GAUGING ANXIETY AND RESILIENCE IN THE MATHEMATICS CLASSROOM: VOICES OF GRADE 7 TEACHERS AND LEARNERS FROM SOUTH AFRICA

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Abstract

It is widely recognised that mathematics achievement is one of the foundations of success in any society. For job creation and employment in the labour market, sufficient levels of mathematical and technological expertise are required to sustain economic expansion. This also applies to the South African economy, which is hampered by serious skills shortages in science, technology, engineering, and mathematics. South Africa's education system is struggling to produce school leavers of the calibre required in industry, most notably when it comes to mathematics achievement. Therefore, mathematics and science should be the subjects of choice for most learners; however, mathematics is, for various reasons, widely perceived to be a difficult subject by learners and teachers. Learners require resilience and encouragement to overcome the difficulties they experience in learning mathematics. To this end, the aim of this study was to explore the causes of mathematical anxiety and how mathematical resilience in Grade 7 learners can be fostered. A qualitative inquiry, rooted in the interpretivist paradigm, was conducted to generate data from participants. The findings provided a multi-perspective on the complexity of mathematical resilience, the factors that inhibit mathematical resilience among learners and strategies to overcome the challenges posed by mathematics. Recommendations are made for consideration by the Department of Basic Education to improve classroom practice, to implement district-based interventions and to amend relevant policy.

Keywords: *Grade 7 learners, mathematics anxiety, mathematical resilience, mathematics achievement.*

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1. Introduction

It is widely recognized that mathematics is one of the foundations of enhancement and success in any society. Betiku (1999, p. 49) claims "Mathematics is the bedrock of science, while science is the necessity for technological and industrial development." Similarly, Makgato (2007) points out that, for job creation or employment in the labour market, a sufficient level of scientific and technological literacy is required to sustain the expansion of an economy. This is true for most countries, but with a third world economy facing extreme economic challenges, South Africa, in particular, is socially and economically very vulnerable. Jojo (2019) correctly points out that, at the heart of a country's prosperity, is the quality of its education system and its ability to contribute to sustainable development. In a report on what is referred to as South Africa's 'education crisis', Spaull (2013) cautions that South Africa's education system faces many challenges and is struggling to produce school leavers of the calibre required in industry, most notably when it comes to the subject of mathematics. He notes the acute shortage of skilled people in occupations in arts or crafts as well as artisans, engineers, architects, and doctors where various kinds of applications of mathematics are required. He (2013, p. 17) emphasizes that "the teaching and learning of mathematics stratify society...mathematics education becomes responsible for the country's economic growth." Similarly, Jojo (2019) describes the dire need for mathematical knowledge and skills to survive and thrive in the so-called Fourth Industrial Revolution (4IR). According to him, learner performance in mathematics at school determines to a large extent access to jobs as well as further and higher education studies in a range of areas, including natural and physical sciences, economics, and technology. In this sense mathematics can be regarded as a gateway subject for admission to study for a large number of high-status, scarce professions that are critical for a flourishing economy (Spaull, 2013).

The reasons for poor performance in mathematics are wide-ranging and varied. While cognitive factors (intelligence) are essential in learning mathematics, Justicia-Galiano, Martın-Puga, Linares and Pelegrina (2017) argue that, on average, more than half of the academic achievement variance in

mathematics can be explained by affective variables. Many learners show little interest in mathematics, have lower perceptions of their mathematics skills, and consider mathematics a difficult subject that generates anxiety (Organization for Economic Cooperation and Development [OECD], 2013). Learners with 'mathematics anxiety' tend to avoid math tasks, show less persistence when it comes to math-related tasks and continue to have lower expectations about their own math performance (Justicia-Galiano et al., 2017).

Several researchers (Hafiz & Dahlan, 2017; Johnston-Wilder & Lee, 2011; Pieronkiewicz & Szczygieł, 2020) are of the opinion that fostering mathematical resilience in learners will contribute significantly to counteract anxiety, feelings of failure and lack of motivation. Johnston-Wilde, Lee, Garton, Goodlad and Brindley (2014) define resilience as learners' ability to deal with various difficult situations they find themselves in during their schooling career, which normally affect them very negatively - especially in their academic performance. By implication, learners developing mathematical resilience will have a better chance to succeed than their counterparts who lack this ability. Although a body of research on resilience in learners is available, we could not find studies that focuses on mathematical resilience which accounted for the views and challenges of learners themselves.

In light of the above discussion, the main research question that guided the study has been formulated as follows:

Which factors cause mathematical anxiety in Grade 7 learners and how, in their view, can mathematical resilience be fostered?

2. The research design and methodology

A qualitative and contextual approach was used, mainly inductive, and which provided a clear understanding of the participants' views and capturing their perceptions in their own words (cf. Babbie 2015). A phenomenological design was used as the strategy of inquiry. The design involved both an interpretive perspective, primarily concerned with meaning, and a constructivist perspective, focusing on the feelings and beliefs of the participants. Twenty-four Grade 7 learners from three purposefully selected primary schools in an Education District in South Africa volunteered to participate in the study. These included African learners from a township school (a township is a poverty-stricken geographical area for black South Africans which was established during the *apartheid* years pre-1994); learners from a rural school, whose parents were farm workers in the area, and learners from a formerly all-white school, consisting of mixed races, situated in an upper-middle class community in an urban area.

Three focus group discussions were held, (one focus group per school) lasting approximately one hour each. Ethical guidelines included obtaining consent from the local Department of Education, the principals of the school, and parental consent from the participants' parents.This was done after all have been informed of the purpose of the study, the procedures to be followed, the risks, benefits, alternative procedures, and the measures implemented to ensure confidentiality (cf. Creswell & Creswell, 2015; Johnson & Christensen, 2011). During data analysis, the process of *in vivo* coding was followed, in which the same codes were reapplied to similar segments of the data. The data were then structured by categorising the codes and identifying the main themes to which the data were interpreted.

3. Findings and discussion

The learners surprised us with their unfeigned observations, candid descriptions and unapologetic views about what they believed their teachers 'missteps. They generally accepted that resilience is within reach of every individual and agreed that people are not born with resilience, but rather, that resilience *develops with time and effort*.

It means you conquer your fears, overcome things, self-independent." (BL2-F)

"Because if you are being negative the whole time, you are giving your mind a mental block to say that you are not capable to do something." (BL1-F)

"If one can tell him/herself that no one can perform better than him/her, then no one will. You are going to be encouraged all the time by saying, 'I know now that there is no one who can outperform me'. When the teacher asks questions, you are the one to answer always." (CL4-M)

A few learners relayed their personal experiences with adversity and how they took a conscious decision to overcome their obstacles.

"I was shy. Always cried. You know? And then when I arrived at primary I was bullied. And then, after that, you know, I decided to stand up for myself because it does not help being the girl behind doors, being shy and everything. I taught myself. I saw other people stand up for themselves, so I also decided to do the same for myself." (BL2-F)

Consistent with literature, participants generally – to a varied extent - found mathematics problematic and difficult to master. From the focus group discussions *teacher factors* emerged as the most important influence on learners 'morale and their attitude towards mathematics. It is thus not surprising that Maluleke (2019) maintains that mathematics is one of the most poorly taught, disliked and misunderstood subjects in South Africa. As a result, the persistent low learner performance has piqued interest in determining how teacher traits and pedagogical techniques impact attitudes toward mathematics. Four broad areas related to teacher factors came to the fore, namely teachers 'antagonistic attitude towards struggling learners; making derogatory and humiliating remarks; the importance of a relaxed and learner friendly classroom environment; and teachers 'tendency to give stronger learners preferential treatment.

The wide-ranging accounts of participant learners who experienced explicit *antagonism* from their teachers were a concern. This antagonism manifested in the form of unfavourable and critical remarks which influenced learner morale and which had a distinctly negative effect on fostering resilient behaviour.

'Sometime the teacher discourages learners when they are trying in the classroom. They tell us mean words or discouraging words. You struggle to have that confidence even when you wanted to ask something or give an answer, he/she will make a joke out of you." (BL1-F)

This resulted in some learners withdrawing as they were too afraid to ask questions for fear of reproach or embarrassment. Poor-performing learners are admittedly those who are disobedient and tend to behave badly - something that can be very discouraging and difficult for teachers to handle, especially when faced with overcrowded classes. However, teachers may never fall victim to their own frustrations and challenges to the extent that learners are forced into submission or humiliated.

The teacher chooses only those learners that are clever so that they can give the correct answers. When one of [the] *other learners raises a hand to answer, they always say, 'Oh no! You know that you are going to give an incorrect answer 'and then they will not choose him, they will rather choose someone else."* (CL1-M)

Participants were vocal about what they referred to as "a free environment" to be able to enjoy mathematics. Learners valued a *positive and learner-friendly classroom* environment that is conducive to learning. They were adamant that it was not possible to enjoy mathematics in a restricted and undesirable learning environment. They wanted to learn in a setting where the teacher makes jokes and allow for meaningful and congenial interaction – this is where a teacher's pedagogical knowledge is important.

"You get teachers who teach and make jokes and make you laugh and enjoy the lesson. And I would say the…the marks are kind of your environment. So, if you are in an environment that is closed [restrictive] *and you cannot do anything, then your marks are even lower. Some teachers do not want learners to have fun or enjoy their classroom session… instead learners are being intimidated and get punished."* (BL1-M)

A strong pedagogical foundation is needed to create an inviting and friendly learning environment. Learners were further critical of some teachers' lack of effective and fair learner behaviour management methods and teachers' tendency to punish the entire class when individual learners overstepped. Another major complaint was the *preferential treatment of performing learners*, which created divisions along performance lines and signalled that the non-performing learners were inferior and not valued.

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A serious complaint was teachers' disinclination to *explain content* sufficiently. Some teachers were accused of impatience and being inapproachable and, as a result, learners refrained from asking clarity-seeking questions.

"Teachers are the ones that sometimes make learner to believe that they are stupid, or they don't know anything….when they think that you're stupid and you know nothing, even when you know an answer, they will not choose you to answer because they believe that you are going to say incorrect answer." (CL1-M)

A related complaint was that *instructional methods* were predictable and 'boring 'and that learners' differing needs were not catered for. The learners were in favour of a variety of instructional methods and strategies. An important complaint was teachers' inability, or disinclination, to explain new content sufficiently.

"Sometimes the teachers are failing learners because they don't make any extra efforts to lay a good foundation on explaining some content and they become very offended when learners try to ask some clarity questions and learners end up being afraid to ask questions even if they don't understand the context." (BL1-F)

Several studies found that mathematics teachers' 'Content Knowledge (CK) was lacking, as was their inability to *explain* content adequately (Pedagogical Content Knowledge - PCK). As can be expected, a teacher with insufficient CK will not be able to explain new content satisfactorily, however, many teachers with sufficient CK do not necessarily know how to skillfully e*xplain* such content (PCK).
"Every learner can learn but not in the same way, we have different learning styles and that is very important. We are not all the same. Don't do it the same way…every day…every day..it is so boring! I don't like it." (BL2-M)
"Some other people, when they get something incorrect, [the teacher] *might think that they do not know anything but if they* [teachers) *sit down with them* [learners] *and explain in detail, they normally understand it better…..even if they did not understand at the beginning."* (CL1-M)

Importantly, Siachifuwe (2017) confirms that teachers are the facilitators of the learning process and as such, they have a unique role in that they are managers, architects and engineers of the pedagogy. This implies that a competent teacher who can teach mathematics in a resilient manner will realise that there is no one fixed way of teaching all content. This is where PK is crucial - understanding different methods and strategies of teaching that allows teachers to continually develop and refine their own practices. Likewise, PCK will enable teachers to implement a variety of creative and proven instructional methods, resources and strategies when teaching mathematics.

Meador (2020) argues that parents are the most influential people in every aspect of a child's life, especially when it comes to their children's education. If the parents value education, it enhances resilience and academic success in their children (ibid., 2020). Boonk, Ritzen, & Brand-Gruwel (2018, p. 10-12) found that home-based involvement positively correlated with academic achievement, especially in cases where parents communicate with their child on school issues and regularly have motivating talks with them on the benefits of mathematics.

Participants 'experiences of their *parents 'involvement* varied between positive encouragement, undue pressure and negative input. The following reactions showed evidence of valuing achievement, academic encouragement and reinforcing schoolwork at home:
"My mother used to tell me that, she does not want me to be like her, but she wants me to be better that her. She encourages me to know better than her, especially mathematics." (CL4-M)

. There was some negative reinforcement as well:
"My parents also tell us and they also tell us sometimes like our older siblings, our older cousins, when we tell them about how hard Grade 7 is, they'll be like, that is nothing, wait until you get to high school! They do not understand we are not in high school yet. We are NOT in high school yet! " (BL3-F)

Learners reported challenges with *mathematics terminology* and struggled to master the mathematics register. This impeded content understanding and created confusion.
There are some difficult words that need to be explained in Sesotho. Sometimes a person knows those words but sometimes when it is said in a different terminology, it becomes so difficult to understand. We will understand if the teachers teach in English and then explains in Sesotho." (CL3-M)

Sufficient language or vocabulary to build a solid mathematics foundation is crucial for understanding mathematics content. Some learners were in favour of a bilingual model of instruction, in which the mother tongue and the LoLT are used alongside each other to facilitate understanding. Most Sesotho learners preferred code-switching between English and Sesotho, however this would exclude learners from other language groups. Predictably, most learners from homes where both English and African languages were used, were in favour of English as the LoLT. All learners regarded English proficiency as important for their future studies and careers.

4. Summary and conclusion

The overall aim of this study was to explore the phenomenon of mathematical resilience as seen from the perspectives of Grade 7 learners and their views on how mathematical resilience could be nurtured. From findings in this study several proposed measures or changes that could help to alleviate the problems presented by poor mathematics performance and negative mindsets were offered. We are fully aware that there is no 'quick fix' in dealing with any burning issue in mathematics education, but we believe that if policy makers and teachers take note of learners' concerns and wishes, much strides could be made in nurturing resilience and fostering a positive mindset towards mathematics.

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