
- Pedagogic knowledge
- Technological knowledge
- Teacher attitudes, perceptions & commitment: I/We can!! I/We can make the difference!!
- Sharing or practice & classroom experiences with one another
- Planning collectively at school
- Providing opportunities to share best mathematical practices with one another
- Reflection: Reflection BEFORE, IN and AFTER action (Teaching)
- **CLASSROOM ACTION RESEARCH HOLDS THE KEY!!**
  - ❖ ***To assist us to develop and expand our own [each teacher's] TEACHING and LEARNING CULTURE & LEARNING EXPERIENCES [Sharing, planning and working together by examining and reporting our own practice]***

# THE POWER OF REFLECTION IS KEY IN ACTION RESEARCH

- Reflection BEFORE action (Making decisions about what to do)
- Reflection IN action (Learning in the midst of practice)
- Reflection AFTER action (Teaching) (Looking back on experience to improve practice)
- Reflection is the *bridge between thinking and acting*

# THE LEARNING PYRAMID

- We need to examine our own teaching and learning practice, because see how effective is each of the following learning strategies:



\*National Training Laboratories for Applied Behavioral Sciences, Alexandria, VA.

# WHAT IS RESEARCH?

- What is 'research'? Think about that for a moment and write your understanding of this question (Individually)
- Why would teachers conduct research in their own classroom?
  - ❖ **THUS, we could argue that we embark on research to:**
    - Understand something better than before OR to find answers to something
    - Do something in a different way and to see whether it works or improves a situation (testing something)

# Action Research is NOT-

- Writing a Research Paper [Although it could also lead to that route]

# WHAT IS ACTION RESEARCH THEN?

- ***“The idea of action research is that educational problems and issues are best identified and investigated where the action is; at the classroom and school level.***
- ***By integrating research into these settings, ..., findings can be applied immediately and problems solved more quickly” (Guskey, 2000).***
- ***Teachers find answers to tough questions through practical experiences!!***

# Action Research refers to:

- A particular way of researching your own learning;
- A practical way of looking at your practice in order to check whether it is as you feel it should be...;
- If you feel that your practice needs attention in some way, you will be able to take action to improve it, and then produce evidence to show in what way the practice has improved. (Jean McNiff, 2002. Action Research Principles and Practice)

# Central Ideas in Action Research

- I am the central person in my research.
- I am asking a real question about a real issue, and I am hoping to move towards a solution.
- I am starting from where I am.
- I am trying to bring about some improvement. (McNiff, Lomax, & Whitehead, 1996)

# WHAT DOES ACTION RESEARCH ENTAILS?

- Action (teacher) research is a natural extension of good teaching.
  - ❖ Observing students closely,
  - ❖ Analyzing their needs, and
  - ❖ Adjusting your teaching to fit the needs of all learners

# Approaches to Action Research

- **Individual Teacher Research**
- **Collaborative Action Research**
- **School-wide Action Research**

Emily Calhoun, 1993

# Individual Teacher Research

- A teacher focuses on an **area of concern** in his or her classroom.
- May receive support and guidance from colleagues, coaches, and/or outside support personnel from district, province, or university.

# Individual Teacher Research

- A problem or issue within a single classroom to study—
  - *How can I make my teaching of maths more exciting and relevant for learners? OR*
  - *Which teaching strategy did my learners enjoy most when exploring the faces, vertices and edges of 3D objects? OR*
  - *“How can I change my teaching so that it is more effective with large classes?” etc.*

# Collaborative Action Research

- Team of teachers
  - ❖ focusing on a grade level issue
- Teacher and district, educational agency, or university personnel
  - ❖ learning and studying a particular instructional practice
- Group of teachers
  - ❖ in the same school studying the same instructional concern

# Collaborative Action Research

- Focuses on studying a problem or issue within one or more classrooms.
  - ❖ How can we as teachers improve our learners' understanding of the four basic operations our **FOUR** Grade 6 classrooms?
  - ❖ Which teaching strategies have had the greatest effect on our learners in the **THREE** Grade 5 classrooms and why?

# School-wide Action Research

- School-wide action research is a school reform initiative.
- ❖ Every school teacher is involved in studying a specific issue identified from school data.

# The ACTION RESEARCH PROCESS as a series of questions:

1. What is my concern in relation to my teaching?
2. Why am I concerned?
3. What data can I gather to show why I am concerned?
4. What can I do to improve the situation?
5. What data can be gathered to provide evidence of the changes taking place?
6. Were my actions successful in improving the situation?
7. How can I change my ideas and practices in light of what I have learnt? (Jack Whitehead and Jean McNiff)

# THE ACTION RESEARCH CYCLE

- IDENTIFY A BURNING ISSUE IN MATHS

**IDENTIFY** an  
Issue &  
**PLAN**  
Action to be  
taken

- CLASSROOM  
IMPLEMENTATION

**ACT** or  
**IMPLEMENT**  
action  
thoughtfully

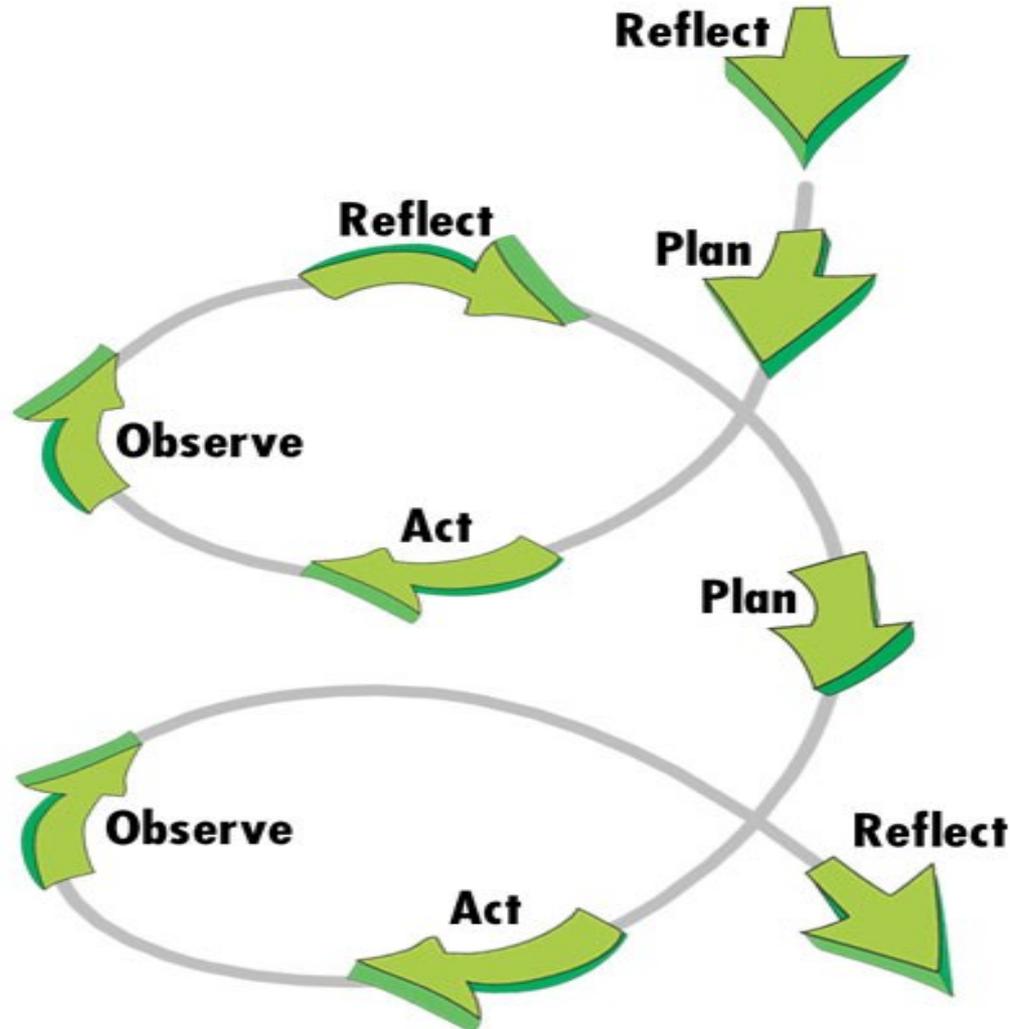
- ANALYSE  
DATA to  
determine  
whether the  
action or  
implementation  
had the desired  
effect or  
outcome

**REFLECT &  
EVALUATE**  
the action

- GATHER DATA  
(Evidence) to  
determine influence of  
class implementation  
[Observation, Journal  
writing, Test,  
Questionnaire,  
Interview learners, etc.]

**OBSERVE  
&  
COLLECT  
DATA**

# ACTION RESEARCH CYCLE: CYCLICAL [ON-GOING or SEVERAL PHASES]



# ACTION RESEARCH PHASES

- PLEASE NOTE: There are several phases, **NOT JUST ONE!!**

# STEP 1: IDENTIFYING A BURNING ISSUE, i.e. WHAT IS MY CONCERN?

- How do you choose an issue to research?
  - ❖ The following process can be followed:
    - What do you feel unhappy about in your teaching?
    - What problem worries you in terms of your learners' performance?
    - What barriers do you experience to effective teaching?
- THUS, asking these questions:
  - ✓ What is my concern in relation to my teaching?
  - ✓ Why am I concerned / What are the problems?
  - ✓ What data or evidence can I gather to show why I am concerned?
  - ✓ What can I do to improve the situation?
  - ✓ What data can be gathered to provide evidence of the changes taking place?
  - ✓ Were my actions successful in improving the situation?
  - ✓ How can I change my ideas and practices in light of what I have learnt? (Jack Whitehead and Jean McNiff)

# What is my concern in relation to my teaching?

- My Concern is: My learners struggle to identify the different 3D objects, as well as the number of FACES, VERTICES and EDGES of each 3D object. They also do not understand the difference between PRISMS and PYRAMIDS.
- PLEASE TAKE NOTE: It is important to make sure that the concern you have chosen is one that you can actually change.
  - ❖ For example, if your concern is that your classes are too big, can you easily change this?
  - ❖ Not really, but you could reframe the question as:
    - “How can I change my teaching so that it is more effective with large classes?” You can see from this example, that the wording of your concern, which becomes your research question, is important.

# WHY AM I CONCERNED?

- Describe why this is a concern for you – is it because it transgresses your values, does it prevent you from teaching in an effective way, are your learners failing?

# What data or evidence can I gather to show why I am concerned?

- At this stage you need to gather data about the concern.
- You can gather this data from:
  - ❖ Learners' work,
  - ❖ Learner journal writing about their experiences
  - ❖ Teacher personal observation that is written as reflection in a teacher journal
  - ❖ Learner Questionnaires
  - ❖ Learner interviews
  - ❖ Test results, etc.

# What can I do to improve the situation?

- E.g. maybe I can use different teaching strategies AND maybe I can use different teaching aids?

# WHAT IS MY RESEARCH QUESTION?

- *Which teaching strategy did my learners enjoy most and had the greatest impact on my learners' understanding of the different 3D objects, as well as the number of FACES, VERTICES and EDGES of each 3D object.*

# What can I do to improve the situation?

- **Maybe I can use different teaching strategies**

- ❖ **Types of Teaching Strategies, e.g.**

- **Direct Instruction**
- **Discussion**
- **Small-group work**
- **Co-operative Learning**
- **Problem Solving**
- **Self-Discovery**

# What data can be gathered to provide evidence of the changes taking place?

- Learners' work
- Learner journal writing about their experiences
- Teacher personal observation that is written as reflection in a teacher journal
- Learner Questionnaires
- Learner interviews
- Test results, etc.

# Example of LEARNER QUESTIONNAIRE to be used at the end of LESSON 1 (INTERVENTION 1) for this specific example

- After lesson 1, please tell me the following:
  - ❖ How did you experience lesson 1? Please tell us why you have made that selection.

Very boring	Boring	Quite boring sometimes	Not sure	Quite interesting sometimes	Interesting	Very interesting

- ❖ What did you enjoy today in the maths class?
- ❖ What did you not enjoy today in the maths class?
- ❖ What changes can your teacher make in future to make this lesson better?

- ❖ How did you experience your teacher during lesson 1?  
Please tell us why you have made that selection.

Very boring	Boring	Quite boring sometimes	Not sure	Quite interesting sometimes	Interesting	Very interesting

- ❖ Was your teacher teaching differently in lesson 1 than normally? YES or NO? Please tell us why you have made that selection.
- ❖ Have you experienced anything different in the classroom in this lesson than before or normally? Please tell us.
- ❖ Are you unclear about anything after lesson 1? Anything that you would like more help in?

❖ How confident are you about this maths topic that your teacher has taught now? Why have you answered in this way?

Not confident at all	Not so Confident	Reasonably confident	Confident	Very confident

❖ How do you find this maths topic after your teacher has taught it now? Why have you answered in this way?

Very difficult	Difficult	Sometimes difficult	Easy	Very easy

# Example of LEARNER QUESTIONNAIRE to be used at the end of LESSON 2 (INTERVENTION 2) for this specific example

- The SAME data gathering tool as used in Lesson 1 (Intervention 1). WHY?
- Just add the following Question for this example
  - ❖ Which lesson did you like more: LESSON 1 or LESSON 2. Please tell us why.
- NOW, the same questions follow that you have asked after Lesson 1 (Intervention 1)

# Were my actions successful in improving the situation?

- Explain what you did in LESSON 1 (INTERVENTION 1) and why and what happened in the class as a result [You used e.g. DIRECT INSTRUCTION as intervention]
  - ❖ Use data gathering tools to indicate what happened in Lesson 1 (Your Findings)
- Explain what you did in LESSON 2 (INTERVENTION 2) and why and what happened in the class as a result [You used e.g. QUESTION AND ANSWER as intervention]
  - ❖ Use data gathering tools to indicate what happened in Lesson 2 (Your Findings)
- Explain what you did in LESSON 3 (INTERVENTION 3) and why and what happened in the class as a result [You used e.g. SMALL GROUP WORK & DISCOVERY as intervention]
  - ❖ Use data gathering tools to indicate what happened in Lesson 3 (Your Findings)

# How can I change my ideas and practices in light of what I have learnt?

- Discuss any positive and negative changes that may have occurred: Remember: **What evidence do you have to substantiate your findings? USE YOUR DATA!!!**
- You will be in a good position to provide advice to other teachers or academics on:
  - ❖ What worked best, why,
  - ❖ What they should do when teaching your burning issue,
  - ❖ What they should not do, etc.
  - ❖ What have you learned while teaching these two/three lessons?
  - ❖ What positive changes have you noticed within your learners and in yourself as a teacher?
  - ❖ Any negative changes that you have noticed in YOUR LEARNERS and in YOURSELF AS A TEACHER?
  - ❖ Which approach worked best? Why do you say so?

- ❖ How can I change my ideas and practices in light of what I have learnt?
- ❖ What do you think you may have to do differently in future in light of what you learnt? The answers to these questions will determine what further action has to be taken.
- ❖ Reflection to provide advice to teachers who would have to teach this content/topic that you have taught:
  - Discuss how another teacher should plan lessons pertaining to this BURNING ISSUE(S) or TOPIC that you have taught.
  - Explain what the benefits could be if they follow your suggestions.
  - Explain what other teachers should guard against OR be careful about when they plan and teach this topic/ lesson/ BURNING ISSUE(S)

# END

- Suggestion: Maybe AMESA and the DOE can provide a ONE to TWO DAY TEACHER DEVELOPMENT SESSION where I can practically help teachers to develop their Action Research investigations AND their DATA GATHERING TOOLS
- Any questions?