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Teachers' perceptions of factors influencing mathematics learning and performance

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Research report in submission for Masters of Education in Educational Psychology

Abstract

The purpose of this study was to explore teachers' perceptions of factors that they feel influence mathematics learning and performance. To better understand issues impacting on mathematics, the current study explored the viewpoints of Grade 9 teachers in private schools and the impact their perceptions have on overall mathematics achievement. This qualitative research was situated within Bandura's Social Learning Theory (1977) and focused specifically on Grade 9 mathematics teachers in private schools within the middle-class, socio-economic sector of Gauteng. The study recruited twelve participants and the instrument used was a semi-structured interview comprising of eighteen open-ended questions, to gather rich and informative information. The questions focused on factors that the participants perceive to influence mathematics learning and performance, specifically focused on the Grade 9 year. The findings revealed a set of seven themes and fourteen subthemes. The key themes identified were that teachers perceived mathematics learning and performance as interchangeable. Without learning the basic skills and concepts of mathematics, understanding becomes challenging which ultimately impacts overall performance. Furthermore, other factors that impacted on learning and performance included learner's intrinsic factors such as motivation, self-confidence, and attitudes towards mathematics. The curriculum was perceived to impact mathematics in relation to structure and time constraints. Additionally, learners background and social media were also perceived to influence mathematics learning and performance. Teachers similarly perceived factors to support them in the classroom, namely team collaboration and small class sizes. These findings suggest that teachers' perceptions have an important role to play in mathematics learning and performance and could enhance mathematical success. Teachers play a crucial role in improving learner's achievements through motivation, increased self-confidence, and engagement in the subject.

The findings of this study add to the body of research regarding factors associated with mathematics learning and performance from a teachers' perspective and may assist in identifying and understanding possible strategies and interventions to support learners in the Grade 9 mathematics classroom.

Key words

Mathematics learning, mathematics performance, teacher perceptions

Declaration

I declare that this research report is my own, unaided work. It is being submitted for the degree of Master's in Educational Psychology at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other university.



Ms. Nina Caroline de Jong 30th April 2021

Acknowledgements

I would like to express my greatest gratitude and appreciation to the following people whose assistance helped me in the completion of this study.

- My supervisor, Ms. Nabeelah Bemath, for her gentle guidance, constant yet firm support and enduring encouragement.
- All the teachers who were willing to participate in this study.

Dedication

Dedicated to Hannah Dianne Purnell – you continue to inspire me with your unconditional love, acceptance, and happiness for life.

> *Education is the passport to the future, for tomorrow belongs to those who prepare for it today.*
>
> *Malcolm X*

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Chapter 1: Literature Review

Introduction

Globally, mathematics is considered to be a key player in shaping how an individual deals with different areas of life and their ability to problem solve and think critically (Brown, Reardon, & Merrill, 2011). According to Jojo (2019), mathematics can be a tool used to empower people with knowledge and skills that are needed to grow economies. Furthermore, Jojo (2019) suggests that these skills need to be taught at school level and mathematics needs to be a critical area of focus. Yet presently, many learners struggle with the subject on all levels (Jojo, 2019). Mathematics appears to be a constant obstacle towards academic and future successes (Anthony & Walshaw, 2009). It is important to acknowledge the influence that teachers have on mathematics learning and performance because they can empower the children in their classroom and are a critical role player in engaging and encouraging the learner to learn and perform in order to enhance their future opportunities (Fidele, Kizito, Angel, & Jean, 2019). To understand challenges towards mathematics, it is therefore important to recognise the influencing factors as perceived by the mathematics teachers themselves as these may lead to identifying features that enhance overall mathematics learning and performance.

Teachers' perceptions of mathematics learning and performance is important because teachers knowledge and beliefs may enhance or limit opportunities for learners to develop foundational mathematical skills and encourage critical thinking (Bray, 2011).According to Beswick (2006) teachers also have the ability to assist learners in making important mathematical links by adjusting their teaching strategies and engaging in ongoing learning. Furthermore, teachers are able to create an active and supportive learning environment by exhibiting enthusiasm for the subject and increase learner motivation and expectations for success (Fidele et al., 2019).

According to Mokgwathi, Graham and Fraser (2019), low learner achievement in mathematics in South Africa is a significant concern for the Department of Basic Education (2019). In global assessments such as TIMMS, South Africa consistently achieved below average across all mathematical domains (Reddy, Visser, Winnaar, Arends, Juan, Prinsloo, & Isdale, 2017). Mathematics performance has improved somewhat in Grade 9; however, this result is still below international standards. Some identified areas of weakness include educational and societal inequalities,

poor physical conditions of schools and inadequate teacher knowledge (Reddy et al., 2017). As Grade 9 is considered a predictor of future successes by The Independent Institute of Education (2019), it is important to identify factors associated with this particular year.

Additionally, a large portion of research has focused on aspects contributing to mathematics learning and performance, such as teaching support (Mutodi, 2014), school resources (Visser, Juan, & Feza, 2015), parental involvement (Muir, 2009) and socio-economic issues (Mutodi, 2014). However, all the research was conducted in public, low socio-economic sectors of the South African population and thus little is known about the factors perceived to impact on mathematics learning and performance in the private school sector. Exploring different social contexts, such as private schools, could explain differences in support and achievement (Reddy et al., 2017).It is therefore important to research the private school sector as this could contribute towards alternative strategies from different perspectives and contexts.

The current study therefore investigated teachers currently, teaching in Grade 9, and their perceptions of factors that impact mathematics learning and performance within a private school setting. It is important to acknowledge the perceptions of teachers and the possible impact their insights have on mathematics achievements (Jackson, 2015).

This chapter will begin by discussing key concepts of the research, namely teachers, perceptions, mathematics learning and mathematics performance. Once mathematics has been defined, it will be related to the perceptions of teachers specifically focused on mathematics learning and performance. This will be followed by a discussion of Bandura's Social Learning Theory (1977) in which the current study is located. The Social Learning Theory is applicable as it explores the impact of modelling and imitation on learning within the social context and the impact observations have on learning. The literature review progresses to discuss broad factors that impact mathematics learning and performance. Before concluding, factors perceived by teachers that influence mathematics learning and performance will be discussed.

1.1 Defining core constructs

1.1.1 Defining mathematics

Mathematics is related to number, patterns, space, and problem solving (Sasanguie, Gobel, Moll, Smets, & Reynvoet, 2013). Some see mathematics as a static, traditional discipline yet others view it as an ever changing and dynamic learning area which is full of new discoveries and advancement (Dossey,1992). It has been detailed in numerous studies that mathematics is an important subject to the development of our increasingly technological society (Acharya, 2017; Jojo, 2019; Visser et al., 2015). Dossey (1992) states that “perceptions of the nature and role of mathematics held by our society have a major influence on the development of school mathematics curriculum and instruction” (p. 39). It is thus evident that the perceptions held by those in education relate to the perception found in society. According to Shay (2019), the knowledge of mathematics is important for logical deduction, interpretation and problem-solving and is a “gateway” subject to many professions such as engineering, commerce, and health sciences. It has been suggested that mathematics is also a critical component to governments promotion of Science, Technology, Engineering and Mathematics (STEM), an interdisciplinary approach to accessing information that aims to enhance mathematical competency and economic growth (Hom, 2014).

1.1.2 Mathematics learning

It is evident that mathematics education is important for communities, governments, and educational institutions as it connects our economy (Morgan, 2014). Mathematics learning is described by Verschaffel, Van Dooren, and De Smedt (2012), as the attainment of new knowledge and skills that are related to quantity, space, and structure. However, mathematics learning is more than just skills and knowledge but a learner’s belief in themselves and their attitude towards mathematics (Grootenboer & Hemmings, 2007). Mathematics learning could be understood as not only the acquisition of skills, facts, and knowledge but the beliefs held by learners and their attitudes in their own ability to learn the subject. Dossey (1992) goes on to say that a person’s mathematical disposition towards the subject may be more important than the learning of content and the learner’s willingness to use the knowledge in everyday life. Further examination of mathematics learning by

Brendefu, Thiede, Srother, Bunning, and Peck (2013) describe learning as the learner's ability to understand truly and clearly. They further suggested that learners need to understand the concepts and their connections in order to become better problem solvers. Even though mathematics knowledge is highly relevant in society, many people have increasing difficulty understanding and learning mathematics and mathematics continues to be a subject that yields poor results in South Africa (Niss, 2003). The South African National Development Plan (NDP) advocates that increased mathematics outcomes may result in increased employment, increased earning, and commercial growth. Therefore, mathematics learning is a key factor in local and global advancement. Creating an environment that is conducive to mathematics learning and performance is vitally important in the academic achievement of students and their future (Visser et al., 2015).

1.1.3 Mathematics performance

As important as mathematics learning is in the transmission of facts and procedural methods (Jackson, 2015), so mathematics performance is important to a student's self-confidence and motivation (Karim & Venkatesan, 2009). Mathematics performance can be regarded as the ability for students to understand and apply methodology, think critically, and engage in problem solving activities. These skills are related to teacher knowledge, teacher behaviour and responsiveness, in addition to other socio-environmental factors (Arends, Winnaar, & Mosimege, 2017; Ke & Grabowskie, 2007). The quality of a student's performance influences their ability to access higher education, boost self-belief and experience opportunities of success regarding employment and earnings (Visser et al., 2015).

Mathematics learning and performance can therefore empower people with skills and knowledge and create opportunities for citizens (Jojo, 2019). With this in mind, it is important to explore the factors that influence mathematics learning and performance, specifically from the teachers' perspective as they contribute to overall mathematic success. (Areepattamannil & Kaur, 2013; Arends et al., 2017; Mji & Makgato, 2006; Tsanwani, Harding, Englebrecht, & Maree, 2014).

1.1.4 Teachers' perceptions

According to the Department of Basic Education (2011), a teacher is an individual who instructs or trains other persons and can provide professional educational services to others. Furthermore, teachers are expected to exhibit characteristics such as dedication, tolerance, and self-discipline. Teachers are given the opportunity

to mould growing minds and develop skills that are needed for lifelong learning and encouraging contributing members of society (Department of Basic Education, 2011). They influence the content and educational space and therefore they are responsible for creating a relationship between the students' beliefs in themselves and the ability to access the mathematics content of the curriculum (Beswick, 2007).

The term 'perceptions' is generally understood to mean personal and intrinsic insights (Jackson, 2015). It also refers to the set of processes used to make sense of all the stimuli we encounter every second of our life (Jones, 1990). This stimulus received from our senses and the subsequent interpretation of our senses culminates into perceptions. This relates to the importance of what teachers perceive to influence mathematics learning and performance as they can identify factors influencing mathematics and contribute to the implementation of collaborative strategies to improve learning and performance (Jackson,2015).

Exploring teachers' perceptions of factors related to mathematics learning and performance can assist in understanding the need for support and intervention in the subject, and teachers' perceptions can directly impact the outcomes of the learning experience (Areepattamannil & Kaur, 2013; Bol & Berry, 2005; Jackson, 2015). According to Reddy et al. (2017), this may be important in Grade 9 as this is a year where learners seem to perform below average, yet it is a year which is critical for subject choices which could ultimately impact on higher education decisions and subsequent career choices.

1.1.5 Grade 9 mathematics

The Grade 9 year is situated in the senior phase of the South African schooling system and is a compulsory academic year and mathematics is a compulsory subject for all Grade 9 learners in South Africa (Department of Basic Education, 2011). According to The Independent Institute of Education, the Grade 9 year can have life-altering consequences for learners as it may impact on future career choices. The purpose of the Annual National Assessments (ANAS) is to enable a systemic evaluation of the education performance and to identify areas that can be best supported in order to enhance learner achievement (Department of Basic Education, 2011). The results of the ANAS showed poor quality teaching and learning, especially in Grade 9, as a cause for concern. The results further indicated that Grade 9 learners are not familiar with the grade appropriate mathematical skills and concepts (Adler & Pillary, 2017).

The results in the TIMMS (2015) concluded that South Africa was one of the lowest five performing countries, amongst thirty-nine countries globally. This is a concern as mathematics is a subject that assesses progress over time for any economy (Reddy, Prinsloo, Arends, Visser, Winnaar, Feza, & Ngema, 2012). Grade 9 performance was particularly low, with only one third of the learners demonstrating achievement at a minimal level (Reddy et al., 2012). The role and perceptions of the teacher is thus important to explore as they assist the learner in demonstrating a proficiency in critical thinking and problem solving that can support long-term development and success (Mooney, 2019). How a teacher perceives factors associated with mathematics learning and performance my provide some insight into future development of support and initiatives to improve Grade 9 success in mathematics.

1.2 Theoretical framework: The Social Learning Theory

Research regarding what teachers perceive to influence mathematics learning and performance can be grounded in Bandura's Social Learning Theory (1977) as the Social Learning Theory emphasise that people learn by observing other people who they believe are credible and knowledgeable (Bandura,1977). Bandura (1977) had certain assumptions about the functioning of humans. He believed that humans are a product of learning and we become what we are because of what we have been taught (Bandura, 1977). By understanding the Social Learning Theory, this may lead to a greater understanding of the powerful role that observation has on individuals. The potential use of the Social Learning Theory is to explore the effects of teachers' perceptions on mathematics learning and performance.

Three core concepts underly the Social Learning Theory (1977).

Firstly, the idea that people learn through observation. Individuals learn and imitate behaviour that they have observed in other people. Observational learning plays a vital role in acquiring new knowledge and skills (Horsburgh & Ippolito, 2018). Learning, and the formation of individual knowledge is through observation (Bandura, 1977). Observation implies that the process of learning occurs through watching others, by retaining the information and then later replicating the behaviour that was observed (Cherry, 2019). This modelling of behaviour is accepted as being very influential in teaching and learning (Horsburgh & Ippolito, 2018).

Three models of observational learning are suggested by Bandura (1977) as impacting on learning, these include live models, symbolic models, and verbal instructional models. Live model includes an actual individual demonstrating or

acting out a behaviour (Bandura, 2008). A learner models a teachers' behaviour, and this could have a positive or negative impact on mathematics learning and performance depending on the quality of the teacher's behaviour and skills. Modelling refers to the ability to copy what others do or say and this is part of observational learning (Cherry, 2019). Symbolic model includes fictional characters displaying behaviours in situations such as in a book and then verbal instructional model includes descriptions and explanations of a behaviour that may be seen in social media such as Podcasts. Learners may also be influenced by verbal instructional models such as Podcasts and other social media platforms.

Furthermore, the Social Learning Theory emphasizes the importance of observation and imitation that takes place from an individual's perspective and how it may bring about a change. Change is most likely to occur if the model holds an admired or valued position (Cherry, 2019). A teacher is perceived to be an authority on the subject and have pedagogical content knowledge, yet teachers are more than just transmitters of knowledge but a dynamic, engaging element in the classroom (Beijaard, Verloop, & Vermunt, 2000). It can then be assumed that learners in a classroom will observe their primary educator, the teacher, and model their behaviour. Therefore, the behaviour of the teacher is critical in order to enhance or decrease motivation in order to achieve in the mathematics classroom. Kurt (2019) states that teachers can use positive role modelling to increase desired behaviour and therefore possibly change attitudes in the mathematics classroom which may result in increased learning and performance. Learners will thus benefit from positive role models.

The Second core concepts underlying the Social Learning Theory (Bandura, 1977) is that internal mental states of an individual are an essential part of the process of learning. According to Bandura (1977) environmental factors are not the only factors leading to learning and a change in behaviour, but internal thoughts contribute to this process as well. Intrinsic thoughts such as pride and a sense of accomplishment play an important role in determining whether behaviour will be learnt or not (Kurt, 2019). The belief in oneself to successfully perform a behaviour required to produce a certain outcome (Siegel, Galassi, & Ware, 1985). Bandura (1977) claimed that observation alone may not be sufficient in order to learn. The learner observes the teacher and may imitate their behaviour if there is a desire to do so. Therefore, a learner's motivation and mental state have a contributing influence on learning (Kurt, 2019). The Social Learning Theory explains that the mental modelling of observed

behaviour and subsequent construction of new behaviour does not necessarily mean the exact imitation of others behaviour. A learner may imitate certain parts of a teacher's behaviour in the classroom but not imitate their complete behaviour, thus influencing overall mathematics learning and performance.

The third core concept states that even though something has been learned, does not mean that it will result in a change of behaviour (Cherry, 2019). An individual can observe and learn new information without demonstrating any change in behaviour (Kurt, 2019). However, the Social Learning Theory recognises that behaviour that is reinforced or rewarded tends to be repeated (Bandura, 1978). Factors perceived by teachers to influence mathematics learning and performance may be impacted by the use of rewards, repetition and reinforcement.

Learning is also influenced by a person's self-efficacy (Siegel et al., 1985). Self-efficacy is a person's judgement about whether he or she can successfully learn knowledge and skills (Siegel et al., 1985). The way a teacher chooses and constructs behaviour in the classroom may be influenced, to an extent, to how they believe they will be successful in teaching and facilitating the learning environment and establishing a rich learning space (Kurt, 2019). Self-efficacy is increased by several methods – verbal persuasion, logical verification, modelling, and past accomplishments. Verbal persuasion is explained by offering words of encouragement to convince others they can learn (Siegel et al., 1985). Teachers' belief in their students could have a significant impact on learning (Beswick, 2006). Modelling involves individuals partaking in an activity who have already mastered the learning outcomes and then demonstrate them for others (Beswick, 2006). Teachers who model mathematics skills that appear accessible and relevant could be rewarded with student success (Siegel et al., 1985). This will result in retention and improved motivation. If a teacher exhibits positivity, encourages, and motivates the learners, this will in turn build their self-efficacy (Kurt, 2019). Strong self-efficacy results in deeper interests and shows greater commitment therefore could result in higher mathematics learning and performance (Kurt, 2019). Self-efficacy reflects factors such a confidence, motivation, willingness, and creativity (Bandura,1977). Torres and Watson (2013) revealed that self-efficacy in teachers and learners is directly related to positive teaching behaviours and learner achievement. Teachers who exhibit low self-efficacy, are more pessimistic about their learner's ability to be motivated and rather focus on the external factors that impact learner performance (Watson, 2013). Self- efficacy is therefore, considered an important element to

deliberate as it is linked to teachers' perceptions of mathematics learning and performance (Beswick, 2006). Teachers' beliefs may also influence their perceptions on their ability to teach and on their ability to create an environment conducive to learning (Beswick, 2006).

This research is underpinned by the Social Learning Theory (1977) as teachers have the capacity to influence learners by the learners modelling their behaviour and developing an environment of positive or negative mathematics experiences. Equally, a learner's ability to model behaviour produces a sense of accomplishment within the teacher (Kurt, 2019). The teacher is reciprocal in their modelling because as the learner retains and models positive skills, so a teacher will respond in a more positive and encouraging manner which also results in meaningful learning experience for everyone.

1.3 Broad factors that impact mathematics learning and performance.

Besides direct learning and observation as stated by Bandura's Social Learning Theory (1977), there are also broad factors that impact on mathematics learning and performance.

1.3.1 Limited resources

While the topic focuses on the perceptions of teachers regarding mathematics learning and performance, in particular, Grade 9 teachers in the private school sector, it is important to acknowledge broad factors that influence mathematics learning and performance. There is a body of international and local literature that speak to factors that impact mathematical outcomes (Acharya, 2017; Jackson, 2015; Mji & Makgato, 2006; Ramohapi, Maimane, & Rankhumise, 2015; Visser et al., 2015). According to Boaler (2015), rich and relevant resources help develop mathematical mindsets and create an environment for deep, critical understanding. Resources within a classroom may therefore enhance positive learning experiences (Boaler, 2015). Dill (2008) states that schools with limited resources have difficulty meeting educational needs of all their learners. Lancour and Tissington (2001) concur that low achievement is closely associated with lack of resources. This is a challenge facing many schools in South Africa. According to Visser et al. (2015), a lack of meaningful resources contributes significantly to poor mathematics achievement. Makgato (2007) concurs and identified lack of facilities and poor resources as inhibitors of overall learning in the mathematics classroom. Maile (2019) found in their study conducted in Limpopo, South Africa, that resources are a

factor that influences mathematics performance and resources that support the curriculum benefit both teachers and learners. Sedibe (2001) indicates that there is still a concern about the availability and accessibility to resources and Visser et al. (2015) explained that a lack of resources had the strong adverse impact on learning outcomes in South African schools.

1.3.2 Socio-economic status

Besides limited resources, over-crowding and poor physical structures, many schools situated within the lower socio-economic sector experience poor mathematics outcomes. Bol and Berry (2005) found that wealth had a positive effect on mathematics attainment. Learners scored lower in communities with lower parental income occupations and schools within these sectors of society achieved below average (Bol & Berry, 2005). Similarly, in a study conducted in South Africa by Visser et al. (2015) it was noted that socio-economic backgrounds of learners, along with language, were both significant indicators of mathematical success. Leaners from higher socio-economic backgrounds achieved consistently higher across all mathematical benchmark assessments such as TIMMS (Visser et al., 2015).

1.3.3 Parental influence

Although socio-economic status is an important factor to consider, one cannot ignore the impact of parental involvement. (Mohr-Schroeder, Jackson, Cavalcanti, Jong, Craig Schroeder, & Speler, 2017). Mohr-Schroeder et al. (2017) and Jackson (2015) argue that parental aspirations and expectations for their children is strongly linked to academic success, especially in mathematics. Parents recognise the importance of being involved in their child's education and they therefore value their ability to learn and succeed (Ramohapi et al., 2015). However, many parents feel inadequate and incompetence in their abilities to help (Mohr-Schroeder et al., 2017). Poor parent education was also a contributing factor towards mathematics success in learners (Visser et al., 2015). Therefore, encouragement and interest of parents appear to be an important indicator of overall mathematics achievement (Visser et al., 2015).

1.3.4 The role of the teacher

While parents are an influencing factor towards mathematics success, the teacher is the active facilitator in learning at school (Jackson, 2015). The role of the teacher and their impact on learning cannot be overlooked. According to Knuth (2002), teachers provide rich opportunities and experiences of the mathematics curriculum. Similarly, Beswick (2006) states that the teacher is a contributing factor who influences the choice of content and culture established in the classroom. They can create an atmosphere with constructive or destructive beliefs about mathematics (Beswick, 2006). Furthermore, teachers are given the task of motivating a learner to perform and learn (Fidele et al., 2019). Therefore, a teacher's role is a critical component in creating a classroom atmosphere that is conductive to successful mathematics learning and performance.

Equally important is the teacher's knowledge and skills as critical factors associated with mathematics learning and performance. Teachers need an in-depth understanding of the subject and clear pedagogical practices (Adler & Pillay, 2017). Research conducted by Brendefur et al. (2013) suggests that many teachers lack rich mathematics experience, and they have difficulty acquiring knowledge and skills to teach mathematics correctly. Not only do teachers need to be able to possess mathematical knowledge but equally important is their understanding of how learners learn and think (Brendefur et al., 2013). Studies in South Africa reported that many teachers use outdated teaching practices and lack basic knowledge which results in poor teaching of mathematics (Mji & Makgato, 2006). Moreover, teachers lack content knowledge, adequate qualifications, and training (Maile, 2019).

1.4 Teachers' perceptions of factors impacting mathematics learning and performance.

Teachers create opportunities for achievement, as learners who have mathematics teachers that hold positive perceptions scored significantly higher than their counterparts with a poor perception of mathematics (Areepattamannil & Kaur, 2013). Similarly, teachers project subtle messages which they communicate to the leaners about the nature of mathematics and the way learners may view mathematics at that moment and into the future (Dossey, 1992). It is thus important for a teacher to be mindful of the way they display their own beliefs and attitudes towards mathematics in the classroom. Dossey (1992) goes on to say that although some teachers see mathematics as a static discipline which develops abstractly, there are others that

see mathematics as an active subject which changes constantly and always resulting in new discoveries. As teachers have daily contact with the learners, they can identify factors associated with mathematics learning and performance. The way that the teacher perceives mathematics in the classroom is often based on the teachers' understanding of the learning of mathematics and what they believe to be the most important principles to convey to the learner (Dossey, 1992).

Although many factors have been linked to mathematics learning and performance, a teacher's perception can have an either positive or negative impact on the learner's overall outcomes (Jackson, 2015). Reviewing studies based on teachers' perceptions, it is evident that teachers have a crucial role to play in their ability to create meaningful learning experiences (Jackson, 2015; Robinson-Cimpian, Lubienski, Ganley, & Copur-Gencturk, 2014; Tsanwani et al., 2014). Thompson (1984) explored the relationship of teachers' perceptions and their personal beliefs which impact the classroom environment. It was noted that the views, beliefs, and preferences of the teacher play an important role in their effectiveness as the primary facilitator between the subject and the learner (Thompson, 1984). The perceptions teachers have relating to mathematics learning and performance could impact on the outcomes in the mathematics classroom and provide insight into influencing factors that may enhance mathematics success.

1.4.1 Motivation as a contributing factor

Studies show that teachers perceive their own ability to motivate as being one of the leading factors contributing to learner's ability to learn mathematics (Areepattamannil & Kaur, 2013; Fidele et al., 2019; Jackson, 2015;). A growing body of literature has examined teachers' perceptions related to mathematics (Areepattamannil & Kaur, 2013; Jackson, 2015; Robinson-Cimpian et al., 2014; Umugiraneza, Bansilal, & North, 2018). Teachers perceived motivation to be an influencing factor in mathematics learning and performance and emphasised that motivation is linked to a positive learning environment (Fidele et al., 2019; Umugiraneza et al., 2018). It highlighted those teachers who are enthusiastic, motivated, and put in the extra effort, have better mathematical outcomes in their class. (Areepattamannil & Kaur, 2013; Fidele et al., 2019; Jackson, 2015). Mokgwathi et al. (2019) suggest that attitudes and beliefs towards mathematics has a significant impact on both learning and performance of mathematics.

A qualitative study in the United Kingdom looked at student primary teachers' perceptions of mathematics (Jackson, 2015). It noted that motivation is associated with the aspect of prior- experience and attitudes. Jackson (2015) states that experience and attitudes can impact on mathematics learning and performance. Although this study is revealing in terms of teachers' perceptions, in was conducted in a primary school setting, therefore, further investigation is required surrounding secondary school environments. The literature on teachers' attitudes was relevant as attitudes are closely associated with perceptions. Attitudes can be defined as a complex combination of behaviour, personality, beliefs, and motivation (Manstead, 1996) and these characteristics of a teacher could possibly impact on the children's beliefs in themselves and the subject.

Beswick (2006) conducted research in rural Australia in which she explored teachers' beliefs that matter in secondary mathematics classrooms. Twenty-five mathematics teachers from six secondary schools participated in the survey and interviews. The teachers varied in experience from 1 – 38 years and the focus were on their beliefs and how they influenced their practice in the classroom. The findings proposed that mathematics is about connecting ideas and making sense and that all learners have the potential to learn. The teacher has the responsibility to enhance the productivity and effectiveness of the classroom and that they are ultimately responsible for being professionally engaged in ongoing learning and facilitating and guiding learners toward the construction of knowledge. Although not focused on teachers' perceptions, other global studies highlight the importance of teacher engagement, motivation, and effectiveness in enhancing mathematical success in the classroom (Grootenboer & Hemmings, 2007). Furthermore, their quantitative research conducted in New Zealand, revealed that attitudes, either positive or negative, are directed towards certain aspects of education, such as mathematics, and these attitudes are mostly grounded in personal experiences.

Another quantitative study in Rwanda, revealed that motivation is indeed a factor that influences mathematics learning (Fidele et al., 2019). Teachers believe that motivation is vital for effective learning and even if there are pre-existing challenges, motivation of students and teaches results in active and positive learning. Twenty-five teachers that taught across the secondary school grades participated in the questionnaire and revealed that mathematics is seen as a difficult subject, but that motivation is increased with caring teachers. However, the quantitative nature of the study appears to limit teacher's ability to express in-depth meaningful experiences

that would possibly be elicited from qualitative research (Creswell, 2013). The research of Fiedel et al. (2019) was conducted in a rural setting and thus only highlights one sector of the population and does not consider teachers who teach in schools located in middle-class, socio-economic backgrounds and based in private schools. Research conducted with teachers within middle-class, private schools may result in different findings as it appears that wealthier schools may have different functionality and outcomes than many public schools in lower socio-economic sectors of South Africa (Spaull, 2013).

Local studies have had similar discussions around the impact of motivation. Tsanwani et al. (2014) suggest that motivation is an essential element relating to mathematical success and state that if a teacher lacks interest, then this results in learner apathy. Teachers need to be positive role models and advocate for the learner and their mathematics achievements. Furthermore, Mokgwathi et al. (2019) conducted quantitative research on the relationship between Grade 9 teachers and learners' perceptions and attitudes towards mathematics achievement. Teachers' attitudes were defined as the characteristics they exhibit in the classroom and how they relate to and interact with their learners. Their findings showed that even if teachers do not find their work full of meaning and purpose, this does not have an impact on learners' achievements. Although this research is of value, it is not qualitative in nature and appears to lack in-depth, subjective discussion as to why this may be the outcome in this specific research (Mokgwathi et al., 2019). It is evident by the above discussion that motivation is perceived by those in education to be a critical factor influencing mathematics learning and performance, but further research is needed specifically on perceptions of teachers in private school settings.

1.4.2 Anxiety as a contributing factor

Beside motivation, another factor perceived by teachers which appears to influence mathematics learning and performance is anxiety. Mathematics anxiety can be defined as feelings of tension and nervousness that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations (Rossnan, 2006). Teachers notice that learner anxiety is related to poor performance in mathematics and is directly connected to mathematics avoidance (Maile, 2019). Anxiety creates feelings of failure, and this results in avoidance and lack of effort on the part of the learner. In an article by Morsanyi, Mammarella, Szucs, Tomasetto, Primi, and Maloney (2016) it was noted that teachers observed that learners with high levels of anxiety tend to underperform,

especially in test situations and they hold long-term negative attitudes towards mathematics which may hinder subject choices and ultimately limit career options (Morsanyi et al., 2016). In a quantitative study aimed at investigating anxiety as a determinant of poor performance in Grade 12, teachers noticed anxiety towards mathematics by Grade 12 learners to be debilitating and a concerted effort needs to be made in order to avoid drop out, negative attitudes and an overall sense of failure amongst learners (Maile, 2019). This study is revealing in terms of anxiety; however, this current study will explore factors perceived by teachers at a Grade 9 level which may affect mathematics achievement and possibly contribute to future successes in the subject.

Teachers also experience their own anxiety which often stems from them feeling incapable, incompetent and lacking in skills and knowledge of the subject (Maile, 2019). These anxious feelings can be passed on from teacher to learner which results in clear anxiety in the mathematics classroom (Maile, 2019). Although this study is revealing in terms of anxiety, it was conducted in a public school in South Africa and therefore there is a need to study teachers' perceptions in private schools as there could be contributing factors associated with this particular context (Zuze, Reddy, Visser, Winnaar, & Govender, 2017). This study will thus explore factors impacting on mathematics learning and performance from a teacher's point of view who teach in a private school setting.

1.4.3 Gender as a contributing factor

Besides motivation and anxiety as perceived factors that influence mathematics learning and performance, literature has shown that teachers perceive gender to be an influencing factor. A quantitative study in the United States of America by Robinson-Cimpian et al. (2014) found that teachers reported gender as a factor that influenced mathematics learning and performance. It was noted that "teachers are the socializing agent in the construction of gender", (Robinson-Cimpian et al., 2014, p. 1262) and therefore influence the achievement of both male and female students. It is worth noting that in this study, teachers perceived female students as been better in mathematics learning due to their diligence and behaviour in the classroom, whereas male students often performed better as a result of recognition and encouragement by the teachers.

Another study in New Zealand found that teachers observed girls to achieve lower in mathematics than that of boys (Grootenboer & Hemmings, 2007). This quantitative

study explored the correlation between learners' beliefs and attitudes and their performance rating from their teachers. Although the study focused on learners between the ages of 8 and 13 years and not teachers, it was suggested by teachers that girls held negative attitudes towards mathematics which results in them being poorer learners in the subject. Teachers believed that boys tended to hold a more positive attitude towards mathematics and the majority of boys perceived themselves to be good at the subject.

In the South African context gender is also a factor impacting on mathematics. A study by Mutodi and Ngirande (2014) conducted in Polokwane, South Africa, revealed that there continues to be myths around gender and mathematics. Culturally, mathematics is still considered a male subject with females feeling they are not competent and are not skilled enough to succeed in the subject.

Although this local study identified gender as playing a role in mathematics performance from students' observations, most of the literature comes from international studies. Given that the South African context differs from the international context, further research is needed on teachers' perceptions of factors that influence mathematics learning and performance in South African schools.

1.4.4 Language as a contributing factor

Along with perceived ideas of motivation and gender, teachers observed language to be a barrier to mathematics success as it ultimately has a negative impact on the learners' ability to understand, implement and interpret mathematical problems (Maile, 2019).

It was observed that teachers believe that learners perform better if the language of learning and teaching is the same, especially if it is the same as the learner's home language (Visser et al., 2015). Similarly, Ramohapi et al. (2015) conducted research in the rural area of Motheo District and found that teachers perceived language barriers and the ability for teachers to meet basic needs for learning mathematics as challenges that teachers faced regularly. Furthermore, teachers commented that mathematics often uses language that is specific to the subject which can result in further confusion, feelings of incompetence and misinterpretation from learners who do not display competent language skills (Ramohapi et al., 2015). Makgato (2007) also stated that language barriers were perceived by teachers to result in poor results from the Grade 12 students in the secondary schools around Soshanguve township. Additionally, Mji and Makgato (2006) conducted research on Grade 11

students in Tshwane North, District 3 and reported that teachers perceive similarities in difficulties with language.

It is evident that teachers perceive language to be a critical and concerning influence on mathematics learning and performance. The above research focused mainly on the impact of language in the upper grades of secondary school; however, it is possible for language to be an influencing factor in the lower grades of secondary school as well. Bansilal (2017) suggested that Grade 9 learners showed poor results due to a number of perceived factors, one of them being language. Grade 9 is seen as a significant year in which learners make subject choices that may impact their future and is a year that assesses the overall performance of the education system (Martin, Mullis, Foy, & Stanco, 2012). As there has not been research conducted on Grade 9 teachers in private schools, this further highlights the need to explore Grade 9 private school teachers' perceptions of factors that influence mathematics learning and performance to determine what factors are perceived to influence mathematics learning and performance at a Grade 9 level. Furthermore, exploring factors within private schools may differ from public schools and may thus add to increased insight and support in mathematics across all school communities (Wamalwa & Burns, 2018).

1.4.5 Family background as a contributing factor

Teachers perceive the home environment and the involvement of parents to influence the attitudes of learners towards mathematics which may ultimately result in improved mathematics learning and performance (Bol & Berry, 2005). It was observed that there is a correlation between parent resources and mathematical achievement (Umugiraneza et al., 2018).

South African research agrees that parents are observed to play an important role in their child's education and teachers feel that a nurturing, stimulating and supportive environment can increase overall mathematics success (Mji & Makgato, 2006). Additional studies have stated that a learner's home environment and level of parental involvement were perceived as being contributing factors impacting on mathematics performance (Tsanwani et al., 2014).

1.4.6 Socio-economic status as a contributing factor

The apparent influence of parents may somewhat correlate with socio-economic backgrounds. Research by Tsanwani et al. (2014) is consistent with the fact that

socio-economic status has a prevailing influence on mathematics achievement. Teachers observed that learners who attend lower socio-economic schools achieved significantly lower than those from more affluent schools (Tsanwani, 2014). Similarly, Bol and Berry (2005) draw attention to social influences. Although their mixed method research was conducted in the United States of America, it revealed that teachers perceive social influences as a significant factor influencing mathematics learning, in particular social media, movies, and music.

Qualitative research in South Africa conducted on teachers' perceptions has found that teachers perceived socio-economic status as a factor that influences mathematics learning and performance (Makgato, 2007; Mji & Makgato, 2006; Ramohapi et al., 2015). All three studies were conducted in rural secondary schools across South Africa and fall within the poor socio-economic sectors of society. Although the above-mentioned social influences and factors are useful to consider for this study, all the research mentioned were conducted in low socio-economic communities (Bol & Berry, 2005; Graven, 2014; Maile, 2019; Makgato, 2007; Mji & Makgato, 2006; Ramohapi et al., 2015).

Thus, there appears to be a lack of research in exploring the perceptions of teachers in private schools located in middle class, socio-economic communities. Given the differences between public and private school contexts in South Africa (Maile, 2019; Makgato, 2007; Reddy et al., 2017), the factors influencing mathematics by teachers in private schools could contribute to alternative and collaborative support strategies and increase ideas to stimulate mathematics achievement in schools across South Africa.

Conclusion

It is evident that mathematics is an area of concern in many South African schools and the Department of Basic Education (2019) is alarmed about levels of achievement. It is thus important to determine factors that influence mathematics learning and performance, especially from a teacher's perspective. Furthermore, the Grade 9 year is considered to be a critical year in the South African education system. The results of the TIMSS conducted in 2015, show that the overall performance for South African learners in Grade 9, with a score of 372, were amongst the lower end of the performance table (Reddy et al., 2017). It is thus necessary to explore the factors impacting mathematics learning and performance in

Grade 9 as they could be significant indicators of mathematical success throughout a learners schooling and future career choice.

From the literature, it can be observed that there are many factors impacting mathematics learning and performance, and teachers perceive these different factors to influence mathematics learning and performance. However, much of the research has been conducted in an international context. Of the research conducted in South Africa, these have focused on public schools, rural settings, with learners from outside the Grade 9 year and teachers that teach in other grades other than Grade 9. Given the issues with the Grade 9 learners in terms of mathematics, and that in the South African context there are different factors that influence the teaching of mathematics across diverse backgrounds and schools situated in different social contexts, this qualitative study attempts to contribute to a wider understanding of contributing factors effecting mathematics learning and performance in South Africa from the perspective of Grade 9 teachers in private schools.

Chapter 2: Methods

Introduction

The intention of this chapter is to describe the methods of this study. The aim of this study and the research questions will be presented. This will be followed by a description of the research design and a discussion of the participants, instrument, and the procedure. Finally, ethical considerations and methods used for data analysis will be explained.

2.1. Research problem

There is limited research on teachers' perceptions of mathematics learning and performance in private schools, with previous research in the South African context having focused mainly on public schools (Makgato, 2007; Mutodi & Ngirande, 2014; Tsanwani et al., 2014). Additionally, the lack of focus on Grade 9 mathematics in the South African context is concerning as this grade is experiencing many challenges, such as minimal level of attainment of basic mathematical skills and concerns around the curriculum content in Grade 9 (Bansilal, 2007; Reddy et al., 2017). Exploring teachers' perceptions may play a role in how students learn and perform in mathematics. This study therefore addressed aimed to address the above research problem, by exploring the perceptions Grade 9 private school teachers regarding mathematics learning and performance.

2.2 Research aim

The aim of this research was to discover the perceptions of Grade 9 mathematics teachers in private schools in Gauteng, South Africa, regarding the factors that they feel influence mathematics learning and performance.

2.3 Research questions

1. What do Grade 9 mathematics teachers perceive to be factors influencing mathematics learning?

2. What do Grade 9 mathematics teachers perceive to be factors influencing mathematics performance?

2.4 Research Design

A qualitative design was used for the purposes of this research as it allowed the researcher to gather rich and informative data based on the perceptions of Grade 9 mathematics teachers (Baxter & Jack, 2008; Silverman, 2011). It shifted away from being bound by rules and disciplinary-based processes and rather focuses on questions about what one already knows (Hennink, Hutter, & Bailey, 2020; Stebbins, 2001). This said, a qualitative research design allowed for in-depth investigation into the subjective perceptions of teachers regarding the factors that they feel influence mathematics learning and performance. According to Fossey, Harvey, McDermott, and Davidson (2002), qualitative research describes and explains individuals' experiences and interactions within the social context as understood specifically by them. Teherani, Martimianakis, Stenfors-Haynes, Wadhwa, and Varpio (2015) further explain that qualitative research enquires about social phenomena and explores human relationships and experiences. Thus, this research explored the perceptions of teachers who are currently teaching Grade 9 learners and allowed for teachers to engage in subjective discussion regarding their knowledge of mathematics in their classroom settings and the factors they perceived to impact on learning and performance. Exploring teachers' perceptions allowed the researcher to delve into the individual experiences within the Grade 9 mathematics classroom and using discussion as a means of exploring processes and interactions and interpreting subjective meaning (Fossey et al., 2002; Silverman, 2011). This research, therefore, identified and examined Grade 9 teachers' perceptions on factors that influence mathematics learning and performance as it allowed for conversation and communication on a subjective level which resulted in rich data of perceived factors influencing mathematics learning and performance.

The research was open-ended and exploratory in nature as it investigated factors which were not clearly defined, as perceptions are subjective in nature (Elliot & Timulak, 2005; Hennink et al., 2020). The researcher was able to discover and acquire a better understanding of the various perceptions of teachers related to mathematics learning and performance through investigating, discussion, and interaction. Therefore, a qualitative research design was appropriate as the study focused on the perceptions of those participants involved in the study (Teherani et al., 2015).

A phenomenological research design was used as it allowed for the identification of similar phenomena and perceptions amongst the participants in relation to

mathematics learning and performance (Maree, 2016). Phenomenological research was suited for this study as the researcher was able to explore similarities and differences surrounding the perceptions of Grade 9 mathematics teachers. In order to focus on the unique experiences of the participants, a transcendental phenomenology was adopted as it allowed for the participants to express themselves without the preconceived ideas of the researcher limiting their expressions (Moustakas, 1994).

2.5 Sample and Sampling

Ten white female teachers, one white male teacher and one black male teacher participated in this study (n=12). Their participation was voluntary, and they all taught in private schools across Gauteng. They ranged in experience from 3 – 30 years with an average of 13 years teaching experience. Two teachers taught at the same private school, while the remaining ten participants taught at different private schools across Gauteng. The private schools willing to participate all had active and engaging mathematics departments who were willing to participate in this research. Furthermore, the principals of the schools recommended other private schools that were able to assist under the difficult conditions of lockdown. The researcher engaged in various private schools until the appropriate sample size was obtained. The participants remained anonymous and were referred to as Participant 1 to 12. The participants were all qualified mathematics teachers, and the sample was homogeneous in nature (Maree, 2016). This means that the teachers taught the same subject and grade, namely Grade 9 mathematics. This sample was relevant as it reflected the population which was being studied.

A non-probability sampling method was used to select the sample. The type of non-probability sampling that was used was purposive sampling because it included participants based on preferred characteristics that would likely produce information, which was relevant to this study namely, Grade 9 teachers teaching in private schools (Patton, 2002). Purposive sampling was suitable in choosing the participants that would best elicit answers to the research question and ultimately meet the aim of the research (Symon & Cassell, 2012). The participants shared similar traits and were consistent in nature as their precise similarities all related to the research questions (Etikan, Musa, & Alkassim, 2016). The participants chosen were therefore all currently teaching Grade 9 learners in private schools. Purposive sampling usually requires a small number of participants which have a pre-determined common link and thus allowed the researcher to gather information-rich cases on the

subjective perceptions of teachers within a selected sample (Patton, 1987; Silverman, 2019). The common link between the participants was the fact that they were all currently teaching at a Grade 9 level and were able to discuss perceptions related to their experiences on mathematics leaning and performance. The research was aimed at exploring the influence of Grade 9 teachers' perceptions that they felt influence mathematics learning and performance. Furthermore, this research used self-selection sampling as the teachers volunteered to participate and they could equally decide if they no longer wanted to participate (Symon & Cassell, 2012).

2.6 Instrument

The data collection instrument that was used for this research was a semi-structured interview schedule comprising of eighteen questions (Appendix A). This type of interview schedule took advantage of the knowledge being produced by the participants (Leavy, 2014). Furthermore, it allowed for the participants to reflect on the topics while the researcher was able to probe for further information (Leavy, 2014). It was not restrictive but still allowed the researcher to have a greater influence in directing the conversation on issues they felt were important in relation to the study and were founded in subjective experiences (Weiss, 1995). The teachers were able to engage in meaningful conversation about their perceptions of factors influencing mathematics. The semi-structured interview also allowed the researcher to have an idea of the areas of interest and which questions or discussion to further pursue, for example, questions on class size related to the perceptions of the participants (Maree, 2016). This type of data collection further allowed the participants to reflect on their experiences and attitudes about certain phenomena such as their own actions and thoughts, instead of the researcher directing inflexible questions (Maree, 2016). It also allowed an opportunity for the researcher to establish rapport with each participant (Eatough & Smith, 2008; Hennink et al., 2020).

The interview schedule, comprising of eighteen open-ended questions, was developed by the researcher, and was based on literature and questions adapted from prior research on teachers' perceptions of mathematics learning and performance (Bol & Berry, 2005; Ramohapi et al., 2015; Tsawani et al., 2014).

The questionnaire from Bol and Berry (2005) relating to teachers' perceptions of the achievement gap was adjusted for qualitative use. Questions relating to teacher's perceptions, societal influences and curriculum instruction were altered to suit the

purpose of the discussions in the current study. Instead of asking questions to secondary school teachers in general, for example, “What do secondary school teachers perceive to be the most important contribution to the achievement gap in mathematics?”, this study focused the questions on overall perceptions of Grade 9 teachers related to factors influencing mathematics learning and performance. Ramohapi’s et al. (2015) quantitative study on factors contributing to learner performance in mathematics was adjusted to focus specifically on perceptions of Grade 9 teachers. Questions such as, “What are the attitudes towards mathematics?”, “How is the use of English affecting the teaching and learning of mathematics” and “How is the provision of learning resources for mathematics at school?” were altered and used in this current study but focusing the questions on the perceptions of Grade 9 teachers only. Additionally, the study by Tsanwani et al. (2014) on perceptions of teachers and learners about factors that facilitate learner performance in mathematics in South Africa was altered in order to focus specifically on Grade 9 mathematics teachers in private schools. Broad question such as “What are the learners challenges for success in mathematics?” and “Of all the factors raised, which are the most important?”. Questions were altered to focus on teachers only and not on the learner’s viewpoint. The contextual questions were adopted from Neveling (2016) and made applicable to the research topic. Some of the questions by Neveling (2016) were also altered to enquire about positive and challenging aspects related to mathematics teaching.

Prior to data collection, the interview schedule was piloted with teachers from the population of interest, who were not included in the sample. This was to ascertain the suitability of the questions and provide quality feedback on the questions. The feedback allowed the researcher to detect if the main components of the study had been accurately represented and then alter if necessary. Two pilot interviews were administered to Grade 9 teachers in private schools in Gauteng. The outcome of the pilot interviews suggested that the questions were well focused on the aims of the research and clearly outlined and easily understood by the participants.

2.7 Procedure

Before proceeding with the research, ethical clearance (Appendix B) was obtained from the Human Research Ethics Committee (Non-Medical) at the University of the Witwatersrand (protocol number: MEDPSYC/20/05). Once ethical clearance was obtained permission was then requested from the principals of the selected schools via email (Appendix C). The approach letter was sent to the principals of the various

private schools, and they then returned the consent form (Appendix D). The principals emailed the information regarding this study to the mathematics department of each school. Potential participants who were interested in the research topic then sent the researcher an email stating their willingness to volunteer in the study. Once the researcher received the email from the participant, the researcher then emailed a participant information sheet (Appendix E) to the participant outlining the research topic and what was required should they choose to participate. Once the individual participants agreed to volunteer, the teachers were sent a consent form for participation (Appendix F) and a consent form for recording (Appendix G). Participants were requested to send the signed forms to the researcher before the interview. The interviews were conducted at a time and date convenient to the participants. The interviews were conducted online, via MS Teams or Zoom. Due to the COVID-19 global pandemic, social distancing was recommended as one of the precautions for the control of the virus. MS Teams and Zoom both provided a platform that allowed online communication and the ability to access the participants, gather data via interviews and continue to follow government regulations and guideline, as outlined by the Department of Health (2019). MS Teams and Zoom provided the most suitable protection for the researcher and the participants whilst continuing to gather data for the research. The participants were given a choice of which online platform they preferred. Factors regarding their decision included time availability, connectivity, data, ease of access and familiarity with the different platforms.

Before the interview began, the aim and purpose of the research was thoroughly explained again, including requirements of participation and ethical considerations. The participants were required to give verbal consent before the interview commenced. The completion of each interview ranged in time from 30-60 minutes. The interview was recorded using the specific function on MS Teams and Zoom. Each interview was transcribed by the researcher for analytic purposes.

2.8 Ethical considerations

Ethical clearance (Appendix B) was obtained by the University of the Witwatersrand's Human Research Ethics Committee (non-medical), protocol number: MEDPSYC/20/05.

As data was collected from various private schools, there was no need to obtain permission from the Gauteng Department of Education. However, permission was obtained from the principals of each school. An approach letter (Appendix C) was

emailed to each principal outlining the research study and the requirements needed from the school if they were to volunteer to participate. A consent form (Appendix D) was obtained from the principals before research commenced. The teachers were sent a participant information sheet (Appendix E) outlining the research topic, requirements to participate and ethical concerns. The teachers who volunteered to participate were asked to complete a consent form (Appendix F) to allow the researcher to proceed with the interview and a consent form for the interview to be recorded (Appendix G). Verbal, informed consent was then required just before the start of the interview to ensure that the participant was in full knowledge and awareness of the research requirements. Participation in the study was voluntary and participants were able to remove themselves from the study at any time without any negative consequence to themselves or the school.

In this research anonymity could not be guaranteed as the researcher knew the identifying characteristics of the participants being interviewed. However, the researcher ensured confidentiality by removing all identifiable information from the data and instead used pseudonyms, for example names were replaced with participant 1. Only the researcher and the supervisor had access to the data. Furthermore, the data was not stored with any identifying documentation and was secured under a password protected computer.

This study was of minimal risk as the possibility of harm was no larger than those imposed by everyday life in a general educational setting. The study was not considered harmful as the topic focused on learning and not on social or emotional aspects of human functioning.

The final written report will be accessible to markers and those who have access to the University of the Witwatersrand Library. The research may be presented at local or international conferences or published in a journal or article. The participants were informed that they will not receive individual feedback but, upon request, will receive a summary of the findings of the research once it has been completed.

2.9 Data Analysis

Once the data was collected, it was analysed using Braun and Clarke's (2006) thematic analysis. This technique was used for identifying, analysing, organising, describing, and reporting on themes found within the data (Braun & Clarke, 2006). This was a suitable form of data analysis for this study as it was a flexible approach to analysis which could yield rich, insightful, and detailed data on the perceptions of

teachers (Nowell, Norris, White, & Moules, 2017). This process of analysis was used to summarise key facets which occur in several steps. Firstly, the data was transcribed, and the researcher read the data to familiarise themselves with the content by repeatedly reading the responses of the factors that teachers perceive to influence mathematics learning and performance (Braun & Clarke, 2006). Secondly, codes were produced from the data and aspects of interest were identified (Braun & Clarke, 2006). Coding or categorising refers to a process of organising the data and assigning it to categories (Maree, 2016). Thirdly, the codes were then grouped together to identify specific themes (Nowell et al., 2017). Once the themes and subthemes had been discussed and the importance elements of the overall research identified, the report was written in a logical and coherent manner (Braun & Clarke, 2006).

2.10 Reflexivity

Throughout the research process, it is important to remain reflexive in conducting and interpreting the interviews. Patton (2002) states that reflexivity is a way of emphasising the importance of self-awareness, cultural consciousness, and ownership of one's own perspective. The researcher needed to consider and reflect on the nature of their contribution to the research procedure and the effect this may have had on the findings (Symon & Cassell, 2012). As the researcher is a former mathematics teacher in the private sector, there was an interest in factors influencing mathematics learning and performance and the possibility of exploring support strategies for both teachers and learners. The researcher felt that teachers' perceptions are seldom considered but can have a significant impact on learner performance in mathematics. Furthermore, it is also important to acknowledge the researcher's role as a white female in a predominantly similar context with possibly, similar viewpoints. This could have led to biases; however, the researcher was aware and reflected on their own perceptions and biases and identified and managed how this impacted the research. It is almost impossible to exclude biases from the analyses, yet they needed to be acknowledged and made aware of throughout the research. A self-reflecting journal allowed the researcher to examine personal goals and explore thoughts and feelings regarding the research process (Symon & Cassell, 2012). The self-reflective journal also allowed the researcher to think about areas of development as they proceeded through the interview process. Initial uneasiness was discussed as the researcher was a novice and found some discomfort interviewing online. Once the researcher felt settled, then they were able

to probe and discuss issues with genuine interest. Furthermore, the researcher found that initially they were providing their own opinions on the topic and needed to be aware of this and change their mode of interaction in order to avoid personal judgement and opinion. Thus, the researcher used a self-reflecting journal in which they engaged in, recorded, and reflected on their own experiences and perceptions. This journal allowed for the researcher's feelings to be collected and reflected to minimize impact on the data.

Conclusion

This chapter focused on the methods for this study. The aims, research questions and research design were presented. After these subheadings, the sample, instrument, and procedure were discussed. Finally, the ethical considerations, date analysis and reflexivity were explored. The results of this study will be reviewed in chapter 3.

Chapter 3: Results

Introduction

The intention of this chapter is to present the results that were obtained in response to the research questions presented in Chapter 2. Thematic analysis was used by Braun and Clarke (2006) to identify the seven themes and fourteen subthemes which have been displayed in Table 1.

Table1

Summary of Themes and Subthemes

Themes	Subthemes
1. The learning of mathematical skills to enhance understanding, and ultimately resulting in performance.	- The interlink between mathematics learning and performance - Mathematics learning and performance impacted by the ability to understand mathematical concepts - Role of practise by the learner and its impact on mathematics learning and performance
2. The role of the teacher linked to motivation.	
3. Learner intrinsic factors that impact on mathematics learning and performance	- Lack of motivation towards mathematics learning and performance - Impact of learner self confidence - Learners attitude towards mathematics
4. Perceptions of the curriculum in relation to mathematics learning and performance	- Impact of curriculum structure and content - Impact of time related to curriculum completion

5. The impact of learner's background on mathematics learning and performance	- The role of language - Role of the caregiver - The impact of foundation skills
6. Effects of social media on mathematics learning and performance	- Advantages of technology - Disadvantages of technology
7. Support strategies impacting on mathematics learning and performance	- The role of team collaboration - Smaller class size

3.1The learning of mathematical skills to enhance understanding, and ultimately resulting in performance.

Across the data set, a theme that emerged was distinguishing between the two concepts namely, mathematics learning and performance. Participants perceived these concepts to be linked and appear to rely on each other in order to achieve in mathematics.

3.1.1 The interlink between mathematics learning and performance.

Some (n=5) participants perceived mathematics learning of skills, concepts, and routines as a requirement to perform in mathematics. Participant 5 believed that "you can't perform until you have solidly done the learning". Participant 4 goes on to say that once the learning has taken place then performance is about "internalising and understanding of those learnt skills". Participant 4 continued to state that,

> "maths learning is knowing the skills, like being able to use the concepts properly and see the link between each concept. I suppose to apply the skills and knowledge taught to them and then performance is more likely the outcome from that learning".

Furthermore, participant 12 reiterated in saying that,

> "maths learning is kind of like the nitty-gritty understanding of the different concepts, the learning of skills in different areas of maths for example,

understanding and knowing the rules of fractions…the more skilled you are at learning then maybe the more capable you are at learning then it is a little bit easier to perform."

Therefore, it is possible that without the learning of mathematics skills, drills and concepts in place, mathematics performance could be a challenge.

3.1.2 Mathematics learning and performance impacted by the ability to understand mathematical concepts.

A lack of understanding by the learner was perceived by the majority (n=8) of the teachers to have a significant influence on mathematics learning and performance. According to the participants, in order to perform, learners need a deep understanding of the concepts and how they link with each other. There was an emphasis on the importance of learning skills that effect understanding, which results in the ability to fully perform in mathematics. There was a concern that many learners do not have a deep understanding of the concepts taught or have difficulty relating and linking the different concepts as perceived by participant 3 who noted that mathematics is "properly gaining that knowledge, logic and real understanding of the concepts." Participant 4 agreed in suggesting that to understand and perform, the learners need the ability to "internalising and understanding the skills". It suggests that the skills needed to understand mathematics is impacting on their ability to perform. Participant 10 felt that many of the learners "need to be able to see the bigger picture…. they can't perform until you have solidly done learning". It could then be said that in order to perform in mathematics, a solid understanding is needed of the learnt concepts which could result in overall success in the subject.

3.1.3 Role of practise by the learner and its impact on mathematics learning and performance

The ability to understand mathematics was perceived by some (n=5) participants to be linked to practice. Participant 10 perceived practice by the learners as an influencing factor related to mathematics learning and performance when they stated that "without all the constant practice they will have difficulty in succeeding and performing". Participant 8 agreed in saying "the more you work with maths the better that you get at it. So, if they have been practising…it's not frightening to have to face all these concepts." Regular practise was identified as an important element towards the attainment of mathematics success. Participant 7 further commented that "maths performance is really based on how much practise" the learner had done and

participant 12 supported this by saying, “maths is really listening, understanding but mostly practising all the time”. Teachers therefore perceived regular practice by the learner as being linked to better understanding and ultimately connected to positive learning and performing in mathematics.

3.2 The role of teacher motivation linked to mathematics learning and performance

The role the teacher plays on learner motivation was perceived to impact mathematics learning and performance.

Some participants (n=4) perceived their role as an educator to be linked to the motivation of their learners. An encouraging approach perceived by the teacher could have a positive impact on overall learning and a negative approach may have a negative impact. Teachers felt that if they are engaged, motivated, and involved in the learning process, then the learner enjoys the subject and learns better. This can be seen in a comment by participant 9, who said that “the attitude of the teacher is really important to help them learn and the way they teach in order to allow them to understand”. Participant 5 felt that “a teacher needs to build some elements of confidence and motivation” for them to achieve in mathematics. Furthermore, participant 3 said that “you always try to keep them on track and try to keep their motivation up”. Participant 3 was referring to the ability to keep learners motivated by encouraging them throughout the learning process.

3. 3 Learner intrinsic factors that impact on mathematics learning and performance

There were several learner intrinsic factors that were perceived to impact on mathematics learning and performance. Three subthemes were identified, namely: lack of motivation, learner self-confidence and attitudes towards mathematics.

3.3.1 Lack of motivation towards mathematics learning and performance

A lack of motivation by the learner was recognised by many of the participants (n=5) as being an important factor influencing mathematics learning and performance. Participant 12 declared that learner motivation was a factor influencing mathematics learning and performance, by stating that “their [learners] motivation is a predictor of success as it is also linked to confidence.” Participant 3 commented that it is a constant struggle to “keep their [learners] motivation up” and that the Grade 9 learners do not understand the importance of mathematics learning and performance

on their future opportunities. Participant 4 stated that the learners lack of motivation effected their attitude, “like a barrier to their understanding and their learning”. And participant 5 described learners as “disinterested”, “apathetic” and “disengaged”. Additionally, participant 5 stated that “they don’t want to engage and try and work for themselves. They want you to supply the information so they can understand without putting in the effort to learn”. Participants therefore perceived learners’ low motivation to be a negative impact on overall mathematics learning and performance.

3.3.2 Impact of learner self-confidence

Learner self-confidence was identified as being a factor influencing mathematics learning and performance by some participants (n=4). Participant 10 indicated that an important part of mathematics success is building confidence when they said,

> “Maths is 95% confidence. Because the minute that you have that confidence you will be able to do anything, and I have seen it in maths…so I feel it is very much a confidence thing…if they start seeing the small victories…that is a huge confidence boost”.

Additionally, participant 5 felt that learner confidence was an important part of mathematics success when they said,

> “it’s a big thing. Confidence is enormous. Because even kids who know stuff but who are insecure in themselves will perform badly in a test and it’s because they are insecure, and they doubt themselves. And if you take the pressure away then sometimes, they can perform better. Unfortunately, the structure is not like that. They actually have to perform in a test, and they have to learn how to do that.”

From the above quotes, it indicates that teachers perceive that when learners are self-confident, they seem to learn and perform better in mathematics.

3.3.3 Learners attitudes towards mathematics

Majority of participants (n=10) expressed that Grade 9 learners found mathematics to be difficult and they expressed negative attitudes towards the subject. These feelings surrounding the subject could possibly negatively impact overall mathematics learning and performance. Participants 1 stated that “there is still a belief that maths is a difficult subject to do, and the attitude is well, I’m not too clever so maybe I won’t do well this year so ja, in Grade 9 they do not have a very good

attitude" towards learning the skills of the subject. Participant 6 that said, "their attitude is pretty poor because basically it is their last year of being forced to do maths and if someone have already made up their minds to do maths lit then they generally just don't care" as they feel that the Grade 9 year is the last year they need to perform in mathematics and therefore their attitudes are one of giving up and not trying anymore. Participant 9 went on to say that the learners "do not enjoy the subject, don't want to do it and they then don't try." These negative attitudes of the learner were perceived by the teachers to influence learners' approach to the subject, diminish their attitude and effort which impacts overall mathematics learning and performance.

3.4 Perceptions of the curriculum in relation to mathematics learning and performance

A common theme that was identified in this study were the perceptions of the curriculum and its impact on mathematics learning and performance. Features such as curriculum structure and time constraints were pinpointed at subthemes.

3.4.1 Impact of curriculum structure and content

Some participants (n=5) felt that the Grade 9 curriculum was not conducive to mathematics learning and performance because it was too cramped with concepts which appear disjointed and jumbled. Participant 7 noted that the "curriculum is overloaded" and this affects the learner's ability to go in-depth into the curriculum and properly understand and perform. Participant 4 tried to "make the curriculum more accessible to them as some of the concepts and work we have to cover is quite advanced and many of the kids seem to have gaps in their learning and understanding". Participant 8 was particularly resolute on this topic when they said,

> "So, maths is a building subject…You can't just throw them in the deep end and expect them to understand. And unfortunately, the way that the curriculum is currently set out, well, I actually hate CAPS…It's the worst thing that they could have ever done to maths ever. CAPS unfortunately introduces concepts that are in no way linked to each other…. It was really written by someone who has zero understanding of what maths really is."

Although many participants felt the curriculum to be overwhelming, there were some participants (n=4) that felt that the curriculum was conducive to mathematics learning and performance. Participant 1 commented that the curriculum was "well

structured…overall the curriculum is sound…it is conducive to good learning practices and good teaching practices." These conflicting findings reveal that although the curriculum can be seen as congested and inflexible, teachers perceived that it was also largely well designed and comprehensive.

3.4.2 Impact of time related to curriculum completion

Even with the divide in perceptions toward the content and structure of the curriculum, the majority (n=10) of participants felt that there was limited time to cover all the skills and concepts needed in Grade 9. The lack of time was perceived to influence mathematics learning and performance as mentioned by participant 7 that said there "is just really no time in the curriculum, it's just push, push and finish and move quickly onto the next sections". Participant 12 agreed when they said that there are "too many areas that we need to cover, and I suppose not enough time to go in-depth into each concept". The lack of time distracts from the learner's ability to learn concepts that will enhance performance. Increased amount of time to focus on the completing the curriculum appears to be an important factor relating to mathematics learning and performance because time is a factor needed to practice more, as stated by participant 11 when they said that "time is not enough for repetition and revision" which may impact on understanding as their ability to learn and ultimately perform is affected, participant 9 concurred that,

"There is never enough time to get everything done properly. So, it is really irritating at the end when you are supposed to have all of these topics together and they are supposed to learn it and they are supposed to be at a higher level, but they can't because there is just too much."

3.5 The impact of learner's background on mathematics learning and performance

The majority of participants (n=9) agreed that a learner's background is an important element relating to their ability to learn and perform in mathematics. The following subthemes were identified, namely: the impact of language, the role of a parent or caregiver and the importance of foundation skills on mathematics learning and performance.

3.5.1 The role of language

Half of the participants (n=6) observed language as having an important role to play in mathematics learning and performance. It appears the vocabulary associated with mathematics is unique and specific to the subject and this impacts on overall mathematics learning and performance as the understanding of the content becomes challenging for many learners. Participant 11 felt that language has a significant impact on mathematics when they said,

> "Huge, huge. They don't understand the vocab….so many kids struggle because they are not understand the language and understanding the words in the instructions…. Kids think that maths is number based without realising the huge link it has to language and the ability to understand that specific maths language''

Similarly, participant 3 explained that "you are not only learning a maths language, but you are learning new words in the English language that are often not used in day-to-day speaking…we expect them to know the meaning behind all the words and then apply them to their learning". Specific mathematical langue is needed to explain and justify concepts in the subject and to gain overall proficiency.

The complexity of mathematics language may affect second language speakers, even within the private school sector as perceived by some participants (n=4). Participant 12 observed that "language plays a huge role in learning, especially in South Africa where we have such vastly different languages in one school.". Furthermore, participant 12 emphasised that learners "are not exposed to good quality of English or a range of vocabulary…I have noticed has quite a negative impact on their understanding". This suggests that learners are perhaps not being exposed to rich vocabulary and this affects their ability to understand many mathematical concepts. Teachers perceive a lack of familiarity with the language of mathematics and not having English as their home language to negatively impact comprehension and understanding and in turn affect the learner's ability to perform.

3.5.2 The role of the caregiver

A nurturing background with supportive parents was considered by many participants (n=7) to be a factor that influences mathematics learning and performance. Participant 4 stated that "children who are stimulated at home especially when they are young it definitely changes their mindset towards maths

and they seem to have a better ability at seeing the bigger picture in maths and having more abstract understanding."' Participant 7 stated that "parents have the responsibility at home to make sure that the work is getting done properly". Participant 12 also promoted the impact of an encouraging and stimulating family background when they said, "if they have an enriching or a nurturing background or are in a nurturing background where they have a lot of support and maybe they have a lot of stimulation then it is definitely easier for them to learn." Participant 4 observed that "the attitude of parents have definitely has an impact on how the children see maths and how they see themselves in doing maths". Parents could be perceived as being a learning barrier as many appear to have difficulty encouraging, supporting, and promoting the importance of mathematics learning and performance. Participant 10 agreed that many "parents are not interested" and that there is often "no push from home".

Additionally, participants felt teachers are becoming the parent to many learners as parents may either lack the skills to support their child or do not consider mathematics as a valuable subject as stated by participant 10 when they said, "it really comes down to that parents being parents. Often in this day and age the teachers need to be the parents". This perceived, added responsibility could put additional demands on teachers and possibly impact their ability to teach effectively. Parents were also perceived by participant 8 as lacking the skills to assist their children as they "not always understand maths and it helps to have parents that also understand."

Participant 10 agreed that many parents are "not interested" and this appears to decrease the motivation of some learners. Therefore, family values and enriching and nurturing parents is considered to have a positive impact on overall mathematics success.

Although participants viewed this in different ways, they all agreed that parents play an important role mathematics learning and performance.

3.5.3 The impact of foundation skills

Majority of the participants (n=7) noticed that there seems to be a lack of foundation skills either from home or from primary school, and this was perceived to influence mathematics learning and performance. Participant 4 stated that "some of the concepts and work we have to cover is quite advanced and many of the kids seem to have a lot of gaps in their foundation understanding" and this impacts the learning in

the classroom as learners are learning at different levels. This lack of certain mathematics skills could affect the overall understanding of mathematics and fail to identify the connection between different concepts. Participant 11 felt that learners lack basic, foundational skills and that due to this, they have difficulty grasping more complex concepts in Grade 9. Participant 11 noted that,

> "maths to me is like building foundations. So, if your foundations are wrong, you not going to build on from them. But if your foundations are ok then for me a lot of learning is done, and they can perform slightly better."

Participant agreed that learning and performance is influenced by a lack of basic skills when they said, "I think quite a lot is from their foundations. So, if they have bad foundations, they really start to wobble in Grade 9, and you can't fix the gaps and learning become difficult."

3.6 Effects of social media on mathematics learning and performance

A common theme that was identified in the research was the influence of social media and its effect on mathematics learning and performance. Social media was considered to be a major influence on mathematics learning and performance with comments such as "profound effect on our children" by participant 1, "tech is a big impact" by participant 6 and "we can't get away from it…major impact" from participant 12. However, teachers perceived social media and technology to be both an advantage and a disadvantage in the classroom.

3.6.1 Advantages of technology

Technology appears to be an important factor influencing mathematics learning and performance, with many (n=4) of the participants emphasising the importance of technology in the classroom. Comments by participant 2 and 12 respectively, suggested that technology such as "flip classrooms" and "interactive boards and Wi-Fi" all support teachers and learners as they are more engaging and increase the learners' interest. Furthermore, participant 2 felt that there are "so many apps that can help" learners understand abstract concepts and allow access to different support strategies. Mathematical apps also generate interest in Grade 9 learners as they appear more interactive, thus technology is not an overall negative influence. The mathematics apps provide additional support and revision of all the concepts and participant 8 continued to say that social media "allows access to more info" and

it “helps them [learners] get unstuck” by allowing the learners an alternative type of support in order to support their learning and performance.

3.6.2 Disadvantages of technology

Half of the participants (n=6) indicated that social media has an adverse impact on mathematics learning and performance. Participant 1 was concerned with the effects of social media and its impact on learning when they said,

> “social media has a profound effect on our children and really I don’t think it is always positive. I really feel that the kids spend so much time on their phones on this crazy stuff like Tik-Tok and spending time on funny YouTube sites that they are actually not using technology to learn and to improve their minds and improve their knowledge.”

Social media was observed to be a hinderance in the ability to engage and understand on a deeper level and this was perceived by many teachers as having a negative impact on mathematics learning and performance. Participant 10 said that “TikTok, Facebook, Instagram whatever they are into definitely becomes more important to them than doing their maths”. Participant 11 agreed in saying that “they are not following mathematicians…. they are choosing to follow glamorous people rather than anything related to school or maths.”

There was an emphasis on technology taking away from their ability to participate critically in mathematics, as noted by participant 12 when they said,

> “I think social media has a major impact on all of our children and their learning. I think it’s so instant you know, they don’t seem to have to work very hard to get any answers.”

This is echoed by participant 6 who stated that technology and social media detracts from their “own thoughts and beliefs” and “they don’t know how to think for themselves anymore”.

The disadvantages of social media appear to focus on the negative effects it has on overall learning but also on the type of input and the lack of quality material that the learners are receiving from social media. Additionally, social media was perceived to interfere with critical thinking, problem solving skills, developing opinions and the ability to understand on a deeper level.

3.7 Support strategies impacting on mathematics learning and performance.

The teachers proposed several support strategies that they perceive to positively influence mathematics learning and performance, namely the role of team collaboration and the impact of smaller class sizes in relation to mathematics learning and performance.

3.7.1 The role of team collaboration

Some of the teachers (n=5) stressed the importance of team collaboration as being an influencing factor in improved mathematics learning and performance as teachers can meet the needs of all the learners.

When asked what support strategies could be implemented to support learning and performance, participant 1 said that “teacher mentoring would be a good idea…time to sit down and have a proper conversation and discussion around strategies for learning and helping”. Teachers’ ability to support and share with each other enhances the learners experience in the mathematics classroom and perceived to aid in increased success in mathematics. Teachers perceived sharing ideas, productive discussions, time to communicate and sharing skills and knowledge that will ultimately benefit learner mathematics success. Participant 11 reinforced this by stating that “team teaching or having an extra body in class to help to get to more learners during our class time”. Participant 10 agreed that “have another teacher in class” is perceived to be beneficial for learning as it allows for teachers to engage in shared planning and clear communication which ultimately impacts mathematics learning and performance. Collaborative teaching was thus perceived to enhance the classroom teaching, and the learning experience as learners will possibly receive greater individual attention and focused support.

3.7.2 Smaller class sizes

Half of the participants (n=6) agreed that smaller class sizes impact on overall mathematical learning and performance because less learners in a class result in increased focus and attention from the teacher. It also allows the learner to be actively involved, ask questions, and prompt an interactive learning experience. Participant 4 observed that “breaking up the classes has really helped the teachers being able to more accommodate all the children and have time for each child”. Smaller class sizes allow for more collaborative work as stated by participant 6 when they said that in smaller classes it is “easier to do practicals” and participant 4 who observed that smaller class sizes results in more “personal attention.”

Conclusion

The data presented in this chapter describes the factors that Grade 9 teachers perceive to influence mathematics learning and performance.

It appeared that learners need to learn skills and concepts correctly to develop an in-depth understanding of mathematics which in turn results in increased mathematics performance.

Teachers also perceived a lack of leaner motivation as a factor that influences mathematics learning and performance. Additionally, participants identified intrinsic factors associated with learners that influence mathematics such as, lack of motivation, self-confidence, and poor attitudes towards mathematics. Issues related to the curriculum were also noted to impact learning and performance, focusing on structure, content, and time restraints.

Furthermore, the learners background was observed to influence mathematics learning and performance in terms of the impact of language, the role of parents and caregivers and the impact on later academic success. Social media and technology were also noted to be an important factor influencing mathematics learning and performance both positively and negatively.

Finally, participants perceived several factors that could support teachers and learners in the mathematics classroom such as, team collaboration and smaller class sizes.

Chapter 4: Discussion

Introduction

The purpose of this study was to explore teachers' perceptions of factors that they feel influence mathematics learning and performance. This chapter will discuss the findings in the order they were presented in Chapter 3. Teachers' perceptions have an important role to play in mathematics learning and performance as teachers play a crucial role in enhancing learner's achievements, motivation, and engagement in the subject (Areepattamannil & Kaur, 2013). However, there appears to be a lack of research that focused on the perceptions of Grade 9 teachers from private schools related to mathematics learning and performance.

In the study, twelve teachers from private schools were interviewed. This qualitative research was situated within Bandura's Social Learning Theory (1977) and focused specifically on Grade 9 mathematics teachers within the middle-class, socio-economic sector. The findings revealed numerous themes around teachers' perceptions of factors that influence mathematics learning and performance namely, the learning of mathematical skills to enhance understanding, and ultimately resulting in performance. Other factors that were perceived to impact on mathematics learning and performance included learner's intrinsic factors such as motivation, self-confidence, and attitude towards the subject. The curriculum was also perceived to impact mathematics learning and performance in relation to its structure and time constraints. Additionally, learners background and social media were perceived to influence mathematics learning and performance both positively and negatively. Finally, teacher perceived several support strategies that could influence mathematics learning and performance, namely smaller class sizes, and team collaboration.

4.1 The learning of mathematical skills to enhance understanding, and ultimately resulting in performance.

In response to both research question one and two, the findings in this study revealed that participants perceived mathematics learning and performance to be rooted in skills, concepts, and routines. They noted that skills, concepts, routines, and drills were crucial in order to understand and ultimately perform well in mathematics. Literature concurred with these findings, and it was suggested that mathematics is perceived to be a subject that requires a level of complex thinking and it is often labelled a difficult subject (Hidayatullah & Suprapti, 2020). Quantitative

studies on teachers' perceptions agree that learners that participate actively in their learning by engaging, reasoning, thinking, and discovering, exhibit increased mathematics success (Jackson, 2015). It has been observed that the ability for learners to learn mathematics requires initial examination into skills such as solving, analysing, and proving (Acharya, 2017). Makgato (2007) agreed that learners who perform well in mathematics appear to have the necessary skills and knowledge to understand the subject. This concurs with the findings of numerous participants. Skills are thus perceived to play a critical role in learners' achievements, motivation, and engagement (Areepattamannil & Kaur, 2013).

Participants in the study stated that it is equally important for learners to understand the concepts in order to develop a deeper understanding of the connectedness of concepts within the subject. Participants perceived a lack of internalising and thoroughly understanding of those skills on the part of the learner and thus resulting in decreased performance. This is in line with literature in which teachers observed that helping learners make links and 'see' the relationship between concepts is important and enhances critical thinking (Beswick, 2006).

Previous literature suggested that many children are noted to have difficulty following through on abstract concepts in mathematics and they lack basic skills which hinder their overall understanding of mathematics (Hidayatullah & Suprapti, 2020). This could be linked to Bandura's (1977) thoughts around modelling and the teacher's abilities in engaging the learner in the classroom. Brendefur et al. (2013), concurred that it was perceived that teaching for understanding begins with an instructional approach focusing on concepts and skills. Learners need to first understand the structural components of mathematics before they can develop in-depth understanding. Bandura (1977) explains that learning new skills comes from two areas. Firstly, from direct experience and secondly from observation and watching others and then replicating these observations. Is could be said that these essential mathematics skills could be enhanced by observing and copying those around them, such as teachers.

Fidele et al. (2019) stated that mathematics learning is a multifaceted process involving problem solving, logical thinking and reasoning abilities. Furthermore, teachers perceived mathematics learning as an active process which includes problem solving, reasoning and critical thinking (Jackson, 2015). Bandura (1977) believed that humans are a product of learning and we become what we have been taught. However, when learners observe a behaviour, they do not always learn that

specific behaviour due to various factors such as lack of desire in the subject, lack of retention or fluctuations in attention. Teachers perceived that only once these skills are properly learnt and understood can learners effectively perform in mathematics.

With this said, it is possible that without these skills and concepts in place, mathematics performance would be challenging. This was perceived by the majority of the participants that in order to perform, a learner needs substantial understanding of the foundational skills of mathematics. Thus, Mathematics learning and performance is the ability to build critical thinking, and to develop these skills, learners need to develop skills of reason (Hidayatullah & Suprapti, 2020).

Teachers is this study likewise perceived the importance of practice in relation to mathematics learning and performance. Practice was observed to impact on overall mathematical success. Literature based on insights of teachers highlighted the importance of hard work, continuous practice, endurance, and perseverance as essential characteristics linked to mathematics success (Fidele et al., 2019). The reality of mathematics learning and performance is the ability to apply oneself, practice and put in the effort (Hidayatullah & Suprapti, 2020). Half of the participants felt that practice is vital in order to succeed in the subject. Studies have revealed that educators perceived the need for greater opportunities to practice as this is necessary to build those basic concepts (Umugiraneza et al., 2018). Additionally, practice was observed to be needed in mathematics, and success is often determined by the amount of labour that has been applied (Acharya, 2017). The results of this study revealed that regular practice and effort was linked to greater understanding and ultimately more positive learning outcomes in mathematics. Participants similarly believed that increased practice results in better content understanding. Past studies concurred with this finding that indicate that mathematics performance is enhanced by the amount of time spent on practicing. Additionally, it was perceived by educators that learners became more confident and worked harder when they were allowed more time to practice (Maile, 2019).

4.2 The role of teacher motivation linked to mathematics learning and performance.

Findings from the current study revealed that teacher motivation is perceived to be linked to the motivation of learners and influences their mathematics learning and performance, answering both research questions. The role of the mathematics teachers is perceived to be multifaceted as they are seen as information providers,

motivators, mediators, and evaluators (Hidayatullah & Suprapti, 2020). Literature revealed that if teacher's motivation and attitudes are positive, then this has a positive impact on their learners and influences the learners' attitudes towards mathematics (Mokgwathi et al., 2019). Further studies concur that when teachers are perceived to engage the learner and create a supportive environment, then active learning can take place and students are motivated by this caring and motivated atmosphere (Fidele et al., 2019). Furthermore, research has explored that a positive relationship between teachers' motivation and leaners abilities positively impacts on learner engagement and overall mathematics performance. This is in line with Bandura's (1977) Social Learning Theory which stated that learner motivation and the ability to learn effectively is linked to the desire to learn. The learner will observe the teacher and may imitate their behaviour if there is a wish or drive to do so (Kurt, 2019). Therefore, a teacher who is motivated and encouraging may contribute towards increased mathematics success.

The Social Learning Theory (1977) explains that a learner will imitate the behaviour in class, therefore, a teacher who is engaging, and motivating may exhibit increased learner success. Teachers that appear encouraging can have a positive impact on learner success. Acharya (2017) agrees that a leaners education depends on the role of the teacher and their active involvement in the learning process. The Social Learning Theory (1977) supports this by explaining that change will occur in the learning process if the model, or teacher, is admired (Cherry, 2019). Further literature exploring teachers' perceptions suggested that teachers who were encouraging, interested in the subject and the learners, were considered positive role models and a key to mathematical success (Tsanwani et al., 2014). Participants identified the need for learners to be engaged, motivated and involved in the learning process and this results in learners enjoying and achieving better in the subject. Positive attitudes of teachers create positive direction and focus for the learner. Additionally, Areepattamannil and Kaur (2013) noted that teachers' beliefs in the learners in their class is linked to their own motivation to teach and witness academic success. Numerous studies have identified the importance of teacher motivation as being an important indicator of overall mathematics achievement, learner confidence and learners feeling inspired in the subject (Maile, 2019; Ramohapi et al., 2015; Tsanwani et al., 2014).

4.3 Learners intrinsic factors that impact on mathematics learning and performance.

Addressing research questions one and two, findings suggest that teachers perceive leaner motivation as being a critical factor relating to mathematics learning and performance. Learner motivation was identified by half of the participants as having an influence on mathematics learning and performance. Studies in Australia concur with this and suggest that teachers perceive motivation and engagements as critical components needed to enhance learner achievement (Areepattamannil & Kaur, 2013). Furthermore, if learners have a positive attitude towards mathematics and they engage and participant in the subject, they are then more motivated to learn, acquirer new ideas and are motivated to develop problem solving strategies (Umugiraneza et al., 2018). Additionally, Umugiraneza et al. (2018) stated that teachers were found to perceive that increasing leaner motivation was crucial because many leaners lack interest and cannot see the value in the subject. In another study examining teacher perceptions, it was noted that teachers perceived learner motivation as a primary factor linked to increased success and an important component for students learning and performance (Makgato, 2007). Based on teachers' perceptions, this is in line with Bandura's Social Learning Theory (1977) where Bandura explains that learning occurs with the assistance of learner motivation. It was perceived that mathematics learning needs to be directed to learners who exhibit effort to obtain information on mathematical problems and acknowledge that hard work and effort and desire to learn are all needed. (Hidayatullah & Suprapti, 2020). Another study to support the impact of learner motivation was conducted in Rwanda focusing on teachers' insights on mathematics teaching (Fidele et al., 2019). It stated that teachers believe that learner motivation is a vital component towards learning and that learners were motivated to learn by caring teachers. This supports Banduras (1977) idea that learning will best occur when the teacher exhibits characteristics such as positive praise and encouragement. Therefore, it can be said that motivation is observed to stimulate the desire and energy in learners to remain interested and committed to learning (Acharya, 2017).

The teachers were found to perceive learner self-efficacy as an influence on their learning and is closely linked to intrinsic motivation. As Bandura (1985) indicated, in an environment like a mathematics classroom in which learners have some responsibility for their learning, their increase autonomy aligns with Bandura's Social

Learning Theory which speaks to the role of self-efficacy on how individuals are able to learn, as learning is impacted by self-efficacy, a person's belief in themselves (Siegel, 1985). This current study revealed that motivation was linked to confidence and in order to achieve in mathematics, learners need to build positive beliefs in themselves, which establishes confidence in the subject. Therefore, developing self-efficacy can impact on confidence, motivation, and willingness (Bandura, 1977). Educators perceived that confidence in a learners own understanding may allow learners to explore new concepts and ideas and persevere when faced with mathematical challenges (Anthony & Walshaw, 2009).

The findings of this study also suggest that most of the participants identified learner attitude as a critical influence on mathematics learning and performance. Learners appear to be overwhelmed by the subject, show a lack of interest, and even fear the subject. Local studies on the perceptions of teachers that facilitate learner's performance in mathematics agree, and state that advocating for a learner, increases their attitudes and ultimately their success in the subject (Tsanwani et al., 2014). Literature examining teachers' perceptions about improving the teaching of mathematics agreed and noted that learners who exhibit confidence often scored higher in the subject (Umugiraneza et al., 2018). International studies on teachers' perceptions concur with the findings and suggest that negative attitudes of the learners towards mathematics can potentially affect engagement and the ability to cope effectively in the classroom (Jackson, 2015).

Attitudes may also be established from their self-perceived abilities, self -efficacy and support from their teachers. When students are surrounded by positive influences, they will be affected in a positive way (Mohr-Schroeder et al., 2017). Teachers claim that their positive support develops learners' positive attitudes. This is rooted in the Social Learning Theory (1977) which states that teachers have the capacity to influence learners and develop an environment for positive or negative learning experiences (Siegel,1985). As mentioned, Bandura (1977) stated that self-efficacy is the root of the Social Learning Theory as without self-belief, mathematics can be a challenging subject to succeed in.

4.4 Perceptions of the curriculum in relation to mathematics learning and performance

In response to both research questions, half of the participants in this study noted the importance of the curriculum and its impact on Grade 9 mathematics learning

and performance. The structure and content of the curriculum was identified as being too crammed, overwhelming, complex, and ultimately not conductive to successful mathematics learning and performance. There is limited research that supports these findings; however, one international study suggested that teachers perceive the curriculum as being difficult to complete as there appears to be a lack of structure and time in the lessons and many teachers and learners alike find it boring and dull (Bol & Berry, 2005).

This study identified time as being one of the most critical components related to the curriculum which hinders overall learning and performance as not enough time is allowed for repetition, reinforcement, and reflection. Similarly, Bol and Berry (2005) in their research on teachers' perceptions found that teachers felt that not enough time is allocated for mathematics due to the amount of content expected to be completed in the academic year. Bol and Berry (2005) conducted their quantitative research on a range of grade teachers from a public school yet even in private middle-class schools, these issues related to curriculum still apply. Furthermore, mathematics is one of those complex subjects and time is needed to learn and understand (Acharya ,2017). The majority of teachers felt that there were too many concepts and not enough time to go in-depth and understand the content fully.

4.5 The impact of language and the role of caregivers on mathematics learning and performance

Half of the participants of this study agreed that language is a barrier to overall success in mathematics. According to Truxaw and Rojas (2014), language is critical to teaching and learning for all students as it is the primary tool to allow us to communicate ideas, concepts and ultimately understanding. The literature suggests that language is perceived by teachers as a significant factor towards learning and performance in mathematics, as it is a subject that can be difficult to understand due to complex and abstract concepts (Ramohapi et al., 2015). Bol and Berry (2005) stated that there is a strong correlation between English language proficiency and mathematics achievement. This study suggests that the vocabulary associated with mathematics is unique and dependent on deeper understanding in order to connect concepts. Maile (2019) agreed in saying that the language of mathematics does not form part of a person's normal vocabulary. The language used in mathematics is perceived to be difficult to understand as it uses vocabulary which is particular to the subject (Ramohapi et al., 2015). Considering the impact of language within the Social Learning Theory (1977), language needs to be modelled by teachers who

exhibit competency in the subject which may result in greater learning and performance (Anthony & Walshaw, 2009). Explicit language modelling is a critical factor perceived by participants in order to convey clear understanding of concepts and ultimately greater understanding of the subject. Participants felt that due to the diversity of languages in South Africa, even in a private middle-class school, language poses a challenge for many learners, as comprehension can be compromised when having difficulty understanding more complex concepts. Similarly, a quantitative study focusing of teacher perceptions revealed that student proficiency in English was a strong indicator of mathematics success (Tsanwani et al., 2014). Visser et al. (2015) agreed and stated that learners perform better if their language at home matched the language in the educational environment, yet this is difficulty in a multilingual country like South Africa. Language is perceived to have an impact on a learner's attitude and self-efficacy (Bandura, 1977). Self-efficacy is associated with effort, persistence and resilience which all have consequences on academic performance (Truxaw & Rojas, 2014).

Along with language, the role of caregivers was perceived to influence mathematics learning and performance. Similarly, a previous study on teachers' perceptions on mathematics learning found that teachers observed parental support, nurturing, and a stimulating environment as important factors relating to overall academic success (Makgato, 2007). The majority of the participants in this current study concurred that children who have stimulation at home, with parents that provide an enriching experience, appear to progress well in mathematics. In the literature, it was identified that teachers perceived the role of parents and caregivers as being an important factor in terms of providing encouragement and motivating their children (Makgato, 2007). Furthermore, previous literature concurs and stated that it was observed by teachers that enhanced learning occurs when learners are provided with learning opportunities and positive modelled behaviour (Ramohapi et al., 2015). Mji and Makgato (2006) agreed that parents can be a stable, positive influence and this can in turn enhance academic achievement.

Additionally, parental skills and competency for the subject were also identified as an important factor which paves a foundation for future successes. Visser et al., (2015) explained that many parents feel inadequate and incompetent in their own abilities in the subject. Mohr-Schroeder et al. (2017) agrees that parents who experience deficiencies in mathematics feel less capable to support their children and this may reflect in the attitudes of their children. Although these studies were not based on

teachers' perceptions, it supports the findings in this study. The findings of this theme answered both research questions, indicating that teachers perceive that parental input assists and increases the learning process and impacts on mathematics learning and performance.

4.6 The advantages and disadvantages of social media on mathematics learning and performance.

The use of social media was identified as playing an important role in mathematics learning and performance with both positive and negative outcomes, thus addressing research questions one and two. Teachers perceive the exposure to technology as both an agent to facilitate learning and limits the learner's engagement in the subject (Bansilal, 2015). However, the use of technology in our schools has become an essential learning tool (Maile, 2019). Literature examining teachers' perceptions about improving mathematics acknowledges the importance of technology and social media as it allows the teacher access to greater content and material to use in the classroom and support the learners (Umugiraneza et al., 2018). Additionally, the digital tools for effective teaching and potentially enhancing learner interest in the subject (Umugiraneza et al., 2018). According to Hidayatullah and Suprapti (2020), more and more learning occurs via the use of visual tools such as YouTube or Instagram. As this is the communication and technological era, many children are relying on devices to assist them in their learning. It was perceived that social media allows learners to gain new insights into different strategies that may support them in the classroom (Umugiraneza et al., 2018). Further studies agree that teachers perceive the need to embrace technology as a means to connect with the learners and create a stimulating, relevant learning experience (Bansilal, 2015). Furthermore, teachers felt that the use of technology can be used to assist in closing the gaps in the learner's lack of basic knowledge and skills in the subject, as revealed in this study (Bansilal, 2015). The findings of this study suggests that social media has raised a new type of relationship between teacher and learner. Although Bandura's Social Learning Theory does not examine the impact of social media, symbolic modelling allows the learner the ability to imitate learning online which may increase the learner's ability to learn by observing different kinds of strategies found on social media sites. Technology allows for the learners to be exposed and observe different representations of concepts to assist in their understanding and learning (Bansilal, 2015). Therefore, teachers will benefit from exploring and recommending sites that learners feel inspired to follow which may add to learners' interest in the subject.

Participants felt that the use of social media allows for more engagement and increases the interest of learners. It was perceived by teachers that learners prefer the colour and instant use of social media as they appear to get easily bored with conventional methods (Hidayatullah & Suprapti, 2020). Therefore, some learners may thrive in a classroom that utilises social media as it lends to various learning styles.

Although the use of social media has its advantages, it was perceived by most of the participants in this study as a disadvantage as most of the information that is being accessed it not educational or mathematical. Literature on teachers' perceptions based on technology and its impact on mathematics indicated that technology may decrease learner's engagement and lessen their need to work independently (Bansilal, 2015). This is in line with the study which suggests that many learners seek instant gratification which they receive from social media, as they lack perseverance and patience in mathematics. Hidayatullah and Suprapti (2020) explained that it is the responsibility of the teacher to guide and facilitate learners towards social media that is both beneficial and at the level in which the learners can access the information. Furthermore, teachers need to encourage critical thinking over instant gratification. When observing the Social Learning Theory (1977) individuals are a product of learning thus the learners may be influenced by the behaviour of the teacher who engages in educational technology which could result in increased mathematical understanding and achievement.

4.7 Support strategies perceived by teachers that impact on mathematics learning and performance.

There were several strategies that were perceived by the participants to influence Grade 9 mathematics learning and performance and answered both the research questions.

Literature suggests that collaborative practises between mathematics teachers appears to enhance learning and performance in mathematics (Arends et al., 2017). This study revealed that half of the teachers felt that collaborative teamwork and mentoring could benefit all learners in the mathematics classroom. Teachers felt that if they work together, this will be in the best interest of the learners and support them in grasping core mathematical ideas. Literature related to teachers' perceptions on collaboration, concurs that teamwork increases communication, ideas are well shared and generates alternative teaching practices which are all directly related to

effective learning practices (Herro & Quigley, 2017). These partnerships are a way to share ideas, discuss strategies and engage in skill distributing. Furthermore, the idea of team collaboration allows the learners exposure to different teaching styles, challenges learners thinking and the possibility of increased understand due to different support strategies being utilised. The Social Learning Theory (1977) supports this collaboration, as teachers can observe various teaching styles and imitate different approached which may benefit learners in the classroom and possibly result in increased mathematics achievement. Furthermore, teachers that observe and model the practices of other teachers, are able to adapt and reproduce these new skills in the classroom (Watson, 2013).

Smaller class sizes were also perceived by most of the participants as having an impact on mathematics learning and performance. Bol and Berry (2005), stated that small class sizes equate to well guided classes and resulted in increased achievement. This is related to the Social Learning Theory (1977) as the individual attention by teachers may allow for increased focus and imitation of positive teaching styles which can result in greater engagement and change in behaviour in the mathematics classroom for the learner. The benefits of smaller class sizes allow learners greater individual attention, more focus on their needs and increased time to engage in practical activities that could increase retention and understanding.

From the discussion above, and in response to the two research questions, teachers perceive a range of factors to influence mathematics learning and performance and these factors may impact overall mathematics achievement and future successes.

4.8 Limitations

The current study identified factors perceived by teachers to influence mathematics learning and performance from the perspective of a Grade 9 teachers in a private school context. As the sample was selected from private, middle-class schools only, a large portion of the South African population was excluded, and thus findings may not be transferable to teachers across socio-economic backgrounds, and this is worth exploring in the future. Additionally, ten of the twelve participants were white, female teachers and this may have impacted on exploring broader perspectives from various cultural backgrounds.

Furthermore, methodological choices were constrained as qualitative research relies upon the experience of the researcher, who in this case was a novice. In qualitative research, data cannot be quantified, and the procedure is not as structured and

formal as quantitative which may have resulted in the collection of different aspects of data (Queiros, Faria, & Almeida, 2017). Additionally, as the study was not quantitative in nature, the findings cannot be generalized.

From previous journal entries, one of the greatest challenges was to access the schools and the principals. During the COVID-19 national lockdown, schools were in chaos and staff and management were having difficulty with school procedures and did not have the capacity to focus on the researcher's request. Thus, communication and commitment were a major stumbling block in the initial stages of the data collection. However, once the initial contact by the first principal occurred and permission was granted, then they assisted the researcher in contacting schools within the same school sector.

A significant and unavoidable limitation was the COVID-19 national restrictions. This prevented the researcher from gaining access onto the school grounds and participate in face-to-face interviews. Potter and Hepburn (2005) stated that interview-based research fails to acknowledge the social interaction between the researcher and interviewee. Due to social distancing protocols, there was limited access to the participants and therefore online interviews were scheduled. Conducting online interviews may have interfered with interpretations due to time restraints, connectivity issues and load shedding challenges. Furthermore, the interviews were organised around the availability of the teachers as they were under pressure due to new online teaching practices and extensive changes in the educational programme. Due to this time limitation, the collection of rich data may have been disrupted. However, the teachers were accommodated by scheduling interviews at a time convenient to them such as weekends, evenings and during exam invigilation but these also came with significant time restraints.

A further limitation caused by COVID-19 was the inability to proceed with member checking. Member checking is the process of validating the participants responses and to ascertain the credibility of the data (Birt, Scott, Cavers, Campbell, & Walter, 2016). Due to time constraints faced by participants, member checking was not conducted. This could be a limitation as the researcher's personal beliefs may have been imposed; however, the researcher was actively aware of personal bias throughout the interview process by engaging in self-reflexivity.

4.9 Recommendations

While the aims of the research have been met and the two research questions answered, there remains a lot of work to be done in identify factors that impact learning and performance at a Grade 9 level. Based on the study, a larger and more diverse sample size could possibly have been included to gain a wider viewpoint of teacher perceptions across socio-economic sectors.

Based on the above limitations, a variety of recommendations are noted. A larger sample would possibly yield richer data. Applying different types of qualitative research may yield relevant date such as the use of observation, case studies or focused group (Queiros et al., 2017). Additionally, a range of ethnic and cultural backgrounds could possibly produce richer information and perhaps explore more factors perceived by teachers that influence mathematics learning and performance.

As the COVID-19 restrictions appear to be lessening, the possibility of face-to-face interviews may be allowed in future which could result in more reliable gathering of data and allow for extended interviews which will perhaps allow for more probing questions.

Conclusion

Mathematics plays a key role in shaping how individuals engage in society (Anthony & Walshaw, 2009). The International Mathematics and Science Study (TIMSS), detailed South Africa as one of the lowest performing countries in mathematics (Reddy et al., 2017). Jojo (2019) explains that mathematics is critical for the growth of an economy and in order to achieve this, schools need to strengthen mathematics learning and performance. Considering the importance of mathematics (Shay, 2019), it is imperative to explore factors that contribute to the improvement of mathematics learning and performance. Teachers' perceptions have a central role to play in mathematics learning and performance as teachers play an important role in enhancing learner's achievements, motivation, and engagement in the subject (Areepattamannil & Kaur, 2013).

Not much is known about the perceptions of Grade 9 mathematics teachers in the private school sector and the factors they perceive to influence mathematics learning and performance. This study, therefore, contributes by exploring what can be perceived to improve overall mathematics in the South African context. Furthermore, studies are limited with regards to teachers' perceptions in private schools and this study may add to the body of knowledge that could aid in increasing mathematics

learning and performance across this sector of South African schools and ultimately lead to increased mathematical success within this context.

This qualitative research was situated within Bandura's Social Learning Theory (1977) and focused specifically on Grade 9 mathematics teachers in private schools within the middle-class, socio-economic sector of Gauteng. The study recruited twelve participants and the instrument used was a semi-structured interview in order to gather rich and informative information.

This study revealed teachers' perceptions related to mathematics learning and performance were mostly concerned about acknowledging the interconnectedness between mathematics learning and mathematics performance. The participants emphasised that without the skills and concepts firmly in place, deeper understanding and connectivity may be impacted, which could result in decreased performance. Other perceived factors included teachers need to motivate learners to achieve in mathematics. Additionally, numerous intrinsic factors by the learners were perceived to influence mathematics learning and performance, namely motivation, self-confidence, and attitudes. The curriculum was identified as an influencing factor related to mathematics learning and performance as the structure and content appeared to be limiting the ability to complete the curriculum thoroughly and in an appropriate time. It was found that language has a significant impact on mathematics learning and performance as perceived by the participants as mathematics was identified as being a unique language and one that needs significant support to facilitate deeper understanding. Teachers also perceived social media as an advantage and disadvantage related to mathematics achievement. Team collaboration and smaller class sizes were strategies perceived by teachers to support mathematics learning and performance.

Overall, the study indicated that there are various and important factors that teachers perceive to influence mathematics learning and performance which may play a role in supporting Grade 9 learners. This study could contribute to increased support strategies and the implementation of future programmes that may enhance mathematics learning and performance.

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Appendix A – Adapted interview schedule

Good day

My name is Nina. We communicated via email. I would like to thank you for agreeing to participate in my study. With the growing concerns regarding mathematics achievement in school, my study focuses on understanding the factors influencing mathematics learning and performance from the perspective of mathematics teachers in secondary schools. I hope to add to the body of information that can be used to develop support strategies in the subject.

With your permission, I am going to record this interview, but I would like to assure you that everything you say during this interview will be kept confidential, and only my supervisor and I will have access to the recordings. The recordings and transcripts will be kept under a password protected computer for three years. This is primarily to facilitate the publication of the study. After that time, they will be destroyed. Although I know who you are, confidentiality will be maintained by not disclosing any information that is of a personal nature in the report. I will allocate a pseudonym to your personal information in the report.

I would like to remind you that you have the right to withdraw from the study at any time during the interview without any negative consequences to you or the school. You also have the right to refrain from answering any questions. A feedback sheet in the form of a summary of the study and its findings will be provided to you upon your request. Please send me an email if you would like to receive feedback. The feedback will be available approximately six months after the collection of the data.

Before we begin, I would just like to confirm the information on the two consent forms (appendix 4 & 5) that I have already received from you. This is to confirm that you are aware of the information regarding confidentiality, feedback and privacy.

Thank you. I believe we are ready to begin.

Section 1: Contextual questions

1. How long have you been teaching mathematics?
2. How long have you been teaching in a private school?
3. How long have you been teaching Grade 9 learners?
4. What are the learner's general attitudes towards mathematics at your school?

5. What are the general problems you encounter while assisting learners?

Section 2: Teachers' perceptions towards mathematics learning and performance

6. What difference do you think there is between mathematics learning and mathematics performance?
7. How do you feel about teaching mathematics?
    a. What are some of the positive aspects of teaching Grade 9 mathematics?
    b. What are some of the problems you notice while teaching Grade 9 mathematics? Why do you think these problems exist?
8. What factors do you perceive to influence Grade 9 students learning of mathematics?
9. What factors do you perceive to influence Grade 9 students performance in mathematics?
10. Of all the factors you have raised as influencing mathematics learning and performance, which do you feel are the most important and why?
11. What role to you think students' backgrounds play in their learning and performance of mathematics?
12. How do you think society influences Grade 9 students learning and performances in mathematics?
13. What role do you think gender differences has on mathematics learning and performance?
14. What role do you think language plays on mathematics learning and performance?
15. Do you feel that the mathematics curriculum is conductive to mathematics learning and performance?
16. What strategies would you suggest need to be implemented to support Grade 9 students mathematics learning and performance?
17. What could be included to support teachers in the mathematics classroom?
18. Do you have any further questions to ask me?

Thank you for your participation. It is greatly appreciated!

Appendix B – Ethical Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT ETHICS COMMITTEE
CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

CLEARANCE CERTIFICATE:	**PROTOCOL NUMBER: MEDPSYC/20/05**
PROJECT TITLE:	Teachers' perceptions of factors influencing mathematics learning and performance
INVESTIGATOR	de Jong Nina (2368166)
SCHOOL/DEPARTMENT OF INVESTIGATOR	SHCD/Psychology
DATE CONSIDERED	11 June 2020
DECISION OF THE COMMITTEE	Approved unconditionally
RISK LEVEL	Minimal Risk
EXPIRY DATE	31 December 2022

ISSUE DATE OF CERTIFICATE 21 June 2020 **CHAIRPERSON** _____
(Prof. Zaytoon Amod)

cc: Ms Nabeelah Bemath (Supervisor)

DECLARATION OF INVESTIGATOR

To be completed in duplicate and **ONE COPY** returned to the Chairperson of the School/Department ethics committee.

I fully understand the conditions under which I am are authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.

_____ 29 / 04 / 2021
Signature **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix C – Approach Letter

Psychology

School of Human & Community Development

University of the Witwatersrand

Private Bag 3, Wits, 2050

Tel: 011 717 4503 Fax: 086 553 4913

Dear Sir/Madam May 2020

My name is Nina de Jong. I am currently completing my Master's degree in Educational Psychology at the University of the Witwatersrand. As part of the degree, I am conducting research exploring Grade 9 mathematics teachers' perceptions of the factors that influence mathematics learning and performance. Considering South Africa's poor level of performance, teachers appear to play a critical role in enhancing mathematics learning. There appears to be a lack of research within middle class, private schools in South Africa and I would, therefore, like to invite you to participate in my study.

Participation will involve an interview of approximately one hour with Grade 9 mathematics teachers at your school who would be willing to volunteer in this study. The interviews will be conducted out of school hours at a time and date convenient for the potential participants. We will discuss their perceptions of the factors influencing mathematics leaning and performance. This study is of minimal risk as the possibility of harm is no larger than those imposed by everyday life in a general educational setting. The study is not considered harmful as the topic focuses on learning and not on social or emotional aspects of human functioning.

Though I will meet with the teachers online via MS Teams, their responses will remain confidential. Teachers' identities and information associated to the school will not be reported in my research report or any other publications. Upon completion of the study, I will be able to provide the school with an overall summary of the findings, if requested. Please note that ethical clearance for this study will be obtained from the Human Research Ethics Committee (non-medical) at the University of the Witwatersrand.

Should you have any concerns or complains regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email Shaun.Schoeman@wits.ac.za

It would be greatly appreciated if your school could assist me by participating in this study. Should you have any queries, please contact either myself or my supervisor, Nabeelah Bemath. My contact details and those of my supervisor appear below.

Thank you for your time.

Regards

Nina de Jong

E-mail: 2368155@students.wits.ac.za

Cell: 073 1404961

Nabeelah Bemath

E-mail:nabeelah.bemath@wits.ac.za

Appendix D: Consent form from the principal

Psychology

School of Human & Community Development

University of the Witwatersrand

Private Bag 3, Wits, 2050

Tel: 011 717 4503 Fax: 086 553 4913

I, _____ principal of

_____ (name of school), grant consent for Nina de Jong to conduct research at this school. I understand that participation in this study is voluntary and that all details will be kept confidential at all times. The school's name will also not be mentioned in the study further preserving the anonymity of responses.

The school will / will not require a summary of the results of the study.

Name: _____

Signed: _____

Date: _____

Appendix E: Participant Information Sheet

Psychology

School of Human & Community Development

University of the Witwatersrand

Private Bag 3, Wits, 2050

Tel: 011 717 4503 Fax: 086 553 4913

Dear Sir / Madam

My name is Nina de Jong. I am currently completing my Master's degree in Educational Psychology at the University of the Witwatersrand. As part of the degree, I am conducting research exploring Grade 9 mathematics teachers' perceptions of the factors that influence mathematics learning and performance. There appears to be a lack of research within middle class, private schools in South Africa and I would, therefore, like to invite you to participate in my study.

Participation will involve an interview of approximately one hour with a discussion around your perceptions of factors influencing mathematics learning and performance. The interviews will be conducted out of school hours at a time and date convenient for the potential participants. This study is of minimal risk as the possibility of harm is no larger than those imposed by everyday life in a general educational setting. The study is not considered harmful as the topic focuses on learning and not on social or emotional aspects of human functioning. Even though I will know who you are, your responses will remain confidential. Your identity and that of the school will not be reported in my research report or any other resulting publications. Upon completion of the study, I will be able to provide the school with an overall summary of the findings, if requested.

Should you have any concerns or complains regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email Shaun.Schoeman@wits.ac.za

It would be greatly appreciated if you assist me in participating in the study. Should you have any queries, you may contact either myself or my supervisor, Nabeelah Bemath. My contact details and those of my supervisor appear below.

Thank you for taking the time to read this letter. Please save it on your computer for further reference.

Regards

Nina de Jong

E-mail: 2368155@students.wits.ac.za

Cell: 073 1404961

Nabeelah Bemath

E-mail:nabeelah.bemath@wits.ac.za

Appendix F– Consent Form

Interview

Psychology

School of Human & Community Development

University of the Witwatersrand

Private Bag 3, Wits, 2050

Tel: 011 717 4503 Fax: 086 553 4913

I _____ consent to being interviewed by Nina de Jong for her study on the perceptions of teachers regarding factors that influence mathematics learning and performance. I understand the following:

- Participation in this study is voluntary
- I may withdraw my participation and / or my responses from the study at any time
- All information provided will remain confidential, although I may be quoted in the research report
- If I am quoted, a pseudonym will be used e.g., Participant 1
- None of my identifiable information or that of the school will be included in the research report
- I am aware that the results of the study will be reported in the form of a research report for the partial completion of the degree, master's in educational psychology
- The research may also be presented at the local or international conferences and published in a journal and/or article.

Signed: _____

Date: _____

Appendix G – Consent form

Recording

Psychology

School of Human & Community Development

University of the Witwatersrand

Private Bag 3, Wits, 2050

Tel: 011 717 4503 Fax: 086 553 4913

I _____ give my consent for my interview with Nina de Jong to be audio recorded via MS Teams or Zoom. I understand the following:

- The recorded interview and transcripts will not be seen or heard by anyone other than the researcher and their supervisor
- The recorded interview and transcripts will be kept under a password protected computer
- No identifying information will be used in the transcripts or the research report
- Although direct quotes from the interview will be used, the researcher will provide pseudonyms e.g. participant 1.

Signed: _____

Date: _____