MAKING THE OBJECT OF LEARNING VISIBLE: USING CARD ACTIVITIES TO TEACH FUNCTIONS IN WAYS THAT MAKE LEARNERS SEE FUNCTIONS AS RELATIONSHIPS

Shadrack Moalosi
University of the Witwatersrand, Johannesburg
Anancia Guvea
Marlboro High School, Johannesburg East District
Joseph Makunye
Realogile High School, Johannesburg East District
Phumzile Mthiyane
Realogile High School, Johannesburg East District
Connie Motsiri
Realogile High School, Johannesburg East District

Abstract
The purpose of the workshop is to provide a platform on which teachers from the Wits Maths Connect professional development project share their professional development experiences with colleagues. The teachers have previously participated in professional development where they engaged with similar activities. In the proposed workshop teachers will present to Grades (8 – 10) mathematics teachers some novel ways of teaching Functions. These are ways that aim to help learners see functions as constituting a relationship between variables. The workshop will cater for 30 teachers who will work in groups of 5 on selected activities. The duration of the workshop is 2-hours and activities will be allocated 1hr 20 minutes excluding reflections and discussions which will take 30 minutes. There will be three different activities for participants. At the end of these activities participants will be allocated 30 minutes to reflect on activities and for general discussions about the workshop. Workshop activities will focus on the definition and the multiple representations of Functions.

Target Audience: Our main target is teachers offering mathematics at Grades (8 – 10) levels.

Motivation for the workshop

This workshop is important for participants since it shares experiences/ideas and novel ways of approaching Functions as a topic in our mathematics curriculum. There is sufficient evidence from both internal and external school mathematics examinations that indicate that majority of our learners perform below expectation in this domain of mathematics as they also do in other domains (Adler 2010). The recent report on the 2011 National Senior Certificate Examination (Education 2011) provides information that emphasizes the magnitude of the problem of low performance. Notwithstanding the fact that other areas of mathematics are also recording incidents of low performance, we selected to focus our workshop of Functions on account of its role as a gateway to University mathematics. The essence of Functions in secondary school mathematics is a passage learners need to traverse in order to access further harder university mathematics (Tall 2010a). As such, there is greater need from schools, government, NGOs, and higher education institutions to minimize obstacles learners encounter along the passage to higher mathematics. We believe the workshop brings an alternative way of teaching Functions in ways that might

minimize these obstacles. One of the obstacles we hope to address is one where learners view graphs of Functions as pictures (Adler 2010) .

In the Wits Maths Connect (WMC) project, we have noticed learners failing to obtain a solution from two intersecting graphs, preferring to solve equations of the graphs simultaneously which in our opinion was an unnecessary waste of time since we thought it could been much easier and quicker to obtain the solution from the intersection of the two graphs. Now what was amazing was the fact that most learners, who had chosen the algebraic manipulation route, could not obtain the correct solution. We believe that learners could not obtain solutions from the graph because they perceived it as a picture. We associate learners' perception of graphs of Functions as pictures with teaching that always move from algebraic equation, to producing a table of values, to plotting and joining of points to produce a graph and where the graph is the product. We think this approach obscures the essence of Functions, (i.e. Functions as relationships between variables) from learners. In the workshop we propose to demonstrate how Functions may be taught in ways that might enable learners to see graphs of Functions as representing relationships that can be studied and to see them as having properties that can be analyzed to obtain solutions (Tall 1997a). But most importantly we intend to demonstrate how all the four ways in which Functions may be represented are independent of each other and can be used to complement each other. What we are saying here is that the verbal, algebraic, numerical, and graphical representations of Functions exits independently and each is a representation of a Functional relationship. This is evident from certain features of Functions that are present across the different representations. By way of example, the intercepts and gradient of a linear Function can be obtained from the multiple ways of representation linear Functions.

Description of Content of Workshop

The content of the workshop will be broken down as follows:

1. **Introduction: 10 minutes**

The workshop will begin with an introduction of participants and this will be followed by explanations about the rationale (for selecting Functions; specific content on Functions; our approach; and target group), purpose, and the design of workshop activities.

2. **Workshop Presentation:**

2.1. *Activity 1: Identifying what is and what is not a Function***: 30 minutes**

In this activity participants will be given 25 cards per group and will work together to sort them into two piles of Functions and Non-Functions.

2.2. *Activity 2: Multiple Representations of Functional relationships****: 30 minutes***

In this activity participants, working in groups of 5, will be issued with 20 cards containing the different representations of Functions – i.e. (i) verbal, (ii) algebraic, (iii) numerical; and (iv) graph. Working in groups, participants will group related representations. Furthermore, they will also extract discernable properties of

Functions from representations of the same Functional relationship. The function content will focus on Linear and Quadratic Functions.

2.3. Activity 3: Working on a Mathematics for teaching task: ***20 minutes***

Here participants will work in groups to respond to tasks that demonstrate learners' limited understanding of Functions. This will be followed by participants' suggestions on what might be done to assist learners

3. Summary and Conclusion

3.1. Activity: Participants' reflections on activities and discussions: **30 minutes**

In this part of the workshop, participants will share experiences drawn from engaging with workshop activities.

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