



AIMS

African Institute for
Mathematical Sciences
SCHOOLS ENRICHMENT CENTRE

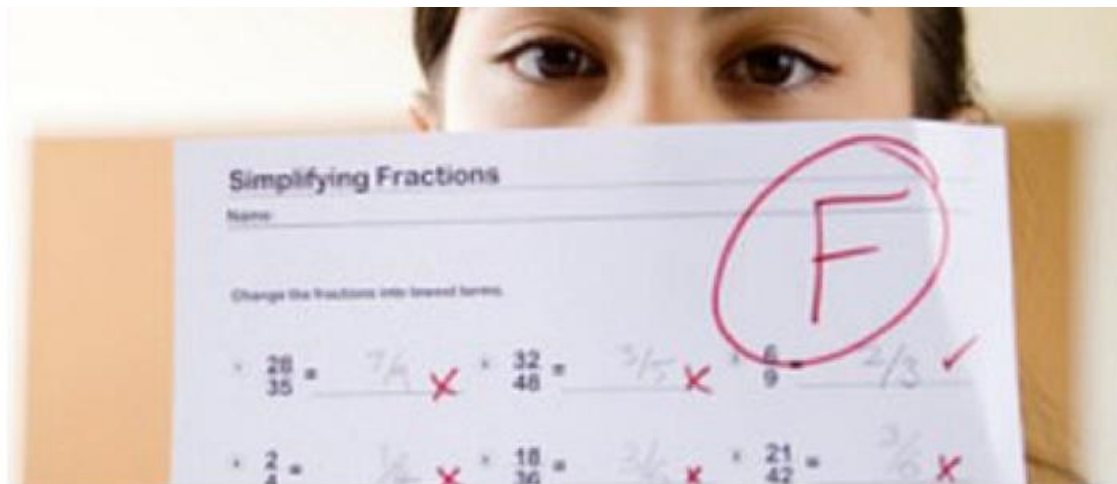


FaSMEd

Formative assessment in
mathematics: a design
research project

Marie Joubert
Ingrid Mostert





Low attainment in mathematics

What's the problem?

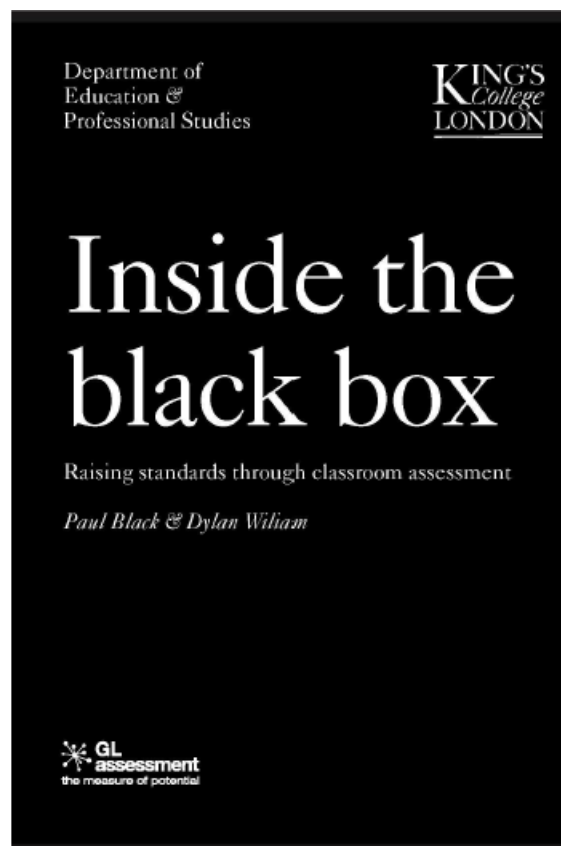
"...in the EU-27 in 2009, an average 22.2% of students were low achievers in

mathematics." (Eurydice, 2011)

"South Africa is significantly underperforming in education, particularly mathematics teaching and learning." (CDE 2013)

Teaching

- Teachers matter
- Teaching can be improved
- Using formative assessment
- Using technology
- Helping teachers



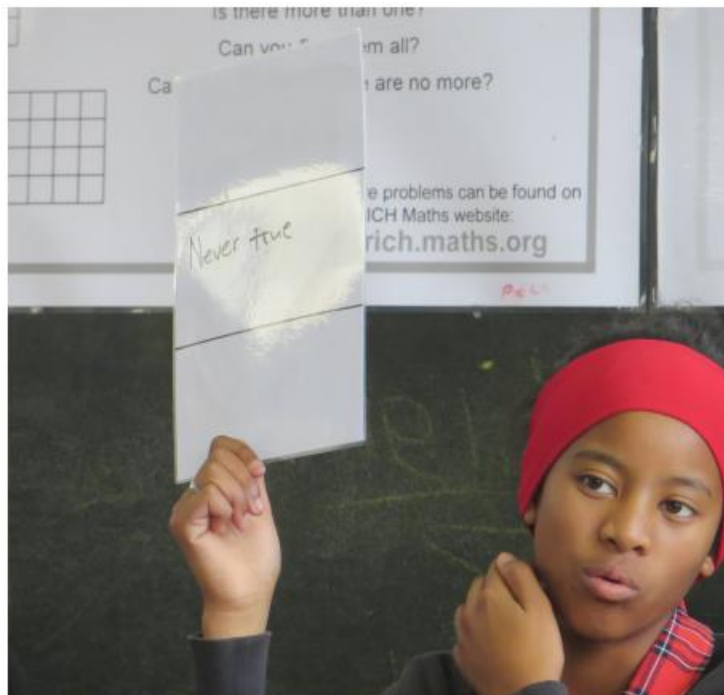
FaSMEd: an attempt to improve teaching

- Formative assessment (Fa)
- In science and maths (SM) education (Ed)
 - A three year research project
 - Funded by the European Union
 - Involving nine partners (8 EU and South Africa)

What we do

- Nine workpackages (WP)
- WP 3 - design a toolkit
- WP 4 - classroom interventions





This presentation is about the classroom interventions: what teachers chose to do and why

Theoretical framing

- Design research for the toolkit

Try something new

- review and improve
- try again

e.g. Carraher & Schliemann, 2002; Cobb, Confrey, Disessa, Lehrer, & Schauble, 2003; Collins, Joseph, & Bielaczyc, 2009

- The role of the teacher

- Formative assessment

- gather information about students' understanding
- act accordingly
- deliberate

e.g. Black and William (2009)

- Learning theories

- social constructivism
- creating concepts with others
- as language and tools used and internalised

e.g. Vygotsky (1978), John-Steiner (1996)



The interventions

- 20 teachers in 10 secondary schools with students in Grades 8, 9, 10
 - 3 lessons each
 - planning together
 - write up lessons, video
 - interviews
 - cluster meetings
- February to November 2015
- Try out 'learning experiences' (lessons)
- Small groups
 - discussion
 - card sorting or matching
 - OR problem solving
- **Formative assessment**



Origin of the 'learning experiences'

- Mathematics Assessment Project (Nottingham)
 - pre- and post-lesson assessment
 - active learning approaches
 - advice and guidance for teachers
- Created by us

CONCEPT DEVELOPMENT

Mathematics Assessment Project
CLASSROOM CHALLENGES
A Formative Assessment Lesson

Interpreting Distance-Time Graphs

Mathematics Assessment Resource Service
University of Nottingham & UC Berkeley
Beta Version

For more details, visit: <http://mrp.mathed.org>
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Interpreting Distance-Time Graphs

Teacher Guide

You have two tasks during the small group work: to make a note of student approaches to the task, and to support student reasoning.

Make a note of student approaches to the task

Listen and watch students carefully. Note different student approaches to the task and any common mistakes. For example, students may interpret the graph as a picture or students may read the graph from right to left. Also notice the ways students check to see if their match is correct and how they explain and justify a match to each other. You can use this information to focus a plenary whole-class discussion.

Support student reasoning

Try not to make suggestions that move students towards a particular match. Instead, ask questions to help students to reason together.

If you find one student has produced a solution for a particular match, challenge another student in the group to provide an explanation.

John matched these cards. Sharon, why do you think John matched these two cards?

If you find students have difficulty articulating their decisions, then use the sheet Suggested questions and prompts to support your own questioning of students.

In this task of this lesson some students had difficulty stating where home is on the graph.

For this graph, where does the journey start? Is that home?

Give me a graph that shows a journey starting away from home.

For this graph, does the journey end at home? How do you know?

If the whole class is struggling on the same issue, you could write a couple of questions on the board and hold an interview, whole-class discussion. You could ask students who performed well in the assessment to help struggling students.

None of the cards are different distances. For example, a student who matches Card 2 and E indicates that they think that graphs are pictures of the situation.

This is how students should articulate their graphs when working on the collaborative task.

Collaborative activity: matching Card sets A and B (20 minutes)

Ask students to work in small groups of two or three students.

Give each group the Card Set A: Distance-Time Graphs, and Card Set B: Interpretations, along with a large sheet of paper and a glue stick for making a poster.

You are now going to continue to explore matching graphs with a story but as a group.

You will be given six graph cards and two story cards in your group take a graph and find a story that matches it. Alternatively, you may want to take a story and find a graph that matches it.

Take notes on matching pairs of cards. Each time you do this, explain your thinking clearly and carefully. If you think there is no suitable card that matches, write one of your own.

Place your cards side by side on your large sheet of paper, not on top of one another, so that everyone can see them.

Write your reasons for the match on the cards or the poster just as we did with the example in class. Give explanations for each line segment.

Make sure you leave plenty of space around the cards, as eventually you will be adding another card to each matched pair.

The purpose of this structured group work is to encourage students to engage with each other's explanations and take responsibility for each other's understanding.

Slide 7 of the projector resource summarises these instructions.

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Allow students time to match all the cards they can.

Sharing posters (5 minutes)

As students finish matching the cards, ask one student from each group to visit another group's poster. You may want to use Slide 4 of the projector resource to display the following instructions.

If you are staying at your desk, be ready to explain the reasons for your group's matches.

If you are visiting another group, write your card placements on a piece of paper. Go to another group's desk and check to see which matches are different from your own.

If there are differences, ask for an explanation. If you still don't agree, explain your own thinking.

When you return to your own desk, you need to consider as a group whether to make any changes to your own poster.

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Guidance

Multiple representations

- Exponents (statements)
- Comparing (description table of values)
- Interpreting (equations)
- Time-distance (description values)



Classifying

- Equations and id
- Central te
- Revision
- Quadrilaterals



Overall findings: what happened?

What teachers did

- planning the activity
- introducing the activity in the classroom
- during the task
- finishing off

Our journey with the teachers



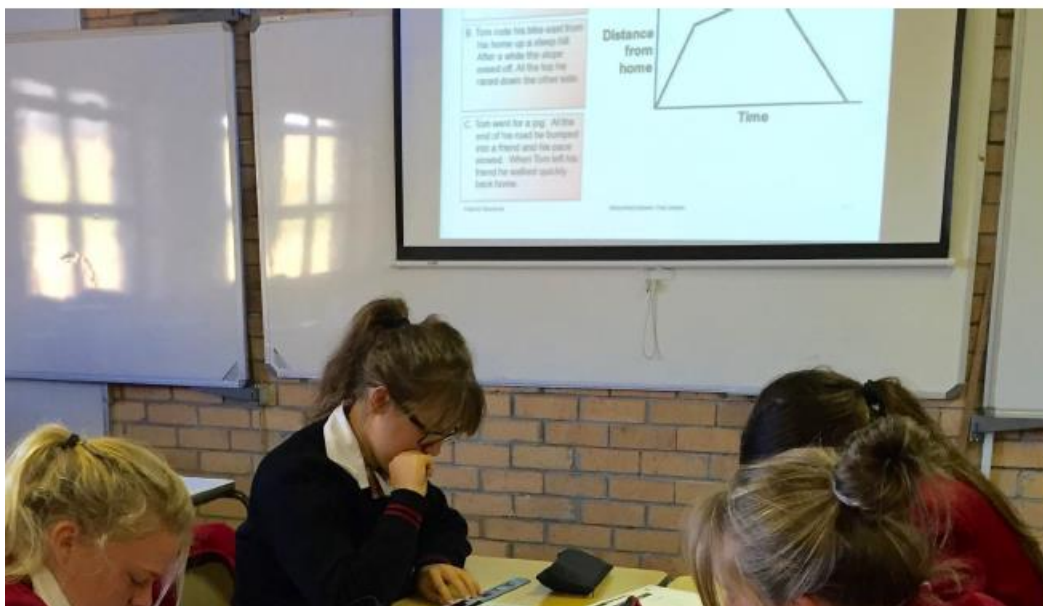
Planning the activity

- Choice of lesson
- The design of the tasks
- Lesson plan



Starting the lesson

Following the script





Modelling the activity

and using mini whiteboards



'Go!'



During the lesson

"Nothing to do"



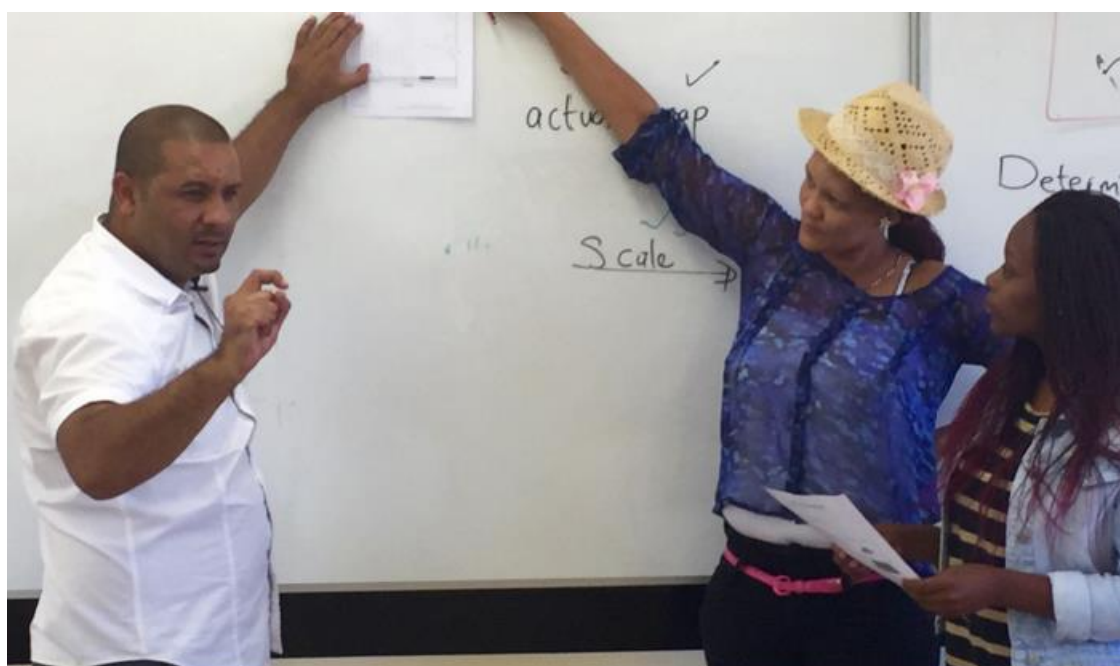
During the
lesson

Teaching ...



Finishing off

Answers on the board

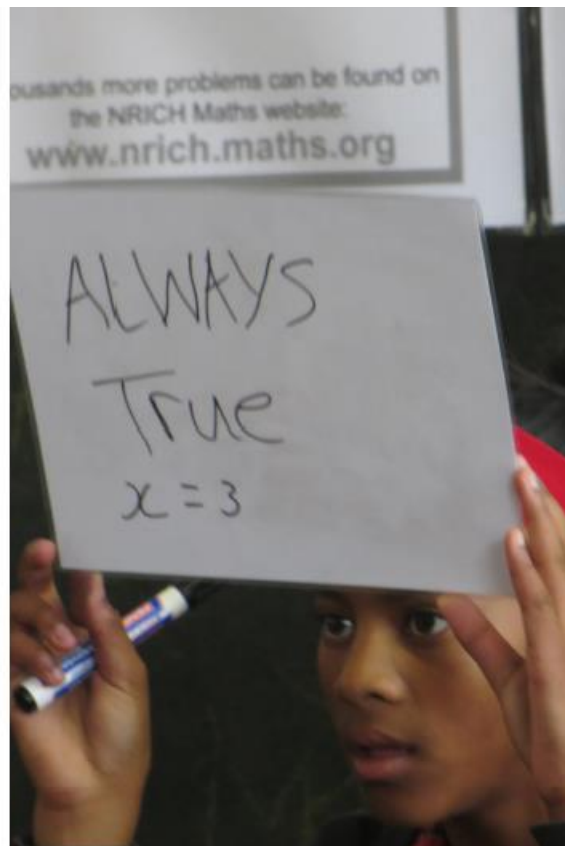


Finishing off

Going through the answers

Formative assessment

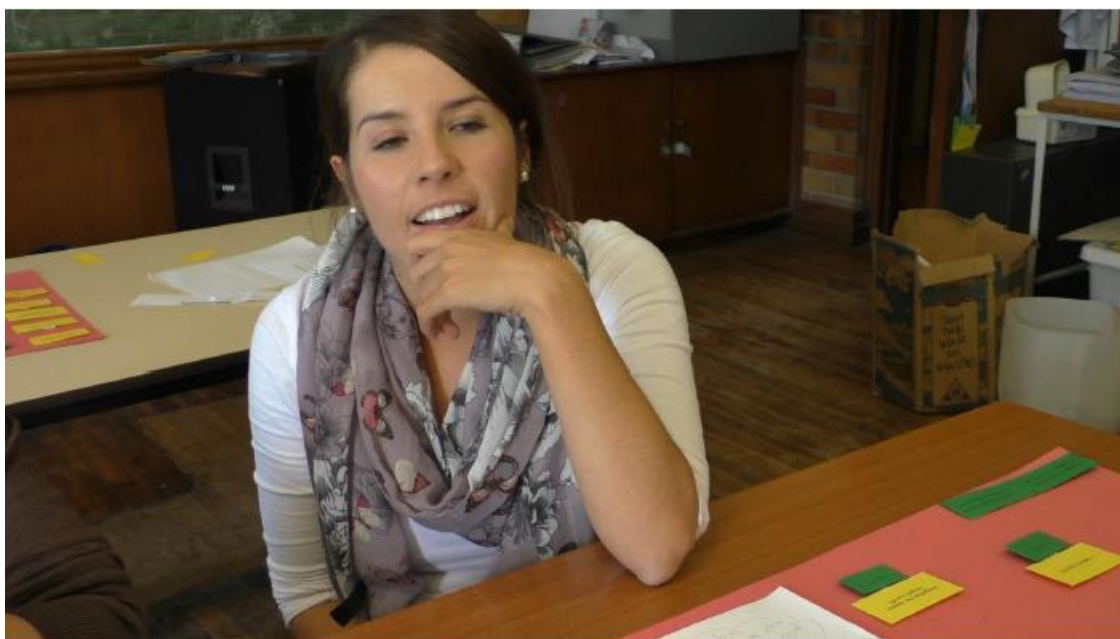
- Good teaching
- Mini whiteboards
- Card activities
- Answers



An important side-effect: teacher learning

- the possibility of creating a space for learning
- the teacher's role once the space has been created
- the value of using "active learning" tasks
 - FaSMEd tasks
 - self made tasks
- the value of finding out what learners know (FA)
 - using mini whiteboards
 - using pair work





Create a space

and learning can take place

made-me-think
group-work
learning-from-others
easy boring confusing
different difficult
exciting
made-us-discuss

Word

What about the
students?

A quick questionnaire

Concluding comments

- A focus on the teachers
- Choices made
- Lesson learned for the toolkit
- More about FaSMEd in South Africa

