Title: **How we teach graphing of parabolas in a less resourced Grade 11 Class**

Presenters: Michael Kainose Mhlolo[1] and Mzikayise Mani[2]
[1] **Rhodes University – FRF Mathematics Education Chair**
mikemhlolo@yahoo.com or M.Mhlolo@ru.ac.za
[2] **Velile Senior Secondary School - Bathurst**
EASTERN CAPE
FET Phase – Grade 11 **Number of learners = 25**

Introduction

In our presentation we are going to show how we taught graphing of parabolas without the use of technology. Without discrediting the use of technology we have two reasons why we went that route. Firstly, the school itself is not technologically resourced and most of our schools in South Africa might be in a similar if not worse situation than ours. So we thought by sharing how we taught in such an environment we would open up discussions on how best to teach such a concept without technology.

Our second justification has to do with the use of technology itself. Clearly, technological developments since the late 1970's have been significant, and they have had an impact on what learners will experience particularly in the realm of graphical displays. Our view however is that technology *can* change the way in which we do graphs but the changes are not guaranteed to be beneficial. Having the vision to see what technology can, or might do, is not synonymous with knowing how to take advantage of this in a teaching context. The reality is that we still have much to learn about the use of technology. Technology-based teaching may be less than optimal because;

- either the hardware, the software, or both, may be inadequate;
- our use of the technology may be inappropriate; or
- the learners may not experience what we think they do.

Most packages, of course, will do what is requested, regardless of whether it makes sense. Packages cannot think, and so we should be training our learners how to think for themselves and to know why they must do what they have to do. Introducing technology effectively therefore requires exactly the same kind of planning and understanding that we should use to plan any other non technologically-based teaching.

Our view therefore was that technology *can* enhance the processes of teaching and learning in general. However, not all technology is fit for this purpose, and the use we make of this

technology is not always appropriate. With specific reference to the use of a calculator, this view is also expressed in the very first specific aim within the CAPS document which expects learners; "*to develop fluency in computational skills without relying on the usage of calculators*." To us this suggests that even in a well resourced class, the use of technology has to be complemented in order for learners to have a deep conceptual understanding of the mathematical objects. The ability to process data with a piece of software is only one aspect of using a graphing package. Selecting the appropriate analysis and being able to interpret the output reflect more conceptual than procedural understanding and are critical for improved learner performances. These skills must be taught if the way we do graphs is to change. They do not just emerge of their own accord.

What does the curriculum expect learners to do at Grade 11 level?

With specific reference to parabolas, the new CAPS document expects learners to:

- Revise the effect of the parameters *a* and *q* and investigate the effect of p on the graphs of the functions defined by $y = f(x) = a(x - p)^2 + q$
- Once the effects of the parameters have been established, various problems need to be set: drawing sketch graphs, determine the defining equations of functions from sufficient data, making deductions from graphs.
- Real life applications of the prescribed functions should be studied

Comment: Two parameters at a time can be varied in tests or examinations.

What knowledge did we assume our learners to have?

We assumed our learners to be able to work with relationships between variables using tables, graphs, words and formulae. Convert flexibly between these representations. At this level it is sufficient to investigate the way output values depend on how input values vary. The terms independent (input) and dependent (output) variables might be useful.

What concepts did we want to teach in this lesson?

1. Learners will identify the defining characteristics of a quadratic function.

- Distinguish how the characteristics are represented symbolically and graphically

- Recognize patterns and relationships among certain characteristics of the function (for example, deducing the *y*-intercept by looking at the c value of quadratic function in its general form)

- Describe the meaning of the vertex, *y*-intercept, and *x*-intercept(s) by analyzing the behavior of a quadratic function at and around those points

2. Learners investigate the coefficients in symbolic expressions of quadratic functions, and how varying coefficients are reflected in graphs.

3. Learners identify significant points on a parabola and how these are reflected in symbolic expressions.

4. Learners make connections between graphical and symbolic representations by examining and manipulating the three symbolic forms of a quadratic function in order to predict shape, orientation (opens upward or downward), and location.

Three forms of quadratic equations were dealt with:

polynomial: $y = ax^2 + bx + c$

vertex: $y = a(x-h)^2 + k$

root: $y = a(x-r_1)(x-r_2)$

5. Learners will gain deeper understanding of quadratic functions as they become more aware and motivated to observe and reflect on its application in their environment

Conclusion

At the time of submitting this abstract, the lessons are still going on. So in the presentation we will then give a more detailed account of how the lessons went taking note of where learners experienced some challenges and what we did about such challenges.