

GRADE 6 TEACHERS' BELIEFS ABOUT MATHEMATICS AS A SUBJECT

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ABSTRACT

This paper reports on a qualitative study where beliefs held by four Grade 6 mathematics teachers about mathematics as a subject were investigated. Data collected after interviewing the teachers telephonically, revealed that mathematics is mainly seen as a practical subject, hence it must be taught practically and learners must do a lot of practice. Teachers also believe that concrete objects or manipulatives must be used when teaching mathematics since learners struggle with mathematics. Another category that emerged was beliefs that are policy-related. Teachers recommend that more time should be allocated for mathematics in order for teaching and learning to be effective. Teachers recommend a review of allocated time to teaching mathematics, allocation of teachers to schools using the PPM¹, and change in pass requirements. Teachers also suggest that assistance should be sought from specialists for learners in their classes who have learning barriers.

Keywords: Teachers' beliefs, teaching and learning, mathematics as a subject

INTRODUCTION, CONTEXT AND BACKGROUND OF THE STUDY

South African schools are divided into four phases, which are Foundation Phase: Grade R to Grade 3; Intermediate Phase: Grade 4 to Grade 6; Senior Phase: Grade 7 to Grade 9 and Further Education and Training Phase: Grade 10 to Grade 12. This paper focuses on Grade 6, which is the exit class (last grade in the phase) for the Intermediate Phase in primary schools. Exit classes are given a greater spotlight by the Department of Basic Education because learners in these classes are expected to demonstrate and apply acquired skills, knowledge and outcomes in all the grades they have passed, that is from Grade 4 to Grade 6 in the case of the intermediate phase. The spotlight is also seen in the fact that sub-districts concentrate more on the exit classes when conducting internal and external moderations.

Primary schools are institutions where learners should receive basic knowledge of all the subjects and not only mathematics. It is therefore essential that factors contributing to poor performance in mathematics be addressed even at a very early stage. Zakaria and Maat (2012) strongly assert that teacher beliefs are very critical in the implementation of teaching and learning. According to Smith (2014), the manner in which teachers are orientated towards a particular curriculum affects how that curriculum is used. This study was prompted by the fact that in overall learners perform poorly in mathematics (Venkat 2013), in spite of all the efforts put in place by the department of basic education. It is important to note that when learners perform poorly in mathematics in primary school, they are unlikely to choose mathematics in secondary school since they may perceive it as a difficult subject.

¹ PPM (Post Provisioning Model) – model or policy for determining number of teachers to be allocated to schools

THE RESEARCH QUESTION AND THE CONCEPTUAL FRAMEWORK

In order to investigate the beliefs that mathematics teachers in Grade 6 hold, the research question for this study was established as follows: **What are the beliefs that Grade 6 mathematics teachers have about mathematics as a subject?**

A conceptual framework which served as a reference for this study was established using teacher beliefs from Handal (2003), in conjunction with those from Beswick (2008), see Table 1 below. These beliefs were used as reference to interviews held with teachers, to investigate if teachers hold these beliefs or they hold other beliefs in addition to these, or they hold other beliefs that were not mentioned in literature consulted.

Table 1: Teacher beliefs from Handal (2003) and Beswick (2008)

Mathematics Beliefs as by Handal (2003)	Mathematics Beliefs as by Beswick (2008)
Mathematics is a complete static body of knowledge with logic and structure. Mathematics is a collection of facts, rules, algorithms and skills to be mastered for utilitarian purpose. Mathematics is a discipline based on rules and procedures to be memorized.	All learners can acquire mathematical skills necessary for life in the modern society. Mathematics requires a good memory. Mathematics requires logic and not intuition. Some people have a mathematical mind and others do not. Mathematicians do problems quickly in their heads.

LITERATURE REVIEW

Several authors such as Liljedahl (2007), White, Way, Perry and Southwell (2006), Kalckman (2011), Handal (2003) and Adam (2012) indicate that teachers' beliefs do not emanate from their teaching practice, but originate from their past learning experiences whilst still at school or tertiary institutions. This indicates that teacher beliefs of mathematics and the teaching of mathematics come a long way and might have deeply rooted structured systems which may have dire impact on the teaching and learning of mathematics. However, teachers may begin to develop beliefs about the learners doing mathematics after entering the teaching profession. Experienced teachers may have strong beliefs in this regard based on the number of years they spent in teaching and the different kinds of learners they have taught.

In addressing the main research question of this study, we established secondary questions along with Polly, McGee, Wang, Lambert, Pugalee and Johnson (2013), Handal (2003) and Adam (2012). They identified three categories in which beliefs can be divided, namely;

1. The teachers' beliefs about mathematics as a subject
2. The teachers' ideas about the nature of mathematics teaching and
3. The teachers' ideas about the learning of mathematics

These categories of beliefs are crucial in understanding the types of beliefs held by mathematics teachers. If teachers do not agree that all learners are able to acquire mathematical skills necessary for life, they will always argue that not all learners can pass mathematics and many reasons will be presented for their argument.

METHODOLOGY

The study was conducted in primary schools, of the North West Province. Qualitative data collection methods were used in which four Grade 6 teachers were selected from the four primary schools. Convenience sampling was used, so as to minimise the cost of travelling by sampling participants in the vicinity of the researcher. Telephonic interviews were conducted after hours at the time agreed upon with the teachers and transcribed. All teachers sampled were qualified and had sufficient teaching experience. Qualitative research was used in this study because it is a field of study which is interpretive and takes a naturalistic approach, which includes many methods such as interviews and classroom observations (Dennis, Carspecken & Carspecken 2013). Qualitative research was important in this study because in qualitative research, data collection methods such as interviews enables the researcher to see and hear the participants' actions at first hand.

DATA OBTAINED FROM INTERVIEWS

There were four teachers who were sampled. All teachers were asked the same (**three**) questions for interviews.

Responses of participants to interview Question 1:

Q1: What are the beliefs that you have about mathematics, the teaching of mathematics or the learners that you teach mathematics?

P₁: *Ja, ...Firstly, mathematics is a practical subject. The learners must practice. And then teachers should use manipulatives when they teach...er, previously we did not have teaching aids and it was difficult to teach mathematics, that is why we resorted to textbook method. But now with the introduction of mathematics laboratories in schools it is much better...er, the other thing is that the classroom must be print-rich. But now the problem with our learners is that there is no initiative on the side of learners. They cannot study on their own, the teacher must always be there you see.*

P₂: *Er, firstly is that mathematics is difficult for most of the learners. ...most of them are not serious with their work. When the teacher is not in class they make a lot of noise and they just sit and do nothing... they must learn to practice on their own because the teacher cannot always be in class, sometimes you go to workshops or attend meetings.*

P₃: *Ja, the beliefs in mathematics are that in South Africa, er, we take mathematics as a difficult subject, but it is not that difficult, you see, it is just that people don't get clear light into it, or you will find that the teacher is overloaded with many subjects. To me if I was the minister, I would say teachers who teach mathematics let them teach mathematics only*

P₄: *let me start by saying mathematics needs people who can think quickly, not people who cannot work with numbers. And this must start at home, At school the teacher can bring along real objects so learners can see what they are being taught about. This will make them understand better when they see and touch objects.*

RESPONSES OF PARTICIPANTS TO INTERVIEW QUESTION 2

Q2: How do the beliefs that you mentioned affect your teaching?

P₁: *mmm.. as a teacher when learners do not understand; they challenge me to come up with different teaching strategies to improve my teaching. But now in primary schools it is unfortunate that all learners must do mathematics and they are all expected to pass irrespective of their differences. When learners do not pass the average pass percentage becomes very low and it affects me as a teacher.*

P₂: *Mmm... when I teach I always repeat the topic with learners and after doing that some learners still do not understand. This makes me hopeless because when I repeat I think they will improve...*

P₃: *Er, these beliefs affect me because with the management duties that I have, I do not manage. As the school manager with 53 periods that I must teach, it is difficult to cover the syllabus. On top of that I have to attend management meetings time and again so I don't see learners more often.*

P₄: *Er... they affect me it means that learners understand better when they see and touch objects ... and they will not forget easily. Teaching aids or real objects must be used in class.*

RESPONSES OF PARTICIPANTS TO INTERVIEW QUESTION 3

Q3: What is it that you recommend to improve your teaching and learner performance?

P₁: Firstly, I recommend that mathematics laboratories be established in all the schools because they are very helpful in keeping learners' interest. Secondly, extra effort is required from learners, if parents can help them at home with their homework, because most of them they just come to school with their homework not done. If parents can be informed in parents' meetings to help learners at home I think it would be better.

P₂: You see, the problem is the PPM, it must change because they are looking at the number of learners in the class but then the teacher teaches many subjects including mathematics as well. The other thing is number of years in the phase. Pass requirements must also change. And also time, they must allocate more periods for mathematics because maths is a difficult subject.

P₃: I recommend study groups for learners. If learners can do study groups it will be better because there is no time to treat all these topics. They are suffering because of the PPM. They should at least give us temporary teachers to offload the staff.

P₄: For teachers I recommend that they must start from simple to complex when teaching and use teaching aids. The department of education must hire assistant teachers permanently to help learners with homework just like in Gauteng Province, because some parents do not understand the homework. The department must also hire specialists, occupational therapists and psychologists who can help learners with barriers because teachers do not have time to do intervention.

DISCUSSION OF THE FINDINGS

Some participants had similar beliefs. It has been found that teachers hold beliefs that can be classified into four categories, of which the first three categories were used by Handal (2003). The first category is beliefs about mathematics as a subject. Beliefs falling in this category were for an example: mathematics is a practical subject; mathematics is a difficult subject for learners and teachers. The second category is belief about the teaching of mathematics. Beliefs in this category were teaching aids or manipulatives should be used, classroom should be print-rich, different teaching strategies should be used and teachers should move from simple to difficult when teaching. The third category is beliefs about learners who do mathematics. Beliefs in this category are: learners should be able to think quickly and be able to work with numbers.

These beliefs have the same meaning with the belief from Beswick (2008) that says mathematicians do problems quickly in their heads. However, teachers' belief that learners should be able to work with numbers is in contradiction to Beswick (2008) when he says that all learners can acquire mathematical skills necessary for life. According to teachers' belief, some learners cannot work with numbers or find it difficult to do so. This supports Beswick (2008) again when he says that some people have a mathematical mind while others do not.

It was important to note that there is a new category that emerged based on the beliefs of teachers that could not be classified in either of the first three categories. This new category is beliefs that are policy-related, where teachers believed that PPM should be reviewed, more time is required to teach mathematics, pass requirements should change, and mathematics teachers should teach mathematics only (because they feel that they are being overloaded with work). Teachers also brought the issue of being unable to cover the prescribed content due to overload, especially in small schools. This leaves learners unprepared to face the challenges of the grade they are progressing to. They also believe that some learners have learning barriers hence require intervention from psychologists since they believe they are not

in a position to teach such learners; despite teaching strategies they use. Recommendations that require policy change, can only be done if the Department of Basic Education consult with all stakeholders before effecting such changes. This may take a long time to be implemented, because of their financial implications or resistance from the system or the stakeholders. It was also revealed that teaching learners with barriers to learning seems to be frustrating to some teachers. This is demonstrated in the fact that Participant 2 used repetition to learners who did not understand. When repetition did not work, she became hopeless.

The research question of our study: **What are the beliefs that Grade 6 mathematics teachers have about mathematics as a subject?** Was answered below.

Teachers' beliefs identified from the interview transcripts can be classified according to the categories identified by Polly et al. (2013), Handal (2003) and Adam (2012).

BELIEFS ABOUT MATHEMATICS

Two teachers believe that mathematics is a practical subject. One of the teachers believe that mathematics is a difficult subject, it requires learners who can work quickly with numbers and to also have a mathematical mind. Saying mathematics is a difficult subject can be discouraging to those who want to study it further, without them being able to discover for themselves the challenges that they can come across, and it is against Beswick (2008) that all learners can acquire mathematical skills necessary for life. We believe that any subject has its own challenges, and it is incumbent of the subject teacher to use innovative approaches that will enhance understanding and foster learners' interest. We believe that there are mathematical and non-mathematical minds. The mind can be receptive once interest in the subject is established. So all learners can have a mathematical mind if teachers use mathematical games and strategies that will help capture learners' interest throughout the lesson.

BELIEFS ABOUT MATHEMATICS TEACHING AND LEARNING

Two of the teachers believe that in order to teach mathematics effectively, teachers should use teaching aids or concrete objects to enhance understanding of concepts. They also recommend that classrooms should be print-rich to encourage unconscious learning. In this category, three teachers recommend that learners should work in groups so that they can be able to engage in discussions to help one another.

Beliefs about the learners doing mathematics.

Three teachers feel that learners are not serious with their work, because most of the time they do not complete their work. As a result, this will cause poor performance. Teachers also recommend that learners should practice a lot if they want to do well in mathematics, because mathematics is a collection of facts, rules and skills to be mastered, and requires a good memory (Beswick 2008). In addition to the categories identified by Handal (2003), the researcher discovered the fourth new category which was not mentioned in literature consulted namely, beliefs that are policy related.

BELIEFS THAT ARE POLICY-RELATED

Teachers feel that they are overloaded with work especially the small schools, and on top of that they are required to do intervention for learners who do not perform well and have learning barriers. As a result, they recommend that the PPM should be revised, pass requirements should change and help should be sought from specialists such as therapists and psychologists to work only with those learners with barriers to learning. Teachers also feel that homework assistants should be hired since most parents are unable to assist learners at home.

CONCLUSIONS AND RECOMMENDATIONS

From the results of our study, it was revealed that teachers' beliefs are divided into four categories of which three of them are mentioned by Handal (2003). However, teachers do not share the same beliefs as Handal (2003). Nevertheless, teachers share some beliefs that are mentioned by Beswick (2008), namely; mathematics require people who can work with numbers and mathematicians do mathematical problems quickly in their minds. Most beliefs that teachers hold were neither mentioned by Handal (2003) nor Beswick (2008).

Teachers regard mathematics as a practical subject, hence it must be taught practically. In that case learners must do a lot of practice, which might not all be possible based on the amount of time allocated in class from the PPM. PPM is part of policy-related category that emerged. The teachers believe that the time allocated to the teaching of mathematics is not sufficient and must be reviewed. Teachers believe that more time must be allocated for mathematics teaching to be effective. In that way, learners will have more time to practice in class. Teachers believe that small schools should be given special treatment, which includes regular visits by the sub-district officials.

Our believe is that since beliefs are regarded as strong determinants of teachers' behaviour in classrooms (Barge 2013), it is important that teachers' beliefs be investigated in order to understand the reasons behind their instructional practices, because ultimately, teachers' instructional practices influence learner achievement. The focus of this study was only to unveil beliefs that mathematics teachers have. The effect these beliefs have on the performance of learners may be investigated in further studies. The research may also explore the influence of teachers' beliefs on their instructional practices.

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