THE EXPERIENCES OF TEACHERS IN THE TEACHING OF MATHEMATICS TO GRADE 3 LEARNERS THROUGH MOTHER TONGUE

by

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DEDICATION

This study is dedicated to:

- my father, Khazamula Piet Mashabane, and my late mother, Winnie Mashabane, for giving birth to me and emotionally loving me all my life.
- my husband, Martin Moshaba, and my children, Sthembile, Lerato and Thato, for tolerating my stress throughout the years and giving me compassionate support to chase my dreams.
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ABSTRACT

The researcher presents findings from a qualitative research study conducted in the Tshwane North District of the Gauteng province in South Africa. Evidence from the literature suggests that the use of the mother tongue as the Language of Learning and Teaching (LoLT) in mathematics teaching contributes significantly to the quality of teaching and learning. The study used semi-structured interviews to discover teachers' experiences teaching Mathematics to Grade 3 learners in their mother tongue. A constructivist interpretivist approach was used, followed by balanced, sound and educationally accountable recommendations, resulting in a model proposed as a strategy to use when utilising the learners' mother tongue as the language of learning and teaching in the Foundation Phase. The study is underpinned by the theories of social constructivism and intellectual development developed by Piaget, Ernest and Vygotsky, and the ecological human development theory of Bronfenbrenner. Document analysis and semi-structured in-depth interviews were used to explore the understanding of the Grade 3 teachers teaching mathematics in a mother tongue, the techniques they used to ensure effectiveness, and their challenges. The theories were an effective lens that empowered the researcher to see the link between the use of mother tongue and Mathematics instruction. The study revealed that the Grade 3 teachers understood mother-tongue teaching as a multicultural reality that entails the holistic development of learners, teachers' competencies and professionalism, learning achievement, innovations and contextual issues. The study showed that the teachers believe they are effective in supporting Grade 3 learners and improving learning. However, they experience mother-tongue challenges, inadequate training of teachers, and difficulties in enforcing educational standards, rules, regulations and laws. The constitutional imperative is the challenge, which advocates. The unique contribution of the study is that mother-tongue teaching and learning can best be achieved using *translanguaging.* This innovative instructional strategy shows insightful results that uphold the merits of all languages in the instructional act. Policies, practices, and future studies need to explore the dynamics and characteristics of the different school contexts to ensure quality learning and teaching in primary schools.

KEYWORDS: Mother tongue, Mathematics, Language of instruction, Language of Learning and Teaching (LoLT), Multicultural reality, Teacher competencies, Language policy, Translanguaging.

LIST OF ACRONYMS AND ABBREVIATIONS

ANA	:	Annual National Assessment
ATP	:	Annual Teaching Plan
CAPS	:	Curriculum and Assessment Policy Statement
CHE	:	Council on Higher Education
DBE	:	South Africa, Department of Basic Education
DoE	:	South Africa, Department of Education
ESL	:	English Second Language
FP	:	Foundation Phase
GDE	:	Gauteng Department of Education
GPLMS	:	Gauteng Primary Language and Mathematics Strategy
HL	:	home language
LIC	:	language of the immediate community
LiEP	:	Language in Education Policy
LIE	:	language of the immediate environment
LoLT	:	language of learning and teaching
MKO	:	more knowledgeable other
MT	:	mother tongue
NCS	:	National Curriculum Statement
NPC	:	National Planning Commission
SACMEQ	:	Southern and Eastern Africa Consortium for Monitoring
TIMSS	:	Trends in International Mathematics and Science Study

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CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND

It is generally believed that teaching Mathematics in their mother tongue (MT) is easier for teachers (Hafiz & Farik, 2016:125). However, closer scrutiny of this topic reveals that changing from English to mother tongue (MT) as the language of instruction or what is currently known as a language of learning and teaching (LoLT) in Grade 3 Mathematics, is a challenge to most teachers (Makeleni & Sethusha, 2014:107). A study by (Cekiso, Meyiwa & Mashige, 2019) also revealed that teachers encountered numerous difficulties in teaching mathematics and life skills using isiXhosa as a medium because of a lack of vocabulary to match mathematics and life skills concepts. The question of MT teaching is hotly contested in South African academia. Findings from studies such as Lafon (2009), Pretorius and Cumin (2010) state that learners' limited competence in their mother tongue is chiefly to blame for their poor acquisition of English as a second language (ESL) which inhibits their academic endeavours.

Learning and teaching are intricately interwoven with the cultural, cognitive, emotional, practical, and linguistic nuances (Vandeyar, 2009). According to Grandall (1998: 18), learners' failure to comprehend the language of instruction and the teachers' inability to assist them to impede their understanding of disciplinary concepts. However, according to Cammarata and Tedick (2012), the teachers struggle to integrate language skills and content knowledge due to competing issues involving expectations and identity. In support of the above, Khan (2016) emphasised that teaching in the native language has some paybacks and prompted world organizations to highlight children's education in the primary level using their native language.

The South African Constitution and Language in Education Policy (LiEP) promotes multilingualism in learning and teaching, explicitly using the 11 official languages (Department of Education, 1997). According to the 1996 LiEP, learners attending schools in townships should use their MT as the language of instruction; however, the learners in the township schools speak diverse languages. Previously, MT was not formally used as a LoLT in the Tshwane North township primary schools. Learners

were required to carry out all instructional and cognitive development activities in English. However, they did not have enough practice and competence in MT usage to support their learning (Bitenelkome, 2013).

In Foundation Phase, learners, as per the directive from the Department of Education, are taught in their home language, including the teaching of Mathematics up to Grade 3, requiring teachers to be competent in diverse MT languages. However, changing from English to mother tongue (MT) teaching in Grade 3 is a challenge for teachers teaching Mathematics in English (Makeleni & Sethusha, 2014). The linguistic skills drawn from diverse languages at the learners' disposal build their scholastic confidence and ushers in a democratic society (Brock-Utne & Holmarsdottir, 2004). In 1997, through the LiEP, the Department of Education gazetted the importance of the use of mother tongue in the primary level of the education system learning (Department of Education, 2010:6).

An essential aspect of LiEP (1997:106) is to promote multilingualism. 'Multilingualism' advocates for the learner's simultaneous proficiency in at least two languages; that is, their mother tongue and an additional language. The intention is that these two language levels are maintained and developed at the same time. The LiEP (1997:108) also states that, for its implementation, the one official language of instruction will be offered at Grades 1 and 2. At Grade 3, the schools add the language of instruction for the learners as a subject. The policy states that at Foundation Phase, the learners' home language should be used for instruction to promote literacy. Additionally, the guideline recommends a planned and scaffolded transition for learners from home to additional language instruction.

According to LiEP, in Grade 1, the learners learn the additional language as part of their curriculum and the home language used to enhance their literacy. In cases where the LoLT is the learners' different language, a scaffolding programme to assist the learners in reaching proficiency should be implemented to enhance their learning. According to Al Asmari (2014), there is merit in primary learners simultaneously developing ability in two or more languages as this overall improves their linguistic skills. However, Nyika (2015) recommended a bilingual process where the learners use their MT as the primary LoLT and another language is then introduced gradually. This suggests that learners must be proficient in their MT by Grade 4 to 5, mid-primary

school level, to transition to an international LoLT successfully. Learners who are introduced to an additional language alongside their MT at the primary stages can use it for scholarly communication throughout their academic journey (Blom, Boerma, Bosma, Cornips and Everaert, 2017).

In the context of this study, *Mathematics* refers to *numeracy*. The South African Constitution in 1996 altered the language policy in the education system by advocating for multilingualism through the recognition of the 11 official languages (Republic of South Africa, 1996) and increased the number of recognised official languages from two to 11. The language policy realised that there are benefits derived from MT education (BiteneIkome, 2010). The type of multilingualism recognised in each school is determined by the governing bodies (Mda, 2004). According to this policy, every child should have access to the language to allow meaningful engagement with the school curriculum. If the learners have not mastered the language used for learning and teaching, their academic, social and cognitive development and success will be limited (BiteneIkome, 2010). Therefore, MT teaching and learning requires an adequate level of proficiency in the MT.

Student teachers trained to become Mathematics teachers in colleges are still taught in English and therefore do not have the MT vocabulary for teaching Mathematics concepts (Ricablanca, 2014). Since learners taught Mathematics in Grade 3 are not all from the same language group (BiteneIkome, 2010), this study, therefore, focused on establishing the teachers' experiences in teaching Mathematics to Grade 3 learners using their mother tongue and on examining the challenges of teaching Mathematics in a diverse and multilingual class to learners from different provinces and across the borders of South Africa. The questions posed are whether Mathematics taught in a MT can be understood by all the native African language speakers; and whether there is a standard language (a language variety used by the majority of the township people) for public purposes, namely, a local dialect. The study sought to create the commonalities that would apply to all learners.

To address the above questions, the researcher focused on teacher experiences in teaching Grade 3 Mathematics in a MT because people in the township speak several languages. In addition, township learners' language is a mixture of languages from

different ethnic groups (Rudwick, 2009). According to the Department of Education, schools were encouraged to use MT as their LoLT because most township primary schools were cited as under-performing and language was highlighted as an inhibitor of effective learning. Teaching Grade 3 learners in an MT was to help improve learner performance (Coffi, 2017). Therefore, all schools were supposed to change their LoLT from English to MT. However, schools performing well continued teaching Mathematics in English as the LoLT, despite the language policy introduced.

1.2 PROBLEM STATEMENT

This paper is premised on the assumption that teachers teaching Mathematics to Grade 3 learners have experience in MT teaching and are competent to help improve learner performance. However, almost all qualified teachers were prepared to teach Mathematics using English as the language of instruction. This is problematic because, although these teachers are from the township and speak the MT used in the school, they have been trained to teach Mathematics using English as LoLT. This means they know using English to explain mathematical concepts, and they now must teach mathematical concepts in an MT. So the question is: Which mother tongue are teachers using to cater for all learners?

Some learners in the school, on the other hand, are from different ethnic groups and use other languages to communicate, which differ from the school's LoLT. The matter is complicated by the multicultural environment where the learners represent different cultures and mother tongues. Furthermore, in their initial teacher education, teachers are not prepared to teach in a MT, and this may cause challenges in facilitating teaching and learning for better understanding subject content; as a result, this might not result in effective learning, which is a prerequisite of the South African curriculum (BiteneIkome, 2010).

Heugh (2004) believes that the language competence required for academic success is challenging to attain in under-resourced schools located in rural and township schools where most learners are from diverse language groups. Many teachers struggle to support learners with limited English proficiency because of a lack of training, knowledge and approaches to adapt to MT teaching. Hence, the study examined teacher experiences and competence in teaching Grade 3 Mathematics in

a MT. Specifically, the study highlights the challenges experienced in teaching learners from diverse ethnic groups in MT instruction. Lemmer, cited in Le Roux (1993:149), explains that the acceptance of English as the LoLT in most African schools has not been harmonized with the instructional quality required for learners to use it as the LoLT effectively. It would also be an overstatement to say that learners learn better English without MT understanding. Hence the policy emphasises that English should be gradual to allow learners to reach a certain level of proficiency after they are competent in their MT (BiteneIkome, 2010).

The language policy assumes that all learners in the township primary schools speak the same language used as LoLT in the Grade 3 Foundation Phase (FP). Since the MTs do not have the terminology for most mathematical concepts, teachers may struggle to translate mathematical information from English to the MT. According to Royds and Dale-Jones (2012:3), the quality of MT translations made by some teachers of mathematical textbooks in South Africa was found unacceptable. As a result, some concepts were oversimplified and did not provide learners with the opportunity for higher-order thinking in mathematical tasks and activities (Roussouw, Rhodes & Christiansen, 1998). The result is that children learn without understanding, hence the many challenges experienced by teachers and children in Mathematics classrooms. This study, therefore, argues that, despite the MT being an accepted LoLT, it does not have prominence as an attribute in the development of children. Based on the context described above, this study sought to understand teachers' experiences in teaching Mathematics in a MT to Grade 3 learners in township schools.

1.3 RATIONALE OF THE STUDY

In constituting the study's rationale, the researcher borrowed from Rojon and Saunders (2012) that one should explain why it is critical to conduct the inquiry given the existing discourses and implications for practice. Based on the empirical findings emerging from the examination of teacher experiences in teaching Grade 3 Mathematics in an MT, this study hopes this study will succeed in redefining teacher experiences in MT teaching instead of how it is currently defined in the existing language policy education. The current literature displays growing concern about how education policies are increasingly becoming insensitive to the needs of the people they are serving and continue to affect the quality of teaching in schools.

The researcher's interest in the study stems from her experience as a former Mathematics Grade 3 teacher who struggled to explain and translate mathematical concepts into an MT. At the time, the LoLT in the primary school was English for all subjects, including Mathematics. Because of the poor performance in numeracy and literacy (the terms used for 'Mathematics' and 'languages' respectively before the policy was changed), the department declared that many township primary schools in Gauteng were underperforming (Karrim, 2020). From the findings of their study, Wuim and Louw (2011) highlighted that the performance of South African learners in numeracy was inferior and indicated the poor quality of education. As a result, MT was introduced as the LoLT. The challenge was that the prescribed Mathematics textbooks were found to be unacceptable for teaching learners Mathematics.

The poor quality of education that learners are currently receiving in South Africa infringes their constitutional rights. According to the South African Constitution, Section 29, the learners have a right to receive instruction in a language of their choice in all public institutions wherever practical (South Africa, 1996). Consequently, most public schools were compelled to change their LoLT from English to MT, which had practical implementation difficulties. According to Ball (2011), there might be challenges in using MT in Mathematics teaching especially given the multilingual context like South Africa. The choice of the languages for MT teaching is partially determined by the language used in the community. The challenge, however, is that choosing an MT for teaching Mathematics in the school from among the many alternatives in the township can result in a discrepancy in the LoLT and the language learners speak at home (Trudell, 2016).

Consequently, the choice of the LoLT might undermine the multilingualism stance as minority languages that are not part of the 11 official languages might be overlooked. The learners' MT is easier to implement in schools that are multiple monolingually-oriented such as in Belgium and Switzerland (Grin *et al*., 2003). However, South Africa, as a diverse linguistic country, can only be able to implement some of the MT in schools in line with the language predominantly spoken in a region as opposed to the actual learners' MT (Ball, 2011).

The state of affairs above provides a glance into the complicated world of MT teaching, where subjects taught to learners in MTs frequently call for the use of English because

the teacher experiences challenges. This orientation is reinforced by opinions that MT is a stop-gap for ensuring equity in learner teaching. The rationale of using English for teaching addresses teacher experiences in MT teaching to allow a meaningful engagement with the school curriculum (BiteneIkome, 2010). Findings from studies such as Mokibelo (2014) reveal that teachers affirm that the use of MT is a short-term solution - until there are resources for producing MT content and concepts and teachers trained to teach in MT. In addition, Bianco (2017) cautioned that the use of MT and the preservation of multilingualism should not infringe on minority language in the education system. There is a need to have governments work closely with schools to develop the proficiency of learners who are not proficient in the selected school MT (Trudell, 2016).

MT teaching for Mathematics is a challenge when doing number names; for example, when the teacher and learners must write down the numbers such as ‘45’, ‘70’ in words. During the Annual National Assessment, the challenge comes up when teachers are tempted to translate and explain to learners, but code-switching is not allowed. Navsaria, Pascoe and Kathard (2011) highlight that teacher training and support coupled with learners’ poor foundational skills are some of the challenges of implementing MT in schools. Although the LiEP advocates for MT as the LoLT, it is not always easy to use the learners’ specific MT in multilingual classrooms (Dicker, 2015:65). To limit these challenges and provide a seamless curriculum, many schools prefer to use English as the language of instruction to provide equality for all learners in Mathematics.

Donaldson (1987:5) encourages code-switching when teaching Mathematics. *Code-switching* refers to the simultaneous use of the learners’ MT and English syntax and words in writing and speaking. For example, using Xitsonga translation into English for ‘one plus one’ would be ‘Yi ringana na’ (instead of saying, ‘is equal to’). Telephone numbers would be ‘tandza, nhungu, mbirhi, mbirhi, mbirhi, nkombo, nhungu, tandza, tandza, na ntsevu’ for ‘zero, eight, two, two, two, seven, eight, zero, zero, six’ (082 227 8006). That is the practical application of numerals. It is also easier and a little more beneficial for the teacher and learners to recite: ‘n’we, mbirhi, nharhu, mune, ntlhanu, ntsevu, nkombo, nhungu, nkaye, khume’ (one, two, three, four, five, six, seven …), when doing mental maths or drill.

Foundation Phase (FP) teachers usually chose to use English as the language of instruction as opposed to MT, as the latter lacks teaching and learning materials (Revised National Curriculum Statement (DoE, 2005:13). Even though efforts have been made to obtain textbooks in MT for the Foundation Phase, the challenge is that learners will struggle when they reach university because the LoLT then will be English. This is not aligned with the purpose of the South African curriculum that advocates for a learner-centred approach in Mathematical instruction, meaning that the language chosen to teach Mathematics should not create a barrier to further studies (Revised National Curriculum Statement (DoE, 2003:23-24) in the learning and teaching material in Foundation Phase, and this may contribute to better development and comprehension of critical concepts in Mathematics.

The utilisation of MT and English should give learners the opportunity for global competitiveness. Even struggling learners can acquire the skills and knowledge they require for academic success in the modern world. When MT is used, it should enable the learners using technology (the internet) for Mathematics to acquire concepts in MT to use in research and communicating in English, thus the importance of having material available in the home language. Dearden's (2014) study highlighted that English has an esteemed status in countries where the majority of the learners use it as a second language and as a strategy for global citizenry. For example, in Hong Kong, English is used to prepare learners for the diverse linguistic needs in the business hub that is Hong Kong.

Another approach that allows younger people to learn a foreign language better, according to Johnstone (2009), is a lowered admission age. Many countries at the Bangalore Young Learners policy conference agreed to this because the more extended learning period leads to higher learning proficiency throughout schooling. By introducing a foreign language early (age six), future generations will be better equipped to communicate locally, regionally and globally. Crystal (2003) asserts that English is essential because it is a global language that is spoken and heard on television worldwide and is used on the signs and advertisements of countries travelled to, as well as by politicians all over the world.

1.4 Research Questions

The research enquiry is guided by the research questions, which align with the topic, purpose and problem statement, and the proposed research approach.

1.4.1 The main research question

How do Mathematics teachers use an MT to teach Grade 3 learners?

1.4.2 Sub-questions

The following sub-questions will be used to answer the main research question:

- How do Mathematics teachers explain Mathematics concepts to Grade 3 learners?
- What are the challenges experienced by teachers using a MT in teaching Grade Mathematics?
- How do Grade 3 teachers overcome the challenges experienced in teaching Mathematics through MT?
- What are the successes experienced in teaching Mathematics through MT?

1.5 RESEARCH AIM AND OBJECTIVES

1.5.1 Research aim

This study aims to explore how Mathematics teachers use MT to teach Grade 3 learners.

1.5.2 Research objectives

The objectives of the study are:

- To determine how Mathematics teachers explain Mathematics concepts to Grade 3 learners.
- To establish the challenges experienced by teachers using MT in teaching Grade Mathematics.
- To explore how Grade 3 teachers overcome the challenges experienced in teaching Mathematics through MT.

- To determine the successes experienced in teaching Mathematics through MT.

1.6 LITERATURE REVIEW

The literature reviewed in this study emphasised the use of home language by learners and its effect on their performance. None of the studies reviewed (Carey, 2013; Dicker, 2015; Hoffman, 2009; Marcaro, 2013; Makeleni & Sethusha, 2014; Navsaria *et al.,* 2011; Royds and Dale-Jones, 2012) investigates the teachers' experiences in teaching Grade 3 Mathematics through MT. Mji and Makgato (2006), advance arguments support the dominant discourse.

My study follows a different direction, which investigates how teachers are equipped with knowledge and skills to use MT in Mathematical instruction. This argument is supported by the Annual National Assessment (ANA) report (Department of Education., 2014), which shows that learners in independent schools where English is the language of instruction achieved better results than learners in public schools. Similarly, Dicker (2015) has researched the challenges Mathematics teachers face in multilingual classrooms and addressed the challenges. However, Dicker's study does not focus on the teaching of Mathematics in Grade 3 using MT. Furthermore, the study does not address how to improve the academic knowledge and skills in townships to guarantee that learners in schools located in the township have access to similar opportunities as learners in well-resourced schools.

In a study that explored the quality of education of South African learners from well-resourced schools, Van der Berg (2008) found that this small group of students received excellent educational opportunities. Unlike the learners in the study above, most learners in South Africa (80%) receive sub-standard education in under-resourced, rural and township schools that are usually dysfunctional. The above two reports suggest that the skills teachers have and the quality of the material that schools use are critical determinants of the type and quality of the enacted instructional environment. Although the researcher went into the field with assumptions on the findings, great care was taken to record the participants' reality of their Grade 3 classrooms meticulously. Drawn from the interpretive stance embraced in this study, the researcher entered the research sites with previous knowledge and some understanding of the research topic. She was alert to the complex, multifaceted and

unpredictable landscape of reality as perceived by each participant. The conceptual framework in this study was developed out of the theoretical frameworks that embrace the following three components: the teaching of Mathematics to FP learners, the teaching of Mathematics through MT, and FP teaching in general.

1.7 SIGNIFICANCE OF THE STUDY

The worth of the study is in its exploration of the pedagogical approaches used by Grade 3 teachers when MT is used as the LoLT. The study further highlights the skills and language proficiency teachers have acquired to teach Mathematics in MT and how this has enabled learners to have an adequate mastery of Mathematical disciplinary knowledge. The researcher, through this study, contributes to alternative approaches to teaching Grade 3 learners Mathematics using supportive linguistic resources that learners already bring to the classroom. One other value of the outcomes is a better understanding of how Mathematics could now be taught through MT in environments where Grade 3 learners with different MTs are accommodated in the same classroom

The knowledge base for teaching Mathematics in MT is critical for schools, parents, and principals to build a supportive structure for learners' success in Grade 3 Mathematic classes. In addition, it will minimise the knowledge gap in how home languages can be used in instructional environments to ensure parental involvement in the children's academic achievement. As a qualitative inquiry, the findings of this study cannot be generalised to other contexts. However, the depth in the data collection provides exciting insights that can be of interest to regulatory bodies as an example of how MT can be implemented.

Several teachers in schools were trained during the apartheid era, where compliance was enforced and thus lacked the necessary creative and innovative skills required to use MT as the LoLT (Mavimbela, 2001). Hence, the study provides practical information to aid decision making when school governing bodies decide on the language that learners use to speak and communicate about mathematical concepts at Grade 3 level, against a background of the latter's Constitutional right. The Department of Education is set to benefit from the findings in this study to understand the strategies used to implement school language policies.

1.8 Delimitations and Limitations of the Study

This study's primary focus was on primary schools, especially the Grade 3 teachers in the Foundation Phase, who teach Mathematics through MT. The research site was Gauteng in Tshwane, in the North District, with 70 primary schools. To answer the research questions, five primary schools were sampled. In line with voluntary participation, a sample size of teachers was selected as participants in the study. The aspects of the study that the researcher has no control over but have the possibility of negatively impacting the inquiry's findings are called limitations (Gay & Airasian, 2000: 625).

The scholarly outputs such as books, policy documents and articles will be published internationally and locally. This inquiry aims not to generalise the findings but rather to address selected concepts to understand the phenomena. Moreover, the study of Mathematics and MT is broad. However, this study only focuses on teacher experiences which is an aspect of the disciplinary discourses.

1.9 CONCEPT CLARIFICATION

1.9.1 Mother tongue/Home language

Mother tongue (MT): According to the Department of Basic Education (2010:3), MT defines" … the language that a learner has acquired in their early years, which has typically become their natural instrument of thought and communication." *Home language* (HL) refers to the learners' language in daily touch at home and in the community. The LiEP promotes the use of MT in learning and teaching. However, according to Howie, Venter and Van Staden (2008) in South Africa, more than 80% of learners do not receive instruction in their MT.

1.9.2 English as Second Language (ESL)

ESL is the language that learners learn in school alongside their MT. It is also referred to as the first additional language (FAL). According to the DBE (2011), in South Africa, English is the language of instruction from Grade 4. ESL, therefore, refers to English as the LoLT for learners whose language is not their mother tongue (Clarke, 2009).

1.9.3 Language of learning and teaching (LoLT)

The LoLT, according to DBE (2010:3), “is the language medium in which learning and teaching, including assessment, takes place.” (It is also referred to as the *language of instruction*. Therefore, the school must select LoLT that enhances the learners’ learning experience as failure to inhibit their academic achievement (Igbojinwaekwu & Dorgu, 2015).

1.9.4 Mathematics

Section 2.2 of the CAPS document defines “Mathematics as a language that makes use of symbols and motions for describing numerical, geometric and graphical relationships; a human activity that involves observing, representing and investigating patterns and qualitative relationships in physical and social phenomena, and between mathematical objects themselves. It helps to develop mental processing and enhances logical and critical thinking, accuracy and problem-solving that will contribute to decision-making” (Department of Education, 2011:3). Mathematics is also described as the foundational skills that learners require to use in their daily lives, such as business transitions (Coffey, 2011:3). The success of teaching these mathematical concepts rests with the promotion of communication and language skills. (Ní Ríordáin, Coben & Miller-Reilly, 2015:9).

1.9.5 Code-switching

The DBE (2010:3) explains that code-switching refers “to switching from one language of instruction to another language of instruction during teaching and learning” . the terms *code-switching and code-mixing* are used indistinguishably. The need to code-switch from one language to another in a teaching and learning situation where learners are from diverse race groupings poses an extra burden on the teacher.

1.9.6 Bilingualism/Multilingualism

According to the DBE (2010:3), “bilingualism refers to the ability to communicate effectively in two languages, with more or less the same degree of proficiency in both languages; and multilingualism refers to the ability to speak more than two languages or to be proficient in many languages”. While Ní Ríordáin, Coben and Miller-Reilly (2015:9) highlight that “we are aware that there are differences between these

contexts for bilingual and multilingual learners, and that more than one language that may be involved, for example, Breton as well as French in France, there are multiple languages in South Africa".

1.9.7 Foundation Phase

The learners in Grades R, 1, 2 and 3, aged between 6 to 9, are in the Foundation Phase of the South African education system. The phase is four years long and begins with a reception year known as Grade R. Life Skills, Literacy, and Mathematics are the most important subjects. This study concentrates on the instructional practices of Mathematics in the mother tongue to Grade 3 learners.

1.9.8 Grade 3 learners

Learners in Grade 3 are in their third year of formal schooling and the fourth and final year of the Foundation Phase. Wikipedia Free Encyclopaedia (online) defines Grade 3 as equivalent to Year 4, the fourth year of primary education (elementary schooling) in many countries, including the UK, Brazil and Canada. Learners are aged 9 or 8, sometimes depending on when their birthday occurs.

1.9.9 Language of the Immediate Community (LIC)

A language recognised and spoken by a community, even if it is not their first language.

1.9.10 Language of the Immediate Environment (LIE)

Synonymous with 'language of the immediate community'.

1.10 OUTLINE OF CHAPTERS

This thesis is organised into six chapters. In the introductory chapter, the context of the chapter establishes the trends in the scholarly literature. In the second chapter, a comprehensive review of the literature around the teaching of Mathematics through a mother tongue is explored. Chapter 3 discusses the theoretical framework for using a mother tongue to teach. Chapter 4 articulates the research approach and the methods employed. The presentation, analysis and interpretation of data are contained in

Chapter 5. The conclusions and recommendations emanating from the findings are discussed in Chapter 6. The content of each chapter is specifically discussed below.

Chapter 1

This is a preliminary chapter that foregrounds the inquiry and locates it in the teaching of Mathematics using the mother tongue. The chapter aligns the practice to the context-specific realities in the South African environment and contains the study problem and rationale based on the current research findings. It articulates the questions that guided the study and lays the foundation for the methods and approaches used to generate, analyse, and interpret the results.

Chapter 2

A presentation and synthesis of the literature on the construct of mother tongue use for teaching Mathematics in terms of four themes: The first theme relates to how Mathematics teachers teach Mathematics concepts to Grade 3 learners; the second theme is on the challenges experienced by teachers using MT for teaching Grade 3 Mathematics; the third theme is on how Grade 3 teachers overcome the challenges encountered in teaching Mathematics through MT, and the fourth theme relates to the successes experienced in teaching Mathematics through MT is detailed in this chapter.

Chapter 3

The chapter contains the theoretical orientations that directed the study. It illustrates the teaching of Mathematics through mother tongue to township primary school learners in a multilingual class, continually reflecting on the current influence of doing this in the primary school Foundation Phase.

Chapter 4

The approach taken in the study is discussed in this chapter. The research design and case study are highlighted and aligned to the research questions and the how and why questions. In addition, the chapter explains the philosophical grounding of the study (locating it in an interpretive philosophy). The chapter also specifies the methods and tools applied and the entire process that was followed to generate the data and the methods of analysis.

Chapter 5

The process of how data was analysed and interpreted as how the research findings were generated, drawn from the responses from documents and semi-structured interviews, is detailed in this chapter. The responses from the participants are presented verbatim. The main themes that emerged from this investigation of the competence and experiences of teachers in teaching Grade 3 Mathematics through MT are identified. Teachers' claims are validated by document analysis.

Chapter 6

In this chapter, the findings on the construct of teaching Mathematics through mother tongue are presented. The chapter focuses on participants' understanding of mother tongue and Mathematics teaching concerning the multilingual school environment, how this is practised and why they practised it that way. The generated views are discussed concurrently while cross-referencing with the literature on mother-tongue teaching in a multilingual educational environment. The chapter is organised according to the participants' perception of teaching Foundation Phase Mathematics using their mother tongue.

1.11 CONCLUSION

This chapter provided an introduction, background and context that guided the research questions and rationale for the inquiry. First, it explained the questions, aim and objectives of the study. Next, a preliminary literature study, the gaps, significance of the study, statement of the problem were presented. Finally, the chapters in the study were outlined.

CHAPTER TWO
LITERATURE REVIEW

2.1 INTRODUCTION

The preceding chapter outlined the research structure by introducing the background and context guiding the questions and rationale for the investigation. It also explained the research question, aim and objectives of the study. This chapter reviews the literature on the experiences of the Grade 3 teachers in teaching Mathematics in a MT during the transition of the language of learning and teaching (LoLT) from English to MT. Local and international literature discuss these experiences of teaching Mathematics to Grade 3 learners through their mother tongue. My two reasons for conducting a literature review are in line with McMillan and Schumacher (2014:85), who states that the researcher has, firstly, to establish meaningful integration of current knowledge and the gap being addressed in the study; and secondly, to offer critical evidence on the methodology merged into the new exploration to enhance the significance of the identified research problem.

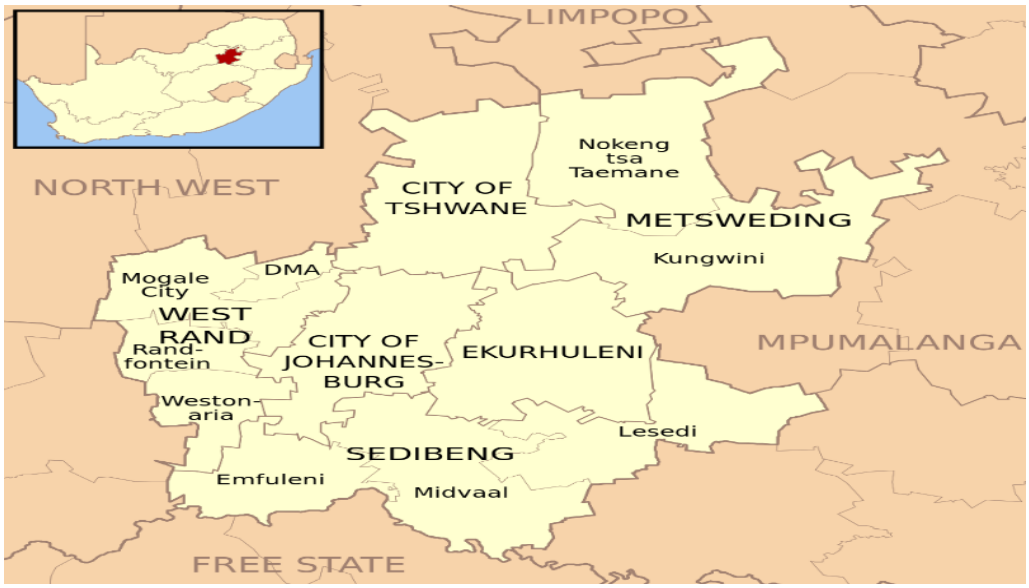
2.2 CONTEXT OF THE STUDY

The research site of the study was Soshanguve, a township located in the Gauteng Province in South Africa. Its name was formulated from the different languages that are spoken in the area, as follows: **So,** for Sotho (Sepedi, Setswana, South Sotho), **Sha,** for Shangaan/Tsonga, **Ngu,** for Nguni (Zulu, Swazi, Xhosa, Ndebele), and **Ve,** for Venda. Soshanguve falls under the Gauteng Department of Education (GDE), established after the democratic elections of 1994.

Gauteng is one of the nine provinces into which the country was divided. The GDE operates under the national department, as defined in the National Educational Policy Act, No. 27 of 1996 (RSA, 1996c), and is responsible for establishing the countrywide regulation on standards and norms and ensuring that these are employed at the provincial level. A provincial department, such as the GDE, has authority over all the public schools; it sets guidelines and funds institutes in the province; hires teachers working in schools referred to as public in the different districts and provincial offices.

This instruction is also responsible for providing support to staff in all the institutions. The map in Figure 0.1 is of Tshwane Metropolitan Municipality wherein Soshanguve Township of Soshanguve is found. The township is situated in the north of Gauteng province in South Africa, coloured in red in the inset (Figure 0.1).

Figure 0.1: Map of Gauteng Province



(Source:https://www.preventionweb.net/files/38589_38507climatechangeadaptationplancit.pdf)

Figure 0.2: Map of South Africa

(Source: www.southafrica.info/about/geography/provinces.htm)

Gauteng, including Soshanguve, was a famous province in South Africa in 2011. It had 12.3 million people, almost a quarter of the national population, crowded into this small province. This suggests that the GDE has a significant impact on both the local and national education systems.

According to Maringe and Prew (2014: xxi), Gauteng performed better than other provinces in Grade 12 school-leaving (matriculation) examinations in an independent review. Gauteng is considered the best province concerning the quality of its education because it managed to adapt the enrolments of Grade 2 in 2004 into Grade 12 passes ten years later in 2014. Even though the matriculation enrolment pass percentage has increased, the number of learners sitting for the Mathematics and physical science exam in the Gauteng province has dropped tremendously after the launch of the CAPS program a few years ago. Two of the ten national districts with the lowest number of Mathematics learners who sat for matriculation are Gauteng. Furthermore, in 2012 and 2013, one of these districts only had Mathematics matriculation remaining at less than 30 per cent. No district in Gauteng had more than half of its matriculants enrolled in Mathematics in 2012 or 2013. These results indicate the challenge schools have in ensuring good performance in Mathematics, one of the basic Subjects needed to receive scientific, vocational and commercial qualifications and employment (Maringe & Prew, 2014:5).

2.3 THE LITERATURE

For many decades in South Africa, most children were instructed in a language they did not speak. These positions the teaching of Mathematics in a mother tongue (MT) at the forefront of this discussion. The debate begins with how *mother tongue* is defined, continues whether Grade 3 Mathematics teachers have enough terminology and vocabulary for teaching and learning Mathematics, and leads back to whether Grade 3 teachers can succeed in teaching Mathematics in a MT (Spaull, 2016). The experiences of teaching Mathematics to Grade 3 learners focus on the transition from English teaching to teaching in the learners' mother tongue. Issues concerning teaching mathematics through MT and the global and sub-Saharan policy trends on LoLT are highlighted. In addition, the study highlights the challenges experienced in teaching Grade 3 Mathematics through MT and how teachers overcome the challenges (UNESCO, 2017). Finally, the successes revealed by literature on

experiences in teaching Mathematics in an MT and the theories that underpin this study are outlined.

The mother tongue (MT) as a form of instruction is an issue that has been debated for years without end because it is often a competition between an indigenous language and a dominant colonial one. Hence, Makeleni and Sethusha (2014:107) opinion that teaching Mathematics in a mother tongue appears to be unproblematic for teachers tasked with teaching it to the Grade 3 learners. However, as a former teacher of Mathematics in the Foundation Phase (FP), the researcher was aware that Mathematics in Grade 3 used to be taught in English, rendering the current teachers ill-prepared to deliver the subject in the mother tongue that the current learners have been familiar with from childhood. In other words, the teachers who have been teaching Mathematics using English as a language of learning and teaching (LoLT), including assessment (Department of Basic Education 2010:3), are now experiencing difficulty in imparting it to learners through the medium of an MT.

For practical Mathematics teaching in multilingual classrooms to occur, the need for committed, well-trained teachers using a variety of teaching strategies emerges (Dicker, 2015). Royds and Dale-Jones (2012:3) point out that FP primary school learners who attended schools where MT is the LoLT were one to two years behind those taught in English as the LoLT. Royds and Dale-Jones (2012:2) also assert that children in South Africa are introduced to their language of instruction way too late, only for too few hours a week, which harms their learning.

2.3.1 Teaching in a Mother Tongue

Mother tongue instruction (MTI) has been a topical matter in education throughout the world. The issue of language in Mathematics has caused researchers to be faced with tension, questions and myths (Moschkovich & Phakeng, 2013:119). Moschkovich and Phakeng (2013) investigated the similarities and differences in two settings (multilingual classrooms in South Africa and the US) to address these issues. Both have Mathematics classrooms where teachers are expected to use a home language where neither the teacher nor the learner has mastered the language.

Because of the lack of teachers who speak specific MT languages in South Africa, a Setswana-speaking teacher cannot teach a Sepedi class. In some instances, learners talk more than two languages, but neither language is used. Due to the limited number of languages offered by the school, learners who speak the language of the minority, such as Xitsonga, are compelled to learn in the LoLT of the school. The teacher then finds it difficult to explain the concepts in Xitsonga because the African languages (for example, Setswana and IsiZulu) differ from each other in the same way as Spanish and Portuguese (Moschkovich & Phakeng, 2013:120).

Researchers like Shvidko (2018), Macaro (2009), Butzkamm and Caldwell (2009), McMillan and Rivers (2011), Phatudi (2013) and Kotze, Van der Westhuizen and Bernard (2017), have all, in their different research undertakings, pointed out that, throughout history, mastery of the mother tongue has been the essential tool for learning a second language (SL) like English in a multilingual country. The idea is that the mother tongue plays a significant role in the classroom context, where meaningful teaching of Mathematics is expected. Butzkamm and Caldwell (2009:14), in support, state that ‘our first language lays the foundation for all other languages we might want to learn’. In terms of the Foundation Phase, it implies the learners must be taught Mathematics in their mother tongue. Furthermore, Butzkamm and Caldwell (2009) aver that their mother tongue is the most valuable and critical resource that a talking child brings to mathematics classrooms.

The above views mean that the mother tongue is a critical medium for learning new knowledge or skills. Barnes (2004) and Plüddemann, Nomlomo and Jabe (2010) stress that the mother tongue must take firm root in the child’s vocabulary before another language can be introduced for teaching and learning Mathematics. Phatudi (2013) and Mzimela (2016) state that the mother tongue should be especially emphasised in the first six years of a child’s schooling because these are the years when a child should be taught Mathematics in a familiar LoLT. These arguments indicate that it is essential to teach Grade 3 learners Mathematics in their mother tongue. Alexander (2006) posits that the neglect of indigenous languages significantly affects the quality of education related to the learner's culture and language.

However, as Chimbuga and Meier (2014) indicate, the question of mother-tongue education in South Africa remains a vexed one. On the one hand, it seems reasonable and desirable that learners receive instruction in their mother tongue if they so wish. On the other hand, there are genuine difficulties involved in the implementation of this ideal. MT languages embody a wealth of knowledge and should be well articulated by African-language users (Lafon & Webb, 2008). Teaching in an African language can help pupils grasp concepts more easily, pass well and support their success later in life. However, it becomes a challenge if used for teaching Mathematics, and the teachers using it cannot use it as a language of teaching and learning. This is because of misappropriation from conclusions deduced by those foreign to the MT languages and their representation.

Another view is that it is expensive because books have to be translated into MTs. Time and money are wasted, especially if MT speakers appear less keen to use the language because of a lack of economic value. Improving the existing materials usually means translating from English to an African language, not necessarily developing original African language materials (Fricke, 2006). Direct translation usually opens itself up to much criticism and has the potential for error and dysfunctionality in the process. The suggestion, however, is for MT or African-language users to play a leading role in inclusive education design. Access to print material in African languages would be equally important in preserving and promoting MT languages.

2.3.2 Challenges of Teaching Through MT

There seem to be many reasons why teaching Mathematics in a MT is problematic for the Foundation Phase teachers teaching their Grade 3 learners. However, mother-tongue teaching is an actively debated issue because teaching and learning are processes that deeply involve the affective, cognitive, emotional, social, cultural and linguistic factors in an intertwined manner (Vandeyar, 2009). This means that learners may fail to understand academic concepts in a language they have not yet mastered because their teachers are incapable of assisting them (Crandall, 1998:18) and because their languages vary. Furthermore, Cammarata and Tedick (2012) add that the teachers' problems are compounded and exacerbated by their inability to balance speech and content. These two factors are further complicated by a struggle that

involves issues related to teacher identity, stakeholder expectations, and the understanding that underscores the relationship between language and content.

Teaching Mathematics to Grade 3 learners in MT is worsened by the constitutional imperative that encourages multilingualism and the use of all the 11 official languages, as contained in the Language in Education Policy (LiEP) (Department of Education, 1997). The 1996 Language in Education Policy (LiEP), although very attractive, is nevertheless challenging to implement because the learners attending schools in townships speak diverse languages. Previously, it was not a problem to teach Mathematics because the LoLT in the Tshwane North township primary schools where this research took place was formerly English. The new setup has resulted in both teachers and learners developing a poor command of their mother tongue for the mastery of Mathematics. The burning issue is that the new policy has found teachers and learners not being ready to carry out all cognitive and academic activities in their mother tongue because they are not sufficiently competent in using their mother tongue to anchor their teaching and learning processes.

An MT as the LoLT in education is a policy for teaching learners in the first three years. However, without proper training in the use of the MT, instructional methods cannot be enhanced. The Department of Education insists that the Foundation Phase learners should be taught in their home language, including the teaching of Mathematics up to Grade 3, which requires teachers to be competent in the diverse MT languages prevalent in the townships. Changing from English to mother-tongue teaching in Grade 3 has become a challenge for teachers teaching Mathematics in English (Makeleni & Sethusha, 2014). Most Mathematics teachers, especially those teaching in former Black schools, struggle to teach in MT because of the diversity of languages and dialects, inconsistent strategies employed to handle the situation, sceptical attitudes of society towards mother-tongue use in education, scarce resources, academic problems, and even the clash between the teachers' MT and that of learners. Similarly, teachers are not trained to teach Mathematics in a MT because their pre-service training was done in English (National Council of Teachers of Mathematics, 2014).

Given the inequitable education provided in the apartheid era and the imbalances in teacher-learner ratios, compounded by the influx of immigrants from other provinces

and neighbouring countries, schools have difficulty employing qualified and competent teachers to teach in the home languages of all learners. By 2013, Gauteng had more learners in the education institution than in other provinces (Maringe & Prew, 2014:2). Machaba (2013:35) points out that South Africa, like other African countries, has a crisis in teacher supply. Because of the demography of the country and the need for MT as LoLT in the Foundation Phase, the township schools suffer a shortage of teachers or are staffed with underqualified teachers. Marine and Prew (2014:3) reveal that the number of learners has risen by 60%, whereas the number of state-employed teachers has risen only by slightly over 20%. Larger classes and the hire of private teachers have filled the gap. But such teachers are not distributed uniformly across all schools (independent schools hire more than public schools).

According to CHE (2013), the school sector contributes to students' poor performance in higher education. The problem is the lousy teacher experience teaching Grade 3 Mathematics in a MT and the different learner languages. The above difficulties increase inequalities in learner performance and result in incompetence in Mathematics (Spaull, 2013). The subdivisions further increase the disparities in educational opportunities in public schools, where smaller and better performing schools (20-25% of wealthiest learners) achieve much higher scores. On the other hand, the poorest (75-80% of poor learners) do not perform well (Spaull, 2013). According to Spaull (2013), the scores of the Grade 3 pupils from former white schools were higher than the scores of the Grade 3 pupils from former Black schools in the same test.

The Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) III of 2007 conducted tests with Grade 6 learners and teachers and revealed that many South African Mathematics teachers have below-basic levels of content knowledge, with a high proportion of teachers being unable to answer questions aimed at their pupils (Spaull, 2013). The results demonstrated that the top five per cent of Grade 6 (schools of wealthiest learners) in South Africa scored higher marks than the 20 per cent of Grade 6 (schools of poor learners). This clearly shows that Mathematics teachers in township schools struggle to understand the subject they teach and translate the concepts into MTs, hence the poor performance. Unless this

problem is addressed, it won't be easy to raise achievement in mathematics and translate from English to MT.

2.3.3 Inequalities that Affect MT teaching

South Africa's history of inequalities is another factor affecting the teaching of Mathematics. According to Van der Berg (2008), some privileged learners in South Africa attend well-resourced and previously advantaged state schools or private schools, where they receive an excellent education. However, most learners (about 80%) are in rural and township schools that are under-resourced and dysfunctional. Moreover, the same Mathematics teachers were schooled in the previously disadvantaged schools where there were inequalities.

Because of this weak foundation, Black learners are affected even beyond matriculation because they cannot perform well at the university level. Letseka and Breier (2008) indicate that the average graduation rate for white students is more than double that of Black students. Similarly, the National Planning Commission (NPC, 2011:16) said that race is still a significant determinant of performance in our learning institutions. The performance and completion rate of Black students is less than half of the completion rate of white students. Figures indicate that only one in five students graduates in the required time (NPC, 2011).

According to Hoffman (2009), the race debate persists because the new South African education authorities have not addressed the inequalities and disadvantages of pre-democracy disparities. Instead of concentrating on upgrading the qualifications of teachers, teachers' training colleges were closed, and little has been done to improve the skills of underqualified teachers (Hoffman, 2009). In addition, Lovemore (2013) reports that children born to affluent parents attend well-resourced schools and are likely to do far better than children born into poverty, who attend schools lacking appropriate resources. Similarly, Carey (2013) states that children of less-educated parents with lower income typically enter school with poorer language skills than their more privileged counterparts. Finally, Lovemore (2013) asserts that children born in rural areas are likely to be taught by ill-qualified teachers and attend ill-resourced schools. As a result, their academic outcomes are possible to reflect their learning environment.

Lovemore (2013) believes every child deserves to attend a school with committed and capable teachers as role models who instil a robust work ethic, curiosity, solid values and self-esteem, in addition to providing an education of such academic rigour that the child is ready to become a globally competitive young citizen. Furthermore, Lovemore (2013) attests that we owe our children to allow them to achieve the excellence to which they are entitled. Teachers who are using an MT as the LoLT for Mathematics in Grade 3 are not coping. They find the switch from teaching in English to teaching in the MT very difficult. The issue of which language to use for teaching Grade 3 learners is controversial. Eloff, Louw and Wium (2010) agree that learners achieve better when taught in their MT. Yet, in the same study, they show that most public schools' enrolment dropped because of the use of MT as the language of instruction. Study participants believed that most parents moved their children to private schools where instruction was English.

Another strong argument that captured the researcher's attention introduced the concept of *immersion*. According to Macaro (2013:72), immersion is a bilingual education programme that was developed in Canada in the 1970s, where children educated using the medium of a second language (L2) were 'immersed' in it to become competent users of the L2 at no cost to their academic achievement. The immersion classes proved to be highly successful and have led to successful immersion education programmes worldwide, including South Africa. In early total immersion, children begin their experience in the immersion classroom at a young age (early) and spend 80%-100% of their time within the L2.

Makeleni and Sethusha (2014:107) indicated that some participants were not comfortable teaching subjects like Mathematics in their home language. Research by Eloff *et al*. (2010) confirmed that school enrolment dropped in most public schools because MT as LoLT caused many parents to move their children to private schools where the language of instruction is English, and this practice is continuing. According to Hoffman (2009), the private schools and the former Model C schools in the leafy suburbs continually produce sufficient graduates of all races, while many township schools and rural schools experience, in the words of the Minister of Basic Education, 'challenges and problems' (Motshekga, 2009**:**1).

Teachers also complain about the limited training and lack of support for teachers. Wium and Louw's study (2011) revealed the need for improvement in the facilitation of literacy and numeracy learning, particularly in the early grades, because language is essential for acquiring literacy and numeracy. In an attempt to address the LoLT problem, the Department of Basic Education (2012:11) developed the Numeracy Handbook to enhance the educational and didactic capacity of Foundation Phase teachers so that they can teach Mathematics more efficiently. The department also provided numerous ideas for teaching the mathematical concepts and skills set out in the Curriculum and Assessment Policy Statement (CAPS). However, the handbook is written in English, which poses a problem, as teachers have to translate it to MTs.

2.4 POLICY CHANGES IN EDUCATION

Since the beginning of the democratic era in South Africa, there have been serious concerns about what schools produce and what transpires in schools (Carrim, 2013:46). Similarly, the school leader has to be up-to-date with the curriculum and policy changes teachers face to ensure effective teaching and learning. South Africa has had four different curriculum changes: NATED, Curriculum 2005, also known as the Outcomes Based Education (OBE), National Curriculum Statement (NCS), Revised National Curriculum Statement (RNCS) and CAPS, each demanding different paperwork and assessment norms. These changes require teachers who were not adequately trained during the apartheid era to produce good results, especially in Mathematics.

Teachers still struggle to master the content of their subject but are now expected to teach Mathematics in a mother tongue (MT) that was not used during their pre-service training and for which they have received no preparation (Maringe & Prew, 2014:5). Although teachers are from different cultures, speaking other languages, they cannot master all the languages spoken in Soshanguve. Based on the context and background, it is crucial to be reasonable and factually evaluate the potential advantages and disadvantages of any language policy change. According to Nyika (2015), some policy changes may be politically credible but may not necessarily be beneficial from other points of view. Policymakers must consider the short- and long-term socio-economic implications, as well as the practicability of implementing national policies.

The South African language policy is based on the finely conceived notions of legal rights enshrined in the National Constitution, which must be interpreted contextually by the Constitutional Court (Ridge, 2004). The Pan South African Languages Board (PANSALB), for example, operates under the strong influence of the decontextualised notions of rights. Stroud and Heugh (2004) see both the Constitution and PANSALB undoubtedly emanating from a metaphysical approach that prioritises structures. However, the interpretation of rights is compromised from the start because it conceives and pursues rights within a predominantly legalistic, rather than a sociolinguistic or realistic, setting. This poses risks for interpreting policy and addressing disadvantages, most highly so in education. Each language is viewed as one thing, context-independent, based on a supposedly neutral standard, urging the policy thrust towards compliance, and making the choice of the language is used in the classroom more important than the quality of the education afforded (Ridge, 2004).

The current language legislation in the country - which protects and promotes South African languages and virtually guarantees mother-tongue instruction, as well as the acquisition of a second and even a third language - came about through conservatives, centrists, and ultra-leftists being able to reach consensus on language issues in a framework of additive multilingualism (De Klerk, 2002). Research shows that teachers frequently use these languages to interpret knowledge from an English curriculum to African-language learners. This practice, however, is likely to create a language barrier between the learning material printed in English (such as textbooks), assessment questions and the actual teaching of Mathematics in a MT.

2.5 THE BENEFITS OF TEACHING IN A MOTHER TONGUE

All humans define themselves by the language they speak and the people who speak it. Their values, ways of socialisation and dignity are exhibited in that language. A language also displays the heritage of a group of people. Thus, mother-tongue (MT) teaching should be a form of schooling that uses the language or languages with which children are most familiar. *Mother tongue* (MT) refers to the language of one's parents, which is usually the language children speak at home with their family. However, the MT does not have to be the language spoken by the mother because children often say more than one or even two languages at home. For example, they may speak one

language with their mother, another with their father and a third with their grandparents.

Children learn better and faster in a language they can understand because it prevents delays in learning. They enjoy school more and feel more at home, with increased self-esteem. Parents become concerned if their children's education is distorted because they do not understand the language of instruction used in the school, especially when the LoLT is different from the language used at home (; Dorgu & Igbojinwaekwu, 2016). The selection of a suitable language as the LoLT is crucial in primary education since the foundation of secondary and tertiary education is laid.

According to Aguiyi (2012), education goals cannot be attained without a language because imparting knowledge must be done through speech. Research by Nyika (2015) demonstrated that MT use in early literacy and content learning stages is more effective than using a foreign or second language. However, there is limited empirical evidence to indicate that using an MT at higher levels of learning could lead to educational success and, consequently, successful career development in the real world.

According to Khosa (2012), MT instruction creates the opportunity to develop the students' practical cognitive skills that serve as a strong foundation for successfully learning a second language. Nyika (2015) asserts that teaching Mathematics and Science in developing countries is negatively affected if there is no training or competency in using the LoLT prescribed in the policy. According to Dorgu and Igbojinwaekwu (2016), MT teaching creates a level playing field and equal opportunities for all, regardless of economic status, ethnic background or geographic location.

When children are taught in their MT, they enjoy school more because they feel more at home, their self-esteem is strengthened, and parent participation is increased because parents can help with homework and participate in school activities. In South African townships, the MT is usually the language spoken in the community. A second language, such as English or Afrikaans, may be one the children hear for the first time when they enter school or have only heard through the media. Although evidence indicates that children learn best in and through their mother tongues, millions of

children worldwide receive their education in a different language. This is usually the dominant language of the country where they live. Let us always remember the quote from Nelson Mandela: 'If you talk to a man in a language he understands, that goes to his head. If you speak to him in his speech, that goes to his heart' (https://www.living-in-south-africa.com/languages-in-south-africa.html).

2.6 MOTHER TONGUE AND TERMINOLOGY

Our mother tongue has a pivotal role in our lives as it encompasses our different cultures and identities. An MT is not just a series of words but is intrinsically tied to a sense of belonging, which is linked to society and its values. MT policies advocate that learners be taught in their MT for some or all of their years of schooling. This would be achieved if the subject taught had its own MT terminology. However, according to Kazima (2010), the picture becomes somewhat complicated when mathematics is taught. Teaching Mathematics in a MT is a challenge when coming to conceptual translation since some English Mathematics concepts do not exist in the MT, and some teachers cannot speak all the languages spoken by all the learners. While the teachers can create their translations and teach the learners to adapt to them, learners from foreign countries cannot understand them since they do not speak the local MT (Kazima, 2010).

Mathematics teaching requires that its terminology be applied to Mathematics; for example, *volume* refers to the capacity of a container in contrast to loudness (Dicker, 2015). However, most times, the direct translation used from English to MT changes the whole meaning. According to the Council of Higher Education (CHE, 2013), the language challenge affects learning and the rate at which learners complete their higher education (for example, the rate of completion by whites is 50% higher than that of Blacks). In support of this statement, the Trends in International Mathematics and Science Study (TIMSS, 2012) indicates that the performance of learners who speak the language of the test in Grade 9 was higher than that of learners who did not talk about the language of the test at home. However, mathematics concept translation is problematic, as evidenced by errors in books translated into MT for Foundation Phase learners and teachers (DBE, 2013:6). This problem will affect learners' performance if there is no intervention. Hence the need for an investigation of teachers' experience of teaching Grade 3 Mathematics in an MT.

A mother-tongue teaching problem is also experienced in other countries, such as Malawi, where the Chichewa language is inadequate for general scientific information, and mathematical knowledge in particular, because the language lacks suitable scientific and mathematical terminology (Kazima, 2008). This finding is important because it shows that using an MT as the language of instruction for Mathematics needs consideration of handling mathematical terminology to help the MT overcome its present limitations. In support of this view, Dicker (2015:65), from South Africa, states that mathematical terms and formulae have meanings that belong to the language of Mathematics only, and therefore cannot be translated into other languages.

2.7. UNDERSTANDING MULTILINGUALISM

In today's globalised world, all children benefit from a multilingual education that offers them the opportunity to become fluent in the official language of the country and one or more foreign languages and their mother tongue (Lafon, 2009). Knowing other languages allows learners to communicate efficiently in more than one language through different media and to contribute meaningfully to society. Children who speak a foreign language at home than the language they are taught at school will, by definition, become bilingual or multilingual. The degree to which they become bilingual may vary considerably, especially if the aim of teaching children a second language is at the expense of their MT. If children who are not fluent speakers of the school language are not offered some form of language support, they may lose out on learning the subject being taught in another language. A school is a meeting place where students, parents and staff - often from diverse backgrounds - are united to share and build knowledge. Language-friendly schools (LFSs) should provide all children access to a language-friendly learning environment where they feel accepted and valued for who they are, as stipulated in the 2030 Sustainable Development Goals.

LFSs should have developed a language plan involving all school members: students, teachers and staff. The plan should be flexible, realistic and allow for incremental changes that are adapted to the school's needs and aimed at creating an inclusive and language-friendly learning environment for all learners. LFSs are an answer to the

increasing multilingualism present in schools worldwide because people migrate to other places seeking employment, reuniting with loved ones or escaping war and conflict. In an LFS, everyone welcomes and values all the languages spoken by the students, the parents and the school's stakeholders. All schools will become linguistically and culturally inclusive, meaning the students' multilingualism is embraced, and space is given to all the languages in the school community (UNESCO, 2017). It is recommended that children be taught through their mother tongue, alongside a second and third language, because they will learn better and faster in a language they can understand (Strydom, 2002). When children take advantage of their multilingualism, some studies have reported higher socio-economic status, including higher earnings.

The planning and implementation of a local language policy cannot occur in isolation. Therefore, it is necessary to set the background against which language-related decisions are made - on a local and a societal level. The challenges faced by Grade 3 Mathematics teachers are inseparably linked to matters ` evolving around the role of language in education and development (Strydom, 2002). The logical conclusion is that a language policy implementation plan should be supported and institutionalised, employing legislation and other measures to meet the developmental needs of its citizens. By promoting and investing in multilingualism, the policy will ensure equal access to knowledge and skills by all children. By formally committing itself to multilingualism and entrenching it in the Constitution and the Languages Bill, South Africa acknowledged that languages have a market value and are an economic resource. If the national ideals are to be met in terms of democratically developing the nation, all citizens must have equal access to all the rights and privileges of the country. Unless we act now, generations of people will grow up failed by their education systems, and we will have to go back to redress this.

2.8 CULTURAL AND LINGUISTIC DIVERSITY

A culturally and linguistically diverse learner is a learner who comes from a home environment where a language other than the language of instruction is spoken and whose cultural values and background may differ from the mainstream culture (Moloney & Saltmarsh, 2016). To address cultural and linguistic diversity, parents who

speak the different MTs may be invited to translate materials and provide a list of words and short phrases that the child already uses for teachers to use when teaching Mathematics. Cultures are transmitted through languages, and languages also reflect the history of the people who use them. Cultural and linguistic diversity is a source of global unity. However, in classrooms where nine or more different mother tongues are spoken, a fast becoming the norm throughout South Africa, it would not be feasible to provide a completely bilingual education programme for each student.

The best solution here is not to ignore all languages and settle for just one language, as is often the case. Instead, translanguaging is a new pedagogical strategy. It shows exciting results when all languages are valued. Opportunities are offered for children to use their home languages in classrooms, submit homework and assignments in their mother tongue, or collaborate with learners who speak the same language at school (Cenoz, & Santos, 2020). The problem is that teachers are not multilingual in MTs, nor are they competent to practice translingual teaching. Teachers speak their own MT and will struggle to teach in an unfamiliar language and use learning materials in a foreign language. This practice required of Grade 3 Mathematics teachers seems unfair and inequitable to learners and teachers, yet it is a reality in the Black townships of South Africa. The consequence is resources lost and talent wasted, marginalization, oppression and discrimination, as well as significant and increasing injustice-a systemic failure of human rights (Leonet, Cenoz & Gorter, 2020).

2.9 LESSONS FROM TEACHING IN A MT

Chitera (2010) posits that, as most countries in Africa have introduced local languages as the LoLT, the same should occur in South Africa for the first few years of schooling. Hence, in South Africa, learners should learn mathematics in their local languages for the first few years of learning. However, according to Chitera (2012), most research has focused on the challenges of using local languages in multilingual Mathematics classrooms in schools and not on how the teachers were prepared to teach Mathematics to Grade 3 in multilingual classrooms. Sometimes, a teacher who specialises in teaching the Senior Phase is appointed to teach the Foundation Phase, even though the teacher did not +study Mathematics and does not have the methodology to teach in the Foundation Phase. These are challenges experienced in the teaching of Mathematics to Grade 3 learners.

A study was conducted by Deacon (2016) of 16 student teachers training at the University of KwaZulu-Natal (UKZN) for a Post Graduate Certificate in Education (PGCE). The study participants were taught the Foundation Phase (FP) Mathematics education module in isiZulu and were optimistic about their experiences. However, they felt that isiZulu lacked sufficient concepts and academic vocabulary for Mathematics, making the module feel lower in status than the same module offered in English. In an investigation by Van Laren and Goba (2013a), the PGCE students indicated that their peers and practising FP teachers looked down on them because they were learning in isiZulu. Mashiya (2014:241) found, in another UKZN FP programme for PGCE students delivered in both English and isiZulu, that isiZulu-speaking students, who were taught and assessed in isiZulu and used some written materials in both isiZulu and English, had received their basic education in schools using English as the language of instruction, and felt uncertain, anxious and frustrated at being assessed in isiZulu. The teachers had difficulty understanding instructions and could not spell correctly in tests and examinations.

Nyika (2015) argues that learning English as early as primary school facilitates proficiency in the language and interdependence in the development of bilingual proficiency. Machaba (2013), Nyika (2015), and Dorgu and Igbojinwaekwu (2016) argue that teachers should be competent in the language used to be able to transfer knowledge to learners; lack of competence only aggravates the children's problems with Mathematics. The argument above is based on the long-term results of students whose MT is not English may be compromised when they begin with university education, where the language of instruction is English (or French) (Nyika, 2015). Moschkovich and Setati Phakeng (2013) complements Nyika's findings by explaining that learning in a language that is not their MT is more demanding for children because they have to learn to do everything in a language they are still learning. This practice also places additional demands on the Mathematics teachers, who have to teach mathematics and the language in which it is learned (e.g., English) simultaneously.

According to the Department of Basic Education (2010:16), between 1998 and 2007, Grade 3 learners learning in English decreased, while those teaching in Isizulu, isiXhosa and Afrikaans increased. Despite this shift, English remained the dominant language of instruction among Grades 2 and 3 learners in 2007 (Department of Basic

Education, 2010:16). The concern is for learners learning languages other than their MT, namely, in a LoLT that is not their mother tongue. Machaba (2013:39) adds that if the teacher and children understand Mathematics concepts, better control and direction of classroom activities will be better. The most problematic aspect that Machaba (2013:143) discovered were teaching Mathematics to learners who struggled with understanding the basics of Mathematics. Machaba explained that using an MT becomes a problem in a multilingual class where the teacher has to explain to children whose home languages are unknown to the teacher.

Children whose MT is not the one used for teaching and learning may experience comprehension barriers. Additional evidence of the importance of language ability in the teaching of Mathematics becomes apparent in teachers' responses to the questions about aspects of Mathematics that are problematic for children. Teachers claim that the language of teaching is the cause of all Mathematics problems and should therefore be addressed. However, when many children have different MT languages that the teacher uses, the children and the teacher find it hard to understand each other.

2.10 GLOBAL TRENDS IN TEACHING MATHEMATICS IN A MT

Historically, the formulation of language policies was geared towards encouraging one official language over other languages (Khosa, 2012). However, many countries are changing their policies to suit their regional and ethnic languages (Ouane & Glanz, 2010). This section focuses on language policies in Papua New Guinea, Saudi Arabia, the United States of America and the sub-Saharan countries in Africa because they are multilingual countries like South Africa. Their experience of teaching in a MT began long before South Africa's did and helped the researcher understand the use of MTs in the Grade 3 classes of South Africa. The global language policies were reviewed and linked to the South African Language in Education Policy (Act 27 of 1997).

2.10.1 Language policy changes

Papua New Guinea (PNG) has the world's highest language diversity, with more than 900 languages, divided into at least 23 different language families (Greenhill, 2015). PNG uses the pidgin lingua francas of Tok Pisin and Hiri Motu as its national languages and English as its official language (Neofa, 2010). The adoption of these

two languages was influenced by the political history that shaped the spiritual, social and national fabric of Papua New Guinea. However, a compulsory English policy at all levels was enforced when Australia took over in 1906. During that time, policy responsibility lay with the Australian Government and not with the communities it impacted (Ahai, 1990). The use of English allowed a mass influx of English-speaking expatriate teachers to help with the rapid expansion of education (Litteral, 2001). As in South Africa, Papua New Guinea's (PNG) new political party came into power and changed the language policy that was in use in 2013 (Clarkson 2016:52).

Since PNG had a variety of languages and cultures, western education was introduced because English as a world language would finally enable PNG to have a cohort of well-educated citizens who could lead their country onto the world stage. However, the introduction of English was stressful because there was no planning for implementing the new policy (Clarkson, 2016:52). As in South Africa, when MT teaching was introduced, there was a problem with what language to use. Therefore, they developed a programme where children were taught to read and write in their MT in Grade 1 (Malone & Paraide, 2011). Later research confirmed that children performed better in formal education when they had a background in vernacular literacy (Petterson, 2013). The development of this vernacular literacy programme was a success because of the support offered by stakeholders, for example, government, education departments and local groups such as NGOs and churches, universities and institutes of linguistics (Malone & Paraide, 2011; Litteral, 2001).

The pre-primary class focuses on school readiness, and basic literacy and Mathematics are taught in the local or community language. In Grade 1, primary education is offered in the mother tongue using activity-based learning with an emphasis on cultural bonding; in Grade 2, primary education continues in the mother tongue, but oral English is introduced; Grade 3 teaches written English and uses 60% local language and 40% English; Grade 4 builds oral and written English skill (Malone & Paraide, 2011).

Saudi Arabia, however, has two education systems: private sector schools use English as the language of instruction, and the language is spoken inside and outside the classrooms, and public sector schools use Arabic. Although English is widely used as

a compulsory subject in universities, some students prefer MT teaching because of their lack of proficiency in English. Most Arab students who formally studied English for many years still fail to achieve the necessary mastery (AbuHmaid, 2014). In a study conducted by AbuHmaid (2014), 54 per cent of the university students preferred using Arabic because they felt it helped them express themselves better than in English. In addition, they appreciated teachers' using Arabic to explain issues. However, the feeling was different with high achieving students, who felt demotivated when their teachers used Arabic during classes (AbuHmaid, 2014). According to Alshammari (2011), a balance had to be maintained by both teachers and learners to increase students' comprehension levels.

In the United States of America, the education programme involves a team-teaching approach at the elementary level. When it comes to catering for learners with foreign languages, a similar programme was used in a large and densely populated city in the western part of the USA (Hellmich, 2018). At the elementary level, partial trilingual immersion is implemented in all classrooms, so the content instruction is in French, Spanish, and English throughout each day. At the primary level, either French or Spanish partial immersion is offered, making it clear that the choice of which language of instruction to adopt in the elementary phase is still not altogether settled. Given the problems experienced by South African schools in mother-tongue teaching in the Foundation Phase, it would be advisable and even worthwhile for the South African government to learn from the American approach of team teaching at the primary level. For example, the teachers could assist each other when different MT languages were in the same Mathematics class.

2.10.2 Sub-Saharan countries

Nigeria supports long-term MT development (Khosa, 2012). The country's objectives in primary education are addressed in its National Policy on Education (NPE). The aim was to inculcate permanent literacy, numeracy and communicate effectively as a sound basis for scientific and reflective thinking (Dorgu & Igbojinwaekwu, 2016). The Federal Republic of Nigeria (FRN) (2013) introduced the language of the immediate environment as the LoLT in the primary schools for the first three years, and the English Language was only offered as a subject. However, English is still used as the LoLT, and the mother tongue is used as the language of interaction at home. The

policy was challenging to implement because there was no programme to train teachers in the use of the language of the environment to enhance their instructional methods (Igbojinwaekwu & Dorgu, 2015). Using the MT or language of the environment to teach involved much more than knowing how to speak the language. The implication in all countries that introduced MT teaching is that teachers may be the speakers of the MT in the environment but still cannot use it to teach a given subject, or they may fail to use it effectively (Dorgu & Igbojinwaekwu, 2016).

Tanzania, too, believed in the use and development of MT teaching (Khosa, 2012). However, its language policy was based on a model of one 'local' language being officially made a national language (Nyika, 2015). This policy was not fair as it marginalised other languages spoken in the country. Tanzania differs from other developing countries who believe in having several vernacular languages as languages of instruction, using each as the mother tongue in the localities where it is predominant (Nyika, 2015). This is similar to what is happening in South Africa, except that, in South Africa, the MT used is the most dominant in the area, but not all learners can speak it.

South Africa's language of learning and teaching (LoLT) issues stem from the South African history of education. Most Black South African languages were disregarded during apartheid. According to Nyika (2015), for most African countries, English or French as the LoLT in educational systems was not by design but was an imposition by the colonisers: Language was used as a tool for oppressing the disadvantaged local inhabitants. Hence, Sayed and Kanjee (2013:6-7) state that the education system during apartheid was inefficient and inequitable, specifically for the disadvantaged people who were not white by race. The significant inequality in the administration of education was the disproportionate distribution of resources among the segregated departments, serving the white minority population better than the other races.

With the introduction of the democratic government, the imbalances in learner-teacher ratios, infrastructure, teacher qualifications and unequal access to education were addressed to improve learning outcomes for the different groups (Sayed & Kanjee, 2013:6-7). Similarly, Lemmer (2010:225) asserts that changing the language policy in South Africa gave the 11 official languages equal status as a strategy to redress apartheid inequalities. According to Lemmer (2010:225), the changes in national

language policy in post-apartheid South Africa affected the Language in Education Policy (LiEP) in the following three main areas: languages of school subjects, the choice of LoLT, and the choice of local school authorities in determining school language policy.

A clear preference for English as LoLT in education, already in place and favouring the minority South Africans, was changed (Lemmer, 2010:226). This decision was informed by Section 6(1) of SASA, which states that the school governing body is responsible for determining a language policy for the school that is appropriate for the school's circumstances while subject to the constitution. Accordingly, the choice of the language of instruction was given to the parent body of each Black school. These choices, according to the National Education Coordination Committee (1992:44), were either English or Afrikaans or an African language as the language of instruction from the first year of schooling, with a sudden transition from MT to a second language medium after the fourth year of schooling; or a gradual change from a mother tongue to a second language medium during the first four years of schooling. The overwhelming response from the Black community was for the second option (Lemmer, 2010:227).

Nyika (2015) posits that graduates from countries that use a local vernacular language as the language of instruction until tertiary level eventually face challenges adapting to real-life environments in which English is the official language of communication. However, in South Africa, an African language is now used as the LoLT from the first year of schooling. A transfer from a MT to a second language medium occurs after the fourth year of education.

2.11 CONCLUSION

The above discussion has focused on teachers' experiences in teaching Mathematics to Grade 3 learners in their mother tongue. The first part of the literature review investigated the effect of the transition of the LoLT from English to mother tongue: The common problem is that politicians influence the choice of the LoLT and change it without proper plans in place. The second part of the literature review examined the competency of teachers to use their mother tongue to teach Mathematics: the changes in the LoLT resulted in a shortage of teachers with the ability to use an appropriate

mother tongue to teach Mathematics. However, there is no evidence in the literature to suggest how this issue of shortage of teachers will be addressed. The third part of the literature review considered the learners' readiness to understand learning in their mother tongue. The literature indicates that Mathematics is linked to technology and that the new generation of learners is exposed to the media. Still, there is no evidence of such media being written in African mother tongues. There was also evidence of teaching material that was wrongly written.

The following section reviewed the literature on teachers' strategies in adapting mathematical concepts from English to mother tongues. The literature revealed that there is a great need for teacher training in the use of mother tongues. Teachers must also be assisted to use strategies such as multilingualism and code-switching in the Mathematics classroom. In addition, the literature demonstrated that the challenge of using a home language to teach Mathematics is prevalent in Papua New Guinea, the United States of America and Malawi. Finally, this chapter explored various examples of mother-tongue instruction, for consideration as possible points of guidance in searching for equitable solutions to the research problems. What is of importance in Chapter 3 is to establish an appropriate theoretical framework or frameworks to direct and support the research project as it unfolds maximally and optimally.

CHAPTER THREE
THEORETICAL FRAMEWORKS UNDERLINING THE STUDY

3.1 INTRODUCTION

Sociocultural and intellectual development issues direct the present research study on the importance of a mother tongue (MT) in teaching Mathematics to Grade 3 learners. They are the philosophical frameworks that underpin the study and its conclusions. This chapter presents those frameworks and the rationale for using the two leading theories embedded in the constructivist and interpretive theories of Ernest, Vygotsky and Piaget. The three theorists use the constructivist interpretivist approach as a theoretical framework. The theories used in this research serve as building blocks that support the development of new knowledge and the research design; they articulate the ontological and epistemological perspectives of the study and specify the concepts and variables under investigation (Grant & Osanloo, 2014).

Scholars like McMillan and Schumacher (2014) and Schunk (2012) define a *theory* as predicting and explaining a natural phenomenon. In research studies, there is a need to use theories to advance predictions and explanations to maintain focus and direction. Creswell (2014), in support, points out that it is essential to use a theory in a research study because it serves as a lens for the enquiry being undertaken. From a different perspective, Schunk (2012) posits that effective teaching requires determining the best theoretical perspectives for the types of learning we want to offer the learners. In this regard, the importance of a theory is again explained by Creswell (2014) as a broad explanation for behaviour and attitudes. The core purpose of the present study is to offer a more comprehensive vision whose goal is to highlight the experiences of Grade 3 teachers who are expected to use mother-tongue instruction when teaching learners.

The use of theory in research is usually problematic because of the uncertainty concerning what, when, how, where, and why in the study. However, the importance of engaging a theoretical framework in research should never be underestimated because it is based on a particular idea that is of interest to the researcher. The researcher employs their knowledge and other people's ideas related to that

knowledge, with observations, to make sense of the phenomenon in question. Insights are gained by ascertaining links, making inferences, drawing conclusions and making predictions. The theory provides researchers with a broader understanding of the knowledge that relates to the topic under investigation. Two theoretical aspects considered were the theoretical perspectives that underpin the fundamental research and the theoretical assumptions that influenced the methodology. Understanding these helped clarify critical concepts, familiarised the researcher with the assumptions related to the research topic, and located the relevant paradigms that represented the notions and suppositions.

Pertinent theories were combined to emphasise the understanding and the application of mathematics teaching in a mother tongue. These practices provided the researcher with justification for using the theories that underpin the research. The theories are also used to support the qualitative methodological procedures, epistemology, ontology, axiology and rhetoric that are instrumental in shaping a researcher's investigation. While epistemology and ontology take the lead in influencing a researcher's choice of research approach, they all play a pivotal role in characterising the entire methodological route: thus, the importance of theoretical contexts in research work.

To recap, the study takes place in the Township of Soshanguve in the Gauteng North District. The study has taken to heart the words of Schunk (2012), who argues that, to study learning occurrences effectively, one must examine them in the settings where they occur. This study is unique because it was undertaken in a multicultural and multilingual township setting.

3.2 THE THEORETICAL FRAMEWORKS UNDERPINNING THE STUDY

Paul Ernest (1991: xi), in the introduction to his book, *The Philosophy of Mathematics Education*, points out that, 'for over 2000 years, Mathematics has been dominated by an absolutist paradigm, which views it as a body of infallible and objective truth, far removed from the affairs and values of humanity'. Currently, this is being challenged by a growing number of philosophers and mathematicians. The present research study was guided by the *social constructivism* theory of Ernest (1991), the idea of Vygotsky

(1978), known as the *sociocultural theory*, and that of Piaget, known as the *intellectual development theory*.

Paul Ernest (1991: xii) answers many burning questions at length when he instructively states: *The aims of teaching Mathematics need to include the empowerment of learners to create their mathematical knowledge. Mathematics can be reshaped, at least in school, to give all groups more access to its concepts and the wealth and power its knowledge brings. The social contexts of the uses and practices of Mathematics can no longer be legitimately pushed aside. The implicit values of Mathematics need to be squarely faced when Mathematics is seen in this way. It needs to be studied in living contexts that are meaningful and relevant to the learners, including their languages, cultures and everyday lives, and their school-based experiences.*

The words of this quotation challenge the Foundation Phase teachers and leave them without defence for their failure to make MT Mathematics teaching meaningful to learners from different race groups who may speak other languages. The following section discusses the theories of Ernest, Piaget and Vygotsky.

3.3 THE DIFFERENT THEORIES GROUNDING THE STUDY

The study moves from the premise or assumption that asks the fundamental question**, What is Mathematics about?** to the question, **What is the best way of teaching Mathematics?** because **no teacher can teach what they do not understand or know.** It is an axiomatic truth that needs no proof and should be accepted as such. This has significant implications for the Foundation Phase teachers expected to teach Mathematics in a mother tongue. In this respect, the central concern of the theory dealing with teaching Mathematics in an MT is finding the answers to mathematical problems. Mathematics is a problem-solving subject and is, by its nature, purpose and function, very practical. This means that the teachers of Mathematics in the Foundation Phase must master teaching methods that are practical, experiential and experimental and use a language understandable to learners. Hereunder is a discussion on the social constructivism theory of Ernest.

3.3.1 The Social Constructivism theory of Mathematics by Ernest

The social constructivism theory of Mathematics rests on the view that Mathematics is a social construction or concept based on a language operated by rules and agreements as to how they should be applied. Mathematical language is practical and experimental because it forces a person to demonstrate it truthfully or through validity. This causes the theory of Mathematics to rely on descriptive grounds rather than prescriptive ones. According to Ernest (1991:42), the grounds for describing mathematical knowledge as a social construction are the following:

- the basis of mathematical knowledge is linguistic knowledge, conventions and rules, and language is a social construction;
- interpersonal social processes are required to turn an individual's subjective mathematical knowledge, after publication, into accepted objective mathematical knowledge; and
- objectivity itself is understood to be social.

From the above, the central focus of social constructivism in this study should be to teach Foundation Phase Mathematics teachers how to use an MT to generate mathematical knowledge that their learners understand, rather than justify the existence of Mathematics or argue that Mathematics is abstract challenging to teach. Ernest (1991:43) further points out that: *'*Newly generated mathematical knowledge can be either subjective or objective knowledge, and a unique feature of social constructivism is that it considers both these forms of knowledge, and links them in a creative cycle*'.*

Constructivists claim that both mathematical truth and the existence of mathematical objects must be established by constructive methods to stress the point. In this regard, Ernest (1991:51) believes that 'Linguistic competence consists of communicating linguistically. This, in turn, depends on the shared grammatical forms, of the relationships between terms, and the applicability of terms and descriptions to situations, including shared meanings of terms, at least in publicly observable, behavioural uses'.

As already pointed out, Mathematics is a practical, experiential, demonstrable and experimental subject that must never be treated or taught theoretically. This has huge implications for Foundation Phase Mathematics teachers because the truth is that 1 + 1 = 2 can be demonstrated by practically counting objects. Again, there are many ways of proving that 2 + 3 = 5 and 2 x 5 = 10. Showing how mathematical problems could be practically solved is the way for the Foundation Phase Mathematics teachers to go when teaching Mathematics using operations/rules/laws like Multiplication x, Addition +, Subtraction - and Division ÷. These linguistic operations or rules and laws are framed in simple everyday language that ordinary people use daily. When children come to school, they already know a lot about these operations, even perhaps in English rather than the children's mother tongue. This means mathematical knowledge is a social concept and value-laden. In the Mathematics class, both the teacher and the learners shape and reshape mathematical knowledge according to their cultural situation and linguistic understanding. The next issue addressed relates to Mathematics teaching in a MT based on Piaget's theory, called the *language development theory*.

3.3.2 The Intellectual Development theory of Piaget

Piaget, a French scholar, studied young Swiss children aged between six and 12 in his research work regarded as a ground-breaking study. Foundation Phase learners feature heavily in all that Piaget spent most of his life studying. The intellectual and moral development of young children were intensively and extensively researched over a long period. This study gained much from the findings and observations of Piaget. He used two methods for gathering his data. One was to watch children playing, join their game (his favourite was marbles), and then question them about the game's rules: what the rules were, who made them up, whether they could be changed, and so on.

The keywords speak about the *rules of the game***,** and Mathematics, as already stated above in the submissions from the theory of Ernest, is based on rules or laws. Piaget's work is significant for this study because it teaches that children of a particular age have **difficulty observing regulations or laws**. Teachers in the Foundation Phase

would do well to study Piaget's research into how children develop intellectually and morally because Mathematics forms a critical part of their lives.

Piaget's observations of children playing with marbles and their reactions to his stories led him to conclude that children pass through three **intellectual and moral development stages**. They are the following, according to Piaget in Hamachek (1990:170): Up to about age four or five, children are essentially **pre-moral**, which, loosely translated, means they are not particularly concerned about **rules.**

For example, when a couple of three- or four-year-olds play marbles, each is likely to have its own idiosyncratic rules. They do not care if one of them has a hand in the ring of marbles or moved a couple of marbles out of the way to have a clear shot with the shooter: the **point is to have fun.** At about age five and up to age ten, children enter the second stage of moral development, which Piaget called **moral realism.** It is during this time that children develop what Piaget termed a **morality of constraint**. During this stage, they take **rules** very seriously and tend to view behaviour as either right or wrong, and they assume that everyone views behaviour the same way. According to the observations by Piaget, the above age levels are significant in that they reveal how children develop both intellectually and morally. Understanding the development of children's intellectual and moral consciousness can help Foundation Phase teachers when assisting the children in mastering the rules governing Mathematics in a MT.

Jerome Bruner (1977:33) helps academics and scholars to understand Piaget better on the aspect of **readiness for learning** by pointing out that any subject can be taught effectively in some intellectually honest form to any child at any stage of development. This is a bold hypothesis, and an essential one in thinking about the nature of a curriculum. There is no evidence to contradict it, and considerable evidence is being combined that supports it. Bruner, a student of Piaget, debunks the fears and challenges the teachers of the Foundation Phase commonly cite when teaching Grade 3 learners in a MT. According to Bruner (1977), Piaget distinguished the following three stages in the intellectual development of children from observing them as they were playing:

The first stage need not concern us in detail, for it is characteristic of the pre-school child. In this stage, which ends around the fifth or sixth year, the child's mental work principally establishes relationships between experience and action; his concern is manipulating the world through movement that has language infused. The second stage of development - when the child is in school (Foundation Phase) - is called *the stage of concrete operations*. This stage is operational in contrast to the preceding stage, which is merely active. A procedure is a type of action; it can be carried out directly by manipulating objects, or internally, as when one uses the symbols that represent things and relations in one's mind through language. Intellectual operations now appear to be predicated upon the same mathematical, logical operations that are the stock in trade of the abstract thinker. At this point, the child can give formal or clear expression to the concrete ideas that guided his problem-solving before but could not be described or formally understood without the use of language.

The above points are significant in many ways, and in the Foundation Phase, teachers are supposed to know and understand them to teach young children, especially the Grade 3 learners, in a MT. These points indicate the critical junctures in the stages of the child's intellectual development that teachers should be able to use in both their preparation and their teaching in a MT. The next theory to be discussed is that of Vygotsky.

3.3.3 The Sociocultural theory of Vygotsky

Vygotsky's theory is relevant to this study because it addresses issues that are related to the demography of the study, such as the different race groups, languages, socio-cultural backgrounds, historical orientations and psychological aspects that have a bearing on the cognitive development of the children attending school in the Foundation Phase. Lev Vygotsky's mother was a teacher, and he was literate in eight languages. His study related to the educational problems of deaf children and those with learning difficulties. He is regarded as the founder of the sociocultural theory, a precursor of social situation, and a giant in the field of scholarship, especially regarding the social interactions of children with teachers using language. His studies have significantly influenced views of the child's cognitive development and contributed to how teachers in the Foundation Phase should use language to handle their young learners.

The importance of Vygotsky's theory to this study is that it emphasises the aspect of social interaction within a cultural milieu in which the child's cognitive development is hugely impacted (Vygotsky, 1978). Undeniably, Vygotsky believed that the community in which the children live, and the language used, play an equally important role in their process of making meaning of the reality that confronts them. In addition, the children's social interactions with their environment play an essential role in their cognitive development. However, unlike Piaget, whose view was that context and culture play a small role (Smidt, 2013; McLeod, 2018), Vygotsky's focus was on the process of child development rather than on the abilities seen in children at particular ages (McDevitt & Ormrod, 2014:240).

McLeod (2018) argues that the individual child's development cannot be understood without reference to the social and cultural environment in which the child is rooted. This includes the language of communication. Furthermore, Shunk (2012) explains that the child acquires skills and knowledge through social interactions inside and outside the classroom. Therefore, the emphasis is on how culture and social interaction influence the child's intellectual development through language (Jaramillo, 1996; Schunk, 2012; Smidt, 2013; Moll, 2014; McDevitt & Ormrod, 2014). This means that social processes and cultural resources play a significant role in facilitating the child's cognitive development concerning Mathematics and, by extension, learning through the medium of a MT. The child's mental processes, such as language development, thought and reasoning, accrue from the social interactions the child is experiencing in their social milieu (Jaramillo, 1996; McLeod, 2018), namely, the Foundation Phase class.

According to McLeod (2018), Vygotsky's social constructivism or socio-culturalism addresses a situation in which the learner is influenced by his background and culture to arrive at a self-directed stage of learning about Mathematics. In other words, Vygotsky assumed that cognitive development varies across cultures due to cultural differences, including the language used. The argument is that children from different socio-cultural backgrounds are exposed to different experiences, and Foundation Phase teachers should take this seriously. Hence, McLeod (2018) statement that the environment, which includes the MT, significantly influences how learners think and what they think about is deemed most relevant. This theory acknowledges that

knowledge for children is actively created rather than passively absorbed (Vygotsky 1978; McDevitt & Ormrod, 2014:214). It also advocates the consideration that the learner is a social constructor and must therefore be assisted by their Foundation Phase teachers through language to master the needed skills (Waller & Swann, 2009). In other words, in the Foundation Phase, teachers should be playing an essential role in facilitating their learners' mastery of Mathematics through the MT. Vygotsky postulates that teachers should be knowledgeable about learners' MT to devise interdisciplinary themes or plans that correlate with their interests (Jaramillo, 1996).

According to Vygotsky, the social world is, therefore, the interpersonal interactions between, for example, Grade 3 learners and their teacher or Grade 3 learners and their peers, coupled with the socio-cultural and historical influences on learning and the language in the learning environment (Zhou & Brown, 2017). In summary, according to Zhou and Brown (2017), the theory of cultural constructivism suggests that cognitive development is the significance of culture, the importance of the prominent supporters of culture, such as language, and the relationship with and development of the learner within this sociocultural world. In this regard, Zhou and Brown (2017) have posited that culture should be regarded as socially acknowledged conduct, attitudes, and beliefs developed through human societal products, such as institutions, symbol systems, and tools like language. This explains that developmental processes are within individuals and group and community processes (Waller & Swann, 2009).

Accordingly, Vygotsky sees the philosophy of historical changes in society as having a significant impact on how people think and behave (McDevitt & Ormrod, 2014:232). This means that children growing up in different contexts will have various forms of cognitive development (Smidt, 2013) because of the language used and the individual cognition occurring in a social situation (Jaramillo, 1996). Additionally, Vygotsky argues that cultural influences on childhood development are first demonstrated by the child's innate or essential functions, known as *elementary mental functions*, such as reacting to the teacher's instruction and asking for help with mathematical problems. McLeod (2018) and Shabani (2016) further describe elementary mental functions as attention, sensation, perception and memory, which the Foundation

Phase teacher should exploit to the advantage of the learners in a mathematical class in a MT.

As the child interacts with the sociocultural environment, the elementary mental functions are progressively transformed into more refined cognitive processes/strategies, known as *higher mental functions*, such as reasoning, problem-solving, propositional and academic reasoning (McLeod, 2018; Zhou & Brown, 2017). Therefore, the Foundation Phase teacher should use more refined mental processes for teaching Mathematics to Grade 3 learners because these processes present the teacher with valuable opportunities for using the language the learners understand. Furthermore, the teacher should use their know-how to create new environments in the classroom because, according to McLeod (2018), the higher mental function in the individual is influenced by culture and language. This means that the school should be a place where new Mathematics concepts can be continually introduced to stimulate the child to learn in a mathematical social environment. For example, McLeod (2018:2) further states that 'children learn note-taking in their culture to aid memory but, in pre-literate societies, other strategies must be developed, using language, for tying knots in string or carrying pebbles or reciting the names of ancestors until large numbers can be repeated'.

Against the above background, Zhou and Brown (2017) and Vygotsky (1986) declare that language is an essential cultural tool by which learning can occur through social interaction, behaviour, attitudes, cognitive development, and culture development. This is the opportunity that the teachers of the Foundation Phase should harness when teaching Grade 3 learners' Mathematics through their MT. In this regard, Vygotsky (1986) identified the following three stages of speech development:

- ***Stage 1 - Social or External Speech***

Social or external speech happens during the first stage of language development, usually in children under the age of three. Because of their limited speech, these children can only express simple thoughts and basic emotions; for example, 'Want sweets'. The child at this stage is not at school yet, so cannot be taught Mathematics, or any subject, without using MT language.

- ***Stage 2 - Egocentric Speech***

Egocentric speech occurs between social speech and inner speech. It usually develops between the ages of three and seven. During this stage, the child begins to formulate complete sentences with more sense. They master this skill by talking loudly to themselves in their MT about the things they are doing. But, again, it would be challenging to teach Mathematics to most seven-year-olds without using language they understand.

- ***Stage 3 - Inner Speech or Self-talk***

This occurs in the final stage of language development. As egocentric speech matures, inner speech progresses. The child can perform activities, such as mental calculations, or analyse a situation by voicing his thoughts or saying words. The formation of inner speech is then linked to internalisation. This involves the child's internal acceptance of social values, beliefs, attitudes or standards, and the child can engage in lower mental functions (Zhou & Brown, 2017). According to Vygotsky (1978), as argued in Zhou and Brown (2017), Moll (2014) and Jaramillo (1996), the psychological/cognitive and linguistic skill is transformed or appears on two levels, namely, the social level and the individual level.

- ***Social level***

On the social or interpsychological/interpersonal level, the function first appears between people; what is needed from the individual is to conform to society. It involves the rules and norms of society that adults and more competent peers teach their younger initiates. This is the level where social learning occurs. At this period of the child's development, the teacher of the Foundation Phase can seriously engage the learners and empower them with mathematical knowledge and skills in their MT.

- ***Individual-level***

At the individual or intrapsychological/intrapersonal level, the function appears within the child. Therefore, it is an excellent time to give the Grade 3 learners homework in mathematical exercises in the MT because they accept interpersonal or personal-cultural influences, such as values, beliefs, attitudes or standards (Zhou & Brown,

2017). At this stage, teachers could use various methods using MT language to teach a group of Grade 3 subject content through the manipulation of materials and social interaction (Schunk, 2012). To this end, Shunk posits that the teacher's use of MT in mathematical lessons should allow learners to construct their meaning out of what they are being taught and points out that the most straightforward recommendations are to involve students actively in their learning and to provide experiences that challenge their thinking and force them to rearrange their beliefs (Schunk, 2012:235).

Wertsch (2010 in Moll, 2014:21) identified the following primary and related themes that characterise Vygotsky's cultural-historical approach: higher mental processes, such as problem-solving and voluntary attention, that have a social origin; human thinking that must be understood developmentally (historically), at both the individual and the cultural level; levels of analysis; mediational means of various kinds, crucial in human social and psychological development; and active subjects that create themselves through their social actions.

Accordingly, the Foundation Phase of the Grade 3 child's education through the MT should positively influence the child's cognitive development so that the child can learn Mathematics with ease. For example, the teachers' good attitudes, beliefs, and values can positively shape the thought patterns and ideas of Grade 3 learners to accept Mathematics as an essential subject using the MT. Furthermore, Vygotsky believes that the learner-teacher and learner-peer relationships are critical in constructing ideas and ways of viewing things using language (Zhou & Brown, 2017).

In the Foundation Phase, teachers use language to facilitate Grade 3 children's learning of new mathematical concepts. According to Jaramillo (1996), learning begins at a concrete level where teachers and peers can use language competently to describe mathematical objects and learn new content in their classroom. For example, when Grade 3 learners are taught how to associate a concrete object, such as a table, with the symbol (word) for it - 'table', the teacher can use the occasion to advance them to the level where they can think about mathematical concepts without any use of concrete objects. After achieving this mathematical competency, Grade 3 learners can be made conversant with abstract concepts. Vygotsky (1978) notes that language is the primary tool whereby a Grade 3 learner's social experience is psychologically

represented. Therefore, the MT is an essential tool for teaching Mathematics to Grade 3 learners in the classroom context.

In a teaching and learning situation, the teacher uses the knowledge of his pre-existing social world to enculturate his Grade 3 learners into the study of Mathematics using their MT. Vygotsky (1987) notes that, through language, the following is achieved: (a) communication that enables social interaction with others and the creation of meaning; and (b) communication that mediates intellectual activity through MT discourse using inner speech. The views of Vygotsky are educationally significant in the sense that the Grade 3 teachers can use them to help their learners master mathematical concepts, especially if they are from the same culture, using the same language. Vygotsky also posits that Grade 3 teachers can use the art of communication to inculcate a love of Mathematics. As the teacher and learners interact with mathematical concepts, the teacher should use cultural artefacts, such as their language, objects and materials, to develop the intellectual capacity of the learners (Moll, 2014).

According to KENPRO (2010:20), *collaborative learning* is the idea that conversations with older people can help children cognitively and linguistically. This theory suggests that language development occurs when the interaction between the learners and their teacher, the *more knowledgeable the other* (MKO) (Lotfi, 2015:3; Shabani, 2016). The MKO in society can be a person, such as parents, adults or anyone who influences the child's development. In this case, the MKO is the Grade 3 teacher, who has more knowledge, skills, ability and understanding of Mathematics teaching than the learners.

The Grade 3 teacher, as the MKO, is experienced and professionally qualified to teach Mathematics in the school situation and influences the development of the child. McDevitt and Ormrod (2014) postulate that the MKO can use various tangible tools, such as paper, the alphabet, writing utensils, books and, in modern industrialised societies, computers, calculators, cell phones and other educational and recreational technologies. This includes cognitive entities, such as concepts, theories and problem-solving strategies. Therefore, practical learning in Mathematics will occur as the knowledgeable teacher uses relevant tools to guide learners during the teaching and learning process.

According to Vygotsky, the social interaction in which the learner can perform a set of tasks with the guidance of the MKO is known as the *zone of proximal development* (ZPD). The ZPD outlines the difference between the Grade 3 child's independent learning accomplishments and accomplishments under the guidance of a teacher who is more competent in a specific subject like Mathematics (Zhou & Brown, 2017:35). Below is a diagram demonstrating how ZPD takes place.

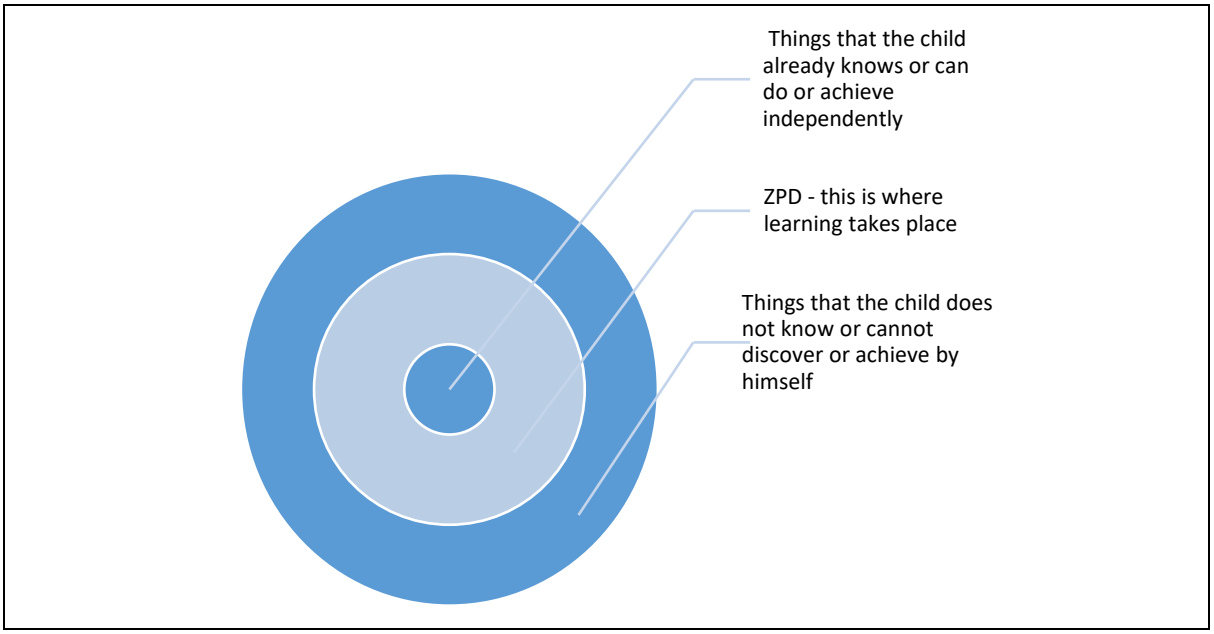


Figure 0.1. The zone of proximal development (ZPD).

The ZPD can be visualised in a set of three circles or rings, with the innermost circle representing the things that the child already knows or can discover or achieve independently. The outer circle represents what the child does not know or cannot learn or achieve by himself but can only achieve through the guidance of the MKO. The space, gap or circle between the inner and the outer circle is where learning occurs and is known as the ZPD. In an intentional and somewhat systematic manner, Vygotsky believed that an adult fosters learning in the MT. Thus, engaging the Grade 3 children in meaningful and challenging activities, and showing them how to use different cognitive and physical tools to facilitate their performance in Mathematics, will give them a good sense of what they are learning (McDevitt & Ormrod, 2014:232).

The Foundation Phase teacher's responsibility is to guide and give instructions to the Grade 3 learners in Mathematics. Vygotsky explains that in the Foundation Phase, teachers must develop lesson plans that direct the Grade 3 learners and a continuity

of experience that effectively makes them able to master Mathematics (Jaramillo, 1996) using MT. The teacher's role in designing this interplay, according to Vygotsky, lies in the ZPD, where the social learning environment embraces the Grade 3 learners' interactions with the teacher and peers. As a result, the Grade 3 teachers and more competent peers guide other learners to master mathematical concepts within their social and cultural experiences (Jaramillo, 1996; Moll, 2014). As Zhou and Brown (2017) argue, learner-teacher and learner-peer relationships are important in generating new ideas, perspectives, and cognitive development using an MT.

According to Vygotsky, a teacher can teach any subject to any child at any level of development by employing modelling and scaffolding techniques at a level that parallels the learner's ZPD. For example, when they teach concepts just above their current skills and knowledge level, they should speak in the MT to encourage learners to use concrete objects in a small group, cooperative learning settings and associate these tangible objects with abstract mathematical concepts (Jaramillo, 1996). This means that teachers in a Grade 3 Mathematics classroom can use concrete objects to demonstrate activities using the MT for proper instructions and then allow learners to perform the activities independently. The teacher (MKO) must consider the learner's level of development (ZPD) to guide the learner in developing his higher mental functions.

Vygotsky acknowledges that peers (other Grade 3 learners) can influence one another through their MT to construct the meaning of mathematical concepts in the ZPD. Vygotsky postulates that Grade 3 children learn by doing things while interacting with others. Therefore, Foundation Phase teachers should accommodate such activities when designing their Mathematics lessons (Jaramillo, 1996). Comparing what Grade 3 children can do independently with what they can accomplish with the assistance of the MKO, according to Moll (2014), not only provides a dynamic perspective on their capabilities but can reveal the importance of MT teaching in Mathematics. Vygotsky suggested that instruction should not be aimed at what the child can already do as an individual, but proximally, at the abilities that are developing and become manifest with help from the use of the MT by knowledgeable others.

Grade 3 teachers should create a social context where a more competent peer is paired with a less capable learner so that the clever child can help the less competent one (Jaramillo, 1996). By this approach, less competent Grade 3 learners will experience cognitive growth through their help, using their MT. When Grade 3 learners collaborate with a more capable peer or teacher, Vygotsky states that the distance between the learners' actual development level of problem-solving and their potential for development through problem-solving determines his ZPD (Jaramillo, 1996).

According to Vygotsky, social group learning and peer collaboration are essential because learners can teach skills and experience higher self-efficacy for learning as models for and observing each other (Schunk, 2012). Therefore, Foundation Phase teachers should create an environment where the Grade 3 learners work in small groups to solve mathematical problems to encourage them to devise problem-solving methods collectively (Jaramillo, 1996). In addition, Shabani (2016) postulates that humans use symbolic tools, such as numbers and arithmetic systems, music, art and language, to mediate the higher forms of human mental activity in teaching Mathematics. *In Vygotsky's theory, scaffolding* is the premise that, as the MKO leads the less knowledgeable Grade 3 learners to engage in the learning activities, they should both participate in an activity known as *dialogue negotiation*, using language for learner benefits (Shabani, 2016).

3.3.4 Vygotsky's theory and professional development

Vygotsky's theory assumes that social interaction using language precedes human development and, by extension, the intellectual development of the Grade 3 learner. Shabani (2016) claims that Vygotsky's sociocultural theory, particularly the ZPD, can improve the learning capacity of the Grade 3 learners using their MT to enable learners to master mathematical concepts. The essential advantages of Vygotsky's approach are twofold. Firstly, it develops the mental capacity of the Grade 3 learners by closing the gap between what they do not know and what they should know in Mathematics. The teachers should achieve this by explaining the concepts of Mathematics through the actual learning process in their sociocultural environment. Second, the theory emphasises the critical role of follow-up support systems for the Grade 3 learners to ensure that effective learning is sustained (Shabani, 2016). This means that

experienced teachers of the Foundation Phase should provide their Grade 3 learners with knowledge and understanding using their MT to help them master mathematical concepts that would cause them to change their ZPD.

Foundation Phase teachers can also improve their expertise when dealing with educational problems learners face when learning mathematical concepts in group activities or working in groups of peers using language (Shabani, 2016). In this regard, the idea of ZPD, which is closely related to the scaffolding approach, plays an essential role because it allows less knowledgeable Grade 3 teachers to be assisted in developing by more knowledgeable teachers. The support given to the Grade 3 learners by their teachers can lead to the learners' mastering mathematical concepts from their socio-cultural environment. The professional development that should be given to the Foundation Phase teachers can be a follow-up, assisting them by providing appropriate teaching materials, textbooks and classroom equipment. Professional journals, newsletters and online forums can have a positive influence on the teachers' ZPD progression. The Foundation Phase teacher's professional development can also be improved by using technology from the internet and computers (Shabani, 2016).

According to Vygotsky, a mutual benefit is created between the Grade 3 teacher and her mentor (a more knowledgeable teacher). They share problems related to teaching Grade 3 Mathematics in a MT. This exercise will eventually assist both Grade 3 teachers to contribute knowledge. As teachers collaborate with their peers, they can jointly construct a ZPD whereby each person will contribute to and benefit from others (Shabani, 2016) using MTs as the LoLT. Grade 3 teachers should become actively engaged in interactions meant to empower the learners to master Mathematics through MT teaching. The partnership between the teacher and her Grade 3 learners can lead to each gaining immensely as they construct knowledge embedded in their socio-cultural milieu. As the Grade 3 learners collaborate as peers, they can jointly build a ZPD whereby each learner will contribute to and benefit from the others (Shabani, 2016), learning by using their MT.

Similarly, Shabani (2016) explains that novice teachers should be granted sufficient time for professional development in teaching complex subjects like Mathematics in

an MT. Furthermore, such teachers should be given opportunities to test their newly acquired skills and ideas in classroom-oriented mathematical activities. They should also be allowed time to reflect on applying their newly acquired skills and knowledge of Mathematics using MT in a friendly classroom environment. Lastly, the effectiveness of Vygotsky's theory is increased if the Foundation Phase teachers' psychological functions, skills, competence and knowledge, and attitudes to using an MT for teaching Mathematics to Grade 3 learners are shaped in the classroom context in which they are interacting. Therefore, the Foundation Phase teachers' professional development programme should be aligned with their Grade 3 learners' needs. Furthermore, these must be contextualised to align with sociocultural factors in the communities from which they come (Muhayimana, 2017).

3.4 CONCLUSION

This chapter discussed the theoretical framework underpinning the study. First, it presented Ernest's social constructivist theory, which emphasises the importance of the teacher's knowledge of Mathematics (subject matter knowledge) and teaching mathematics (pedagogical knowledge) in a MT. The Grade 3 teacher's mathematical ability is thus essential and should assist in lesson planning, demonstration, explanation of concepts, diagnosis of misconceptions and acceptance of the learner's methods using MTs.

Second, it presented Piaget's intellectual development theory, which states that cognitive learning occurs in stages of intellectual development. The pre-operational stage, emerging from age two to age six, is when the child is preoccupied with verbal skills and can name objects and reason intuitively. The concrete operational stage experienced by seven to 11 years is the formal active stage when the child can reason logically and systematically. At this stage, the child can deal with abstract concepts, such as the numbers and symbols that are popularly used expressions in Mathematics. Therefore, teachers must plan age-appropriate mathematics lessons and teach them through a language they understand.

Lastly, it presented Vygotsky's sociocultural theory, which proposes that learning is a socially mediated process influenced mainly by the common language used by the community. This means that Grade 3 teachers must create an environment that is

socially accessible to the learners to benefit from their teachers as knowledgeable others. According to Vygotsky, the learning potential of the learners and the influential role of familiar others, such as teachers and more knowledgeable peers in mediating learning, is embodied in and by the ZPD. Zhou and Brown (2017) state that the best way to enhance the learner's cognitive development is for the teacher to use activities that are linked to the language used by the learners. Moll (2014) recommended that teachers be given opportunities to engage in lifelong learning because of the knowledge explosion in all fields of study. The following section deals with the research methodology adopted in the study.

CHAPTER FOUR
RESEARCH METHODOLOGY

4.1 INTRODUCTION

This chapter describes and discusses the research design and methodology used to collect data on teachers' experiences in teaching Mathematics to Grade 3 learners in a MT in the Tshwane North District of South Africa's Gauteng province. It outlines the objectives of this thesis and describes the research process that informed the study. It details the choice of the research paradigms underpinning the research and the research approach, design and methods used to sample participants and research sites. The chapter also provides a detailed description of data collection processes, strategies and data analysis. It explains how the trustworthiness issues were attended to ensure that the study was ethically conducted. An outline of the study's objectives is followed by a description of the research paradigm, ontological and epistemological standpoint, methodological paradigm, ethical considerations, and limitations. The chapter concludes with an explanation of the importance of the study in the broader educational context.

The following were the Sub-questions for addressing the research question: How do Mathematics teachers use an MT to teach Grade 3 learners?

Sub-questions

- How do Mathematics teachers explain Mathematics concepts to Grade 3 learners?
- What are the challenges experienced by teachers using an MT in teaching Grade Mathematics?
- How do Grade 3 teachers overcome the challenges experienced in teaching Mathematics in a MT?
- What are the successes experienced in teaching Mathematics in a MT?

4.2 RESEARCH PARADIGM

Every researcher has a view of what constitutes truth and knowledge. A review of the literature by scholars in the field led to a deeper understanding of the meaning of a *research paradigm*. According to Hernandez, Fleurence and Rothman (2015), the term *paradigm* describes a researcher's world view. Similarly, Guba and Lincoln (1994) and Schwandt (2001) describe a paradigm as a whole belief system that guides an enquiry or an individual concerning their place in the world. Rehman and Alharthi (2016) first used the word *paradigm* to refer: (a) to a particular way of thinking shared by a community of scientists, which acts as a guide or map in solving a problem in their field; and (b) to represent the commitment, beliefs, values techniques and methods shared across the discipline. The concept allows researchers to identify the relationship between variables and specify appropriate methods for conducting thorough research (Hernandez, Fleurence & Rothman, 2015).

As the above explanation implies, a *paradigm* is a specific way of looking at the world; the values and assumptions inform the researcher, guiding the focus and form of the intellectual structure on which the research process is based (Rehman & Alharthi, 2016). Because the paradigm defines the researcher's philosophical positioning, the research design or plan cannot be separated from the researcher's constructivist (or interpretivist) paradigmatic perspective on the world of research. A paradigm has four elements: ontology, epistemology, methodology, and axiology (Creswell, 2014).

Ontology is the term that refers to what people believe about reality or how the social world is constituted. Thus, ontology is a philosophy concerned with assumptions that something makes sense or is real (Scotland, 2012; Kivunja & Kuyini, 2017). Philosophical assumptions about the nature of reality are essential for understanding how the researcher derives meaning from the data gathered. According to Kivunja and Kuyini (2017), these assumptions, concepts, or propositions help orientate the researcher's thinking about the research problem, its significance, and how to approach it to contribute to its solution. Therefore, researchers need to take a stand on their perceptions of how things are and how things work (Scotland, 2012:1).

Epistemology refers to how knowledge can be created, acquired and communicated. In considering the epistemology of research, the researcher asks questions like: 'What

is the nature of knowledge and the relationship between the knower and the would-be-known? What is the relationship between the enquirer and what is known? These questions are essential because they help position the researcher in the research context to discover what is new, given what is known (Scotland, 2012:9).

The methodology is how the enquirer finds out what they believe can be known; it is concerned with the strategy or plan of action (Scotland, 2012:). Keeves (1997) refers to methodology as the research design, methods, approaches and procedures used in an investigation that is well planned to establish something. In short, the questions address the issues (a) of what in the researcher's view constitutes reality; (b) of how the researcher positions himself concerning this reality; and (c) of how the researcher will go about finding out something about the reality. For example, data gathering, participants, instruments used and data analysis form part of the broad field of methodology. These three questions provide a holistic view of how people view knowledge, how they see themselves concerning it, and the methodological strategies people use to discover it (Keeves,1997).

'The researcher's methods can be traced back to an ontological position through methodology and epistemology' (Scotland, 2012:10). Thus, everything the researcher wrote and researched in this study was influenced by the researcher's ontology and epistemology, which guided the methodology. In other words, the researcher's ontological and epistemological stances are that (a) knowledge is socially constructed; (b) individuals interact with their social worlds in different ways; and (c) therefore, the constructed realities will reflect these differences (Merriam, 2009).

In this study, the researcher believed that she had to interact with participants to understand how Mathematics teachers use an MT to teach Grade 3 learners. This would, in turn, assist in understanding the different meanings the participants attached to their experiences. The researcher understood that the information obtained from the participants (experiences) should be interpreted according to the purpose the participants adhere to them (Blumberg, Cooper & Schindler, 2011; De Vos, Delport, Fouche & Strydom, 2011).

Axiology deals with ethical values that the researcher is expected to observe while engaging the participants. This applied to the different meanings by participants

attached to their experiences of using an MT to teach Mathematics to Grade 3 Learners.

De Vos *et al*. (2011) argue that conducting every research in a specific paradigm is essential. Therefore, the researcher's clear ontological and epistemological stance significantly influenced this study's choice of paradigms. According to Creswell (2014), five alternative enquiry paradigms in social science research are positivism, post-positivism, critical theory, constructivism and participatory approach. The specific paradigm reflected in this study and that represents the researcher's world view relating to the topic under scrutiny is the social constructivist (or interpretivist) paradigm.

4.2.1 Social constructivism and interpretivism

The philosophical world views proposed in this study are, as mentioned, social constructivism and interpretivism (Creswell, 2014). *Social constructivism* refers to the subjective meanings often negotiated socially and historically; they are not simply imprinted on individuals but are formed through interaction with others and historical and cultural norms that operate in individuals' lives (Creswell, 2014). This approach aims to understand people's views and opinions (Ormston, Spencer, Barnard & Snape, 2014).

In this study, the terms *constructivism*, *constructivist*, *interpretivism* and *interpretive* are used interchangeably. However, their meanings are shaped by the intent of the users. *Constructivism* as a theory of learning explains the way people learn or develop: It is not a prescriptive theory of knowledge but the way people should learn (Richardson, 1997:4). As Denzin and Lincoln (1994) maintain, the proponents of these arguments share the goal of understanding the complex world of lived experiences from the point of view of those who live it. Therefore, *constructivism* suggests that individuals create a new understanding based on the interaction between what they already know and believe and the phenomenon or idea they encounter (Richardson, 1997:4).

Similarly, Creswell (2014) argues that social constructivists believe that individuals seek to understand the world they live and work in. Therefore, as stated in Creswell

(2014), the goal of the research is to rely as much as possible on the participants' views of the situation being studied. Furthermore, Scotland (2012) highlights the importance of explicitly recognising the researcher's values and social, economic, cultural and political orientations on choices and decisions made during the research process and on the intention, structure and outcome of this process.

The main aim of the *interpretive* research process is to understand how different individuals or groups of people perceive their reality and their place in that reality (Guba & Lincoln, 1994). In this study, the researcher argues that there are multiple realities and that the views of individuals are important and valid, with one person's interpretation of an issue different from that of another; reality is mutually and socially constructed, and a diversity of interpretations can be made. Each mathematics teacher is a 'knower' in this research, whose knowledge can therefore only be shared by exploring participants' views, meanings, experiences, and actions. Thus, the researcher had to make sense of (or interpret) the meanings others assigned to the world. (Creswell, 2014). The researcher framed the current study within the interpretivism paradigm to understand how Mathematics teachers use an MT to teach Grade 3 learners.

Blumberg *et al.* (2011:36) assert that human interests channel our thinking and sway how the world is investigated and how knowledge is constructed. Therefore, the approach to social phenomena for the current study had to reflect the recent standard construction of knowledge; and therefore, made the following assumptions:

- the social world is observed by seeing what meanings individuals give to it and interpreting these meanings from their viewpoint; and
- social phenomena are understood by looking at reality.

Gathering and measuring facts would consequently not disclose the essence of social phenomena; instead, one would need to explore why different Grade 3 Mathematics teachers have different experiences in their use of an MT and to understand how these differences result in the various constructions and meanings they give to their social world. In this way, the researcher made sense of how different Grade 3 Mathematics teachers interpreted their social world. This required that she delve into the processes of subjective interpretation, acknowledging the motivations, interests, intentions,

beliefs, values and reasons, meaning-making and self-understanding of the participants (Blumberg *et al*., 2011:18). An individual cannot be isolated from the environment in which they live because reality is 'socially and experientially based' (Guba & Lincoln, 1994:110). Therefore, a researcher cannot study individuals exclusively; because they are members of a greater society, the researcher must study an individual in conjunction with their environment.

According to Lincoln and Guba (1985) and Morgan (2007), research that is conducted under the interpretive paradigm usually exhibits the following characteristics: the admission that the social world cannot be understood from the standpoint of an individual; the belief that realities are multiple and socially constructed; acceptance that there is an inevitable interaction between the researcher and research participants; acceptance that context is vital for knowledge and knowing; the belief that the findings create knowledge, can be value-laden and that the values need to be made explicit; the need to understand the individual rather than universal laws; the belief that causes and effects are mutually interdependent; and the belief that contextual factors need to be taken into consideration in any systematic pursuit of understanding.

As far as research methodology is concerned, Henning, Van Rensburg and Smith *(*2004:20) view that the interpretive understanding of knowledge is grounded in interactive, field-based, inductive, and intertwined in practice in a particular context. Therefore, it is the researcher's responsibility to look at different things and in other places to understand a phenomenon. Interpretivist views tend to show a preference for methods that produce facts and analyse and describe the meaning of the social world (Gephart, 1999). Gephart argues that the main analytical techniques applied in interpretative research are *grounded theory* and *expansion analysis*. These methods entail qualitative data-gathering methods, whereby data are generated mainly through interactions like conversations and interviews.

Therefore, it is the researcher's responsibility to comprehend, describe, and interpret how different participants in a social setting construct the world around them (Merriam, 2009). This researcher chose to base the study on a qualitative approach because qualitative design utilises an inductive strategy that is not based on predetermined or

preconceived ideas but on theories that emerge from the data. The researcher was guided by Creswell's (2014) view that a qualitative researcher intends to make sense of the meanings others assign to the world, to generate or inductively develop a theory or pattern of meaning. The researcher obtained the views and perspectives of teachers as critical informants, that is, people who were knowledgeable about the phenomena. The researcher also probed the research setting to understand teachers' experiences in using an MT to teach Mathematics in that setting. The researcher was concerned with their experiences and how such experiences influenced effective teaching and learning.

According to Kivunja and Kuyini (2017), the best methods within the interpretive research paradigm are interaction and interpretation. Ormston, Spencer, Barnard and Snape (2014) and Kivunja and Kuyini (2017) advance the view that it is researchers' responsibility to understand how human beings experience and interpret their world. Therefore, they engage in active collaboration with the participants to address real-life problems in a specific context to offer and implement feasible solutions to the problem (Blumberg *et al*., 2011:17). Therefore, transcripts and conversations were studied to understand any understated non-verbal communication and understand the interaction in its actual context (Neuman, 2011:101). This is because Grade 3 teachers cannot be isolated from the environment in which they work, that is, from the school where they are required to use an MT to teach Mathematics.

In summary, the guiding methodological strategies that correlate with those mentioned above ontological and epistemological frameworks are interactional, interpretive, and qualitative. The ontology of constructivism supports this point of view in that it regards people's subjective experiences as being accurate, valid and unconditionally important. The researcher's perspective is that teachers' experiences can best be understood by interacting with them and listening to them. From the debates presented above and the literature reviewed, the conclusion could be drawn that qualitative methods are more suitable for the interpretive paradigm of this study, which explores teachers' experiences in teaching Grade 3 Mathematics in a mother tongue.

4.3 RESEARCH METHODOLOGY

According to McMillan and Schumacher (2014:16), the methodology is how one collects and analyses data. The methodological question, 'How can the inquirer, which is the would-be knower, go about finding out whatever he or she believes can be known?' (Guba & Lincoln, 1994:111) was used in this study to explore the experiences of teachers when teaching Mathematics to Grade 3 learners in their mother tongue. According to Keeves (1997) and O'Cathain (2010), the *methodology* is the general term used to refer to the research design, methods, approaches and procedures used to determine something with a well-planned enquiry. They assert that it is a broad field of practice, encompassing data gathering, participants, instruments used and data analysis. In short, McMillan and Schumacher (2014:16) and Creswell (2014) define methodology as to how one collects and analyses data. The methodological approach taken in this study is qualitative.

4.3.1 Qualitative research approach

This study used qualitative research to investigate how Grade 3 teachers use an MT to teach Mathematics to Grade 3 learners. Many qualitative researchers function under different ontological assumptions about the world. They believe that the world comprises people with assumptions, attitudes, beliefs and values (Maree, 2012:55; Kawulich, 2015). Every researcher has an assumption of what constitutes truth and knowledge (Kawulich, 2015). These assumptions, concepts, or propositions help orientate their thinking about the research problem, its significance, and how they might approach it to contribute to its solution (Kivunja & Kuyini, 2017).

Scotland (2012) and Maree (2012) postulate that the way of knowing reality is to explore the experiences of others in connection with a specific phenomenon. By employing qualitative modes of enquiry, the researcher attempts to position him- or herself in the research context, to describe the epistemological element of their paradigm, which is the relationship between the researcher as the enquirer, and what is known by the participants (Kivunja & Kuyini, 2017).

Epistemology establishes how much faith the researcher has in the data collected and how they will uncover knowledge in the social context that is being investigated. It

allows the researcher to describe how to become familiar with something and discover what is new, compared to what is expected (Kivunja &, Kuyini 2017). Research design aims to provide a detailed analysis of what is involved in planning and executing a research study, from identifying the problem to reporting and publishing the results (Punch, 2005). This paradigm enables researchers to understand individual experiences and how participants create the meaning that informs their unique understanding of the world (Creswell, 2014).

This section refers to the plan and procedures for the proposed research study, from broad assumptions to detailed data collection, analysis and interpretation (Creswell, 2014). The selection of the approach is thus based on the nature of the research problem or issue being addressed, the researchers' personal experiences, and the audiences of the study (Creswell, 2014). Finally, the research design is applied so that suitable research methods are used to ensure that the goals and objectives as set out in Chapter 1 are attained. For this reason, the researcher must be entirely sure which approach or method would best provide the information required (Clough & Nutbrown, 2012:29, 316).

Creswell (2014) posits that qualitative research is an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem. The researcher entered the setting with an open mind, immersed in the situation's complexity, and interacted with the teachers. This process involves using emerging questions and techniques, data collected in the participant's setting, data analysis inductively built from particular to general themes, and the enquirer's interpretation of the meaning in the data (Creswell, 2014). Therefore, a qualitative approach helped the researcher understand how teachers make sense of their own lived experiences to teach Mathematics to Grade 3 learners in a MT by going to the schools to interview the participants and analyse documents in their natural setting.

However, the qualitative methods are distinct from those used in quantitative designs. They emphasise gathering data on a particular phenomenon in a natural context, whereas quantitative research designs emphasise objectivity in measuring and describing phenomena (Yin, 2012; McMillan & Schumacher, 2014:31). Therefore, a qualitative research approach was suitable for this study because it accommodates both the constructivist and the interpretivist paradigms within which the study was

conducted. Another reason for conducting this study via a qualitative approach was to present a detailed view of the topic from teachers who were part of the language transition from English to MT and their perceptions and understanding of it. For this reason, the researcher collected data through multiple avenues, such as face-to-face interviews and document analysis.

4.3.2 Research approach/design

Though there are various approaches at the disposal of all researchers, for example, qualitative, quantitative and mixed methods (Creswell, 2014:41), this study employed the qualitative case study approach to achieve objectives. The study was grounded in the interpretative thinking paradigm (Creswell, 2014:37) and thus vested in the qualitative interpretative paradigm, a case study in the qualitative approach. This approach was preferred because the researcher wanted in-depth information and divergent conceptual views on the issue under studies, such as ideas, views, opinions, beliefs, feelings, perceptions, thoughts, values, and philosophies.

According to Merriam (2009:69), the qualitative approach generates data using words. This study explored teacher competence and experiences in teaching Grade 3 Mathematics in the mother tongue: This is a social phenomenon that can best be studied using the qualitative approach because it is an approach that is not limited to the superficial description of the phenomenon (Schultze & Avital, 2011). It explores the understanding and meaning of a society's problems and collects data in the natural setting through face-to-face interviews, learning and reflecting with the participants on the importance they attach to individual experiences (Creswell, 2014)

4.4 RESEARCH DESIGN

A research design is a plan that describes the conditions and procedures for collecting and analysing data (McMillan & Schumacher, 2014:6). A qualitative method was adopted to conduct the study (Creswell, 2014). It focuses on the end-product and every step to achieve the outcome (Blumberg *et al.,* 2011:316). Therefore, to select an appropriate research design, the researcher should start by looking at the purpose and research questions of the study (Yin, 2012; Wahyuni, 2012). Then, the study was positioned in a case study framework (Creswell, 2014).

4.4.1 Case study

Though there are various approaches at the disposal of all researchers, for example, qualitative, quantitative and mixed methods (Creswell, 2014), the researcher employed the qualitative case study approach to achieve the research objectives. A case study includes a programme, an event, an activity or a group of people (McMillan & Schumacher, 2014). McMillan and Schumacher (2014:53) explain that a case study investigates a single bounded system using multiple data sources over time. In other words, it is a case because one subject is studied. The point in this study was how Grade 3 teachers experienced teaching Mathematics in a MT. The researcher's decision to use a case study design was based on her belief that very little about how Grade 3 teachers teach Mathematics in a MT. In a phenomenological study, lived experiences are described from the informants' perspective (McMillan & Schumacher, 2014). Therefore, the case study approach allowed the researcher to explore and understand the phenomenon holistically. Furthermore, it afforded the researcher an in-depth understanding of how the Grade 3 teachers used an MT in teaching Mathematics.

This research design seemed relevant for the focus of the study, which was an extensive exploration and understanding in particular, and not on confirmation and quantification. It was also appropriate for the study because it accommodated the researcher's intention not to generalise to any population beyond cases similar to those of the Grade 3 teachers in this study. Furthermore, they were using an MT when teaching Mathematics. This means that the reason for choosing this design was based on the ability to obtain a detailed description that was transferrable to similar situations (Bell, 2014). Finally, the case study design was also applicable because the researcher did not intend to manipulate the behaviour of participants. Instead, the researcher and the participants were collaborators generating knowledge (Mills, Harrison, Franklin & Birks, 2017).

The research design of this study allowed the researcher to limit the number of people to be interviewed while providing reliable data (McMillan & Schumacher, 2014). Because of this case study design, the researcher was able to select, solicit and collect documents from ten participants, to be specific. A case study allowed the researcher to generate knowledge and describe the complexity of the real-life experiences of

Mathematics teachers speaking in a MT to Grade 3 learners (Mills *et al*., 2017). Clough and Nutbrown (2012) explain that case studies adopt an interpretive approach to data, study subjects within their context, and consider the subjective meaning that people bring to their situation. Using a case study, the researcher worked in natural settings and bounded contexts, namely the schools. The researcher could select only two participants from each of the five selected schools in Tshwane North District (Creswell, 2012). Yin (2017) and Wahyuni (2012) explain that a case study in research deeply investigates a real-life contemporary phenomenon in its natural context. In this study, teachers were interrogated about their experiences in the schools where teaching and learning occurred.

4.5 POPULATION AND SAMPLING

The population is the larger group from which a sample is selected. De Vos (2005:135) defines it as a design in which a single person, group or event is studied once, after some agent or treatment presumed to cause damage. *Thus, sample* refers to the specific participants representing a larger population of individuals from whom data are collected in a research study. Their performance is often assumed to indicate how the entire population would perform (McDevitt & Ormrod, 2014; McMillan & Schumacher, 2014). These authors argue that qualitative research sampling is determined by the researcher's philosophical stand, constructivism or interpretivism. The researcher did not intend to generalise the study findings to the larger population but to gain a deeper understanding of Grade 3 teachers' experiences of teaching Mathematics in a MT.

The most appropriate and relevant sampling strategy to select sites and participants for this study was purposive sampling (Babbie, 2010; Maruster & Gijsenberg, 2013; Creswell, 2013). According to Yin (2014), Creswell (2014) and McMillan and Schumacher (2014), a purposive or convenience sample is one whose participants are chosen based on convenience and their availability. Furthermore, these participants are assumed to be representative of a larger pool so that data collected from the smaller pool represents data from the more extensive collection (Yin, 2017). The researcher's decision to employ purposeful sampling was based on the fact that this is a qualitative study where Grade 3 Mathematics teachers teaching in a MT can

provide relevant information about and a deeper understanding of teaching Mathematics in a MT (Creswell, 2014).

Babbie (2010) posits that purposive sampling refers to selecting a sample following knowledge of the population, its elements, and the purpose of the study. Ten information-rich participants disclosed their experiences of MT teaching in five primary schools (two teachers per school) in the Tshwane North District of the Gauteng province. The five primary schools had changed the LoLT from English to MT for teaching Grade 3 Mathematics. The two Grade 3 teachers from each school (10 teachers) offered a service to learners aged five and 15. The criteria for selecting them were that they were teaching Mathematics in a MT and were knowledgeable about teaching Grade 3 learners in a MT (Maruster & Gijsenberg, 2013). However, Blumberg *et al*. (*2*011) and McMillan and Schumacher (2014:5) indicate that the gathered knowledge cannot be used for generalisations.

4.5.1 Criteria used for selection

Concerning inclusion in the study, the researcher believed in having an equal number of male and female participants for the sake of representivity. However, in primary schools, most teachers are female, and the researcher ended up having ten female teachers as participants in the study because there were no male teachers/participants. The 10 participants were teachers from five schools in a township area in Tshwane North District. The selected teachers were responsible for Grade 3 and had between 10 and 15 years' experience in the Foundation Phase. The researcher assumed that the selected participants would be able to remember their experiences of transition from using English as LoLT to using an MT as LoLT.

4.5.2 Plan

The data collection plan was for obtaining information from the research sites: interviews and document analysis. The researcher decided to select a small sample to interview the participants and do follow-up interviews. The selected participants were also willing to provide information about their experiences of using an MT. The thinking also informed the decision on the size of the sample of Yin (2017), who warns that having a large number of participants makes it difficult for the researcher to filter the analysis of interviews.

Gauteng is one of the nine provinces of South Africa, as can be seen in Figure 0.2. This province (Figure 0.1) is located north of the country, bordered in the north by Limpopo province, to the west by North West province, to the east by Mpumalanga province, with the Free State province to the south. The Gauteng Department of Education is categorised into regions and further classified into districts (D). As highlighted in Chapter 1 of this study, the researcher focused on Tshwane North District and particularly on District 4 (D4) because of her familiarity with this context. The schools are not far apart, and she visited ten primary school teachers, i.e., two Grade 3 teachers from each school, over two months. Data collected will be shared by providing copies of reports to participants and stakeholders, making information available on websites, and publishing the studies (Creswell, 2014).

4.6 DATA COLLECTION

Qualitative approaches to data collection are different from the traditional quantitative approaches. The former is framed using words, and the latter is stated in terms of user numbers (Creswell, 2014). In this study, the researcher used qualitative data collection methods to investigate teachers' experiences in using MT to teach Mathematics. Qualitative research allowed the researcher to conduct ten one-on-one interviews. The literature reviewed in Creswell (2014) reveals that data collection steps include setting the boundaries for the study, collecting information through unstructured or semi-structured interviews, documents and visual materials, and establishing the protocol for recording data.

4.6.1 Interviews

Interviews come in different forms, such as one-on-one (face-to-face) interviews, focus group interviews, telephone interviews and email interviews (Creswell, 2014). An interview is a data collection technique that acquires self-reported data on a topic of interest through face-to-face conversation (McDevitt & Ormrod, 2014). In line with other researchers (for example, Creswell, 2014; Alshenqeeti, 2014), interviewing was used as a natural and social way of obtaining direct explanations for human actions through an extensive speech interaction. During the interview process, relevant questions were prepared in advance to be asked during the interview.

Creswell (2014:39) posits that the research goal is to obtain the participants' views of the situation being studied, using probing questions to gather enough information. Creswell (2014) and Alshenqeeti (2014) add that probing questions can encourage individuals to elaborate on their answers and follow-ups. Thus, the use of interviews in this study provided the viewpoints of Grade 3 teachers regarding their experiences of using MT to teach Mathematics, and these will be communicated to a larger audience of stakeholders. According to Creswell (2014), the advantage of qualitative interviews is that they provide useful information in cases where the researcher cannot directly observe the participants, which is what happened in this study.

According to Creswell (2014) and Alshenqeeti (2014), the use of interviews has drawbacks, such as time constraints and financial implications. Creswell (2014) advised that data could quickly be deceiving when the interviewee provides information that the researcher wants to hear. To avoid this situation, the researcher reminded participants during the interviews to be honest in their responses because the data they provided would only be used for academic purposes. So as not to influence how they responded, the researcher started with general questions to establish rapport with participants. The five sites to which the researcher obtained access were not distant from one another, which worked to the researcher's advantage. The interviews provided indirect information filtered through interviewees' views, and the research report contained only a summary of the participant's views.

Before entering the field, the researcher designed questions, and developed interview guides accepted interview protocol (Creswell, 2014; Alshenqeeti, 2014). According to Creswell (2014), the interview protocol is a plan that is used for asking questions and recording answers during a qualitative interview. Several interviews were conducted. One set of interviews was with six teachers, for 40-60 minutes with each teacher. The process of data collection took place over a semester, as soon as ethical clearance was obtained, on the perceptions of Grade 3 Mathematics teachers teaching in MT (using a voice recorder).

The semi-structured interviews were well-conducted to generate detailed and rich data capable of providing diverse insight into the subject under study (Schultze & Avital, 2011). The researcher asked broad and general questions so that the participants

could construct meaning from a situation, typically forged in discussions or interactions. The more open-ended the questioning, the more carefully the researcher listened to what was said or done in the natural context. During the interview, the researcher asked individuals to explain their experiences of using MT to teach Mathematics in Grade 3. In line with Alshenqeeti (2014:40), interviews were interactive, and the interviewer pressed for complete, clear answers, using probes for any emerging topics. With this kind of interview, the researcher was flexible in allowing participants to share their perspectives, stories, and experiences of MT to teach Mathematics (Wahyuni, 2012).

This method seems to have attracted some ongoing criticism for its contextual challenges and human limitations that can undermine the credibility of the data collected (Forsey, 2012). However, the perceived weaknesses of the method were dealt with through the flexible structure that guided the interview procedure and allowed for probing with detailed questions that were well understood yet respectful and collaborative with the participants. The ten selected Grade 3 teachers were interviewed through face-to-face, semi-structured interviews.

4.6.2 Semi-structured interviews

For this study, one-on-one semi-structured interviews were used. One-on-one semi-structured interviews were appropriate for obtaining relevant data, instead of the structured interviews used in quantitative design (Creswell, 2014). This is a type of research where a researcher asks questions of one participant at a time while recording the responses (Creswell, 2014; McMillan & Schumacher, 2014; Alshenqeeti, 2014). The researcher's choice of one-on-one interviews was to facilitate the interviewees' participation and allow them to share their knowledge with the researcher in conversations (Wahyuni, 2012).

First, in-depth semi-structured interviews are a method of directly engaging participants in a study so that they can share their experiences and perceptions in a more collaborative way (Maruster & Gijsenberg, 2013). Second, qualitative semi-structured interviews allow participants to give a detailed description of their personal information. Lastly, in qualitative interviews, the researcher can control the data received by asking specific questions to produce relevant information. The researcher

used audio tape to record the data and took handwritten notes in case the recording equipment failed. In line with Creswell (2014), a standard procedure was used from one interview to another, using the same questions for all participants in the interview protocol.

4.6.3 Documents

The interview protocol included the researcher's log that was kept to record documents collected for analysis (Creswell, 2014). The researcher collected data from documents such as the Annual Teaching Plans (ATPs), the teachers' lesson plans and learners' activity books to identify the challenges of teaching Mathematics in a MT to Grade 3 learners and how teachers dealt with these. The collected samples of learners' workbooks from each teacher's class were used to establish whether they reflected the experiences that teachers had highlighted during the interviews. The teachers' lesson preparations were analysed to determine how teachers prepared their lesson plans, particularly the language they used when writing their lesson plans. The teachers' ATPs were also analysed to discover whether they were written in English or a mother tongue.

4.7 DATA ANALYSIS

According to (McMillan & Schumacher, 2014), data analysis is a process in which a researcher begins to interpret the data collected. The qualitative content data analysis technique was used for this study because the design calls for investigating how participants in a research experience phenomenon, rather than on the phenomena. Qualitative analysis is a systematic process of coding, categorising, and interpreting data to provide explanations of a single phenomenon of interest (McMillan & Schumacher, 2014:395). This line of thought is supported by Pietkiewicz and Smith (2014). They argue that an interpretive phenomenological approach focuses on the meaning of the life experiences of individual people through a detailed analysis of their accounts. Erhingsson and Brysiewicz (2013), De Casterle, Gastmans, Bryon and Denier (2012) and Pietkiewicz and Smith (2014) agree that practical qualitative data analysis calls for transcription, categorisation and development of themes. Creswell (2013) asserts that data analysis is aimed at reducing data to minor pieces.

In this study, the researcher used an inductive and ongoing data analysis process (Creswell, 2009; Creswell, 2014; McMillan & Schumacher, 2014). The reason for using an inductive approach, as explained in Thomas (2003), Creswell (2014) and McMillan and Schumacher (2014), is its ability (a) to summarise a large amount of data; (b) to create links between the research objectives and the summary findings that emerged from the data, and (c) to develop a model or theory about the underlying structure of the experiences or processes that are in the raw data. In addition, Thomas (2006) argues, inductive data analysis means that the researcher must read the transcripts several times to identify themes and categories. Therefore, the researcher in this study analysed data by continually moving backwards and forwards between the research text and the tasks of data creation, data analysis and interpretation (Onwuegbuzie & Leech, 2007).

The researcher used research questions and concepts from the theoretical framework to analyse data. Even though the researcher was aware of a qualitative computer data analysis program, data in this study were hand-coded because the process was time-consuming (Creswell, 2014). The researcher employed a thematic analysis method to identify patterns and themes in the data (Wahyuni, 2012). According to McMillan and Schumacher (2014), thematic analysis is one of the methods that lean more towards the constructivist/interpretivist paradigm within which this study was conducted. It is a type of qualitative survey using semi-structured interviews to investigate subjective experiences of objective items (Percy, Kostere & Kostere, 2015:18; Nowell, Norris, White & Moules, 2017). Percy *et al.* (2015) acknowledge that thematic analysis follows an iterative inductive process. During the data analysis, the researcher followed the six steps Braun and Clarke (2006) of becoming familiar with the data, generating the initial codes, searching for themes, reviewing the themes, defining and naming the themes, and producing the report.

4.7.1 Becoming familiar with the data

In line with Braun and Clarke (2006), Percy, Kostere and Kostere (2015) and Nowell *et al*. *(*2017), familiarising oneself with one's data is a process of transcribing and repeatedly listening to the recordings or reading and re-reading the transcription, while

highlighting the main ideas. After transcribing the data from interviews and documents, the researcher immersed herself in each participant's data individually (Braun & Clarke, 2006; Percy, Kostere & Kostere, 2015). *Immersion* refers to reading data repeatedly while searching for meanings and patterns and highlighting any sentences, phrases or paragraphs that appear to be meaningful (Percy, Kostere & Kostere, 2015). After the researcher was familiar with the transcribed data, the initial ideas were noted down.

4.7.2 Generating initial codes

Data were organised into understandable concepts to construct meaningful groups of initial codes (Williams & Moser, 2019). *Initial coding*, also known as *open coding*, is breaking data down into different parts and then coding them (Saldana, 2013). *Coding* simply means labelling (Wahyuni, 2012:77). In line with Creswell (2014), coding involved taking written data and pictures gathered during data collection, segmenting the sentences (or paragraphs) or images into categories, and labelling the categories. Each category was assigned an initial code representing its core topic (Wahyuni, 2012). Initial codes are not permanent because they change during analysis. This was the first level of coding (Williams & Moser, 2019). The data features that appeared exciting and meaningful were identified (Braun & Clarke, 2006). As Braun and Clarke (2006) recommended, these were from information that carried an indication of the context of the conversation. Interview questions broke the data down before being coded.

4.7.3 Searching for themes

Themes are broader than codes (Braun & Clarke, 2006). Percy, Kostere and Kostere (2015) explained that the themes emerged when related codes were clustered. After coding the data, the different codes were sorted to build themes and patterns for a deeper understanding of the data (Braun & Clarke, 2006).

4.7.4 Reviewing themes

A more in-depth review of identified themes was performed (Braun & Clarke, 2006). Next, the data items corresponding to a specific pattern were placed (Percy, Kostere

& Kostere, 2015). Finally, the researcher combined and separated initial themes following their meaning, as Braun and Clarke (2006) advised.

4.7.5 Defining and naming themes

Following the above strategies, a data set was collected from the open-ended interview schedules, observation checklists and audio recordings and carefully transcribed into written text. The text was then coded into categories of meanings, which were eventually developed into themes and sub-themes to answer specific research questions. As suggested by Braun and Clarke (2006), brief theme names and clear working definitions that captured the essence of each theme were assigned. The names or descriptors of these patterns were abstract phrase patterns (Percy, Kostere & Kostere, 2015). The researcher then refined the themes by going through all the assembled concepts to ensure they formed a discernible pattern to define and name the themes.

4.7.6 Producing the report

Finally, the data set was transformed through analysis into an interpretable piece of writing (Braun & Clarke, 2006). The researcher went back to the assembled data, extracted a theme from each assembly and organised the themes into a clear and consistent interpretation, accompanied by quotations.

4.8 DOCUMENT ANALYSIS

Documents serve as a valuable data source because of their scientific and detailed information (Creswell, 2013). The use and analysis of documents as sources of information is an effective method of social research that is meaningful and appropriate in the research strategy. Documents include policies and teaching and learning materials in the organisations (Creswell, 2014). Analysis of documents requires descriptive data about the acquisition of the documents (McMillan & Schumacher, 2014:388), for example, by whom, how, where and why they were used. Documents are usually used to execute several functions, like certifying, attesting, projecting or even guaranteeing specific actions (Creswell, 2013), even when the users may be aware of their shortcomings, like vulnerability to alteration, destruction and one’s inability to dialogue with them.

For this study, official documents available in the schools were requested from the teachers after obtaining permission to research the District Director. These documents provided information about the Mathematics teachers and the LoLT's work. They included Curriculum and Assessment Policy Statements (CAPS) documents, the teachers' Mathematics lesson plans, Mathematics (DBE) textbooks, and learners' workbooks. The records were analysed to establish background information on the teaching of Mathematics in a MT. This information was compared with results from the interviews, to provide a holistic picture of how Grade 3 Mathematics was taught in a MT in the province.

4.9 TRUSTWORTHINESS

Contrary to the positivist paradigm criteria of internal and external validity and reliability, Guba and Lincoln (1994:300) and Nowell *et al*. *(*2017) propose using five interpretivist paradigm criteria for trustworthiness: credibility, transferability, dependability, confirmability and authenticity. Therefore, the researcher adopted Lincoln and Guba's (1985:289-331; 1994) guidelines for qualitative research to enhance the trustworthiness of the findings. Considering that this study aimed to explore teachers' experiences in teaching Grade 3 Mathematics in a MT, the trustworthiness of the study could not be ensured separately but was an integral component of the overall design and implementation of the various processes throughout the study.

Trustworthiness is a process of ensuring rigour in qualitative research without sacrificing relevance. It demonstrates that the evidence for the results reported is sound, and the arguments made are based on the results (LaBanca, 2010). The research findings were the real issues with which teachers were faced in the implementation of MT teaching in their Mathematics classrooms, without leaving out any information. The following sections discuss the five criteria to ensure trustworthiness and their relevance in the study. In addition, the following procedures were applied to enhance trustworthiness: using codes to verify the credibility of the analysis and interpretation; collecting rich data through case studies; using participant verification; using an audit trail; fully describing the research method and procedure, and doing ongoing reflective practice.

4.9.1 Credibility

The credibility of a quality study refers to how a researcher plans to ensure the trustworthiness of the methods and tools used in the study to generate a trusted study result (Noble & Smith, 2015) to represent the phenomena under study accurately. It further refers to how a researcher plans to prove to the audience of the study how procedures can be emulated to arrive at a comparable result with great certainty and substantive evidence (Maruster & Gijsenberg, 2013). In this study, the researcher used data from interviews, an audio recorder and documentary review to cross-check whether the findings pointed in the same direction, verified the raw data through member checking, corroborated findings from the different participants, and kept an audit trail of all field studies to refer to them where necessary (Nieuwenhuis, 2014).

According to Lincoln and Guba (1985), *credibility* assures the truth value of the finding and accommodates the need to understand holistically. White (2005:203) argues that the *truth value* establishes how confident the researcher is about the conclusions, based on the research design, information and context. It is the extent to which the results of an approximate study reality are thus judged trustworthy and reasonable (McMillan & Schumacher, 2014:2). An intensive engagement was undertaken with the data (recordings, notes and transcripts) to demonstrate clear links between the data and the interpretations. The researcher made follow up visits to seek clarity on the interview transcripts from the participants. The regular discussions held allowed the researcher to adjust following suggestions and recommendations.

Multiple triangulation methods were used to achieve credibility (Maree, 2012; Graneheim & Lundman, 2004; Nowell *et al.,* 2017).

4.9.1.1 Data source triangulation:

Different Grade, three teachers from other schools, were selected for interviews. Interview schedules and a voice recorder were used to collect data.

4.9.1.2 Data type triangulation

Reading different transcripts and listening to the audio tapes revealed different meanings.

4.9.1.3 Investigator triangulation

More than one researcher analysed the data (a colleague who is an expert).

4.9.1.4 Analysis triangulation

Several different analytic techniques were applied to validate meaning in the data set. Analysing involved organising and dissecting data into smaller units, coding and synthesising and searching for patterns and then, in the interpretation of the data, ideas were explained concerning theory and practice.

4.9.2 Transferability

Transferability and generalisability (Nowell *et al.,* 2017) refer to the extent to which findings can be transferred or have applicability in other settings or groups. The study's findings can thus be applied to similar contexts, settings or groups (White, 2005:204). Hence, a clear and distinct description of the culture and context, selection and characteristics of participants, data collection and process of analysis and a rich and vigorous presentation of the findings are provided by the researcher (Graneheim & Lundman, 2004; Nowell *et al*., 2017).

4.9.3 Dependability

Dependability assists in determining whether the findings of the study would be repeated if replicated with similar respondents in a similar context (Lincoln & Guba, 1985:290). According to Creswell (2009), dependability can be achieved by maintaining an audit trail, a process in which the researcher documents all activities in the research process. Methods and methodological choices of the research design are logical, traceable and thoroughly documented, and a detailed report of the study process is provided to enable any future researcher to repeat the work, if necessary, to obtain the same results (Shenton, 2004; Nowell *et al.,* 2017). All project documentation, such as transcripts and audiotape data, is safely stored in the supervisors' computers and the researcher's laptop to ensure its availability should there be a need.

4.9.4 Confirmability

Confirmability refers to the degree to which the findings of an enquiry are a function solely of the respondents and conditions of the investigation and not of the biases, emotions, interests and perspectives of the researcher (Lincoln & Guba, 1985:290; McInnes, Peters, Bonney and Halcomb, 2017). The aim is to establish that the interpretations and findings are derived from the data and demonstrate how conclusions and interpretations were reached (Nowell *et al.,* 2017).

In line with Creswell (2014), the researcher reflected on and clarified the bias brought to the study that might have affected the interpretation of the findings. Part of the rationale to conduct this study was based on the researcher's background and experiences as a Grade 3 teacher, and this has been acknowledged. As her experiences and biases might affect the interpretation of the findings from the Grade 3 teachers, triangulation was applied to a form of audio recording, transcription of interviews and summaries (Shenton, 2004). The research findings, themes and narratives were confirmed and verified by a peer reviewer.

4.9.5 Authenticity

Authenticity came to the fore through the ability of the researcher to report a situation through the eyes of the participants (Cohen, Manion & Morrison, 2007:139). It established the degree to which different points of view were pretty and adequately represented (Denzin & Lincoln, 2005:23). This evolved through the accurate description of people, events and places. The researcher shared data with others by providing copies of reports to participants and stakeholders (Creswell, 2014). The interview schedule was first carried out in a pilot test to ensure that the data would be reasonable, unbiased and valid.

4.10 ETHICAL CONSIDERATIONS

Research projects are subject to ethical concerns, considering that they engage various participants who are always inclined to give meaningful ideas during the engagement (Creswell, 2013). Qualitative studies like this one, which explored teacher competence and experiences in teaching Grade 3 Mathematics in a MT, have an even

higher potential to generate severe ethical concerns by the fact that they require the researcher to work closely with the participants to gain deeper and broader insight into the subject under study. The researcher was therefore obliged to seek permission from all relevant authorities to access the participants, gain their consent to participate freely in the study, allow them to withdraw if they felt they could not continue to participate, explain to them the purpose of the study, ensure that the study does not harm them, and apply for ethical clearance from the University of South Africa before data collection, as guided by a code of ethics.

During and after the data collection, the researcher ensured the confidentiality of the information and the anonymity of the participants. Since Creswell (2014) advises researchers to seek approval from the ethics committee at their university as they would receive objective advice concerning the ethics of the study they intended to conduct, this was done. The researcher was mindful of ethical issues before conducting the research and assessed the potential for risk to participants in the study, considering the unique needs of vulnerable populations, by doing the following: requesting permission, ensuring participation was voluntary, obtaining informed consent, confirming participants were not deceived or compensated, and maintaining privacy and confidentiality.

The researcher requested permission to research schools from the Gauteng Department of Education (GDE), and it was granted. The researcher applied for ethical clearance from the Ethics Committee of the University of South Africa and obtained it before conducting the study. After receiving ethical approval, the researcher wrote to the relevant schools to access them as research sites. In the selected schools, the researcher requested potential participants (Grade 3 teachers) in writing for their permission to include them in the study and asked permission to use their learners' books.

After the researcher was granted access to schools, she ensured that the participants gave her *informed consent*. This meant that participants should be aware of the information the researcher sought, why the researcher required it and the level of the risk to which they would be exposed (Creswell, 2014). Therefore, the researcher informed participants about the purpose of the study and the role they were expected to play in it. The researcher assured them that their participation in the study was

voluntary and that they had a right to withdraw at any time. The researcher requested the participants sign the consent forms prepared as evidence that no pressure or coercion was put on them to participate willingly. There was neither deception nor compensation of participants in this study. The researcher only promised participants access to the report from the University of South Africa library should they want it.

Confidentiality maintenance means that no one has access to an individual's data or the names of the participants except the researcher, and the subjects know who will see the data (McMillan & Schumacher, 2014:134). The researcher accomplished that by assuring participants of confidentiality and anonymity and that whatever they revealed during one-on-one interviews would not be disclosed to anyone other than the supervisors for guidance purposes. The researcher also ensured that the names of participants were not mentioned during the release of the results and used pseudonyms instead of their real names.

After obtaining ethical clearance from the Ethics Committee of the University of South Africa, interviews were conducted with ten Grade 3 female teachers. In compliance with the rules of the Gauteng Department of Basic Education (GDBE), the interviews were conducted at the schools, after school hours, through direct engagement with participants, to ascertain the experiences of the teachers who were teaching Mathematics in a MT (Maruster & Gijsenberg, 2013). The data collection was done for about an hour to generate detailed and in-depth data that provided the researcher with diverse insights into the subject under study (Schultze & Avital, 2011).

Alshenqeeti (2014) argues that it is vital to follow ethical considerations when dealing with participants. As a result, when the researcher observed during the interviews that participants seemed to be very careful about how they responded to the questions, the researcher managed the situation by re-explaining the purpose of the study, re-assuring the participants that the collected data would be strictly confidential and that the information provided would be treated with confidentiality. With the permission of the participants, the researcher audio-recorded all interviews. Further approval was requested to access the documents of the ten Grade 3 teachers: their Curriculum Assessment Policy Statements (CAPS), Mathematics lesson plans, Mathematics textbooks and learners' workbooks.

4.11 DELIMITATIONS AND LIMITATIONS OF THE STUDY

It is documented that conducting qualitative research aims to explore and understand how individuals or groups ascribe meaning to a social or individual problem and not to generalise (Creswell, 2014). McMillan and Schumacher (2014:5) indicate that purposeful sampling (as a qualitative study) is a type of sampling that allows the choice of small groups or individuals who are likely to be knowledgeable and informative about the phenomenon of interest, the results are not generalisable. This applies to this study because the sample is small (10 participants and five schools). As a result, the findings can only be transferred to situations similar to those conducted in this study. This study was also limited by the scarcity of literature that focuses on using an MT to teach Mathematics in the primary school context. The available studies only focus on the use of English as the LoLT in schools.

The scope of this study is limited to 10 Grade 3 primary school Mathematics teachers purposively selected from five primary schools in a Tshwane North township in the Gauteng province. The study aims not to generalise the findings, considering that it targets only a few sample units, but to dig deeper into teacher competence and experiences in teaching Grade 3 Mathematics in a mother tongue.

4.12 REFLEXIVITY IN QUALITATIVE RESEARCH

The researcher reflected on how her role in the study and her background, culture, and experiences shaped the interpretations and how the themes advanced the meaning ascribed to the data. She considered more than just identifying biases and values in the study, but also how the researcher's background may shape the direction of the study (Creswell, 2014). The researcher recognised that her background as a teacher shaped the interpretation and positioned herself in the research. The researcher acknowledged that her understanding would flow from her cultural and historical experiences to make sense of (or interpret) the meaning others assigned to the world. To reduce reflexivity, she observed, closely and constantly, her interactions with participants, reactions, roles, biases and any other matters that might have caused prejudice in the research results. These observations were kept in the research journal.

4.13 CONCLUSION

In this chapter, the researcher has provided the details of the process followed in conducting this research. The pragmatic assumptions, research design, sampling procedures, data collection, data analysis and interpretation, trustworthiness, ethical considerations, and the study's limitations were discussed. The next chapter discusses data analysis and interpretation.

CHAPTER FIVE
DATA ANALYSIS AND INTERPRETATION

5.1 INTRODUCTION

This chapter handles issues of the analysis and interpretation of the data collected in chapter four regarding the teachers' experiences of teaching Mathematics to Grade 3 learners in a MT. The data presented was obtained through qualitative data collection methods from the respondents, Grade 3 teachers from public primary schools. As explained in Chapter 4, it was deemed necessary to conduct interviews with key informants involved in teaching Grade 3 learners in a MT. The data were generated using individual semi-structured interviews and analysis of documents. The study focused on the following research questions:

1. How do Mathematics teachers explain Mathematics concepts to Grade 3 learners?
2. What are the challenges experienced by teachers using a MT in teaching Grade Mathematics?
3. How do Grade 3 teachers overcome the challenges experienced in teaching Mathematics through MT?
4. What are the successes experienced in teaching Mathematics through MT?

The views generated were synthesised and presented as seven sub-themes, namely**:**

1. Teachers' lack of conceptualisation of MT concepts,
2. Teachers' training regarding teaching in a MT,
3. Teaching Mathematics in English is better than teaching in MT,
4. Inadequate teaching and learning material in MT,
5. Lack of parental involvement,
6. Teaching through code-switching, and
7. Participants' contributions regarding teaching in a MT.

Qualitative semi-structured interviews were used in this thesis to generate explanatory answers. Data were collected until saturation was reached.

5.2 THE INTERVIEW PROCESSES

All interviews were carried out at the schools of key informants, and a rapport was established to allow them to be at ease when responding to the questions. Before all interviews began, the participants granted the researcher's request to use an audiotape during the interview. Therefore, a tape recorder was used as an instrument to collect data from the participants. The interviews were conducted after school hours through direct face-to-face engagement with the participants. The interviews lasted for about an hour. The semi-structured interview questions focused on the study's specific issues. After receiving answers from the participants, the researcher asked additional probing questions for clarification of unclear answers. All interviews were conducted personally by the researcher.

5.3 QUALITATIVE DATA ANALYSIS

The data analysis allowed the researcher to link ideas as they emerged from the collected data, thus reducing the loss of valuable information. This mode of study is different from quantitative data analysis, in which data are collected and analysed all at once. Alshenqeeti (2014) and Percy, Kostere and Kostere (2015) indicate that data analysis can be done by coding, which generates valuable data units, followed by the unit classification condense the amount of generated data. In the current study, codes and themes were developed from the responses of the participants. Then the theme-by-theme analysis was performed following the research questions, direct quotations were selected, and meaning was attached to the data. In the research, conclusions are taken from the theory of Vygotsky, which influenced both the current study and the literature reviewed. In the data analysis, all that occurred during the interviews between the researcher and the respondents were considered and referred to when necessary.

This chapter will first follow a pattern of analysing the teachers' responses according to each question that was asked as per the interview schedule (see Appendix G).

Below are the reactions as captured according to the sequence of the interview questions.

5.3.1 Interview questions one

What is your experience of teaching Grade 3 Mathematics through MT?

Teachers said that it is challenging to teach Mathematics in a MT. The elicited responses from all teachers trained in English at the Teacher Colleges revealed that they do not have the MT words for Mathematics concepts to teach in a MT. They articulated that they do not use the concepts in their real-life situation. Furthermore, the excerpts imply that teachers are struggling cause not all Mathematics concepts are found in the MT dictionary, leading to the emerging theme of ***teachers' lack of conceptualisation of MT concepts***.

THEME 1: Teachers' lack of conceptualisation of MT concepts

Although the LiEP stipulates the use of a MT, participants' views suggest that adherence to the policy is flawed. Below are the opinions of teachers in their exact words:

> *It was also tricky for me as a teacher because some of the words in MT I had to research for their translation from English, such as 2-D shapes, in MT, square, triangle, etc. We do not know some of these words in MT because the concepts are in English, and the ATP [Annual Teaching Plan] comes in English (T3B).*
>
> *Some other things we do not know what to call them in Sepedi. Sometimes I see the line of symmetry, and you do not know what to say to the learners. When it comes to shapes, prisms and pyramids, we do not know their names in Sepedi. We only tell the learners that we have rectangular prisms. That's why I'm using English in my class, which the policy does not allow (T10E)*
>
> *I also find it difficult because I do not say 'this makgolo supa masome tharo a diranta' (R730). It is shocking for them, and it does not bring any interest in the*

classroom. It takes away the teacher's confidence. Even at the beginning of the year, we say, 'compliments for twenty nineteen'. No one says 2019 in MT (T1A).

As a teacher, I have to compromise and use a dictionary to search for the words in MT. But sometimes, when I cannot find the terms in MT, I use the English phrases (T9E)

Umar *et al*. (2018) consider that educating children through their MT is a good approach that helps to facilitate teaching and learning because it builds on their previous experiences and knowledge. This argument is supported by Nolasco (2010), who explains that the MT should be used in Grades 1-3 because this is the level where the basic concepts of Mathematics are introduced. However, Chalmers (2017) emphasises that the use of the MT in the learning environment results in lower second language English acquisition.

Recent findings by Ssentanda, Huddlestone and Southwood (2016) reveal that teachers had difficulty using their MT as the LoLT because they could not translate concepts from English to the MT. Participants in this study contradicted this view because the learners live in a multilingual environment where the mixture of languages corrupts the MT. Furthermore, some of the learners' parents are educated and use a combination of English and their MT. Promoting a single-language policy is highly damaging and more challenging among underprivileged multiple language communities because it confuses learners and teachers in a context where several languages are spoken in the community. Therefore, it may result in a difference of opinion amongst them. The Department of Education and the Schools needed to use MT as their instructional medium (Gobana, 2013). Therefore, the teachers' capacitation of learners could be questioned. Teachers stated that having learners who do not understand the LoLT simply because it is not their MT is challenging. This finding corroborates those of Kotzé, Van der Westhuizen and Barnard (2017) and Spaull (2015). They argue that teachers do not have the skills and knowledge to offer different languages as the LoLT in one classroom by one teacher.

This is supported by the teacher who said:

> *Using MT is a challenge because it is not related to the learners' lived experiences from home. Learners acquire Mathematics concepts through English language interactions, hence the difficulty for teachers to capacitate learners in MT (T1A).*

Another participant added that:

> *It was challenging to teach in MT. Some of the words are difficult for learners, even though it is their MT… but when you say even or odd numbers, it is simple. Still, when you are saying Tinhlayo fedzenga in Xitsonga, it is like you are talking another language, not their MT (T3B).*

5.3.2 Interview questions two

How were you trained to teach Grade 3 Mathematics through MT?

Views generated from interviews revealed that no training was offered to teach in MT. All teachers indicated that their pre-service training in the colleges and universities was conducted in English. They added that the workshops they attended were presented in English and not in an MT, leading to the emerging theme that ***teachers' training is done in English as the language of instruction and not their MT***.

THEME 2: Teachers' training was done in English as the language of instruction and not their MT

> *I was never trained in MT; I was trained in English. Even presenters use English, with English concepts, during workshops (T4B).*

> *In college, I was never trained in Setswana. I was taught in English in college and, when I came here, I just had to translate. Even workshops are done in English, but you have to use a dictionary to check most of the words (T5C).*

> *There was no training given to us to teach in Sepedi. We were just told that the LoLT for the school is changing. So we never had proper training for teaching in*

MT. It was just the switching. From college, I was trained in English; I did courses in mathematics conducted in English. I also did one year of teaching Mathematics in Grade 3 presented by the Department of Education in English. It is difficult for the District to conduct workshops in MT because we have teachers in different languages (T8D).

I was trained in English. In the workshops, they teach us in English. Even when we attend the Mathematics workshops, they use English. They do not use this MT that they want us to use … We were never trained in MT. They use English and say we must translate in MT (T10E).

Umar *et al*. (2018) define *teacher training* as professional development through formal practical work and teaching experience. This is commonly referred to as a *teaching practice period*. They further explain that adequate preparation enables teachers to implement their school's language policy. However, the above excerpts indicate that institutions responsible for training teachers, such as universities and colleges, are not producing teachers ready to teach a subject like Mathematics in their MT. However, one question that needs to be asked is how teacher training institution programmes are aligned with the implementation of the language policy. Teacher education is fundamental in successfully bridging the policy-practice gap. From a similar viewpoint, Begi (2014) suggests that in-service training would help teachers understand the importance of an MT and embrace the policy's adoption. Likewise, Mata (2014) believes that training teachers to use their MT in teaching Mathematics would enable them to learn how to support learners' development and learning processes. However, it was found in the study conducted by Ssentanda, Huddlestone, and Southwood (2016) that, in some schools, only certain teachers were trained in the use of an MT.

One teacher said she was trained in English, but her practice teaching in schools was done in a MT with learners. She has experience teaching in Sepedi, but now she is expected to teach in Setswana as the LoLT. Her views are provided below:

In college, teachers were teaching us in English and, during practice teaching, we did our practical in Sepedi. So when I started teaching, I used the experience from the college, which is leading in English. So I know Sepedi, but the problem is that I am given a class I am teaching in Setswana class (T7D).

The excerpt above suggests that the teacher is teaching in a language that is not her HL. This is a challenge for teachers, especially in Soshanguve, where teachers are expected to teach in a language they have not mastered. This view is supported by Umar *et al*. (2018), who assert that a teacher who is well-equipped by further training and retraining on using a MT can participate positively in the employment generation for sustainability.

According to Van Dam, Van Vuuren and Kemps (2017), the idea of sustainability refers to the way people and organisations interact with the environment. In this instance, the DoE must ensure that its policies will accommodate all communities. The DoE must also ensure that the pre-service and in-service institutions afford teachers contextualised teaching skills to benefit the learners and the wider community. They must not implement a one-size-fits-all policy. For example, a language policy suitable for teaching and learning in the deep rural areas of KwaZulu-Natal (where almost everybody speaks isiZulu) is not appropriate for learners living in an urban area such as Gauteng.

5.3.3 Interview question three

How different is teaching Grade 3 Mathematics in English from teaching in MT?

Teachers were asked to give their views on the differences between using English and their MT to teach Mathematics to their Grade 3 learners. All teachers indicated that teaching Grade 3 Mathematics in English is more accessible than teaching in their MT. Views generated from interviews also revealed that concepts in English are more straightforward because teachers, learners and parents use English concepts when communicating in a real-life situation, leading to the emerging theme of ***teaching Mathematics in English being better than teaching in the MT***.

THEME 3: Teaching Mathematics in English is better than teaching in the MT

It can be concluded that Grade 3 teachers hold negative perceptions of the use of an MT in the teaching of Mathematics. Even though research by Nolasco (2010), Begi (2014) and Taylor and Von Fintel (2016) acknowledges the significant role that the MT plays in the development and learning processes of the learner, participants argued that the use of English as the LoLT would be the best route to follow in a context such as Gauteng, especially in Soshanguve, where an MT is not recognisable. They explained that learners understand English better because they mostly use English concepts when playing and communicating in real-life situations. This was affirmed by Grade 3 teachers who said:

> *It is different. English is easy because it is what they live, and it is what I live. Numbers are consistently named in English. MT is not accurate: when they play, they call out numbers in English. The same applies to the months of the year: January is January; they do not use MT. When going to malls for shopping, they use English. English is simple because learners are familiar with English concepts that are used in Mathematics (T1A).*

> *But English, let me tell you, is okay. Learners understand it fast because they use it even when they play; when they watch television is English. So, English is excellent (T5C).*

> *When I teach the concept 'time', I say, 'half-past five', or '30 minutes past five' in English. However, in isiZulu, I will say, 'Iigamenqe ihora lesikhombisa', and the child start by asking, 'What is "ligamenqe"?' (T9E).*

Further to the above, participants pointed out that teaching in English is more accessible than teaching in MT because learners and parents prefer English to the MT.

> *Teaching in English is so excellent. I have done it, they like English, and they understand it more than Sepedi. They love English very much. But, once I use MT, they get bored. So, I can say, if they could bring English back, oh! It would be a*

bonus, and They don't like Sepedi; they don't want it. You can see that they don't wish to Maths in Sepedi because they look down when you tell them that now is time for Mathematics. They will even ask you that: 'mam, why cannot we do Maths in English?' Then you have to explain that: 'No, it is not me, it is our government; they want you to know your MT' (T5C).

At home, they speak Xitsonga, but they must talk to Sepedi when they get into the classroom. That is why they get bored with Sepedi. When you teach them in MT, they will tell you, 'No, mam, why other kids are talking English?' There is a shift in the languages that the children are playing with; they play in English because they play with children from English schools. These learners use English when they go shopping (T7D).

Furthermore, teachers mentioned that it is better to teach English because learners are multilingual.

The school's LoLT is Sepedi, but in my class, I have languages such as Zulu, Venda, Tsonga, Sotho and Tswana. To cater to all these learners, I have to switch to English to understand what you are saying (T8D).

I also have Shona learners in my class, and they do not know Xitsonga. However, they know common words [Shona is the language spoken by immigrants from Mozambique] (T3B).

Teachers indicated that parents are also a contributing factor to their experience that teaching in English is better than teaching in their MT:

Parents cannot help their children with homework and, when you ask, they will say that they do not understand. Then, they will come to the teacher and say that they did not help their learner because the MT is difficult. Others will say that they did a different MT and not the school's one (T4B).

They read Sepedi without understanding. So when you give them the reading homework in MT, they do not do it. But in English, their parents assist them, and the learners can read (T10E).

Other teachers admitted that they had changed the LoLT to English due to the challenges experienced when using MT.

English is the perfect language for Mathematics instruction. It is easy for the learners and me when I teach in English. They do not know our MT. But English is much better because the Tsonga spoken in our township is not the real Xitsonga. This is the reason why we have changed back to English (T4B)

The finding reflects another study that found English was much preferred as a LoLT to the MT: Taylor and von Fintel (2016:76) indicate that some schools chose to go 'straight-for-English' as the LoLT from Grade 1, irrespective of the recommendation by the national and provincial departments of education that the schools should use the first language in Grades 1, 2 and 3, and then switch to English as the language of instruction in Grade 4. Likewise, other researchers who looked at the issue of the language of instruction for teaching Mathematics have found that using English is better than using an MT. For example, Umar et al. (2018) found that primary school teachers in Adamawa State also usually teach Mathematics using English, despite the National Policy on Education's recommendation that pupils in the lower primary schools in Nigeria be taught in their MT.

Ssentanda, Huddlestone and Southwood (2016) explain that *using an MT* refers to the transmission of knowledge and skills from the teacher to learner using (a) the MT of the teacher; (b) the MT of the learner; (c) the dominant MT spoken where the school is located; or (d) the dominant MT in the area where the learner usually lives.

Ssentanda, Huddlestone and Southwood (2016) found that teachers in Uganda were not employed where their linguistic knowledge could support their learners. For example, teachers were placed in classes where they could not speak their learners' MT. Participants in the study experienced a similar challenge, as they were placed in categories where they did not understand the MT of some learners.

In contrast to the argument by Taylor and von Fintel (2016) about teachers who adopt a 'Straight-For-English' approach, Umar *et al*. (2018) argue that learners who have been immersed in a learning environment where their mother tongue has been used show significant improvements in their academic performance compared to children who were learning in a foreign language. The situation in this study is complicated because the environment itself does not support the use of a particular MT because there are different mother tongues. A broader perspective was adopted by Van der Berg, Spaull, Wills, Gustafsson & Kotz (2016). They advocate that, where children in the Foundation Phase cannot attend a school that teaches in their home language, they should at least attend a school in the same language group. However, the participants indicated that they had learners from different provinces and across the borders of South Africa.

The school's decision to use English is based on the fact that the South African government leaves the choice of languages to the school bodies that represent the parents, who frequently choose English, especially in Black schools (Nomlomo & Mbekwa, 2013). Furthermore, the data from Selamat, Esa and Saad (2011) revealed that the blame should not be on the use of English as the language of instruction to teach Mathematics, but rather on its incorrect and faulty implementation. Similarly, the study conducted by Yunus and Sukri (2017) indicated that Malaysian teachers also had the challenge of changing the LoLT for Mathematics. However, the Malaysian teachers opted for the use of Malay rather than English. The difference is that, in South Africa, teacher development is conducted in English, in contrast to Malaysia, where the Malay language was the language of instruction, which was deeply rooted in Malaysian minds (Yunus & Sukri, 2017). According to Yunus and Sukri (2017), the reason for this choice was that Malay was viewed as being very much in their comfort zone.

5.3.4 Interview question four

In which language do you feel competent to teach Grade 3 Mathematics and why?

When asked about the language they felt competent to use when teaching Mathematics to Grade 3 learners, all the participants replied that it was English. This

concurs with the results obtained from the third interview question about the teachers' view of the differences between using English and using their MT for teaching Mathematics. Furthermore, the teachers indicated that they did not have appropriate teaching and learning material for their MT, leading to the emerging theme of ***inadequate teaching and learning material in a MT.***

Below are examples of teachers' responses concerning the theme:

> *I have been teaching for 20 years and, in all these years, I only used MT for three years. Therefore, I would say using English is the best. I prefer English because of this environment. Outside they say 'ten'. They do not say 'lesome' (T6D).*

> *I feel competent to teach Mathematics in English. It is easy because that is what they live: for example, money, 'Rand' is 'Rand', 'a half a litre' is 'a half a litre' and nothing is 'seripa sa borotho'. Even with the symbols, 'one Rand' is abbreviated as 'R1', and '50c' will remain '50c'; 'c' represents 'cents' and, in Sepedi, 'cents' is 'disente' yet is written as '50c'. The challenge is that 'disente' does not begin with a letter 'c'; it also does not have letter 'c' (T1A).*

> *English is the best language to teach Mathematics because the languages spoken in this township are not a real MT (T4C).*

The participating teachers pointed out that the Annual Teaching Plan (ATP) they were using, which the DBE provides, is only written in English. In addition, they explained, they experienced a challenge when translating concepts from English to MT during lesson planning because they had to search for the correct MT concepts. Again, participants emphasised that not all the concepts are found in the MT dictionary and searching the internet, such as in Google, does not assist with MT concepts. Therefore, the theme emerging is that of ***inadequate teaching and learning material in a MT***.

THEME 4: Inadequate teaching and learning material in a MT

Inadequate learning and teaching materials are among the many issues facing MT education in Africa (Glanz, 2013; Ssentanda, Huddlestone & Southwood, 2016). For

example, de Schryver and Nabirye (2010) indicated that learning and teaching MTs in Uganda's context are very scarce. Similarly, teachers' responses revealed that they did not feel competent to use English as the LoLT because of the difficulties related to learning and teaching material.

> *I think English because also the ATPs are in English; therefore, the concepts are in English. Even the dictionary we are provided with is full of borrowed words, so most terms are in English (T6C).*

> *As a teacher, my challenge is that the ATPs are in English, and you have to translate and look for the words, making sure that, when you translate, the meaning does not change. (T7D).*

> *It is also challenging to use the material because most of it is in English and, when you Google, you find that they are in English; again, when we buy, we struggle because the suppliers come in the wrong language. Moreover, other words are mistranslated, some in Sesotho, not in Sepedi (T8D).*

From the above excerpts, it is evident that the teachers do not support the usage of an MT in teaching Mathematics, hence their responses that they only felt competent in using English. A similar finding in the study conducted by De Schryver and Nabirye (2010), whose participants indicated that the challenges of teaching and learning material in MT had led them to use dictionaries to translate the concepts into the MT. However, participants in the current study indicated that using a dictionary or Googling for words was pointless because most MT words cannot be found there. In this way, the education of learners in a MT is compromised because teachers resort to using English words. Furthermore, in Yunus and Sukri (2017) study, researchers found that it was impossible to use the Malay language for academic purposes because it was always laborious to translate the science terminology from English to Malay, and the materials translated became outdated.

Furthermore, the teachers mentioned that they felt competent when using English because of the challenges of using the learners' workbooks known as *DBE workbooks*. Below are the teacher's exact words:

Even the DBE books that they bring, as a teacher, you do not understand what they were trying to say when you try to read it. We do not even have a copy of the answers for these DBE books. So you, as a teacher, you are having just a DBE book, and then you have to find the answers on your own. Sometimes it is unclear what they are trying to say to explain according to your understanding (T9E).

I am a Sepedi teacher, and I know Sepedi but, I don't get what most of the words in the DBE book mean... Sometimes they write the isiZulu words in this Sepedi book. They don't have words for those concepts, but they want us to teach in MT. Teaching aids are in English (T10E).

The DBE has designed the DBE workbooks that are translated into all 11 South African languages. These workbooks were introduced in 2011 and are available to all students in Grades 1 to 9 in Mathematics and Language, reaching approximately 9 million students (Van der Berg et al., 2016). In addition, workbooks are used to measure curriculum coverage every quarter (Van der Berg *et al*., 2016; Hoadley & Galant, 2016). Therefore, Schools that regularly obtain poor ANA results are ordered to use DBE workbooks as a critical language and mathematics preparation resource. (Van der Berg *et al.,* 2016). However, the participants reported that they prefer to use English because the language in the books is full of errors.

The responses from interviews reveal that a DBE workbook, a tool that is designed to help learners practise Mathematics in their MT, is not assisting as expected because teachers, in most cases, have to deal with the difficulty of correcting and sometimes trying to make sense of what the concepts mean. Hoadley and Galant (2016) explain that the workbook can function as a practice tool in the classroom or as a homework resource, emphasising rehearsing content, concepts, and skills. However, teachers are challenged due to the standard of the language used in the workbooks. Participants reported that concepts are wrongly translated, such as isiZulu words in Sepedi workbooks, when these words are from totally different language groups. Participants also noted that other ideas are written in English in the MT workbooks. Workbooks are designed to help teachers track the progress of learners and provide extra support if needed. They are a simple way to structure learning activities for learners (Hoadley and Galant, 2016). Instead, teachers complained that workbook

activities are not in line with the ATP, so they cannot use them following the prescribed daily activities. Teachers also complained that they sometimes struggled to understand what was written in the DBE workbooks.

The third issue revealed by the interviews concerned the classroom material. Teachers indicated that they were provided with wall charts and teaching aids written in English instead of an MT.

> *We find it easy to teach in English because we do not have all the material in Xitsonga. The wall charts and teaching aids are also written in English (T3B).*

This problem was also evident in the study that was conducted by Ssentanda, Huddlestone and Southwood (2016), whose participants indicated that the English materials available to teachers in government schools were not suitable for learning and that learners in government schools were not being given the same treatment as English language learners. A participant in the study felt that if she were expected to teach in Luganda, she should be given materials in Luganda and not in English. A well-planned, attractive and structured classroom offers an atmosphere that promotes learning and becomes a part of the learning programme (Jackman, Beaver & Wyatt, 2014). Teaching aids form part of the classroom learning programmes, so they have to be relevant to the children's learning. Wall charts stimulate the children's memory and often remind them of the concepts that they have already learned in class. Therefore, it is crucial that teachers can use wall charts and teaching aids related to the LoLT.

5.3.5 Interview question five

What are the challenges of teaching Grade 3 Mathematics in a MT?

When participants were asked what challenges they experienced in teaching Mathematics to Grade 3 learners in a MT, they all specified the challenge that learners struggle with understanding MT concepts. Comments made by teachers were based on the learners' inability to learn in the MT. They explained that learners understand Mathematics concepts in English better than in the MT. Furthermore, the responses

revealed that learners use English concepts more often when they interact in ordinary life. Their basis is in English because most of them were taught in English at a crèche and in Grade R. This led to the emerging theme of ***learners' incapability to learn Mathematics in a MT***.

THEME 5: Learners' inability to learn Mathematics in a MT

Examples include:

> *Challenges are mainly focused on language. As soon as I use MT, they get bored. It is not even in their schema, and they cannot relate to it. They are hearing it for the first time from me. This means that they are not moving from the known to the unknown because parents do not use that language (T1A)*

> *These learners are used to English words, and it becomes problematic when they have to do Maths in MT. When I compare the average of using English to that of MT, learners were performing better when using English as LoLT. With this MT, the performance is terrible. I do not know if they do not like the language or do not know it. But English, I can assure you, they enjoy it. I have been there. You would love them when teaching in English. You can even see that they love this English. And they perform exceptionally well, even the slow ones, when is English, they raise their heads with confidence. But with Sepedi or MT, they just seem like they are tired (T5C).*

> *My experience in using MT is that we come across many challenges when we are teaching these learners. On my side, I prefer English. Most of the learners are being taught in English from the crèche and Grade R. It becomes difficult for them when they come to our school because we are using MT. It is a challenge for us teachers to teach in MT because their basis is English, especially numbers and number names. The numbers and number names in English are straightforward. But with MT, it is challenging. The numbers are very wrong. Besides, our children like English. They dislike their MT. Their parents also like English. This is all of the competition in our area because most schools offer English as LoLT and most parents take their children to those schools (T4B).*

The finding demonstrated that Grade 3 learners experience several challenges in their learning of Mathematics due to receiving education in a language they have not mastered. Learning in a LoLT that is different from learners' home language can create an educational obstacle that can become a significant challenge for a fully inclusive education system if not tackled quickly and effectively (MacKay, 2014). However, the data from the participants reveals that it is easier for teachers to teach in English than in the learners' MT. The research participants stated that there is a challenge for Grade 3 learners who were educated during their early years of schooling (referring to Grade R) in English, which differs from the LoLT of the school. As a result, these learners do not understand the concepts used in their MT (Kotzé, Van der Westhuizen & Barnard, 2017). In addition to the fact that exposure to English in Grade R did not prepare the learners sufficiently for the use of their MT in the Foundation Phase (Grades 1 to 3), the participants indicated that some learners were not exposed to the LoLT before the Foundation Phase, where the LoLT was neither their mother tongue nor their everyday spoken language. They described this challenge as a *language barrier* (Maake, 2014; MacKay, 2014; Kotzé, Van der Westhuizen & Barnard, 2017). The language barrier is why learners are not performing well (Kotzé, Van der Westhuizen & Barnard, 2017).

Another issue is that, to some learners, the LoLT is not even a second language that they can master but a third language. Therefore, in line with the above viewpoint, participants testified that:

> *In our school, we have 70% of learners that are foreigners. They come from Mozambique and Zimbabwe, and most of them understand English (T4B).*

> *In my class, I have different learners, such as Sepedi, Xitsonga and isiZulu. All these learners are there, but I try, as I said, that it is foreign languages. Still, I have to force them to do Sepedi. We cannot group the learners according to their different languages because you will find that there are five Sepedi learners, five isiZulu learners, five Xitsonga learners. Therefore, these numbers do not qualify us to get different language teachers (T5C).*

I teach in Sepedi, but we have different languages, such as isiZulu, Xitsonga, Venda, Ndebele. All these languages are there, even the white learner from Maputo. You can find that there are only five Sepedi learners out of 40 learners in a class (T10E).

It is suggested from the excerpts that some learners experience the challenges of hearing words for the first time in class. In line with the abovementioned finding of this study, Kotzé, Van der Westhuizen, and Barnard (2017) agree that learners struggling to understand the MT concepts used for learning Mathematics are not competent to master LoLT that is supposed to support learning. Akin to the above perspective, participants shared that the learners' difficulty in grasping the LoLT had three contributing factors, namely: (a) learners, including first language learners, speak the township language that is spoken in the community; (b) parents usually speak with their children in English, and (c) learners' lack exposure to the MT outside the classroom due to using English or English words when speaking or playing with their friends. Therefore, according to the teachers, it isn't easy to use a single MT to teach such learners. In a similar view, NEEDU (2013) found no apparent dominant mother tongue among students in some environments due to the high level of language diversity in the classroom, especially in urban areas.

According to the participants, there is a lack of community resources to support and practice the LoLT outside the classroom because the environment does not promote indigenous languages. In the same vein, Van der Berg et al., 2016 (2016) report that socio-economic status contributes to children's language development. The solution to the LoLT problem is to use English as the language of instruction. However, a study conducted in a similar context by Machaba (2014) revealed that it is challenging to offer mother-tongue education where children speak more than three different languages, some of which the teacher does not know. For instance, for children from certain countries north of South Africa, the first language is French. None of the teachers knows it and could not explain it to such children in their language. The children, too, would be unable to express themselves. Hence the LoLT is itself a severe barrier to learning Mathematics. The above indicates that the environment does not allow second or third language learners to practice the language they are being taught (the MT in this study). Therefore, it is reasonable to conclude that the

teachers feel they face challenges in teaching Mathematics to learners who struggle with the LoLT.

5.3.6 Interview question six

What are the successes of teaching Mathematics in MT?

When asked about the successes of teaching Mathematics in MT, all teachers interviewed responded that none. Instead, they indicated that, since the introduction of MT teaching, learners had not performed well. Furthermore, most teachers explained that, instead of successes, they experienced a decline in parental involvement. They added that some parents even took their children to English schools. Therefore, the theme emerging is that of ***lack of parental involvement.***

THEME 6: Lack of parental involvement

Parental involvement can be defined as support by parents for their children's education and academic achievement through participation in the home and school (Hayes, 2011; Beard, 2017). Therefore, parental involvement in school activities is essential for learners' success because it can have a positive effect on the learning and school experiences of children. However, this study's teachers' responses indicated little or no success in teaching Mathematics to Grade 3 learners due to lack of parental involvement. Examples of teacher's views include:

> *I don't want to lie: In this 21st century, I do not see any success in using MT because everything has changed so much. Even the gadgets that our children use are in English. Even parents cannot help their children with homework and, when you ask, they will say that they do not understand. They will come to the teacher and say that they did not help their learner because the MT is difficult. Others will say that they did a different MT and not the school's one (T4B).*

> *I do not have success. Most learners come to class knowing English. I do not know if it is from their previous grade or home or crèche and Grade R, but parents understand English more than the LoLT of school. Sometimes when you give children homework, they write it in English because they do not know the words in*

MT. They say that they did Mathematics in English. When we were teaching in English, the results were much better than now. In English, questions are shorter and only needs straightforward answers. In Sepedi, like I have given an example of fractions, parents understand fractions in English than in Sepedi. So parents are not helping their children because they do not understand Sepedi (T8D).

The responses from interviews demonstrated that teaching in a MT was negatively affected due to lack of parental support. However, a recent study by Güngör and Önder (2020) showed that parents could give their young children a sense of success and confidence in what they have learned at school by practising at home. Furthermore, Radzi, Razak, and Sukor (2010) and Harji, Balakrishnan and Letchumanan (2016) argue that parents are the first teachers of children, and their involvement in their children's education is crucial to the children's successes.

Moreover, participants revealed that parents moved their children to schools where the LoLT was English due to their lack of success. One teacher said:

Even the parents like English; they do not like this MT… Some parents took their children away, saying that they thought that their children would be taught in English and wanted their children in English schools (T5C).

Ssentanda (2013) explained that one of the reasons parents move their children to schools where the LoLT is English is that parents do not understand why there is an emphasis on MT teaching since the MT is not valued sufficiently as a subject to be examined at the end of primary school. When children become proficient in English at an early age, teachers and parents believe that their educational journey becomes lighter and brighter (Ssentanda & Nakayiza, 2017). One teacher explained:

I did not see any success. It is terrible because they would do MT in Grade 3 and struggle with English in Grade 4 … Then you have to explain to the parents that the government decides to do MT (T3B).

The excerpt above reveals that parents are not informed about the reasons for their learners to learn in a MT in Grades 1-3 and for the transition to English in Grade 4.

According to Johnstone (2018), parents should be consulted by policymakers. Research has shown that increased parental involvement leads to high student success, increased parent and teacher satisfaction and an improved school environment (Aziz, Hassan and Atta, 2011; Durisic and Bunijevac,2017; Patton, 2019; Rapp & Duncan, 2012; Van der Berg *et al*., 2016). By contrast, lack of parent involvement in their children academic activities contributes to low academic achievement (Choi, Chang, Kim, and Reio, 2015; Huang and Mason,2008). Another factor contributing to the lack of parental involvement is that many parents believed the schools their children attended did not require their involvement (Beard, 2017). Sometimes, they felt unwelcome (Alexander, Cox, Behnke & Larzelere, 2017). However, in this study, findings from participating teachers were that parents of learners were not involved in their children's education because they did not speak at home the LoLT that the school offered. In addition, ethnically diverse parents are not engaged because of language and cultural barriers (Beard, 2017). According to Beard (2017), schools experienced challenges in getting parents of diverse ethnicities involved.

The same challenge was experienced by Kotzé, Van der Westhuizen and Barnard (2017), except that, in their study, parents who spoke isiXhosa and other South African languages were not involved in the education of their children where the LoLT was English. Kotzé, Van der Westhuizen and Barnard (2017) postulated that the language barrier negatively affected communication, understanding and relationship-building between parents and teachers. Vandergrift and Greene (1992) suggested that being committed to parental participation and support may include assisting with homework and attending parent-teacher meetings. In this research, participants revealed that parents did not help learners with their homework. Participants explained that this was because the parents did not understand the mathematical concepts. Hence the learners' homework was written in English instead of MT.

Hourani, Stringer and Baker (2012) indicated that communication and socio-cultural contexts could limit parental involvement. On the other hand, Van der Berg *et al*. (2016) explained that home support is strongly influenced by parents' education and involvement with a child. Van der Berg *et al.* (2016) identified platforms that can affect home-background learning, such as (a) access at home to the material resources

needed for stimulation and learning in the early years; (b) the availability and quality of home teaching support; (c) a home environment conducive to learning; or (d) parents who wanted to ensure their children attended a good quality school. Jackman, Beaver and Wyatt (2014) further articulated that it is the teacher's responsibility to make sure that the communication lines with parents are open. Still, it is the parents' responsibility to become involved with their children's teachers and schools.

5.3.7 Interview question seven

How do you overcome the challenges experienced in teaching Grade 3 Mathematics through MT?

Teachers said they used English terms to explain concepts that were in the MT. The responses from teachers revealed that learners used English ideas in their real-life situations. They used English for learners who did not understand the LoLT of the school. Furthermore, teachers from two schools indicated they had changed from an MT LoLT and were now using English as the LoLT. Thus, emerged the theme of ***Code switching.***

THEME 7: Code-switching

Teachers use code-switching to connect with learners, foster learning, form a bridge between first language and second language, put forward the teacher's inner voice, express emotions and abstract concepts, facilitate comprehension and keep students engaged in class (Raman & Yigitoglu, 2015). Milroy and Muysken (1995) describe code switching as alternative usage of the same conversation by bilinguals of two or more languages in a multilingual background. T1A said:

> *When I code switch, I use English to teach numbers and then explain in MT.*

Another teacher explained:

> *I am worried because most words are not available in Sepedi, such as 3-D shapes. So I survive by using English (T10E).*

Teachers had learners who spoke different languages in their classrooms, and the teacher below explained how they dealt with that challenge:

> *I deal with diversity by using English because they understand English better. They use English when they play, and at home, they also use English. So they take time to know when you say words in their mother tongue (T4B).*

Furthermore, one teacher explained how the school used a group effort to translate the DBE's English teaching and learning material.

> *We sit in a group, do the translation. Even the question paper that we get in a USB is in English, and we must translate the whole question paper in Sepedi with the HOD and other teachers (T7D).*

The excerpts reveal that teachers depend on code-switching to overcome the challenge of teaching Mathematics in a MT. Several other studies have found that in countries where a foreign language is used as the LoLT, teachers and students prefer to use the mother tongue of the students in the subject classroom in alternation with the foreign language (Makgato, 2014; Tabaro, 2013; Teklesellassie & Boersma, 2018). However, the study participants indicated they depended on English when explaining MT concepts, slightly different from the previous statement. T9E explained:

> *When you teach them, you start by saying it in English, then explain it in MT… So I emphasise the concepts by using both English and MT.*

In support, Gotosa, Rwodzi and Mhlanga (2013) argue that prescribing what language to use in the classroom is pointless when instruction is a foreign language. The recent finding by Teklesellassie and Boersma (2018) revealed that both teachers and students with higher English skills favour using the mother tongue less often in the classroom.

A further finding is that, in overcoming the language barrier, teachers allow learners to answer in the language they are familiar with, either English or MT. In line with this finding, other studies have shown that learners are more likely to engage and gain

information when they can use the most familiar language (Abad, 2010; Khonakdar & Abdolmanafi-Rokni, 2015; Tandoc, 2016). It has been said that the use of code-switching in classrooms should not be seen as a lack of language skills by teachers and students but instead as a technique to improve learning (Benu, 2018). However, teachers in this study indicated that they used English because of the challenges they experienced due to not knowing some of the concepts in the MT. The evidence from the interviews is that some schools have changed to using English as the LoLT because they could not deal with the pressure of using an MT.

> *As I have already said, I use English concepts … but now is better because we are currently teaching English (T3B).*

In Soshanguve, the classes contain bilingual and multilingual learners. If they have to learn English and learn in English, it is a problem for them. Therefore, the teacher needs to use code switching to develop the students' English language competence in this situation. However, according to Benu (2018), code-switching Might not be suitable for high-level English-speaking learners because they understand the simple use of English as the target language. In other words, code-switching is only appropriate to build trust or clarify meaning for learners with low levels of language skills.

5.3.8 Interview question eight

What MT strategies/methods do you use to explain Grade 3 Mathematics concepts to learners?

Most teachers interviewed indicated that they used English to explain concepts. One teacher explained that she used repetition and drill work to assist learners, but the methods are time-consuming, leading to an emerging code-switching theme.

THEME 8: Code-switching

This result concurs with the results obtained from research question seven, about how teachers overcame the challenges experienced in teaching Grade 3 Mathematics in a MT. Below are the teachers' responses in their exact words:

It is difficult. I code-switch, first in English, then tell in Sepedi. When I begin to explain in Sepedi, the children laugh at me. For example, I say, 'This is a "square"; in Sepedi is "khutlonne".' Then one learner said, '"Square" is okay. We don't want "khutlonne"' (T1A).

I am using English to explain because Sepedi and English can have different meanings. In Sepedi, one word can have two meanings. For example, in English is easy when you say, 'Write the numbers that are bigger than 100.' This is because, on the number board, they are 101, 102, 103, but in Sepedi, when you say 'ngwala dinomro tse godimo ga 100', they write numbers that are on top of 100, which is 90, 80, 70 … They do not write numbers that are bigger than 100 because they are using a number board. So it is one word but explains two things (T8D).

Another teacher explained that she uses both MT and English when she teaches Mathematics. She allowed learners to answer in any language they understood, English or their MT, even though the LoLT is their MT.

I write the word 'sum' in Sepedi in the chalkboard. I then read and explain. Then I write the same word 'sum' in English then I read it in English. Some answer in MT and some answer in English. If numbers are bigger than ten, they always answer in English. They know the MT number names mostly up to 10 or 20 (T10E)

Two teachers from one school indicated that they were no longer using an MT because they had changed the LoLT back to English. However, their responses indicated that they also used code-switching to explain the concepts that are written in English:

I am using English. I would have to tell them in English because they understand English when we are doing shapes. In English, I would first tell them that 'Now we are doing 2-D shapes, in Xitsonga it is not known. Then I will show them the picture of 2-D shapes or 3-D objects. But when you tell learners in Xitsonga, they will tell you in English (T3B).

It is easier now because we have changed the LoLT of the school into English. So we are currently teaching in English when you say, 'even-odd numbers, it is simple to learners, but when you are saying 'Tinhlayo fedzenga', it is like you are talking another language, not another language their MT (T4B).

The views in the above excerpts suggest that, even though teachers use code-switching, they rely primarily on English to teach MT concepts to the learners. The quotes imply that learners understand English better than their MT, hence the transition of the LoLT from MT to English by some schools, irrespective of the language policy that stipulates the use of MT.

5.3.9 Interview question nine

What language would you recommend for teaching Grade 3 Mathematics to learners?

All teachers recommended English for teaching Mathematics to their Grade 3 learners. They explained that learners do not speak their MT properly because they speak at home is full of English concepts. This led to the emerging theme that ***teaching Mathematics in English is better than teaching in MT***.

THEME 9: Teaching Mathematics in English is better than teaching in a MT

This result concurs with the results obtained from research question three about how teaching Grade 3 Mathematics in English differs from teaching in a MT.

I would recommend English because that is what they live. Parents use English at home; even those that do not know English understand concepts in English. Parents do not know MT concepts. Therefore, there is no prior knowledge that an educator can build on (T1A).

English because I am weighing the understanding. With MT, it is challenging to understand some of the words but, with English, it is easy for learners to understand …. Learners learn fast English. They know it well. I think English is

better because they use English almost every day, and the problems will be minor (T5C).

Even the slow learners perform much better in English than in their MT (T9E).

Surprisingly, two teachers from one school indicated that, after switching the LoLT back to English, learners' performance improved.

They switched to English, and it is better (T3B)

I recommend English. Since we have changed the LoLT of the school to English, marks have improved (T4B).

5.3.10 Interview question ten

Do you have any other contribution to make regarding the teaching of Grade 3 Mathematics in MT?

Teachers were against the use of an MT for teaching Mathematics to Grade 3 learners. Instead, they indicated that English should be used, leading to the emerging theme of ***a proposal to teach Mathematics in English.***

THEME 10: A proposal to teach Mathematics in English

This result concurs with the responses to research questions three and nine.

In MT, I do not have any contribution because I feel like, when you teach in MT, you are wasting time trying to explain the words in English … You do not have to drill it for the whole week for learners to understand. But when you tell them in MT, tomorrow they will forget the word (T3B).

I do not know, but I do not see the MT LoLT materializing, even in the coming years. The gadgets that our children are using are in English. We are so much in English (T7D).

Again, teachers indicated that to support the use of an MT, the DoE should provide them with material written in the MT, such as teaching aids, books and the ATPs.

I would recommend that they provide us with the teaching aids written in MT for support and not English. They must do them in MT. The ATPs must also be in MT (T6C).

To our, Department to bring the material in MT because the material they get is in English. I do not have a Mathematic book in isiZulu. So when I need something, I take an English text and translate it to MT … It is challenging to solve because we do not know some of the concepts in MT. Therefore the meaning will not be the same (T9E).

Furthermore, teachers complained about the quality of the language used in the DBE workbooks. They recommended that they be provided with the memorandum for the DBE workbooks and that the DBE workbook be aligned with the policy.

Sometimes you find the language used in the DBE for the word 'sums' is not good. Sometimes they have written the word, but it does not mean that. If the DBE books can go hand in hand with the policy: If the first lesson is counting, the first lesson in the DBE book must be counting. If the next lesson is money, it must also be like the DBE (9E).

Teachers further recommended that the work should be reduced so that the ATP addressed one concept per week.

They should treat the concepts in such a way that was done in the past. For example, one concept was done for the whole week, unlike the ATP, where more than one concept is treated in one week. And this is confusing to the learners; they do not know what they are doing (T10E).

The work is too much for Grade 3 learners. Therefore, they must reduce the work and the number of learners per class (T7D).

The participants' excerpts suggest that teachers prefer the use of English to MT. The school's decision to use English is based on the fact that the South African government leaves the choice of languages to the school bodies that represent parents, who frequently choose English, especially in Black schools (Nomlomo & Mbekwa, 2013).

5.4 DOCUMENT ANALYSIS

Data were collected from the Annual Teaching Plan (ATP), teacher's lesson plans, learners' activity books, learners' DBE workbooks and wall charts. In addition, the data were analysed and triangulated with other data collection methods. Finally, each participating teacher was asked to present their documents, and the resultant analysis and findings are shown below.

5.4.1 Annual Teaching Plan (ATP)

The researcher expected to find that the ATPs were written in English but translated into an MT. However, all teachers using ATPs were using the ones written in English and never even tried translating them into an MT. Therefore, the theme emerging is that ***teachers use documents that are written in English***.

The following nine teachers had their ATPs written in English: T1A (T2A did not honour the appointment), T3B, T4B, T5C, T6C, T7D, T8D, T9E and T10E.

5.4.2 Lesson plans

The researcher expected to find that lesson plans were written in a MT. However, most teachers interviewed had all their lesson plans written in English, except Teacher T2A, who did not honour the appointment, and Teachers 7C and 8D, who had lesson plans written in English, but the concepts were written in both MT and English.

All teachers interviewed wrote their lesson plans in English. However, there were only two teachers whose English lesson plans included MT concepts. Therefore, the theme emerging is that ***teachers use documents that are written in English.***

5.4.3 Learners' written activities from the workbooks

The researcher expected to find that activities were written in a MT. However, the following examples were found in the learners' activity books.

- Most teachers had lesson topics with instructions on the worksheet written in English.
- T5C gave learners instructions for assessment in both English and MT.
- T6C, though instructing a MT, did not write it correctly. For example, the teacher wrote 'hlantsha' (make mad) instead of 'hlakantsha' (add). A learner who does not know the correct spelling would continue to spell it because learners believe what teachers say.
- T7D had the headings of all worksheets written in English, such as fraction circles and fraction strips, but the instructions were written in English and MT.
- T8D had the activity dealing with the time written in both English and MT. For example, 'Bontsha half-past three. Meaning: indicate the half-past in the clock'.
- T9E: The activity was written in English but translated into MT by the teacher.
- T10E had written all the instructions for the activity in English.

When the researcher requested the children's writing books from the teachers, the aim was to find the language of instruction children use when writing activities. A scrutiny of the writing books revealed the successes and challenges of using MT. Generally, all participants gave the researcher samples of the children's work, and the researcher could establish how the LoLT was used. The researcher discovered that children from the schools that opted to use English had instructions and activities written in English only. In schools that indicated they were using MT as LoLT, the researcher observed a lack of consistency in the written activities done in the schools. The instructions and activities were sometimes written in English, sometimes in MT and sometimes in both MT and English. In the English-medium schools, not one used an MT for writing activities. The evidence from the activities was that teachers prefer

to use English rather than MT. Hence the theme here is that ***activities were written in English***.

5.4.4 DBE workbooks

The researcher requested their DBE workbooks from the teachers and then compared how concepts were presented in the English DBE workbook with those shown in the MT (Xitsonga) DBE workbook. The following are examples from the DBE workbooks:

Example 1

DBE Grade 3 English Mathematics workbook 1 (2013:61) and DBE Grade 3 Xitsonga Mathematics workbook 1 (2013:61)

DBE ENGLISH WORKBOOK 1	**DBE XITSONGA WORKBOOK 1**
Cost/price	Durha

DBE Grade 3 English Mathematics workbook 2 (2013:77) and DBE Grade 3 Xitsonga Mathematics workbook 2 (2013:77)

DBE ENGLISH WORKBOOK 2	**DBE XITSONGA WORKBOOK 2**
Cost/price	Vitana

In the DBE Xitsonga workbook 1, the concept of 'cost' is misleadingly translated as *durha* because *durha* means very expensive. The actual activity requires the learners to calculate the cost or price. The word *vitana* should have been used instead of *durha*.

In the DBE Xitsonga workbook 2, the concept of 'cost' is represented by the correct word *vitana* and *durha* is no longer used. This means that there is no consistency in the use of MT concepts.

Example 2

DBE Grade 3 English Mathematics workbook 1 (2013:24) and DBE Grade 3 Xitsonga Mathematics workbook 1 (2013:24)

DBE ENGLISH WORKBOOK 1	**DBE XITSONGA WORKBOOK 1**
Triangle	Tinhlanharhu
Circle	Xirhendzevutana
Rectangle	Rekthengula

DBE Grade 3 English Mathematics workbook 2 (2013:72) and DBE Grade 3 Xitsonga Mathematics workbook 2 (2013:72)

DBE ENGLISH WORKBOOK 2	DBE XITSONGA WORKBOOK 2
Triangle	Yinhlanharhu
Square	Xikwere
Rectangle	Yinhlamune

In Xitsonga workbook 1, the mistake with the terms used in the home language is that some of the words used are borrowed from English, and some are Xitsonga words. For example, the phrase *tinhlanharhu* for 'triangle' is plural instead of *yinhlanharhu* for one.

In Xitsonga workbook 2, the word *yinhlanharhu* is correctly written. However, the word for 'rectangle' in Xitsonga workbook two is given as *yinhlamune*, whereas in Xitsonga workbook one, the word *rekthengular* is used.

These errors are confusing to the learners when they are still learning the concepts. The teachers are also faced with correcting the mistakes, which is not easy because they are printed in the workbooks. There is no consistency in the terms used in the DBE Xitsonga workbooks 1 and 2. The concepts in the DBE English workbooks are used correctly and consistently, but the concepts in the MT DBE workbooks are full of errors, and there is no consistency in the terminology. For example, different words were used to represent one item. There was **inadequate teaching and learning material in the MT**.

5.4.5 Wallcharts

The researcher expected wall charts to be labelled in a MT. However, most teachers had wall charts from the Department of Education written in English (see 0). There was no whole wall chart in MT. Teacher TA2 did not honour the appointment. T5C and T8D had wall charts written in English from the Department of Education but had translated some words into MT (see 0). T9E had wall charts written in English from the

Department of Education and only translated two charts into MT. T10E had wall charts written in English from the Department of Education, but they were numbered from 1 to 20 in the MT by the teacher.

Wall charts from all teachers were written in English, but some teachers took the initiative of translating parts of the wall charts into the MT (see 0). For example:

Fraction
Fraksene

Whole
Palomoka

Therefore, the theme here is that ***the Department of Education provide the teachers with the wall charts that are written in English***

Findings

The information deduced from the documents suggests that teachers use documents that are written in English. The findings further reveal that instructions for learners' activities are primarily written in English. However, some teachers write in both English and MT. Terms used in the English DBE workbooks are correct and consistent, but the MT DBE workbooks are full of errors, and there is no consistency in the terms used. For example, different words were used to represent the same concept.
Furthermore, among the classroom resources were wall charts written in English provided by the DBE. Although some teachers translated some of the wall charts into an MT, only one language was used. Thus, the teachers who were using English had wall charts that were only in English. On the other hand, teachers using an MT had wall charts that were mainly in English.

5.5 CONCLUSION

Chapter 5 demonstrated how the qualitative research procedures were put into practice. It presented an interpretation of the data that corresponded with how the key

informant interviews were conducted. Emphasis was placed on the coding and theme formation that derived meaningful information to answer the study's research questions. Finally, the chapter presented teachers' views about the teaching of Mathematics to Grade 3 learners in a MT in their own words. Chapter 6 will show the results.

CHAPTER SIX
SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

The previous chapter dealt with the analysis and interpretation of data collected about teachers' experiences in teaching mathematics to Grade 3 learners in a MT. The purpose of this study was to investigate teachers' experiences in teaching mathematics to Grade 3 learners in a MT. This chapter summarises the findings from the interview questions asked in this study and provides a conclusion and recommendations from the discussions.

6.1.1 The experiences of teaching Grade 3 Mathematics in a MT

Teachers struggle to translate English mathematical concepts into their MT. Their struggle is exacerbated by:

- teachers' inability to teach Mathematics in a MT;
- teachers' being trained in English at the teacher colleges;
- lack of MT Mathematics concepts;
- the unavailability of translated MT concepts in the dictionary; and
- the non-use of MT concepts in their day-to-day interactions with learners.

The above perspectives agree with the available literature and the diversity of understanding of teaching in a MT, which conforms with the interpretivist, relative ontology, personal epistemology and hermeneutic, phenomenological, philosophical schools of thought that guided the study. This agrees with Nolasco (2010), who asserts that MT usage in a multilingual environment, at the level where the basic concepts of Mathematics are introduced, may confuse learners because the MT becomes corrupted through the mixture of different MT languages. The findings also align with the theory of Vygotsky, who emphasises the importance of language to address issues of race groups, different languages, and different socio-cultural backgrounds for the cognitive development of the children attending school in the Foundation Phase (Vygotsky, 1978).

6.1.2 Training in teaching Grade 3 Mathematics in a MT

The teachers had never received training or support in teaching Mathematics in a MT. Thus, their lack of MT teaching skills and their lack of knowledge of MT concepts was as a result of:

- all teacher training colleges and universities using English as the language of tuition;
- workshops conducted with teachers being presented in English and not in a MT;
- mathematics teachers feeling disempowered to teach Mathematics in MT; and
- in-service teacher training courses not considering the importance of MT, though embraced in schools' language policy.

Following the concerns about Black South African children's failure to acquire literacy and numeracy skills, the Minister of Basic Education, Angie Motshekga, announced at a press conference in Pretoria on 6 July 2010 that early learning should be conducted effectively in a MT. It is, however, still challenging to use an MT in South Africa because there is no teacher training in the various languages, as well as the issue of parents who do not want their children to learn through the medium of their mother tongue because they believe it will hamper their children's ability to speak English fluently (Jankie, 2010).

6.1.3 How different it was to teach Grade 3 Mathematics in English from teaching it in MT

Teachers preferred to use English because they were familiar with communicating in English. They felt competent using it because their training, workshops and interactions are in English. Their reasons for preferring to teach in English were based on the fact that:

- they struggle to translate English mathematical concepts into the MT;
- teachers still in college doing practice teaching in schools use English because their MT language might be different from the teacher's MT;
- the districts under the Department of Education are unable to conduct workshops in a MT because the teachers speak other languages;
- universities and colleges are still producing teachers who are taught subjects like Mathematics in English and not an MT;

- some schools disregard the language policy and use English as the LoLT from the first grade; and
- there were inappropriate teaching and learning materials for teaching in a MT.

These findings are in line with the changing demographics in many countries with multi-ethnic societies and a teaching workforce that has not kept pace with the increased diversity of the student population. Coming from a previously oppressed community, language and cultural background can positively impact people's self-esteem and academic performance, disregarding the fact that all students can benefit from a diverse teaching workforce.

6.1.4 The language in which teachers felt competent to teach Grade 3 Mathematics

All teachers designated English as the language they preferred and deemed qualified to use in teaching Grade 3 Mathematics learners because:

- most teachers had been teaching for many years in English and had never taught in their MT;
- the teaching and learning environment is one where learners can communicate in English and write in it better than in their MT;
- Mathematics concepts are referred to in English and are not known in the MT;
- the Mathematics documents and Annual Teaching Plan (ATP) provided by the DBE are only written in English;
- the electronic gadgets children use are in English; and
- it is difficult to translate concepts from English to the MT during lesson planning.

Yu and Shandu (2017) state that children should use the language they are familiar with; otherwise, they are unlikely to perform well in their tasks. In addition, the Department of Basic Education (DoE) (2005) indicated that language barriers are often caused by forcing learners to communicate and learn in languages they do not use daily at home: They are not competent to learn effectively.

6.1.5 The challenges experienced in teaching Grade 3 Mathematics in a MT

The finding revealed teachers' inability to capacitate learners in a MT. This lack of the ability to teach Mathematics in a MT stems from the following:

- English is easier to use than an MT because English Mathematics concepts are known and are simpler to understand by learners. Teachers, learners and parents use English when communicating in their daily lives;
- the lack of consideration for learners by the Department of Education, demonstrated by their emphasis on MT language usage in schools, knowing that teachers could not master the MT due to their training in English;
- most learners are taught in English in crèches and Grade R, hence their inability to grasp MT concepts. Their basic Mathematics knowledge was in English, especially numbers and number names;
- the non-involvement of teachers in the development of a language policy for schools;
- the DoE's drafting of policies that do not accommodate all communities for the benefit of the learners and the broader community; and
- the use of a one-size-fits-all policy in a multilingual environment where one MT is considered over other MTs.

According to Joubert (2010), teachers experience challenges in teaching learners in a MT because of using a one-size-fits-all policy, which cannot address the issue multi-ethnic teachers and learners face. In South Africa, despite government efforts to relieve the challenges of teaching in township schools, there is still poor performance due to the language issue.

6.1.6 The successes experienced in teaching Mathematics in a MT

There were no successes in teaching Mathematics in an MT because of the lack of training and parental involvement in using an MT to teach Mathematics in Grade 3. The lack of success is seen in the following:

- the poor performance of learners in Mathematics;
- some parents taking their children to English-medium schools;

- poor parental involvement in the learners' home and school activities;
- the teaching of learners in a multilingual environment;
- most learners coming to class knowing English from their previous grade or their crèche;
- children writing homework in English because of not learning the MT words;
- English questions being shorter and requiring straightforward answers;
- decreased parent and teacher satisfaction and low academic achievement; and
- non-involvement of parents due to language and cultural barriers, impacting communication, understanding, and relationship-building between parents and teachers.

According to Skutnabb-kangas (2000:3), successful teaching can only happen if many parents choose the language in which their children are educated. The Department of Education cannot contradict children's right to education in a language they understand. According to Jankie (2010), if parents are not involved in decision-making about their children's education, many Black learners may be unable to read or write fluently in their own language or even communicate in it, and teachers have to resort code-mixing when teaching. According to Owen-Smith (2010), a Lack of parents' involvement would prevent them from falling into the trap of suppressing their mother tongue.

6.1.7 How Mathematics teachers overcome the challenges experienced in teaching Grade 3 Mathematics in a MT

Teachers depend on translating English words to the MT when explaining Mathematics concepts during Mathematics lessons. Some strategies adopted to overcome challenges experienced in teaching Mathematics in a MT are:

- some schools have stopped using an MT and are now using English due to the difficulties encountered in using the MT;
- using code-switching for learner support, and for most words that are unavailable in MT, such as 3-D shapes;
- working in groups to translate the DBE teaching and learning material and question papers from English to an MT;

- emphasising English concepts by repeating them and then translating them into the MT;
- allowing learners to answer in the language they are familiar with, either English or their MT; and
- the use of code-switching as a technique to improve learning and to deal with learners with a low level of language used to build trust or to clarify meaning.

The above strategies are associated with ethnicity-matched teaching and also with increased teacher-learner diversity. These findings highlight the need for all teachers to be trained to work effectively with diverse student populations. In addition, the role of teacher education programmes in developing a culturally responsive teaching workforce for a future South Africa should consider the multilingual and multi-ethnic society in which teachers operate.

6.1.8 Strategies or methods used to explain Grade 3 Mathematics concepts to learners

Teachers use English repetitively to explain Mathematics concepts in the MT. This finding concurs with the responses from research question number seven on how teachers overcome the challenges experienced in teaching Grade 3 Mathematics in a MT. Below are strategies used to explain MT Mathematics concepts:

- First code-switching, repetition, drill and then translation into the MT because the MT and English can have different meanings.
- Using both MT and English to teach mathematics allows learners to answer in any language with which they feel comfortable.
- I am teaching shapes, numbers and pictures in English.

The above assortment of techniques for explaining Grade 3 Mathematics concepts conforms to the idealist, interpretivism, relative ontology, personal epistemology and hermeneutic, phenomenological, philosophical schools of thought that guided the study.

6.1.9 What language teachers would you recommend for teaching Grade 3 Mathematics to learners

All teachers recommended teaching Mathematics to Grade 3 learners in English. The reasons given add to findings and are indicated as follows:

- Learners do not know their MT properly because the MT they speak at home is full of English concepts.
- English is what the learners use in their lives.
- Parents use English at home; even those who do not know English understand English concepts.
- Parents do not know the MT concepts, so there is no prior knowledge that an educator can build on.
- Learners learn fast in English and understand it well, and there are fewer problems.
- Even slow learners perform much better in English than in their MT.
- Since switching to English, learners' performance and marks are much better.

English is recommended for teaching Mathematics to Grade 3 learners because MT education is still challenging in South Africa. The reasons for this are the variety of mother tongues among teachers and learners, the lack of teacher training in the languages, and the lack of resources available (Cekiso, Meyiwa, and Mashige, 2019).

6.1.10 Other contributions regarding the teaching of Grade 3 Mathematics in a MT

The finding was that teachers disapproved of using an MT for teaching Mathematics to Grade 3 learners. Their contribution ties in with the recommendation made about the language to use for teaching Mathematics. The following are the contributions regarding the teaching of Mathematics to Grade 3 learners:

- the use of English as the LoLT;
- to have one concept per activity in the ATP;
- the ATP to be aligned with the DBE workbooks;
- the DBE to provide the teachers with material that is written in the MT; and

- teaching Mathematics in English is better than teaching in MT.

The above agrees with the available literature. The assortment of understanding of quality teaching and learning conforms to the idealist, interpretivism, relative ontology, personal epistemology and hermeneutic, phenomenological, philosophical schools of thought that guided the study. According to Ansre (1979:12-13), this is known as *linguistic imperialism*, a phenomenon in which another language dominates the minds and lives of the speakers of a speech to the point where they believe that they can and should use only that foreign language when it comes to dealing with educational aspects*, such as the teaching of Mathematics in a MT*. Linguistic imperialism has a subtle way of warping the minds, attitudes, and aspirations of even the noblest in society and preventing them from appreciating and realising the full potentialities of indigenous languages.

6.2 RELEVANCE OF THEORIES TO THE TEACHING OF MATHEMATICS GRADE 3 LEARNERS IN A MT

Drawing from the theoretical framework that guided this study, especially the theory of Vygotsky, it is logical to conclude that teaching Mathematics in a MT was not considered a fundamental mechanism for achieving success in teaching and learning Mathematics in Grade 3, especially in Black township schools. This is despite the Social Constructivism theory of Mathematics by Ernest that Mathematics is a social construction or concept that should be supported by using a language familiar to learners. This makes the theory of Mathematics rely on descriptive grounds rather than prescriptive ones, making it a social construction based its requiring linguistic knowledge, conventions and rules, as well as interpersonal social processes and the ability to teach learners how to generate mathematical knowledge that learners can understand (Ernest, 1991). Ernest (1991) describes *linguistic competence* as the ability to communicate linguistically, showing how mathematical problems can be practically solved in simple everyday language that children come to school already knowing reasonably well, using operations in English rather than the children's own mother tongue.

In support of Ernest (1999), the Sociocultural theory of Vygotsky is relevant. It addresses the effects of race groups, different languages, and different socio-cultural backgrounds on the children's cognitive development in the Foundation Phase. Vygotsky's sociocultural theory emphasises the importance of social interactions within a cultural environment in which the child's cognitive development is hugely impacted (Vygotsky, 1978). Vygotsky believed wholeheartedly that the community in which the children live plays an essential role in their process of '*making meaning'* of their reality (McLeod, 2018:1). He further postulated that children's social interactions with their environment play a central role in their cognitive development. In support, McLeod (2018) argues that the individual child's development cannot be understood without reference to the social and cultural environment within which the child is rooted.

The emphasis, therefore, is on how culture and social interaction influence the child's intellectual development (Jaramillo, 1996; Schunk, 2012; Smidt, 2013; Moll, 2014; McDevitt & Ormrod, 2014). The child's cognitive processes, such as language development, thought and reasoning development, accrue due to the social interaction the child is experiencing within their social milieu (Jaramillo, 1996; McLeod, 2018). This means that the classroom should be a place where new socio-cultural environments can be continuously created that stimulate the child to learn even Mathematics.

From the above excerpts, it is evident that teachers should support learners through language that will enhance the teaching of Mathematics and does not compromise their learning.

6.3 RECOMMENDATIONS

6.3.1 Revision of the language policy

Based on the participants' experience of teaching mathematics to Grade 3 learners in a MT, the Department of Education should consider revising the language policy for teaching Mathematics to Grade 3 learners to ensure learners effectively attain early grade capabilities in Mathematics.

6.3.2 Workshops for teacher support in the LoLT

The Department of Basic Education should assign more funds to train and support Grade 3 Mathematics teachers in the language of learning and teaching (LoLT).

6.3.3 Strategies for using the LoLT to teach multilingual Grade 3 learners Mathematics

Considering that the study focused only on the experiences of Grade 3 Mathematics teachers in teaching learners in a MT, techniques developed from other studies done on ensuring that learners acquire mathematical skills through language usage should be benchmarked with the ones used in South Africa to ensure learners receive mathematical skills and overcome the challenges they face in Mathematics learning.

6.3.4 Involvement of education stakeholders in the development of language policy

All stakeholders should be involved when developing the policy on the language of learning and teaching to ensure this aligns with the multi-ethnic context and facilitates successful teaching and learning of Mathematics in Grade 3.

6.4 CONTRIBUTION OF THE STUDY TO THE BODY OF KNOWLEDGE

This study investigated mathematics teachers' experiences teaching Grade 3 learners in a MT, focusing on two primary constructs: Mathematics teaching and mother-tongue teaching in Grade 3. This chapter identified a gap in the literature. It made a unique contribution to the body of knowledge about language for Mathematics teaching to achieve excellence in teaching Mathematics in one MT in a multilingual and multi-ethnic society.

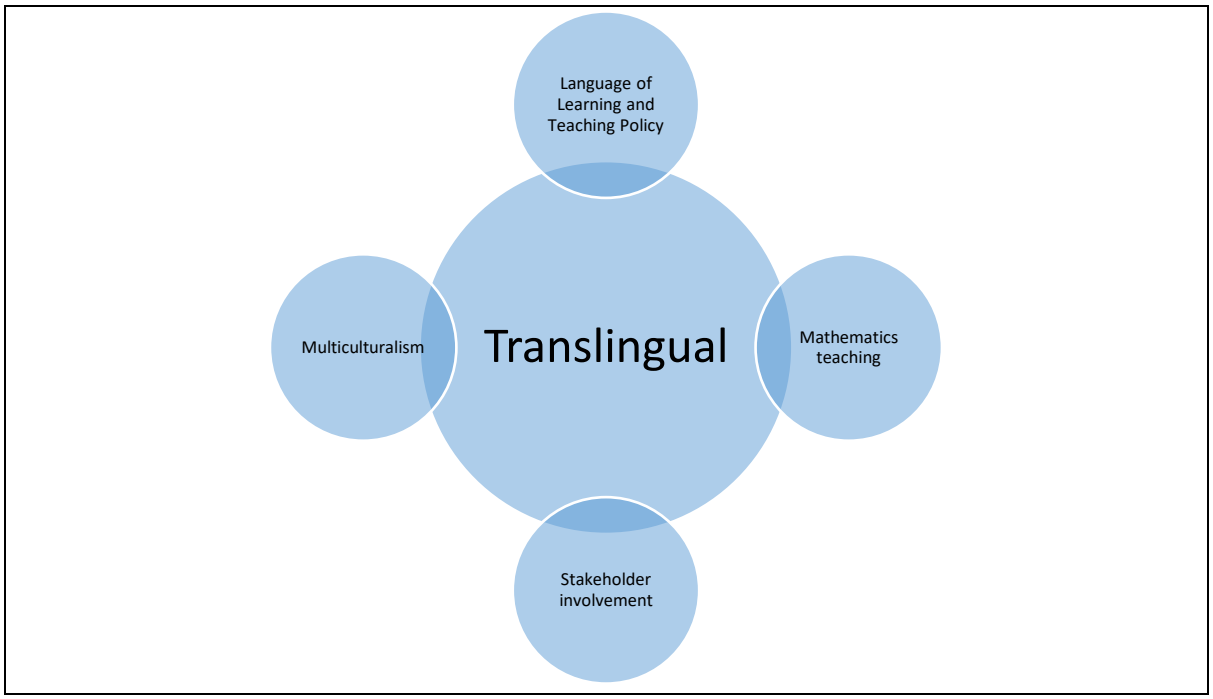
The available literature on the use of an MT for teaching Mathematics to Grade 3 learners showed that previous scholars have focused their researches on the experience of Mathematics teachers in MT internationally, but not on the occasion of

teaching the subject to Grade 3 learners within a multi-ethnic and multilingual context such as South Africa. This was the reason this study was undertaken.

The study's findings have brought to light a unique model as a contribution to the body of knowledge in the field of education.

6.4.1 A translingual theoretical model proposed for implementing mother tongue instruction

A growing number of studies recommend translingual teaching in classrooms. However, these are rarely extended to primary school teaching. Many learners who have not had formal instruction in a language other than their lack creative and strategic learning methods in a multilingual class. Drawing on theories of translingual and Mathematics teaching, the following translingual model is proposed for teaching foundation phase learners Mathematics in a mother tongue:



Proposed translingual model for teaching Foundation Phase learners Mathematics in a mother tongue

Translingual refers to the phenomenon where words and other aspects of language are relevant in more than one language. Thus, *translingual* may mean 'existing in multiple languages' or 'having the same meaning in many languages and sometimes

‘containing words of multiple languages’ or ‘operating between different languages’.Learners from other countries in the classroom may not be represented in the country’s multilingual culture but may contribute cultural knowledge to the other learners. *Multilingualism* refers to speaking more than two languages; or being proficient in many languages (Department of Basic Education, 2010:3).

Not all teachers or learners can communicate effectively in two languages with more or less the same degree of proficiency when their Mathematics classrooms have learners speaking more than one language. Learners from different ethnic groups should be grouped to allow them the comfort of familiarity to bridge the dominant culture in the school. The grouping of multilingual learners prompts them to reflect on the advantage of activating their own linguistic and cultural differences in a Mathematics learning classroom. Time should be allowed for them to use and manipulate their linguistic and cultural skills during the lesson. The interaction of learners, including international ones, may contribute to closing the gap of unfamiliarity and cultural knowledge between the different cultures in the classroom. Anxious students may become discouraged and not participate, so the teacher should support them by being sensitive to their difficulties.

Mathematics teaching would require the teacher to set up Mathematics learning tasks in different languages so that learners are given homework tasks that involve their parents in translating common English words into their mother tongue. Teaching Mathematics in a MT is a process that requires the use the multiple languages in a classroom as a resource and not liabilities. Language is not stable and is always subject to negotiation. For the MT to be more concrete and accessible from a theoretical orientation to pedagogy, it should be adapted for Mathematics learning to engage issues of language differences.

Stakeholder involvement refers to the engagement and participation of parents and other education stakeholders in schools with different ethnic groups when developing the policy on the language of learning and teaching. Usually, the learners in a multilingual classroom are immigrants from other provinces and neighbouring countries and have to be taught in the local mother tongue. However, teaching in a

MT should consider the multi-ethnic context to foster success in the teaching and learning of all learners.

The *language of learning and teaching* (LoLT) in South Africa refers to any of the 11 official languages in the country. In Black schools, the LoLT is used from the first year of schooling up to Grade 3. The transfer from MT to a second language medium occurs after the fourth year of education. Teaching mathematics in a MT that has been established as the LoLT in the policy needs to be improved because language is essential for the acquisition of literacy and numeracy.

The material developed for the academic and didactic capacity of Foundation Phase Mathematics teaching, as set out in the Curriculum and Assessment Policy Statement (CAPS), should be written in various MTs to allow for ease of use by Grade 3 Mathematics teachers.

6.5 CONCLUSION

Teaching Mathematics in diverse classrooms is a complex and challenging endeavour (Anhalt & Rodríguez-Pérez, 2013; Clarkson, 2004) because, in such settings (as in all classrooms), mathematical content is intertwined with issues of language and culture. In multilingual Mathematics classrooms, several languages and concepts interchange and coexist (Clarkson, 2009; Barwell, 2014). Learners whose language is not accommodated may have difficulty accessing mathematical content presented in verbal forms (Elbers & De Haan, 2005). Furthermore, the content of Mathematics curricula and the teaching and learning in a MT vary significantly (Andrews, 2007, 2014; Bishop, 1994; Campbell & Kyriakides, 2000). Immigrant learners bring their ethnic cultures' mathematical values and aspirations to class. Therefore, the Language in Education Policy (LiEP) (Department of Education, 1997) compelling teachers to teach learners in their mother tongue (MT) is challenging.

Changing from teaching Grade 3 Mathematics in English to teach in an MT is difficult, especially if teachers are not familiar with the MT or cannot speak the language.

The schools in the Black townships of the Gauteng Province are characterised by different ethnic groups, learners from other provinces and immigrants neighbouring

countries, so the teaching of Mathematics in the mother tongue (MT) was established as the LoLT in the policy, produces children who learn without understanding. This sometimes results in parents' moving their children to private schools where instruction is English. According to Hoffman (2009), parents do this because the former Model C schools and private schools continue to produce good results, while many township and rural schools have poor outcomes.

The limited training and lack of support for teachers teaching in a MT in the townships (Wuim & Louw, 2011) hamper the facilitation of literacy and numeracy learning, particularly in the early grades. Training and support need to be improved because language is essential for the acquisition of literacy and numeracy. In addition, the Numeracy Handbook developed to enhance the educational and didactic capacity of Foundation Phase Mathematics teaching, as set out in the Curriculum and Assessment Policy Statement (CAPS), should be translated into MTs to allow for ease of use the Grade 3 Mathematics teachers.

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APPENDICES

Appendix A

Permission Letter: Gauteng Department of Education (GDE)

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	14 May 2018
Validity of Research Approval:	05 February 2018 – 28 September 2018 2018/64
Name of Researcher:	Moshaba P.O.N.
Address of Researcher:	96 Block H
	Soshanguve
	1052
Telephone Number:	012 429 4314 082 575 8327
Email address:	emoshap@unisa.ac.za
Research Topic:	The experiences of teachers in the teaching of mathematics to Grade 3 learners through mother tongue.
Type of qualification	PhD
Number and type of schools:	Three Primary Schools
District/s/HO	Gauteng North.

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

14/05/2018

1

Making education a societal priority

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

Appendix B

UNISA Ethics Certificate

UNISA university of south africa

UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE

Date: 2018/10/17

Ref: **2018/10/17/31721435/09/MC**
Name: Mrs PON Moshaba
Student: 31721435

Dear Mrs Moshaba

Decision: Ethics Approval from 2018/10/17 to 2023/10/17

Researcher(s): Name: Mrs PON Moshaba
E-mail address: emoshap@unisa.ac.za
Telephone: +27 82 575 8327

Supervisor(s): Name: Prof ST Mampane
E-mail address: mampast@unisa.ac.za
Telephone: 012 429 6542

Title of research:

The experiences of teachers in the teaching of Mathematics to Grade 3 learners through mother tongue

Qualification: PhD in Early Childhood Development

Thank you for the application for research ethics clearance by the UNISA College of Education Ethics Review Committee for the above mentioned research. Ethics approval is granted for the period 2018/10/17 to 2023/10/17.

*The **low risk** application was reviewed by the Ethics Review Committee on 2018/10/17 in compliance with the UNISA Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.

Open Rubric

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

APPENDIX C

Letter requesting permission to conduct research: Principals

Dear Participant

Re: The experiences of teachers in the teaching of mathematics to Grade 3 learners through mother tongue.

My name is Patricia Ouma Nomsa Moshaba, a student at UNISA, registered for PhD (Early Childhood Education). I am doing research entitled "The experiences of teachers in the teaching of mathematics to Grade 3 learners through mother tongue" under Professor S.T Mampane. I applied for permission and was granted approval by the GDE Research Coordination Unit to conduct this study. I therefore request your permission to participate in the study and will also need to look at documents of the teachers and learners such as Curriculum Assessment Policy Statements (CAPS); Mathematics lesson plans; and Mathematics (DBE) learners' workbooks and exercise books, for analysis.

The main purpose of this study is to determine how teachers teach Mathematics to Grade 3 learners through MT. There are no anticipated risks involved in conducting this study and no sensitive information will be collected. If given permission, you will be interviewed through semi-structured interviews, which will be tape-recorded with your permission. You are hereby requested for your voluntary participation and you have the right to withdraw at any time should you wish to do so. The interview will be for approximately one hour and meetings will be arranged at a time that is convenient for you, preferably after school. A consent letter is attached for you to sign as an indication of your willingness to participate in the study.

The data collected for this study will only be used for the researcher's PhD degree. Transcripts of responses will be made available to you for member checking. Under no circumstances will your name and the schools' names be mentioned in the report. A copy of the formal findings of the research project can be made available upon request. Your assistance in this matter will be highly appreciated. Please do not hesitate to contact me or my supervisor for any clarity regarding this study.

Yours Sincerely

Patricia Ouma Moshaba

……..

Email: emoshap@unisa.ac.za
082 575 8327

Supervisor: Prof ST Mampane

……

E-mail: mampast@unisa.ac.za
Tel: 012 429 6542

Appendix D
Consent letter for individual participants

CONSENT FORM

CONSENT TO PARTICIPATE IN THIS STUDY (Return slip)

I,……(participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation in this study.

I have read (and it was explained to me), and I understand the nature, procedure, potential benefits and anticipated inconvenience of participation in this study. I have had sufficient opportunity to ask questions and hereby give consent to participate. I understand that my participation is voluntary and that I am free to withdraw at any time without penalty.

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree/do not agree to the recording of the semi-structured interview.

I have received a signed copy of the informed consent agreement.

……	……	……..
Participant 's Name (print)	Participant' s signature	Date:

Appendix E

Letter requesting permission to conduct research: Parents

Dear Parent

Re: The experiences of teachers in the teaching of Mathematics to Grade 3 learners through mother tongue.

My name is Patricia Ouma Nomsa Moshaba, a student at UNISA, registered for PhD (Early Childhood Education). I am doing research entitled "The experiences of teachers in the teaching of mathematics to Grade 3 learners through mother tongue" under Professor S.T Mampane. I applied for permission and was granted approval by the GDE Research Coordination Unit to conduct this study. I therefore request your permission to look at your Grade 3 learner's book for analysis.

The main purpose of this study is to determine how teachers teach Mathematics to Grade 3 learners through MT. There are no anticipated risks involved in conducting this study and no sensitive information will be collected. If given permission, I will analyse the Grade 3 learners' mathematics books. You are assured of your right to agree or refuse the use of your child's mathematics book should you wish to do so. A consent form is attached for you to sign as an indication that you gave permission for use of your child's book.

The data collected for this study will only be used for the researcher's PhD. Degree. Transcripts of responses will be made available to the school. Under no circumstances will the child's name be included in the report. A copy of the formal findings of the research project can be made available upon request. Your assistance in this matter will be highly appreciated. Please do not hesitate to contact me or my supervisor for any clarity regarding this study.

Yours Sincerely

Sincerely

Patricia Ouma Moshaba

……..

Email: emoshap@unisa.ac.za

082 575 8327

Supervisor: Prof ST Mampane

……

E-mail: mampast@unisa.ac.za

Tel: 012 429 6542

Appendix F
Consent letter for parents

CONSENT FORM

CONSENT TO PARTICIPATE IN THIS STUDY (Return slip)

I,……(parent's name), confirm that the person asking my permission to use my Grade 3 child's books for analysis has my permission to do so. The researcher has told me about the nature, procedure, potential benefits and anticipated inconvenience of using my child's book in the research.

I have read (and it was explained to me), and understand the nature, procedure, potential benefits and anticipated inconvenience of allowing the use of my child's book in this study. I have had sufficient opportunity to ask questions and hereby give consent for the researcher to use my child's books in the study. I understand that my permission can be withdrawn at any time without penalty.

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that the name of my child will be kept confidential unless otherwise specified.

I agree/do not agree to the use of learners' books.

I have received a signed copy of the informed consent agreement.

……	……	……..
Participant's Name (print)	Participant's signature	Date:

Appendix G

Interview questions for teachers

1. What is your experience of teaching Grade 3 Mathematics through MT?
2. How were you trained to teach Grade 3 Mathematics through MT?
3. How different is teaching Grade 3 Mathematics in English from teaching in MT?
4. In which language do you feel competent enough to teach Grade 3 Mathematics and why?
5. What are the challenges of teaching Grade 3 Mathematics in MT?
6. What are the successes of teaching Mathematics in MT?
7. How do you overcome the challenges experienced in teaching Grade 3 Mathematics through MT?
8. What MT strategies/ methods do you use to explain Grade 3 Mathematics concepts to learners?
9. What language would you recommend for teaching Grade 3 Mathematics to learners?
10. Do you have any other contribution to make regarding the teaching of Grade 3 Mathematics in MT?

Appendix H

An example of an Annual Teaching Plan (ATP)

GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL MATHEMATICS ANNUAL TEACHING PLAN

GRADE 3 TERM 3

CYCLE	WEEK	COUNTING	MENTAL MATHS	CONCEPTS	WORD SUMS	EXPECTED PERCENTAGE COMPLETED PER TERM (25%)	DATE	ACTUAL PERCENTAGE COMPLETED	EXPECTED SBA %	ACTUAL SBA %
5	1	Count forwards & backwards in 1s & in Multiples of 5s & 10s up to 700	Add & subtract multiples of 10 from 0-100	Identify, recognise,Vread & write No. names to 500 & No. symbols to 1000 Place value of numbers to 700	**Combine, Compare & Change**: Solve word problems rounding off in tens	52.5%				
	2	Count forwards & backwards in:Multiples of 5s & 2s up to 700	Multiplication facts 2 x table	Describe, order & compare numbers to 700 Ordinal numbers up to 31st	**Combine, Compare & Change**: Addition & subtraction word problems up to 800	55%				

CYCLE	WEEK	COUNTING	MENTAL MATHS	CONCEPTS	WORD SUMS	EXPECTED PERCENTAGE COMPLETED PER TERM (25%)	DATE	ACTUAL PERCENTAGE COMPLETED	EXPECTED SBA %	ACTUAL SBA %
	3	Count forwards & backwards in: Multiples of 3s up to 700	Multiplication facts 10 x table	Time Read dates on calendars Tell 12 hour time in hours, half hours, quarters and minutes Analogue and digital Convert between days and weeks Convert between weeks and months	**Combine, Compare & Change**: Word problems involving time	57.2%			Oral	
	4	Count forwards & backwards in: Multiples of 4s up to 700	Add & subtract multiples of 10 from 0-100	Add up to 800 Subtract from 800 Number line Breaking down and Building up Doubling and Halving	**Combine, Compare & Change**: Solve word problems using number lines	60%				

CYCLE	WEEK	COUNTING	MENTAL MATHS	CONCEPTS	WORD SUMS	EXPECTED PERCENTAGE COMPLETED PER TERM (25%)	DATE	ACTUAL PERCENTAGE COMPLETED	EXPECTED SBA %	ACTUAL SBA %
6	7	Count forwards & backwards in: Multiples of 4s up to 700	Division facts	3-D objects and 2-D shapes: Recognize, Name, Sort and Compare Draw shapes Position, Orientation Views: Read, Interpret, Draw informal maps Find objects on Maps Follow directions	**Combine, Compare & Change**: Word problems using doubling and halving	67.2%			Oral	

Appendix I

An example of a lesson plan that is written in English

Activity 1: Whole class activity

Place a variety of objects on your table. As you discuss each object draw it on the board. (Point out the connection between the drawing of the object and the real examples of the object to the class. The drawing is an abstract representation of the object. The drawing is flat but is drawn to show the 3-D nature of the object.)

- Ask the learners to show you objects in the class or on your table that look like a ball or have a ball shape.
  - Revise with them that a ball in mathematics is called a sphere.
  - Ask: *Is a tennis ball a sphere?* (Yes, it is perfectly round.)
  - *What about a rugby ball?* (No, it is not a sphere, it is shaped more like an egg.)
- Ask the learners to show you objects in the class or on your table that look like a box or have a box shape.
  - Revise with them that a box shape in mathematics is called a prism.
  - Ask: *What are the things we know about prisms?* (The opposite faces are the same. The sides are rectangles. All the surfaces are flat.)
  - *Name some prisms you know.* (Triangular prism, rectangular prism, cube.)
- Ask the learners to show you objects in the class or on your table that look like a pyramid or have a pyramid shape.
  - Ask: *What are the things we know about pyramids?* (The bases can be any shape with straight sides. The sides/faces are triangles. All the surfaces are flat. They join at a point at the top.)
- Ask the learners to show you objects in the class or on your table that look like cylinders.
  - Ask: *What are the things we know about cylinders?* (They have circles as the base and the top. The side is curved.)
- Ask the learners to show you objects in the class or on your table that look like cones.
  - Ask: *What are the things we know about cones?* (They have a circle as the base. The side joins at a point at the top.)

Activity 2: Optional: Whole class activity

Learners work in groups of four. Give learners toothpicks/straws, cut out 2-D shapes, clay. Ask learners to build the shapes discussed in Activity 1 above.

As they do this go from group to group asking questions such as:

- *Show me the triangles on the sides of the pyramid.*
- *Do the opposite sides of this prism have to be the same size? Why?* (No, cubes have all the same size square faces but other rectangular prisms can have different rectangular faces.)
- *Can a pyramid have a square face?* (Yes – a square pyramid has a square base.)

4. Classwork activity (25 minutes) (See next page)

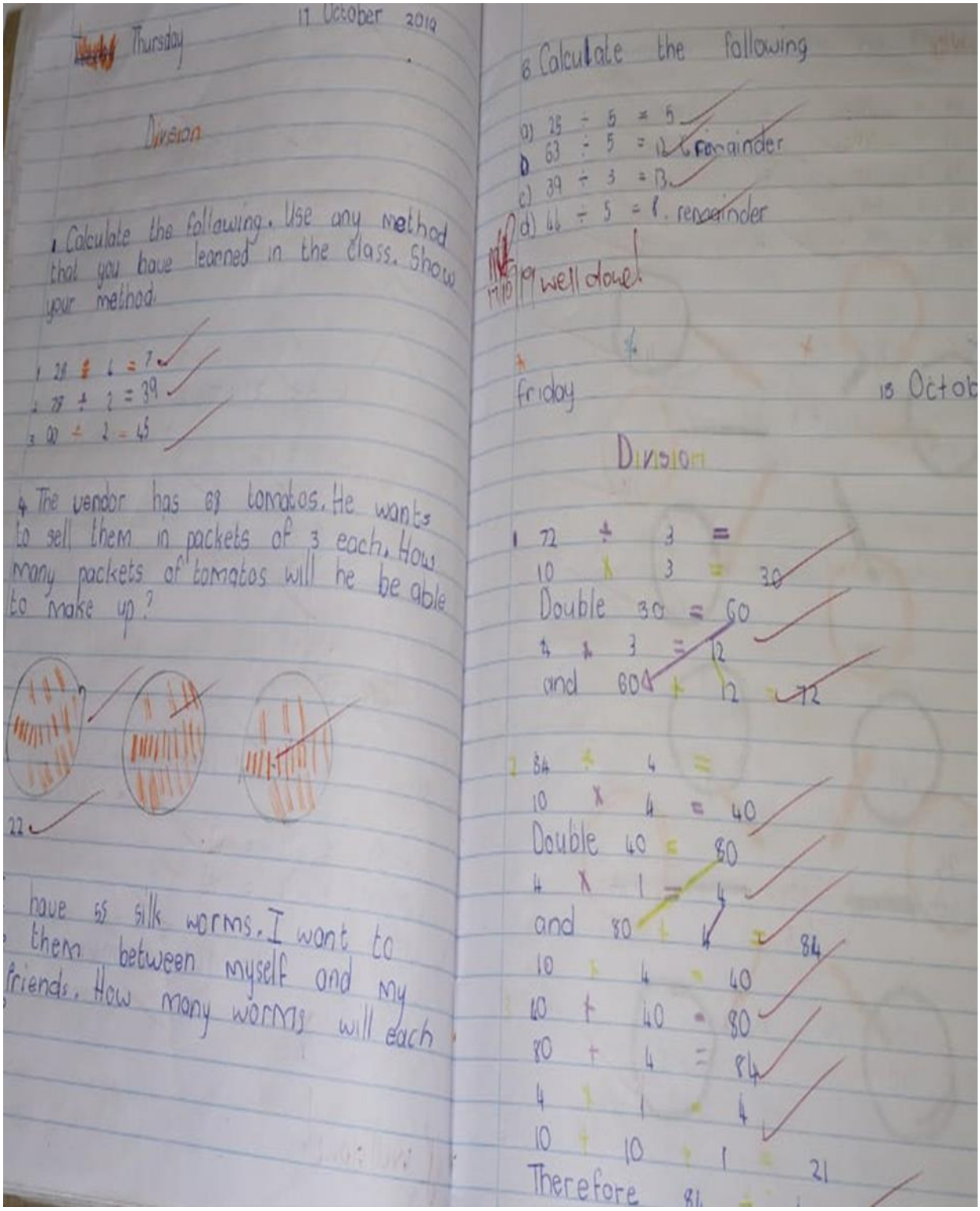
5. Homework activity (5 minutes) (See next page)

6. Reflection on lesson

0

An example of an English Mathematics activity

(Done by learners in a class that is using English as LoLT



Thursday 17 October 2019

Division

1. Calculate the following. Use any method that you have learned in the class. Show your method.

1. 28 ÷ 4 = 7
2. 78 ÷ 2 = 39
3. 90 ÷ 2 = 45

4. The vendor has 63 tomatos. He wants to sell them in packets of 3 each. How many packets of tomatos will he be able to make up?

22

have 55 silk worms. I want to them between myself and my friends. How many worms will each

8 Calculate the following

a) 25 ÷ 5 = 5
b) 63 ÷ 5 = 12 remainder
c) 39 ÷ 3 = 13
d) 44 ÷ 5 = 8. remainder

17/10/19 well done!

Friday 18 Octob

Division

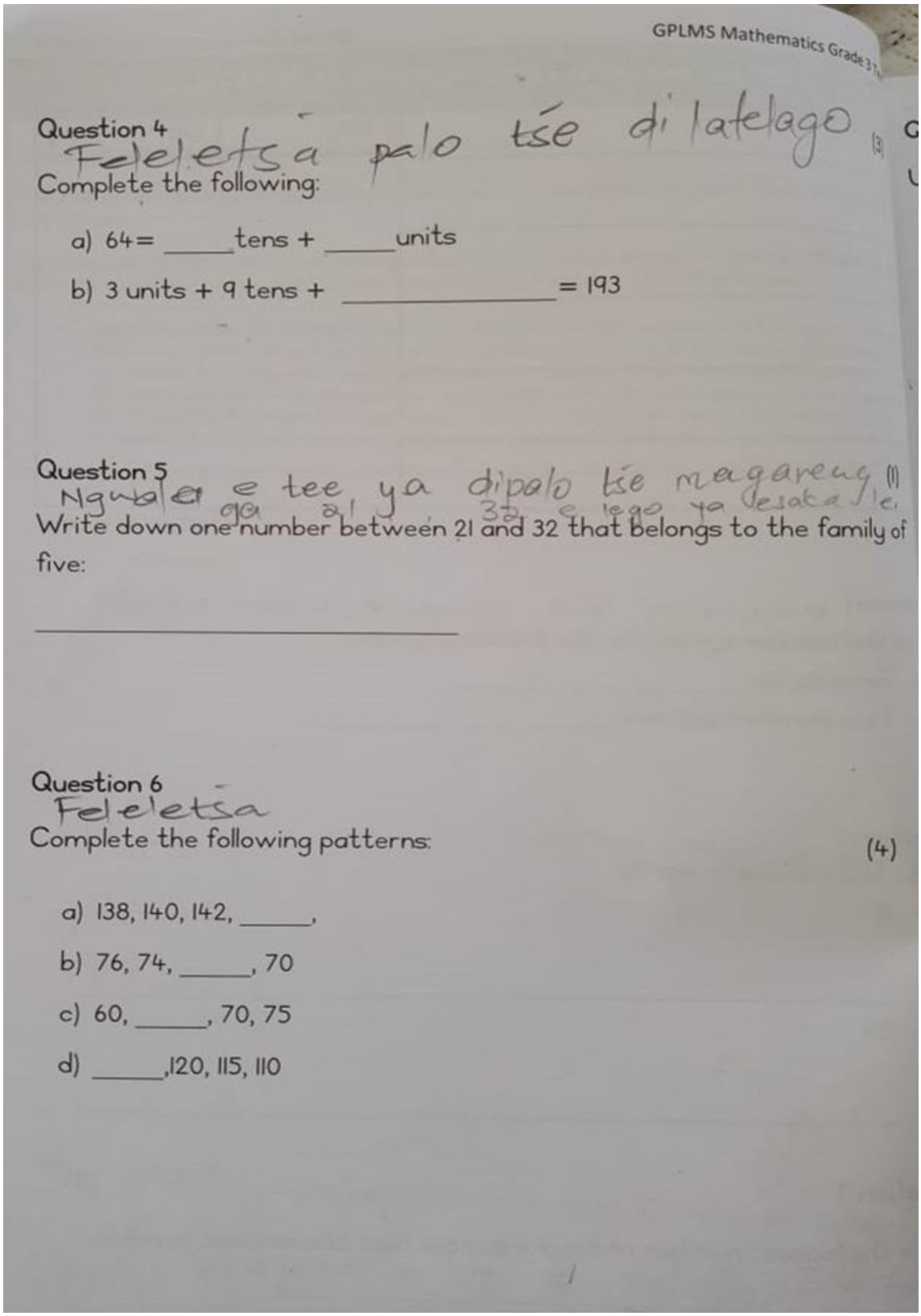
1. 72 ÷ 3 =
10 × 3 = 30
Double 30 = 60
4 × 3 = 12
and 60 + 12 = 72

1. 84 ÷ 4 =
10 × 4 = 40
Double 40 = 80
4 × 1 = 4
and 80 + 4 = 84
10 × 4 = 40
10 + 40 = 80
80 + 4 = 84
4 × 1 = 4
10 + 10 + 1 = 21
Therefore 84

Appendix K

The activity was written in English but translated in MT by the teacher

(instructions are written in both MT and English).



GPLMS Mathematics Grade 3

Question 4 Feleletsa palo tse di latelago (3)

Complete the following:

a) 64= _____tens + _____units

b) 3 units + 9 tens + _____= 193

Question 5 Ngwalela e tee ya dipalo tse magareng (1)

Write down one number between 21 and 32 that belongs to the family of five:

_____

Question 6 Feleletsa

Complete the following patterns: (4)

a) 138, 140, 142, _____,

b) 76, 74, _____, 70

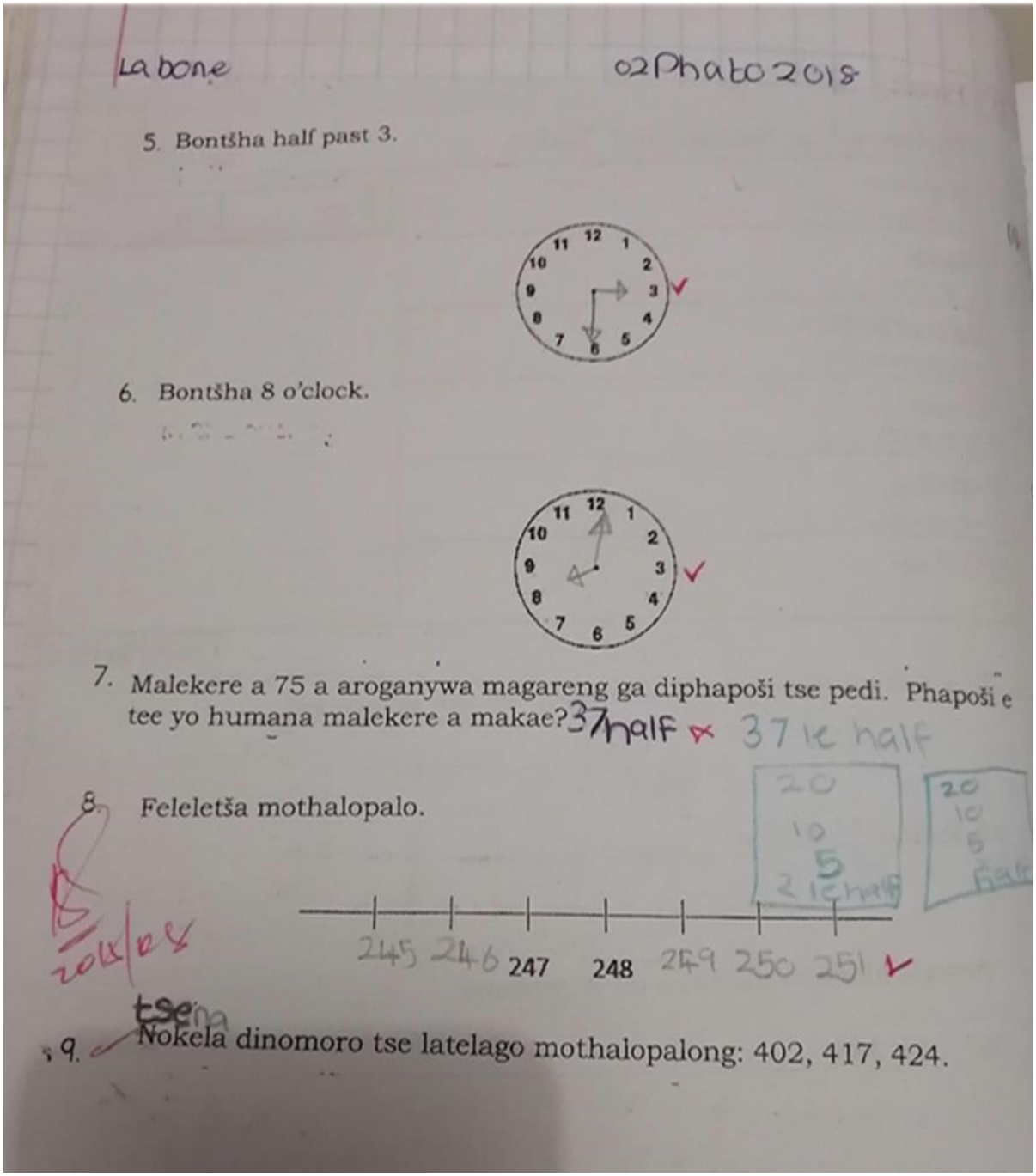
c) 60, _____, 70, 75

d) _____,120, 115, 110

I

Appendix L

An example of a Mathematics activity done by learners using MT as LoLT. (instructions written in both MT and English).



Labone 02Phato2018

5. Bontša half past 3.

6. Bontša 8 o'clock.

7. Malekere a 75 a aroganywa magareng ga diphapoši tse pedi. Phapoši e tee yo humana malekere a makae? 37 half 37 ke half

8. Feleletša mothalopalo.

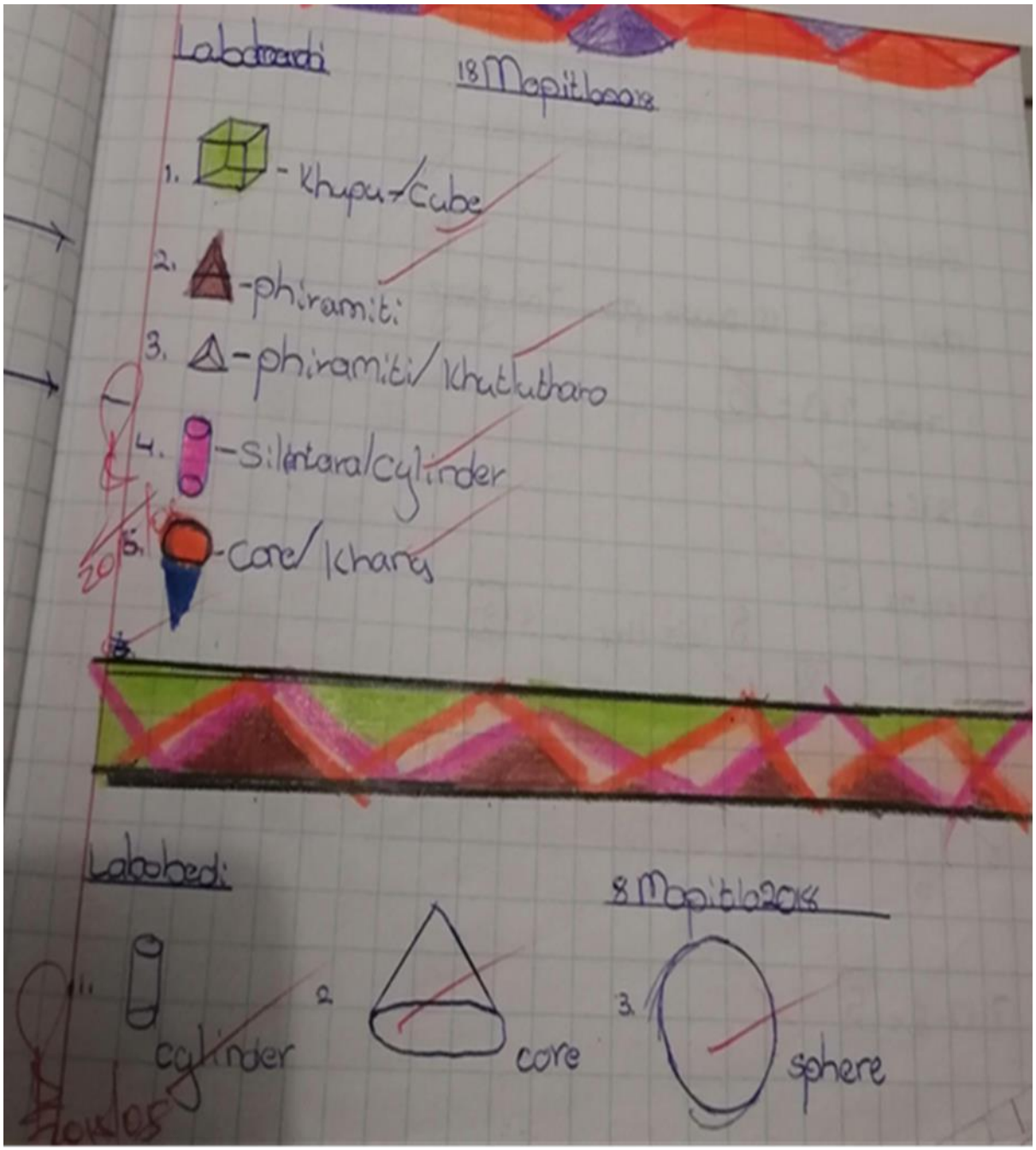
245 246 247 248 249 250 251

9. Nokela dinomoro tse latelago mothalopalong: 402, 417, 424.

Appendix M

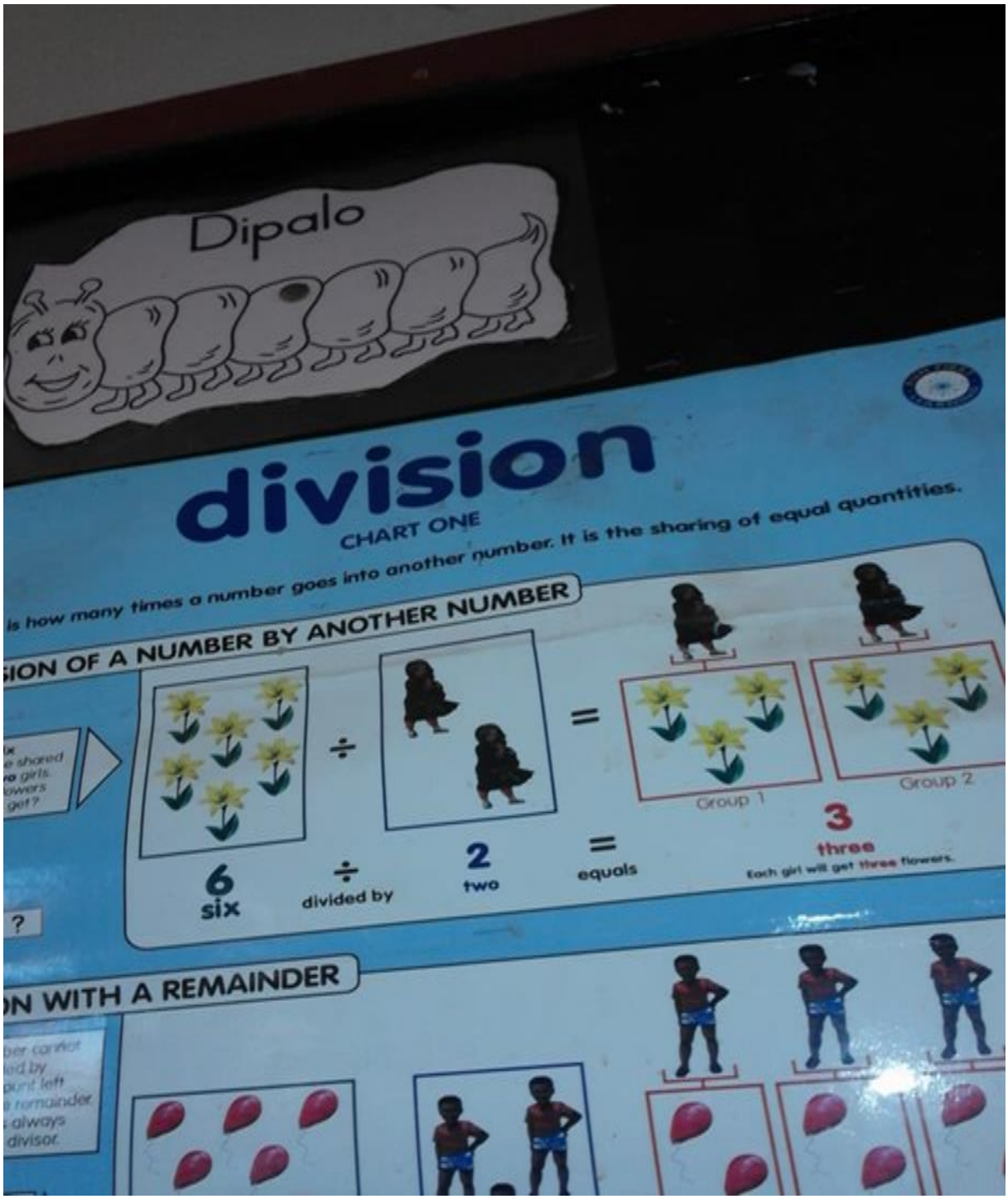
An example of a Mathematics activity done by learners using MT as LoLT

(The concepts in an activity are written in English by learners).



Appendix N

Wallchart in a MT classroom primarily written in English




100
Fractions
hexagonal pyramid
triangular prism
hexagonal prism
Dikgwed
Sepedi
Janaware
Febereware
Matšhe
Aporele
Mei
June
Julae
Agostose
Setemere
Oktobere
Nofemere
Disemere
January
February
March
April
May
June
July
August
September
October
November
December

Appendix O

Concepts translated into MT by the teacher

Appendix P

Interview Transcripts

***Question 1**: What is your experience of teaching Grade 3 Mathematics through MT?*		
SA	T1A	Using MT is a challenge because it is not their lived experiences. From home, Mathematics is done in English. Concepts in class are different from how they use them in everyday life. They will never use MT anywhere; for example, numbers in MT are very long. To learners, they don't make any sense, and even parents do not use them. When I code switch, I use English to teach numbers and then explain in MT. So…there is a difference in what is done at home and in class.
	T2A	
SB	T3B	It is difficult because some of the words are difficult for learners even though it is in their MT. But, still, when you try to teach things like shapes or even numbers, you will have to drill so that the learners can know how to spell, for example, I can say 'khume n'we and makhume n'we, there is no difference, some learners will write makhume n'we which is wrong. Twelve is khume mbirhi, and 20 is machine mbirhi, and learners will be saying makhume mbirhi instead of khume mbirhi and vice versa. And when you mark, they will say, if it is a mistake or a simple mistake, keep it right, and you will see that this is not a mistake; it is an incorrect answer. For shapes, it was difficult for learners to know the shapes. You will see that the learners are surprised because you are saying the words they are hearing for the first time; words such as 'tinhlayo

		fedzenga' are even challenging for an educator to say to learners. They are used to something like multiplication, division, something that is simple. Tinhlayo fedzenga, I am not sure whether it is even numbers or odd numbers because we are now teaching in English. Still, when you say even or odd numbers, it is simple to learners, but when you say Tinhlayo fedzenga, you are talking another language, not their MT. Suppose you teach 2-D shapes and 3-D objects in their MT and only find out that that word is so difficult for the learners to try. And it was also difficult for me as a teacher because, in some of the comments, I had to research 2-D shapes in MT before I said square, triangle, etc. I have to explain to learners what the topic is, and I have to research what 2-d shapes are in Xitsonga. So, when I prepare, I have to explore even numbers, odd numbers, 2-D shapes, etc., in Xitsonga. We find it easy to teach in English because we do not have all the material in Xitsonga.
	T4B	My experience in using MT is that we come across many challenges when we are teaching these learners. Most of the learners are being taught in English from the crèche and Grade R. It becomes difficult for them when they come to our school because we are using MT. It is a challenge for us teachers to teach in MT because their basis is in English. Especially numbers and number names. The numbers and number names in English are straightforward. But with MT, it isn't easy. The numbers are very wrong. Besides, our children like English. They dislike their MT. Their parents also like English. This is a lot of competition in our area because most schools offer English as LoLT and most parents take their children to those schools.
SC	T5C	Learners do not understand. MT tongue is a complex language to teach Mathematics, so learners have a problem, but we are trying a lot to explain to them. Even if it takes time, we code switch. We explain in English and go back to MT. because the expect us to code switch, but learners must write in MT, so this is the problem that we have. The material comes in English, the ATP (the plan for the whole year) comes

		in English even the lesson plan we prepare in English, but we have to teach in MT. is only the DBE that comes in the languages that we teach learners, but we prepare in English and teach them in their MT. We are teachers and we have to make all the means that we teach. Even the facilitators understand that we prepare in English and teach in Sepedi. The other challenge is that I am a Setswana teacher, but I have to teach in Sepedi because it is the medium of instruction in our school. It is not simple, but we are trying because there are books, we consult, and we ask. Again, in my class I am having different learners such as Sepedi, Xitsonga, Sepedi, isiZulu, all the learners are there but I try as I have said that we have different languages. They are different, but I have to force them to do Sepedi. Even the parents know that this school is for Sepedi learners. It is a problem to deal with different languages. The first thing is that learners have to understand, but it is difficult. Maybe using different languages is the cause of the problems of learners not to understand fast. Maybe if they were Sepedi learners only, it could be something different, but since well we are living in Soshanguve, where we find Nguni languages (isiZulu, isiNdebele, isiXhosa and siSwati) and other languages. Therefore, I am teaching Sepedi and I am having mixed languages in my class. The DBE is helpful because it covers all the concepts that are in the ATP so that the learners can understand better.
	T6C	It is easier for us because the children have already got the foundation in MT from Grade 1 and 2. We just continue with the levels. However, we do not know some of the words in MT because the concepts are in English and the ATPs comes in English. We have to use the dictionary to translate such words. Sometimes we code switch so that learners can understand better because learners use English words such as one, two, three…, when they are in play such as skipping a rope. They also use English words that they learned from home. They do not use MT or Sepedi words such as tee, pedi, tharo when they play or communicate because such a language is not spoken at home. They know words such

		as hundred and thousand from their parents or sisters. So, the spoken words outside is usually English. But in class we have to use MT. We have to teach them in MT because they must know their MT. the spoken language is English. When we talk about money we say five Rands, *we do not say diranta tse hlano* (five Rands). So, we have to code switch so that they can understand. I teach Sepedi, but I have diverse languages in my class
SD	T7D	It is important to use MT so that the learners could get the foundation before they go to Grade 4. They must learn how to pronounce one, tee, and ten lesome. It is difficult because of the students do not understand Northern Sotho (Sepedi) because it is too long. The numbers in MT are too long. They also find it difficult to write the numbers in words. Our LoLT is Sepedi. We have the children that are Zulu, Venda, Sepedi, Xitsonga, and I have also white learners and they are all doing Sepedi. They are struggling with Sotho. In order to deal with these languages, we just force Sepedi. That is why we have many failures in Grade 3. The white learner is forced to do Sepedi and I always explain to her in English
	T8D	It is a challenge to Grade 3s. A very big challenge as learners have to know numbers in their MT whilst in Grade 4 they are using English as a LoLT. So, it becomes very difficult for learners in Grade 3 to go on using MT as LoLT than using English as LoLT. Therefore, to my experience learners suffer. Some other topics need to be addressed in English like the concepts of the 2-D shapes. In MT is very difficult for learners to understand the pyramid because you have to translate it into the MT. again when coming to numbers, numbers in Sepedi are very long than numbers in English. It is also difficult to use the material because most of it is in English and when you Google you find that they are in English. Again, when we buy we struggle because the suppliers come with the wrong

		language. Other words are translated wrongly, some in Sesotho not in Sepedi. The Department of Education provides us with the material that is written in English. Even the workshops that we attend are in English. Because of the different languages from different school we receive the packs in English. It is very difficult to do the translation, We are not coping we just use English. In GPLMS, they used to give us material that was written in Sepedi even though most of the words were wrongly translate but not it is phased out. We are now using CAPS that is in Sepedi but it is difficult for learners because it is difficult for learners to understand some of Sepedi concepts. Although the teachers have to explain the concepts to the learners, the problem is that other teachers do not understand Sepedi that much. Therefore, you have to go through assessing them checking if what they do is right before they can do it in class. I was trained in English, did courses in Mathematics that were conducted in English. I also did a one-year course on teaching Mathematics in Grade 3 that was offered by the Department of Education in English. It is difficult for the District to conduct workshops in MT because we have teachers in different languages.
SE	T9E	My experience is that learners more especially her in Soshanguve speak the township language. As an isiZulu teacher, I have experienced that their isiZulu mixed with Sesotho. So, as they are not good with their MT. they do not know most of the terms in IsiZulu. When we count in isiZulu is much simpler than when we count in English like when we say eight, in isiZulu is isishiyagalombili. Nine in isiZulu is isishiyagalolonye. It is a very long word. So, children becomes very confused and they cannot differentiate between isishiyagalombili and isishiyagalolonye so it is very difficult. In my experience some of the terms are not in isiZulu

		for instance, when we are treating some of the concepts it is very difficult to use isiZulu. Most of the terms in the material they are using English. Words such fraction, they are amacezu, but they are using Words such as fractions. We do have a dictionary, but not all of the words are found in the dictionary. And if we do not find the words we use the English words. The children are more comfortable in English words than in isiZulu. Like for example. In the last term when we do Mathematics in English because we are preparing them for Grade 4 because the LoLT is English. You can be surprised when you tell them to write the number names which means they must write in words even the slow learners are able to write in words. But in isiZulu they cannot. It is very difficult even in assessment when you tell the child to count in isiZulu. The child cannot count in isiZulu. But when you say in English the child can count. So how do you assess? Do you say the child can count or the child cannot count? Or do you say the child cannot count in isiZulu? Because I am assessing Mathematics, I am not assessing the language. I do not know what the reason is for these learners to understand English better than MT, maybe these children are watching more of the television and are becoming familiar with English words. Or is because English words are shorter, like I said a thousand in isiZulu is inkulungwane it is a long and a strange word. Four hundred and six in isiZulu is amakhuluamanenesithupha it is a very long word. English is very simple, but in isiZulu it is very difficult. There are no single words to explain *line of symmetry* in isiZulu. Even myself I have no single word to explain *line of symmetry* I must just explain by giving examples of what I mean by line of symmetry. In English is very simple. I demonstrate we play with it and then they understand what line of symmetry is. Even other learners when they are writing an assessment they ask you 'Mam can I write in English?' I say no you are not supposed to write in English, you are supposed to write in isiZulu.

	T10E	Teaching Grade 3 Mathematics using MT is a very difficult thing because learners cannot write even write *number names*. When you say makgolopedi masumetharo nne (two hundred and thirty-four) to them is a very difficult thing. In my class, I for one, I do not teach learners in their mother tongue, even though it is wrong. But there is nothing I can do because when they proceed to another class they start teaching them in English. So they become confused we do not know. What is the purpose of teaching learners in MT whereas when they proceed to the higher phase these things are no more there.
Question 2: How were you trained to teach Grade 3 Mathematics through MT?		
SA	T1A	I was taught in English, even presenters use English during workshops. As a teacher I have always used and still prefer to use an English CAPS document. The department also delayed to give me the CAPS document in MT.
	T2A	
SB	T3B	I was not trained. I was attending workshops; they will not train you how to do it. They will not train you in MT, they will give you the method for example, they will tell you that they prefer this method for Grade 3 learners than this method. This is because the teacher can come up with his own method only to find out that this method is too easy, too difficult, or too complicated for learners. Therefore, we go to the workshops so that they can show us the easiest method. But it will not involve the language. They won't workshop you on how to teach Mathematics in a language, no, they can maybe show you how to teach sounds, but for Mathematics no. these workshops are held twice or three times a term. We are two teachers, sometimes I will attend the language or life skills workshop and my colleague will attend the Mathematics one, so I cannot attend all the Mathematics workshops

		because we have to alternate. Sometimes I will not be attending Mathematics for the whole term.
	T4B	I was never trained in MT. I was trained in English. It was easy for me to teach in Xitsonga because it is my MT. and I was also taught in my MT in primary level. In our school we have 70% of learners that are foreigners. They come from Mozambique and Zimbabwe and most of them understands English. They do not know our MT. This is the reason why we have changed back to English. The school was facing challenges such as having different languages in one class. It is easy for me and for the learners when I teach in English. I think Xitsonga is difficult for them. They are exposed to English in different ways, such as using English word at home and watching television. When we were using MT, all learners were doing Xitsonga. It is easier now because we have changed the LoLT of the school in to English.
SC	T5C	In the college, I was trained in Setswana. I also attended workshops that were done almost regularly because we were changing to CAPS. And we have to follow a policy document because it directs us on what to teach. These workshops are fine because they teach us about the methods that we have to use in class. Even when we come to class, we can use some of those methods. Not all of them are working because learners will sometimes just look at you like this, and you do not understand whether they hear you or what. but you have to keep on trying because the ATP repeats itself and if they did not hear you in the first term, it will come again like that in the second term but with higher order numbers.
	T6C	I was not trained in Sepedi, I was trained in English so I just code switch. I was taught in English at the college and when I come here, I just had to translate. Even workshops are done in English but when you come to class, you have to use a dictionary to check most of the words.

SD	T7D	Teachers were teaching us in English, and we were doing our practical in Sepedi. When I started teaching I used the experience from the college. I have the experience of teaching in Sepedi.
	T8D	There was no training given to us in order to teach in Sepedi. We were just told that the LoLT for the school is Changing, but we never had a proper training for teaching in MT. it was just the switching.
SE	T9E	From the college I was trained in English. There are also workshops that are organized by the district but in these workshops, they do not use MT, they use English. In those workshops they only use the English concepts, they do not treat the concepts in MT. There was no training for teaching in MT. As a teacher, I have to compromise and use a dictionary to search for the words in MT. But sometimes when I cannot find the terms in MT I use the English terms as long as the learners understand the methods and the concepts.
	T10E	They just told us to use MT. They put a chard on the chalkboard and say this is tee you know it. Yes, we know it because we know it from the past and as times go on things changed. So today these learners are too much technologically. They use cell phones and they know the numbers in English. I was trained in English but there was a time when we were to go to the Sepedi class. In the workshops, they train us in English. Even when we attend the Mathematics workshops, they use English. They do not use this MT that they want us to use. Some other things we do not know what to call them in Sepedi. Sometimes I see the *line of symmetry* and you do not know what to say to the learners. I am teaching Sepedi in class, but we have different languages such as isiZulu, Xitsonga, Venda, Ndebele, all these languages are there even

		the whites from Maputo. You can find that there are only five Sepedi learners out of 40 learners in a class. I am a Sepedi teacher and I know Sepedi but some of the words in the DBE book I do not understand what they mean. Maybe is because some of the things were no there during my time of schooling. Today's education and the education of the past are not the same. Even the parents when you give the children homework they say this we do not know. It was not there in our times. We did Mathematics in English. This is what is happening to us. You have to compare and teach something that you do not understand very well. I have a Sepedi book that I use and in order to understand some of the Sepedi words I have to look at the English book in order to compare what the words mean, sometimes they write the isiZulu words in this Sepedi book. When it comes to shapes, the prisms and pyramids, we do not know their names in Sepedi. We only tell the learners that we are having rectangular prisms That's why I'm using English in my class which the policy does not allow. When my learners go to Grade 4, the teachers say my children are better than children from other teachers. They say I do my job and is not doing my job, the reason is that I teach in English and other teachers are struggling with MT. even the official from the district complained last that I am not using MT. But because I got position one in Mathematics competition they never complained that I am using English instead of MT. In their books, I encourage them to use both English and MT but mostly they use English. The learners get bored when I teach numbers or call numbers in MT, and they become excited when I call numbers in English. When I teach the concept for example, money. I use a picture then when I ask how much the money is, they say *50 cents* but when I ask in Sepedi they say *five bob* and there is nothing such as five bob in Sepedi, it is called *disente tse masome hlano.* We were never trained in MT. they use English and say you must translate in MT. the training is mostly about how to teach the concepts that we do not understand. I still remember I had a problem in dealing

		with *word sums doing a number line* and I just taught them in English. In fact, according to me the LoLT must change to English. Some of the *3-D objects* are not there in Sepedi. In English we have words such as *triangular prism and triangular pyramid* but in Sepedi they only write *prism* and the learners will be asking for clarification and I am unable to explain. They don't have words for those concepts, but they want us to teach in MT. Teaching aids are in English.
Question 3: How different is teaching Grade 3 Mathematics in English from teaching in MT?		
SA	T1A	They differ. English is easy because it is what they live, and it is what I live. Numbers are always named in English. MT is not real, when they play, the call out numbers in English. Same applies in months of the year, January is January not in MT. When going to malls they use English.
	T2A	
SB	T3B	In teaching in English, I do not waste time trying to explain some of the words. When I say multiplication, the learners know multiplication. I won't explain about multiplication for two to three days but in MT you will explain one thing like every day so that they can know that word, like xikwere which is square in English, they forget even if it is their MT. But when you teach them in English is simple. Even with colours, when you tell them to colour a rectangle in yellow they know yellow than when you say xitshopana. Some of the learners they do not know what is xitshopana, they would just guess and just take a green colour instead of yellow. So, it is not easy to teach learners in MT. Truly speaking you would drill something. Instead of teaching a concept or a topic in a day, you would teach but only five or six learners in a class, the rest of the class they would be like in the dark. And i have just found out that when I teach in English it is easy I just flow, even when I mark I don't get the

		mistakes like in MT. I just find it easy in English and it is also difficult for the learners when they go to Grade four the teacher would be complaining that yooo! these learners they don't know anything. It is like we are not teaching. The Grade four teacher will have to start from the scratch as if I did nothing. I also have Shona (language spoken by immigrants from Mozambique) learners in my class and they do not know Xitsonga. with English they know common words like when you say transport they know what transport is than when you say swifambo, even at home when you say flowers, they know flowers they will not call it in their MT, they use English words. They always switch to English and you would see that these learners they know English than Xitsonga words. Most of the things they do not know it in Xitsonga, but they know it in English, that is why I find it easy and even learners find it easy in English. It is difficult because I have to do a research before I teach some of the words. But what about learners? As a teacher I have to research words in Xitsonga so can you imagine for learners, it is more difficult. The Shona learners would begin to be on track with us after four to five months. Even myself I do not know Shona but there are some learners that would translate.
	T4B	
SC	T5C	Teaching in English is so excellent I have done it. Even these learners when they go to Grade 4 they excel because they like English and they understand it more than Sepedi. They love English very much. I can say if they could bring English back, oh! It would be a bonus. Even the parents like English, they do not like this MT. Because it is the government that switched us and said we must use our MT because learners understand better in their MT. We have no choice, but English let me tell you is ok. Learners understand it fast because they use it even when they play, they look at the television is English. So, English is very good. When we teach in English, we speak it because they have to listen to it and speak it so that they can be able to write it. They don't

		like Sepedi, is not that they don't know it, they don't want it. You can see that they don't want Maths in Sepedi because when you tell them that now is time for Maths, they look down. They will even ask you that mam why can't we do Maths in English. Then you have to explain that 'no, it is not me it is our government, they want you to know your MT'. Funny enough it is only Foundation Phase, when they go to Grade 4, 5, and 6 all the subjects are done in English. So, they say they want us to lay the foundation in Grades 1, 2, and 3 but from there it is English.
	T6C	The difference is that at home, they use English concepts and in class, they use Sepedi. I think using English is better but for the promotion of our languages we have to use our languages, yet the spoken language outside is English. The learners like English and I do not know whether the reason is that their friends at home attends English schools. When you teach English First Additional language, they enjoy it.
SD	T7D	The difference is that it is easy to use English. Learners already know the numbers. They are used to watch the cartoons that are talking in English from the television. They Know English better than MT because there are different MTs. In the morning when we do mental calculation, they become bored with Sepedi but enjoy counting in English. These learners know English better that the LoLT of the school because most of them Sepedi is not their MT which is the LoLT. They come from different homes with different MTs. At home they are talking Xitsonga but when they enter get into the school they must talk Sepedi. That is why they get bored with Sepedi. It is difficult. The workshops that are provided by the Department of Education are very fruitful because they teach us and give us the manuals, we refer from the manuals. We use the strategy that was given to us in the workshop. They teach us in English and when we come to school we teach in Sepedi. That is why they are hiring people who know Sepedi. They also provide us with the material that is written in English and we have to translate. We sit in a group do the translation. Even the question paper that we get in a USB

		is in English and we have to translate the whole question paper in Sepedi with the HOD and other teachers, but the DBE book is prepared in Sepedi. The DBE book has everything and is aligned with the question paper because it has everything. When you open on page one you find the mental Mathematics which is the same as the question paper. The standard of the DBE books is very high.
	T8D	Teaching in English is very much simple because learners grasp easily. Teaching in MT is a problem because learners do not understand Sepedi, at home they speak different languages, so it becomes difficult for parents to help learners with their home works looking at the language that we are using. The LoLT of the school is Sepedi, but in my class, I have languages such as Zulu, Venda, Tsonga, Sotho and Tswana. To cater for all these learners, I have to switch to English for learners to understand what you are saying. We code switch. The learners understand English more than their MT. The reason is that English is simpler than MT looking at the Mathematics concepts. Explaining in English is much simpler than explain in the LoLT. If I were to teach in English I would use English and explain where do not understand in Sepedi.
SE	T9E	When teaching in English children understand easily but when you teach in MT they cannot follow the instructions because some of the terms are very much difficult. Like for instance when you teach the concept time, when I say *half past five*, or *30 minutes past five* is English. In isiZulu I have to I am going to say *ligamenqe ihora lesikhombisa* and the child start by asking what is *ligamenqe*. So, when you teach them you start by saying it in English then you explain it in MT. in my class all learners are Zulu learners

	T10E	Teaching Mathematics in English is better to my side. The MT is ok, the learner must Know his or her language, but it will not take the child anywhere. Even in the interview that learner will struggle to express himself. English is better if you prepare very well so that you are able to help the learners.
Question 4: In which language do you feel competent enough to teach Grade 3 Mathematics and why?		
SA	T1A	I feel competent to teach Mathematics in English. It is easy because that is what they live, for example, money, '…*Ranta ke Ranta, (means Rand is Rand) half litre is half litre and nothing as serepa sa borotho.* Even with the symbols, one rand is abbreviated as R1. 50c will remain 50c, c represents cents and in Sepedi cents is disente yet is written as 50c. The challenge is that disente does not begin with a letter c it also does not have letter c.
	T2A	
SB	T3B	For me I think English is the best. Like I have said, words. If you teach problem-solving sums you have to understand the language, if you don't understand the language you will not find data. I am thinking for learners if the learners do not understand what I am teaching it means I am also finding it difficult because I am not doing it for myself, I am doing it for learners. You will see when you teach a topic and when you mark a book you will realise that these learners they did not hear anything. Even when you assess you will see that I have to drill this topic because sometimes you would find out that you as a teacher you understand but learners don't hear anything when you teach them. When they speak Xitsonga, they mix it with English. They will often give you English word than Xitsonga words and you will see that these learners are used to

		English word than Xitsonga words. They don't know, and you have to tell them what the words are called in Xitsonga.
	T4B	English is the perfect language for Mathematics instruction. As a Teachers experience problem when I come across the words that you cannot explain in Xitsonga, you must go around to other teachers. But English is much better because the Tsonga that is spoken in our township is not the real Xitsonga
SC	T5C	English. When I compare the average of using English to that one of MT, learners were performing better when they were using English as LoLT. With this MT, the performance is bad, I do not know if they do not like the language, or if they do not like it. But English, I can assure you they enjoy it. I have been there. You would love them when teaching in English, you can even see that they love this English. And they perform exceptionally well, even the slow ones when is English they raise up their heads with confidence. But with Sepedi or MT, they just seem like they are tired.
	T6C	I think English because also the ATPS are in English therefore the concepts are in English, even the dictionary that we are being provided with is full of borrowed words so most of the words are in English. So, for their understanding I code switch because outside they say ten, they do not say lesome have been teaching for 20 years and in all these years I only used MT for three years. Therefore, I would say using English is the best, I prefer English because of the environment of these learners. They use English when they go shopping, when they talk about money, they use words such as change which are in English. I mostly use Sepedi when coming to writing and mix English and Sepedi when I explain and want them to understand.
SD	T7D	English because it is easy for the learners to understand it. They see it on the TV then they practice it. Then when they come to class they do

		not struggle as we do English during the last term so that we must prepare them for Grade 4. They do not practice MT because they play with children that are from English schools and they compete with them. They are impressed by the children that are coming from white schools. When you teach them in MT they will tell you that: 'No mam why those kids are talking English.' there is a shift in the languages that the children are playing with, they play in English because they play with children that are from the white schools.
	T8D	In English, because it is much simpler with concepts. Like I told you at the beginning with shapes. It is much simpler to do the 2-D shapes and 3-D objects in English. Sepedi words are much longer than the English words. Fractions are also much easier in English than in Sepedi because in Sepedi is longer it (tee tharong) and in English is simpler as one third.
SE	T9E	I am competent to teach in isiZulu and in English, but I am more comfortable to teach Mathematics in English.
	T10E	English, when you say to the learners, *tee arola ka pedi* they look confused and uninterested, but when you say *multiply*. You can see that they see what is happening and they show interest. And you always give practical examples two multiply by five. But when you say *pedi ka pedi*. You can even feel that you are boring. Let them do Sepedi as a language/subject they can know their roots and learn their culture there. Not do Mathematics in Sepedi. I think they understand Mathematics in English than in MT because they like it. When you tell them to take their Sepedi books, they shrink, they do not even enjoy reading in Sepedi. But when you tell them to read in English, they become very excited event the slow learners. But I think the Sepedi learners in Limpopo they can enjoy Sepedi, but these ones in the township I do not see it happening. They are having difficulty in

		using MT because most of the time they are using a township language. They do not know anything about the idioms. So, for the township learners is difficult. I don't get what most of the words in the DBE book mean…
Question 5: What are the challenges of teaching Grade 3 Mathematics in MT?		
SA	T1A	Challenges are mainly focused on language. Once I use MT they get bored, it is not even in their schema and they cannot totally relate with it. They are hearing it for the first time from me, this means that they are not moving from the known to the unknown because parents do not use that language. MT makes teaching and learning very difficult, it is also difficult for me because when I talk to my children at home I do not say '*tlisa makgolo supa masome tharo a diranta* It is shocking for them and it does not bring any interest in the classroom. It takes away the teacher's confidence. Even in the beginning of the year we say 'complements for twenty nineteen'. No one say 2019 in MT. it is practically impossible. The very same radio station we listen to never use MT words to explain numbers. It is a challenge.
	T2A	
SB	T3B	I feel like the learners are not gaining anything. I am not giving them the education of the lifetime because when they go to Grade 4 they have to switch to English and start from the scratch and learn numbers and number names. So, can you imagine a learner starting number names in Grade 4. The Grade 4 teachers were experiencing problems but now is better because we are now teaching in English. Can you imagine a Grade 4 teacher teaching numbers and number names 1 to 20 in English just because learners would be knowing concepts in their MT. Learners in Grade four are dealing with bigger numbers like 100, 200 therefore, they were experiencing problems when they have to start with 1 to 20. They would feel like Foundation Phase teachers are not

		teaching, not knowing that we are experiencing the problem with regards to language.
	T4B	
SC	T5C	The challenge is understanding, learners do not understand the MT language. They take time to understand MT. Different concepts can also be a challenge, for example, when I teach them about capacity, I have to say mothamo. Some don't understand what mothamo is and you have to explain 'mothamo capacity'. The major problem can be the concepts e.g. Hlakantsha, addition you have to explain to them because the child does not understand because she is a Tsonga. Setswana is better because most of the Setswana words are similar to Sepedi words, but in IsiZulu is something else. You have to explain that in addition, we bring them together the go back and explain in another language. Sometimes you have to ask learner '…In isiZulu what is it? No mam is that'. Then you go back to your language and say 'Hlakantsha'. We cannot group the learners according to their different learners because you will find that there are 5 Sepedi learners, 5 isiZulu learners, 5 Xitsonga learners therefore the number does not cover the ratio and they want the special teachers. The reason for learners to have the negative attitude towards English is that they love English and they want to talk English.
	T6C	The challenge is that they are not used to the language. Like when we are doing measurement, they are used to a word ruler, when you come to Sepedi you have to look for the meaning of words such as centimeter in Sepedi we do not have those words. It is a borrowed word. Again, when we talk about money, the learners understand faster when you say three Rands, or hundred Rands than when you are using Sepedi words. Calling numbers in English is faster than in Sepedi. The DBE books are assisting but the money is written in English. As a teacher my challenge is that the ATPs are in English and you have to translate and

		look for the words, making sure that when you translate the meaning does not change. I deal with diversity by using English because they understand English better that their MT because they use English when they play and at home they use English. They do understand when you say words in English.
SD	T7D	The challenges that I face is that firstly, the children do not understand bo makgolo what (hundreds in Sepedi). Secondly, the parents at home they do not assist their kids with the homework. When we give the learners the homework the parents are not involved. And when you teach it is a parent, a child and a teacher. It must be a triangle. When you call the parents and ask them, they will say 'I do not know Sepedi, I am a Zulu.' Then there comes a difficult part now. They will say I cannot read Sepedi.
	T8D	For my side it is not that much challenging because I understand them, but for learners it is too much for them because when they get into Grade 4 it becomes difficult for them to understand the language of teaching now because they come with the Sepedi concepts. They were taught counting in Sepedi. So, it is difficult for learners more than me. So that is why we start teaching in English during term 4. For the learners that are not Sepedi I use English to explain and if they do not understand I try to explain in their MT. if I do not know the language of the learner, I do research or ask other teachers to assist.
SE	T9E	As I have said before that the challenge is that Zulu is more difficult that English because the terminology in Mathematics is very difficult. So, before the learners can carry the instruction you must explain what you mean and is not much easier than when you use English.
	T10E	As teacher when you talk to the learners you do not have to say the language without using English words. You use the language that they understand which the township language is. In this class we have

		different languages such as isiZulu, Xitsonga, Venda, Ndebele all these languages are there even the whites from Maputo they say they must come to my class because they are playing with the Sepedi learners from my class. You can find that there are only five Sepedi learners out of 40 learners. Have another one who comes from a different country, it was difficult with that learner because she could not hear a word, but after six months the learner was better than most of the learners because she was eager to learn.
Question 6: What are the successes of teaching Mathematics in MT?		
SA	T1A	Successes are very minimal, for example, previous ANA ultimately ended up using/adapting English memorandum. Answers were adapted because learners were failing dismally. If the learner has written in English was credited. If the spelling was wrong, the learner was also credited. If the Sepedi was wrong, the learner was credited. Learners answered in both English and MT, for example, Calendar (the question on the exam was about the months of the year and learners wrote Desember which is Manthole in Sepedi) but they were credited. Date of birth is also said in English, even indigenous radios used English.
	T2A	
SB	T3B	I did not see any success. Because they would do MT in Grade 3 and they would struggle in Grade 4 which is their future. They would be struggling because if a learner does not get good foundation it is going to be difficult for that learner in higher Grades. They need a good foundation. They start with MT in Grade 1, but even still in Grade 3 I have to teach the concepts 1 to 20.
	T4B	I don't want to lie, in this 21st centuary I do not see any success in using MT because everything has changed so much. Even the gadgets that our children are in English. Even parents cannot help their children in

		homework and when you ask they will say that they do not understand, they will come to the teacher and say that they did not help their learner because the MT is difficult to them.by the school Others will say that they did a different MT and not the one that is offered.
SC	T5C	Even if learners do not understand at the end, they will have to listen and do the work. You can see in writing. Even if they don't have a choice they have to do what you have taught them by writing in Sepedi. You have to beg them by saying: 'Learners you have to write because this is our language, and we have to use it.' But others they tell you that they do not like this language. Even some parents took their children away saying that they were thinking that their children will be taught in English and they want their children in English schools. Then we would explain to them that it is only Foundation Phase (Grades 2 to 3) that they are doing English.
	T6C	Is that learners learn their language. I think it is important for learners to understand their home language. They gain knowledge of the word in MT. However, I do not know where they are going to use them because in Grade 4 the use English. I think if they were using English, they were going to progress well, but now they are using Sepedi. Actually, I do not know of any successes.
SD	T7D	It can favour other children. Those that can read they become successful. And those that cannot read they are on the average. As a teacher I do not have a choice, it is a must that I should teach in MT. I was teaching at the English-medium school. And when the government pronounced that the LoLT of the school has to be MT, that school did not change, they are still using English even now. We cannot do anything about the change that is imposed to us, they are the government and they are above us. We must just dance to the band. We were having Xitsonga and isiZulu here, but they were taken away. They force us to teach our children in Sepedi and when they go to

		interviews, there is no Sepedi. Where is English, they want English. Where is Afrikaans they want Afrikaans.
	T8D	I do not have successes. The only thing is that some learners come in class knowing Sepedi numbers from Grade 2 and you can explain that in English the number is written like this. But most earners come to class knowing English, I do not know if it is from their previous Grade, or if it is from home or from crèche and Grade R. maybe is from Grade R, but parents understand English more than the LoLT of the school. Because sometimes when you give a homework, they come back written in English because they do not know them in MT. the reason is that they did Mathematics in English during their time. When we were teaching in English, the results were much better than now. The assessment questions are much simpler in English than LoLT. In English questions are shorter and only needs straight forward answers. In Sepedi like I have given an example of fractions, parents understand fractions in English than in Sepedi. So, the previous question papers which were written in English were much better than the ones written in Sepedi.
SE	T9E	I can say learners can express themselves although there could be difficult in terminology, but they are free to talk.
	T10E	For the brighter learners, you can see them writing number names in Sepedi and in English. But for the other learners, even now they still struggle with the number names in Sepedi, but it is better in English. Most of the time when I use Sepedi they fail. When we do addition, I use words such as fifteen minus nine in English. I told you that I use English, that how I survive, With regards to the assessment they use English because the district facilitator advised us that we can give a mark to the child as long as the answer is correct the language does not matter. The question paper

		comes in Sepedi. I read for them and explain then they answer in English. Even when we practice the previous question papers I use the English ones. The tasks are also written in English.
Question 7: How do you overcome the challenges experienced in teaching Grade 3 Mathematics through MT?		
SA	T1A	I overcome the challenges by accommodating the learners to answer in the way they know, knowing that once they exit Foundation Phase everything will be taught in English. At home everything is done in English. I leave them the way they call them in English. Some concepts are not known in MT, only known in English and It is understandable why the DBE (Department of Basic Education) say we must accommodate English. When dealing with sharing in fractions, they use concepts such as halve and as I have already mentioned that even at home they call it halve. In money, rand is rand, when writing the 50c the c indicates cents and it is not there in MT. The MT does not accommodate the concepts that are familiar in English. This is just proof that Mathematics should be done in English, examples are two-dimension shapes, three dimension objects, fractions etc. are challenging to deal with in MT.
	T2A	
SB	T3B	As I have already said that I use English concepts and then I will introduce those words in Xitsonga. I have changed to English this year but I only struggled during the first term and they were very much better in term two.
	T4B	You must go around asking other people, especially the terms that we find in our textbooks. In addition, you must do a lot of research and prepare thoroughly so that your children can understand. You have to do a lot of repetition since well most of our learners are not from South

		Africa and they do not know Xitsonga, the just take Xitsonga so that they can be in our school and learn. Most of them come from Zimbabwe and Mozambique. We struggle so much. The learners are given the DBE textbooks that they have to use it at home, but they are a bit difficult for them to use at home because parents say they do not understand what the DBE is saying. Therefore, we are forced to use it in class whereby I have to explain each and every word.
SC	T5C	It is not easy but we are trying. We have to help learners, we have to even ask parents by giving them homework also by doing extra classes. We sometimes take those learners that are slow and help them maybe for 30 minutes before the school is out. We are trying even if there is no time, maybe once or twice a week.
	T6C	You just have to work harder so that the learners can understand. You use different methods so that learners can grasp whatever you are trying to say. For those learners who do not understand you have to call then aside so that you can explain to them. For the learners that are not Speaking Sepedi, I just use English because this is their spoken language. They use it outside when they are playing and when they are at home.
SD	T7D	I just try I cannot say I overcome. There is a period for those that are too slow are called a learner on risk. We sit down with them and go back and teach them one by one. Something that disturbs us is a roll, we are having a number of children. At town they are having 25 to 30 learners and we cannot complain. If you complain they say you must fill an HR21 form and excuse yourself from the work. When they write the test the teacher has to read for them before the start writing. Thereafter they have to write on their own. The learners that cannot read will then suffer and get the zero. The problem is that you stand for the whole 30 minutes explaining to them and you become tired. And when they start writing they do the scribbling and they cannot explain what they have written.

		The government proceeds these learners to the next class. We are having problems in Grade 3 because learners come here not knowing anything. As a teacher, you have to work very hard. The major problem is reading because everything that they are doing involves reading. They did not get the basics in Grade 1 and 2. There is no foundation from Grade 1 and 2 and Grade 3 is a boundary. Even though these learners have started the MT in Grade 1 still they do not perform well. Every day we have a library class where they teach them Sepedi. It is heavy for them when they get into Grade 4. They are having more subjects with different teachers. And you will find lots of failures in March and June because these children are not ready. We are not allowed to say that English is better because they say that these children are not white, and English is not their language.
	T8D	I would not say that we overcome them hundred percent because in Grade 4 teachers are complaining that learners do not grasp, and they do not understand what they are doing as they were doing everything in Sepedi. It is difficult for Grade 4 teachers to can help learners with Mathematics. That is why our results from Grade 4 onwards are dropping year by year.
SE	T9E	Well, I can say I have the extra lessons for slower learners. I remain with them after the lessons and give them extra work. During the extra lessons I emphasis the concepts using both English and MT. I think the concepts are important than the language, but I also take into consideration that the learners must understand the language in order to follow the instructions.
	T10E	We have to practice. When we practice with them every day they become better. You have to give them a lot of work so that they can understand what is taking place in their books. We are striving, but we are getting there. Maybe next time I will be able to teach them in Sepedi,

		but I am worried because most words are not available in Sepedi such as 3-D shapes.
Question 8: What MT strategies/ methods do you use to explain Grade 3 Mathematics concepts to learners?		
SA	T1A	It is difficult. I code switch, first in English then tell in Sepedi. When I begin to explain in Sepedi the children laugh at me, for example, 'I say this is a square, in Sepedi is khutlonne' then one learner said 'square is ok we don't want khutlonne. Sometimes when I teach in Sepedi, they laugh. When you teach them in English the learn easily because that is how these concepts are known at home, even when they play with friends
	T2A	
SB	T3B	I would have to tell them in English because they understand English. For example, when we are doing shapes, I would first tell them in English that: 'Now we are doing 2-D shapes, in Xitsonga is…' then I will show them the picture of 2-D shapes or 3-D objects. I am using English even though I am not supposed to do that way, But when you tell learners in Xitsonga they will tell you in English.
	T4B	Most of the time we repeat and it is time-consuming to repeat. We also do drill work so that the learners that find it are not left behind, even though it is boring for the fast learners.
SC	T5C	Different concepts can also be a challenge, for example, when I teach them about capacity, I have to say mothamo. Some don't understand what mothamo is and you have to explain 'mothamo capacity'. The major problem can be the concepts e.g. Hlakantsha, addition you have to explain to them because the child does not understand because she is a Tsonga. Setswana is better because most of the Setswana words

		are similar to Sepedi words, but in IsiZulu is something else. You have to explain that in addition, we bring them together the go back and explain in another language. Sometimes you have to ask learner '…In isiZulu what is it? No mam is that'. Then you go back to your language and say 'Hlakantsha'.
	T6C	Like I said I use different methods so that learners can understand. If they do not understand I go to English.
SD	T7D	With regards to the strategy for explaining concepts we have the GPLMS books and the ATP that leads us on what to do and what not to do and the DBE workbooks
	T8D	Is code switching Sepedi to English so that the learners can understand. Using the correct material for the correct concepts. Practically doing what you are teaching. Showing them what we are talking about (using real objects). Also using the number chart to compare numbers to show which number is bigger than and less that the other. Also using English to explain because Sepedi and English can have different meanings. In Sepedi is one word but explaining two things E.g. in English is easy when you say write the numbers that are bigger than 100. On the number board (they are 101; 102; 103…) But in Sepedi when you say ngwala dinomro tse godimo ga 90 (they write numbers that are on top of 100. Which are 100; 200; 300…), they do not write numbers which are bigger than 90 because they are using a number board. Is one word but explaining two things.
SE	T9E	I demonstrate, for example, when teaching *fractions*, I would say *whole* means icqwelele. Then I demonstrate to learners. When it is *half* the children use mostly the word half. Even at home they use the word halve. I would say half then I demonstrate and say incenye oyodwa. (One half) because in isiZulu we do not half but one half. Then I can divide a whole in two halves and say these are two halve in isiZulu. And

		when is quarter we do not have the exact word in isiZulu. We say okukodwea ko kunye meaning one of four.
	T10E	I always give examples and use some word sums. I write the word sum in Sepedi in the chalkboard. I then read and explain. Then I write the same word sum in English then I read it in English. If is smaller number some answer in MT and some answer in English. If they are bigger numbers they always answer in English. They know the MT number names mostly up to 10 or 20.
Question 9: What language would you recommend for teaching Grade 3 Mathematics to learners?		
SA	T1A	I would recommend English because that is what they live. Parents use English at home, even those that do not know English they understand concepts in English. Parents do not know MT concepts. Therefore, there is no prior knowledge that an educator can built on.
	T2A	
SB	T3B	English, because I am weighing the understanding, with MT is difficult to understand some of the words but with English is easy for learners to understand. They switched to English this year and during term two it was better.
	T4B	English. Since we have changed the LoLT of the school to English marks have improved.
SC	T5C	The language that I would recommend is English, because learners learn fast in English. They understand it well, even if there are problems, but not as much as the MT. I think English I better because they use English almost every day and the problems will be less.

	T6C	I would recommend English, so that learners do no struggle too much in Grade 4. I think if it was like that the percentage pass rate of our learners would be higher. The transition to Grade 4 is too much for the learners as the have to deal with the changing of LoLT, the subject are more and most of them are new, and they are now going to be taught by different teachers. This is a lot for them to grasp in one year. But if we do Mathematics in English when they proceed to Grade 4 they will just flow.
SD	T7D	English it is easy for the kids. They can pronounce it. I also cannot teach in Sepedi because I am not a perfect Sepedi teacher.
	T8D	English because learners understands it more than MT. other questions are more confusing in Sepedi than in English. English is a straight forward question.
SE	T9E	I would recommend English. as I have said before the children understand English more easier than MT The children would understand because I would use English and where they do not understand I would explain in MT. However, they will have to write in English because English is easier. When it comes to reading in English, learner do not have a problem as compared to reading in English. even the slow learners perform much better in English than in their MT.
	T10E	English. they understand English better

Question 10: Do you have any other contribution to make regarding the teaching of Grade 3 Mathematics in MT?		
SA	T1A	English should be and remain the language that is used. At present I would recommend code switching to MT when learners do not understand the concepts in English.
	T2A	
SB	T3B	In MT I do not have any contribution, because I feel like when you teach in MT you are wasting time trying to explain the words so in English when you say division you just say division. Then you show them the division sign, you do not have to drill it for the whole week for learners to understand. But when you tell them in MT, tomorrow they will forget the word. It is not easy in MT, but also wasting time which we do not have.
	T4B	I do not know, but I do not see the MT LoLT materializing even in the coming years. The gadgets that our children are using are in English. We are so much in English.
SC	T5C	I can suggest that we if we could get extra lessons for learners that could be done on Saturdays for both language and Mathematics. By taking them through what we have done during the week. Maybe these learners could be helped. Because when I compare the average of using English to that one of MT, learners were performing better when they were using English as LoLT. With this MT, the performance is bad, I do not know if they do not like the language, or if they do not like it. But English, I can assure you they enjoy it. I have been there. You would love them when teaching in English, you can even see that they love this English. And they perform exceptionally well, even the slow ones

		when is English they raise up their heads with confidence. But with Sepedi or MT, they just seem like they are tired.
	T6C	I would recommend that they provide us with the teaching aids that are written in MT. we are being provided with the teaching aids that are written in English. They must do them in MT. The ATPs must also be in MT.
SD	T7D	The work is too much for Grade 3. They must reduce the work and the roll. They must also allow the use of English as LoLT.
	T8D	I do not see any improvement teaching Mathematics through MT. Mathematics should be taught in English. Mathematics must start in Grade 1 till Grade 12. When they start in Grade 1 learners will not struggle in Grade 12 and they will never be afraid to do Mathematics. Learners understand Mathematics in English than in MT because MT is not straight forward. In English is straight
SE	T9E	To our Department to bring the material in MT because the material that they bring is in English. I do not have a Mathematic book in isiZulu. When I need something, I take an English book and translate it to MT. Even the books, I do not have the Mathematics book in isiZulu. It is difficult to translate because it won't be exactly as what is in the book. I will just make it almost the same, but it won't be the same. Even the DBE books that they bring, as a teacher when you try to read it, you do not understand what they were trying to say. We do not even have the copy for the answers, the memorandum for these DBE books. You as a teacher you are having just a DBE book and then you have just to find the answers on your own. Sometimes it is not clear what they are trying to say, so you will explain according to your own understanding. If the DBE books can go hand in hand with the policy, if the first lesson is counting, the first lesson in the DBE book must be counting. If the next

		lesson is money, it must also be like that in the DBE. But say we must not go according to the policy in the DBE books. They say we must not skip the pages even if the concept is not similar to the one in the policy document. For example, if I treat money according to the policy document. The concept that I will be treating in the DBE will be something else for example, measurement. I believe that what I treat in class must be what the children will be doing in the DBE. The other problem is that when I treat money in class. When I go the page with money from the DBE, it becomes a problem because they say I have skipped the pages. Sometimes you find he language used in the DBE for word sums is not good sometimes they have written the word, but it does not mean that.
	T10E	Only if they can give us more time or more periods for Mathematics Sepedi so that they understand Mathematics in Sepedi and to instil the love of doing Mathematics in Sepedi. They should treat the concepts in such a way that they were treated in the past for example, one concept for the whole week. Unlike the ATP where more than one concepts are treated in one week. And this confuse the learners. They end up not knowing what they are doing. These learners do not speak Sepedi even with their parents. They read Sepedi without understanding. When you give them the reading homework in MT they do not do it. But in English their parents assist them and the learners are able to read.

Appendix Q

Document Analysis

T=Teacher	**ANNUAL TEACHER PLAN (ATP)**	**LESSON PLAN**	**LEARNERS' ACTIVITY BOOKS**	**FINDINGS** **Documents used by teachers.** **Written activities in learners' books.**
T1A	The ATP was written in English	Lesson plans were written in English	The topic and the instructions on the worksheet were written in English.	Documents and activities were written in English
T2A				
T3B	The ATP was written in English	Lesson plans were written in English	The whole activities were written in English.	Documents and activities were written in English
T4B	The ATP was written in English	Lesson plans were written in English	The whole activity was written in English.	Documents and activities were written in English
T5C	The ATP was written in English	Lesson plans were written in English	The instruction for assessment was written in both English and MT.	Documents were written in English and the activities

T=Teacher	ANNUAL TEACHER PLAN (ATP)	LESSON PLAN	LEARNERS' ACTIVITY BOOKS	FINDINGS Documents used by teachers. Written activities in learners' books.
				were written in both English and MT.
T6C	The ATP was written in English	Lesson plans were written in English	The instruction was wrongly written in MT. the teacher wrote 'Hlantsha' instead of 'Hlakantsha'	Documents were written in English and the activities were written in both English and MT
T7D	The ATP was written in English	Lesson plans were written in English	The heading on the worksheet was written in English, 'Fraction circles' the other one was 'Fraction strips' but the instructions were written and read in both English and MT.	Documents were written in English and the activities were written in both English and MT
T8D	The ATP was written in English	Lesson plans were	The activity was written in both English and MT	Documents were written in English and the activities

T=Teacher	ANNUAL TEACHER PLAN (ATP)	LESSON PLAN	LEARNERS' ACTIVITY BOOKS	FINDINGS Documents used by teachers. Written activities in learners' books.
		written in English	when dealing with time. For example, 'Bontsha half past 3.' Meaning 'indicate the half past n the clock	were written in both English and MT
T9E	The ATP was written in English	Lesson plans were written in English	The activity was written in English but translated in MT by the teacher	The documents are written in English and the activities are written in both English and MT
T10E	The ATP was written in English	Lesson plans were written in English	The instruction on the activity was written in English	The documents were written in English and the activities are written in both English and MT
THEMES	**The ATPs were written in English**	**Lesson plans were written in English**	**Most activities were written in English. Some**	**The documents are written in English and the activities are**

T=Teacher	**ANNUAL TEACHER PLAN (ATP)**	**LESSON PLAN**	**LEARNERS' ACTIVITY BOOKS**	**FINDINGS** **Documents used by teachers.** **Written activities in learners' books.**
			written in both English and MT.	**written in both English and MT**