

**TEACHER IDENTITIES AND MATHEMATICS CLASSROOM
PRACTICES IN SELECTED PRIMARY SCHOOLS IN
LESOTHO**

By

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Declaration

I, **Maboi Zacharia Mphunyane**, declare that the Philosophiae Doctor Thesis, ***Teacher identities and mathematics classroom practices in selected primary schools in Lesotho***, that I herewith submit at the University of the Free State, is my independent work and that I have not previously submitted it for a qualification at another institution of higher learning. I also declare that I am aware that the copyright is vested in the University of the Free State.

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Abstract

The study explored the influence of teacher professional identities on mathematics classroom practices in primary school classrooms in Lesotho. According to literature there is need for more explorations of the relationship between teacher identities and classroom practices. Social Identity Theory (SIT) provided the theoretical framework. Data analysis and interpretation drew concepts from the Mathematical Discourse in Instruction (MDI) framework and related concepts. The study was motivated by reports from earlier studies showing unsatisfactory learner performances in primary school mathematics in Lesotho and the Southern African Development Communities (SADC) region. Another challenge was inadequate performance of teachers in mathematics classrooms amidst efforts to improve performance through, inter alia, curriculum reform.

This qualitative study focussed on cases of three teachers with teaching experience in primary school mathematics exceeding 5 years. Data were collected through classroom observations and interviews (pre and post classroom observation). Data analysis derived meaning from patterns, themes, categories and regularities. The findings indicate that teacher professional identities can be linked to teachers' life experiences. The findings further indicate that teacher professional identities influence mathematics classroom practices, in some unique ways based on factors that include subject matter knowledge, classroom environment and school context. The study recommends that the design and implementation of pre-service teacher training and in-service professional development programmes should be informed by research on teacher professional identities, because teacher identities influence meaningful classroom experiences. Teacher training and Continuing Professional Development (CPD) needs to strengthen strategies of equipping teacher trainees with content and related pedagogical knowledge and skills to build their confidence in teaching mathematics or numeracy across the primary school grades.

Key words/phrases: Teacher Professional Identities (TPIs); mathematics classroom practices; Social Identity Theory (SIT) and Mathematics Discourse in Instruction (MDI).

Dedication

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List of Acronyms

ACE	Advanced Certificate in Education
AIM	American Institutes for Research
BEd (Hons)	Bachelor of Education (Honours)
CAP	Curriculum and Assessment Policy of South Africa
CAP-L	Curriculum and Assessment Policy Framework of Lesotho
CECE	Certificate in Early Childhood Education
CIE	Cambridge International Examinations
CK	Content Knowledge
COSC	Cambridge Overseas School Certificate
CPD	Continuing Professional Development
DipEd (Prim)	Diploma in Education (Primary)
ECOL	Examinations Council of Lesotho
GCE	General Certificate in Education
GOL	Government of Lesotho
JC	Junior Certificate
LCE	Lesotho College of Education
LGCSE	Lesotho General Certificate of Secondary Education
MCK	Mathematical Content Knowledge
MDI	Mathematical Discourse in Instruction
MEd	Master of Education
MOET	Ministry of Education and Training

MTPI	Mathematics Teacher Professional Identity
NCDC	National Curriculum Development Centre
NCTM	National Council of Teachers of Mathematics
NUL	National University of Lesotho
NTTC	National Teacher Training College
PCK	Pedagogical Content Knowledge
PISA	Program for International School Assessment
PTC	Primary Teachers' Certificate
UNESCO-IBE	United Nations Educational, Scientific and Cultural Organisation – International Bureau of Education
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Educational Quality
SADC	Southern African Development Community
SIT	Social Identity Theory
STC	Secondary Teachers' Certificate
TIMSS	Trends in Mathematics and Science Study
TPI	Teacher Professional Identity

Chapter 1

Introduction and Background

1.1 Introduction

This study explored the influence of teacher professional identities on the practices of mathematics teachers in primary school classrooms in Lesotho. There has been a shift of view in educational research as many studies have established the relationship between teacher professional identities and their practices (cf. Arpaci & Bardakçi, 2016; Bjuland, Cestari & Borgersen, 2012; Kouhpaenejad & Gholaminejad, 2014). According to these studies, teacher professional identities create a framework within which teachers operate and, as a result, they influence teachers' classroom practices (Battey & Franke, 2004; Gee, 2001; Sfard & Prusak, 2005). The study aims to find out how Teacher Professional Identities (TPIs) relate to primary teachers' classroom practices when teaching school mathematics at primary school level in the context of a less developed country, Lesotho.

This chapter gives an overview of this study. This is presented in ten sections, namely, introduction, background, problem statement, research questions, rationale and significance of the study, theoretical framework, conceptual framework, research design and methodology, delimitations, limitations, definition of terms and thesis outline.

1.2 Background

The background section discusses the general importance of teaching mathematics, the Lesotho primary education structure and learner performance, teacher preparation, the role of the MOET in supporting education, mathematics classroom practices and teacher professional identities.

1.2.1 The importance of teaching mathematics

Ernest (2010) points out that the answer to the question “why teach mathematics?” depends on who asks it. Ernest (2010) therefore classifies the reasons for teaching

mathematics into seven capabilities that range from basic knowledge and skills that form the foundation for further studies, those needed for functioning at the workplace, skills and knowledge relevant to culture and society, and the more specialised knowledge needed for higher education.

The Curriculum and Assessment Policy framework of Lesotho (CAP-L) notes that mathematics and numeracy play an important role in promoting “numerical and mathematical skills for everyday life and further learning” (MOET, 2009:15). Therefore, mathematics and numeracy are taught so that learners develop their knowledge and skills in the following ways. Firstly, that they appreciate the contribution of numerical and mathematical skills towards scientific, technological and socio-economic development of the society. Secondly, that they acquire numerical and mathematical skills useful in solving everyday problems and in effective participation in activities related to scientific, technological and socio-economic development. Lastly, that they develop positive attitudes towards mathematics as an area of learning at school as well as a foundation for further learning and career development (UNESCO-IBE, 2010/2011).

1.2.2 Lesotho primary education structure and learner performance in mathematics

This section describes the educational structure in the primary education before and after CAP-L was introduced in 2009 and the performance of learners in primary school mathematics.

1.2.2.1 Educational structure

Prior to the introduction of CAP-L in 2009, primary education consisted of seven class levels, Standard 1 to Standard 7. The curriculum structure was organised around specific subjects that included mathematics at all seven levels. Grading was based on performance in individual subjects. At the end of Standard 7, learners were assessed externally on their performance in five subjects: English, Sesotho, mathematics, science and social studies. A candidate could pass and proceed to Form A (which was the beginning of secondary education at the time) without passing mathematics. So a

learner's progress to secondary education was entirely based on his/her performance in the examinations written at the end of seven years in primary school.

The introduction of the CAP-L in 2009 brought a new structure to education. The primary education levels were renamed Grade 1 to Grade 7. The curriculum was reorganised as the subject system was phased out in most grades of the primary school level to the grouping of traditional subjects into learning areas. Central to the reorganisation of the curriculum is an integration across learning areas and subject areas and within specific subject content areas. At lower primary school, content is laid out in units where each unit consists of two literacy windows (Sesotho and English), a numeracy window and the integrated part. The subject system begins to emerge in higher grades. Grades 5 and 6 have content organised into learning areas. Mathematics is found in the Numerical and Mathematical Learning Area. In Grade 7, the subject system emerges with mathematics as one of the subjects.

Even though these were efforts intended to improve learner performance, this has not yet been realised. Learner performance, particularly in mathematics and numeracy, has still not been satisfactory as explained below.

1.2.2.2 Learner performance in primary school mathematics in Lesotho

There has been a general dissatisfaction in learners' performances in mathematics in Lesotho schools. This has been particularly observed in the results of national exit examinations at the end of primary education in Standard 7 (ECOL, 2010) that were administered and graded by the Examinations Council of Lesotho (ECOL).

Even in the lower classes of primary school education, learner performance in mathematics assessments has been weak. The Lesotho National Assessment surveys of Grade 3 and Grade 6 learners, which was piloted in 2003 and rolled out in 2004, and thereafter repeated every two years, have provided evidence that supports these claims. For example, the data in Table 1.1 indicate weak performance that did not remain stable, which means there may have been unreported factors responsible for this instability.

Table 1.1: Summary of performance for the Lesotho National Surveys in the years 2006 to 2014

Year	2006	2008	2010	2012	2014
Grade 3 Mathematics overall mean score	54%	49%	43%	-	-
Grade 6 Mathematics overall mean score	58%	56%	56%	53%	51%

Source: ECOL (2014:42, 86); ECOL (2010:52)

Evidence to support the claims of weak learner performance in the primary schools in Lesotho is the report by SACMEQ (2011). When compared to other countries in the Southern African Development Community (SADC) Region, Lesotho performs poorly in mathematics and numeracy. For example, SACMEQ reported a low performance in Grade 6 mathematics compared to other SADC countries in 2011 (SACMEQ, 2011). The unsatisfactory performance is not observed only in primary education, but also at other levels. The mathematics results have been poor at the Junior Certificate (JC) and Senior Certificate (Cambridge Overseas School Certificate [COSC]), which has been changed to the Lesotho General Certificate of Secondary Education (LGCSE). Evidence of this unsatisfactory performance can also be found in the examiners' reports on national examinations for the various mathematics papers, in annual publication by ECOL (ECOL, www.examsCouncil.org.ls).

Internationally, assessment programs, such as the Program for International School Assessment (PISA) that assess learners' performance in mathematics at the national level and Trends in Mathematics and Science Study (TIMSS), provide information on learners' performance in mathematics (Klieme, 2016; Cambridge International

Examination [CIE], 2015). These programs provide governments of member and non-member countries with reports on the learners' performance in mathematics at a national level. This is done with the assumption that the governments would use the information to improve their education systems, particularly to inform policies that target the improvement of the teaching and learning of mathematics (SACMEQ, 2011). Based on these reports, some educational systems have initiated school reforms and innovations. For example, the Southern African Consortium for Monitoring Educational Quality (SACMEQ) has indicated that, as a response to some of the reports, the southern African community aims to improve mathematics and numeracy performance among learners.

Unsatisfactory performance in mathematics in Lesotho schools appears to be the result of substandard teaching and learning of mathematics. Most of the secondary school leavers with good performance in external examinations prefer to join the universities and other tertiary institutions in the country and outside. Fewer of those with good performances join the teacher training college (the Lesotho College of Education) where they join either the secondary education programmes or the primary education programme. The primary education programme attracts mostly those who would have failed to secure a place elsewhere (Mulkeen, 2010). The students who enrol in the primary teaching program undergo training in a programme with partial subject specialisation. Student teachers manage to do a group of subject inclined to either mathematics and science (maths/science) or non-maths/science in the second and last semester of their third year, which is an attempt to equip them with subject matter and pedagogical knowledge and skills to teach these subjects. So the student teachers train more as generalist teachers and less as specialist teachers. The generalist teacher versus specialist teacher debates have occurred for many years (Dinham, 2014; Elliot, 1985; Felton, 2016) and it does not seem an easy decision to make for teacher training institutions to fully shift to training specialist primary school teachers.

According to trends in the Teacher Education and Development Study – Mathematics (TEDS-M) (Tatto, Schwille, Senk, Ingvarson, Rowley, Peck, Bankov, Rodriguez and Reckase, 2012) training of generalists seems more common for primary schools and

specialists for secondary schools. The study further established that the generalist pre-service teachers perform lower than the specialists in Mathematics Content Knowledge and (MCK) and Mathematics Pedagogic Content Knowledge (MPCK). The study therefore recommends that policy should set ambitious goals for improvement of MCK and MPCK among future teachers. This study highlights that some student teachers may graduate and proceed to teach mathematics with limited subject matter knowledge. Bennett (2018) describes this as a vicious cycle and Mulkeen (2010:2) adds, “There is a vicious cycle where poor teaching of mathematics (and sciences) results in poor performance in these subjects, limited availability of student teachers with understanding of mathematics and science, and a shortage of teachers in these subjects”. Teacher training institutions may need to reconsider their selection criteria during admissions for better grades in mathematics (Dinham, 2014; Felton, 2016; Lukaš & Samardžić, 2015). Dinham (2014) and Felton (2016) argue for the introduction of specialist teachers in mathematics who will help generalist teachers with their in-depth knowledge and skills in the subject. Their argument suggests that the two institutions in Lesotho that train primary school teachers need to consider introducing subject or learning areas specialisation in their programs.

Usually, primary school teachers receive their initial teacher training at diploma level from Lesotho College of Education (LCE) through full- or part-time programs (Moru, Qhobela & Maqutu, 2014; LCE, 2017). The National University of Lesotho (NUL) also offers a part-time undergraduate degree in primary education for in-service teachers (NUL, 2015). The requirements for admission into these programs do not include a compulsory background in mathematics (see Table 1.2). LCE indicates that a pass in mathematics is an added advantage (LCE, 2017), but not a requirement for entry into teacher training (Mulkeen, 2010:103) while the same applies for the admission requirements of the Bachelor of Education (Primary) [BEdPrim] program offered at NUL. Table 1.2 below shows the admission requirements for teacher training at Lesotho College of Education (LCE) and National University of Lesotho (NUL). The admission requirements in this table indicate possibilities of varying strengths of the candidates admitted in relation to the mathematics they are to teach when they complete their studies.

Table 1.2: Admission requirements into LCE and NUL teacher training certification programs for primary school teachers

Lesotho College of Education		National University of Lesotho
Pre-service Programme: Diploma in Education Primary	In-service Programme: Certificate in Early Childhood Education (CECE)	In-service Programme: Bachelor of Education (Primary)
<p>COSC with 4 credits and a pass. The English language must be one of the subjects passed or</p> <p>COSC with 3 credits, a pass in English language and a credit in a Certificate or a Diploma from a relevant institution or</p> <p>Recognised equivalent certificates shall be considered.</p> <p>A pass in mathematics is an added advantage</p>	<p>COSC/GCE/LGCSE or at least a second class pass at JC level</p> <p>At least three (3) years of teaching experience at an early childhood centre recognised by the Ministry of Education and Training.</p>	<p>Diploma in Education (Primary) offered by LCE, with at least 5 years of teaching experience.</p> <p>Any other equivalent qualification that will be determined by the Senate of NUL; the candidate must also be practising teacher.</p>

Sources: Lesotho College of Education brochure (2017); NUL Information Booklet (2015/2016)

Lekhetho (2013:86–87) attests that “the generally poor academic performance in Lesotho schools could be linked to low admission requirements into the initial teacher training programs, especially in the primary school teaching phase”. McKinsey & Company (2007 cited in Lekhetho, 2013:87) indicate that there are three key strategies for improving instruction: (1) making entry into teacher training highly selective; (2) developing the candidates into effective teachers; and (3) putting in place systems and support to ensure

effective teaching that benefits learners. These strategies are required due to the low levels of teacher competencies as evidenced in Figure 1.1 below. The figure shows performances of primary and secondary school teachers in Lesotho in a baseline study reported in 2019. Average performance of 49% and 31% for secondary mathematics and primary numeracy/mathematics respectively in their teaching subjects is bound to be worrying.

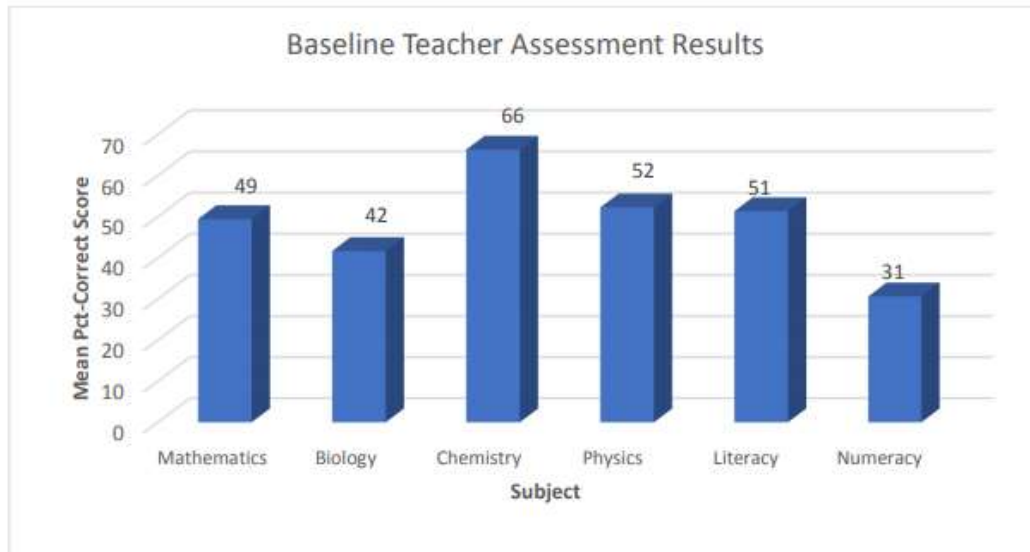


Figure 1.1: Lesotho National Sample Teacher Assessment Results

Source: AIR (2019:55)

1.2.3 Teacher preparation and performance

Gellert (2013) attests that school policies, the professional development initiatives the teacher is exposed to and his/her identity as a mathematics teacher influence the development and growth of a mathematics teacher. This has implications for the induction of teachers into the school system and on the teaching of various subjects or learning areas including mathematics.

Teacher professional development should be one of the priorities in the school system to advance the teachers' knowledge in the teaching and learning processes (Battey &

Franke, 2008). Teaching is not only a collection of knowledge, beliefs, skills and competencies but is a way to participate in communities of practice. These communities provide teachers with the opportunities to share their experiences, attitudes and beliefs through various ways that include personal stories.

Hodgen and Askew (2007) refer to teacher identity as a construct that involves participation in communities of practice. They argue that the concept of a primary teacher's identity "could be enacted in a variety of distinct communities, including the classroom, planning sessions with colleagues, ... professional communities and more" (Hodgen & Askew:473). Belonging to the different communities may cause tensions, according to Hodgen and Askew (2007:473), and, in order to deal with these tensions, teachers construct an identity that encompasses the membership of different communities by negotiating and reconciling the different forms of participation and meaning.

Bathey and Franke (2008:145) further argue that "teachers' identities carry personal histories, emotions, values, and knowledge and they shape how teachers participate in professional development and their classrooms". Teacher professional development initiatives should be structured in ways that accommodate a variety of teacher identities to allow teachers to connect their "knowledge, skills and identities" (Bathey & Franke, 2008:147) to normal acceptable behaviours in professional development initiatives to that of their classroom practices. This is echoed by Fajardo Castañeda (2014) as he points to the importance of connections between teacher beliefs and classroom experience in the shaping of teacher identity.

Continuing Professional Development (CPD) programs for teachers shape their professional identities and provide them with learning opportunities (Mokhele & Jita, 2012). These programs consider teacher involvement in planning and are aligned to teacher needs and experiences. Teacher identities, therefore, need to be a part of teacher professional development (Arpaci & Bardakçi, 2016) not only as a tool to understand classroom practice but should also be developed and shaped as the teacher continues to grow professionally.

Ball (1995) argues that one of the key issues in reforming the teaching and learning of mathematics is what the teacher has to learn and perhaps even “un-learn”. Ball (1995) indicates that reforms, such as the National Council of Teachers of Mathematics (NCTM, 1988), do not determine the specifics and details of what should happen in the classroom. This means that, in an effort to have reform enacted in the elementary mathematics classroom, it is the teachers who have to implement these reforms since classroom situations require that teachers’ reactions and decisions are done on the spot to respond to emerging unplanned situations (Enyedi, Goldberg & Muir, 2005).

The participants in this study had their teacher training during the past four decades (1980–2020). One did a Primary Teacher’s Certificate (PTC) and the other two did their Diplomas in Education (Primary) (DipEd (Prim)).

In the 1980s, when one of the participants began training to teach at the primary school level, the then National Teacher Training College (NTTC) (currently the Lesotho College of Education (LCE)) offered only certificate qualifications, which were the Primary Teacher’s Certificate (PTC) and the Secondary Teacher’s Certificate (STC). The duration of both programs was three years. Student teachers spent the first two years at the college, the next six months at the schools doing teaching practice then came back to the college to complete the last six months in classrooms. This arrangement provided them with two and a half years of classroom learning and half a year of classroom practice and field learning. The curriculum for PTC also included methodology and content courses that were spread out over the duration of three years.

In the year 2002, the college was re-established by law (GOL, 1998) as the Lesotho College of Education (LCE) with one of its functions being “to recommend conferring, granting or giving diplomas, certificates or other educational awards through the affiliation relationship with the University” (p. 214). The curriculum also changed as the college began to offer diploma programs for primary and secondary levels and phased out the certificate programs for pre-service students. The curriculum for DipEd (Prim) also

consisted of methodology and content courses. The courses offered were also spread over three.

The programs that the college offered when the three participants were enrolled at the college were designed to provide the participants with appropriate courses (methodology and content) for the teaching of primary school mathematics from the lowest to the highest levels. Exposure to the teaching practicum also helped prepare them for school experience.

Only a few studies have been undertaken in Lesotho about the teaching of mathematics particularly for the primary school level. These studies are in the form of project reports, theses and dissertations rather than published research papers.

Teaching and learning of mathematics in Lesotho remains a challenge, particularly at the primary school level. Many reports, which include the study carried out by Moloji et al. (2008), the yearly exit examinations taken at national level at the end of Grade 7 (then known as Standard 7), and the 2011 Southern and Eastern African Consortium for Monitoring Educational Quality (SACMEQ) report, have reported unsatisfactory learner performance in mathematics in primary schools in Lesotho. For example, in 2011, SACMEQ ran a national assessment on various subjects, including mathematics and numeracy, among Grade 6 learners in Lesotho. Compared to other subjects, the learners performed poorly in mathematics as the scores were below average and the lowest in performance ranking.

Factors that have been associated with this poor performance include insufficient teaching and learning materials, limited infrastructure in schools and chronic hunger and ill-health among learners, particularly those with poor economic backgrounds (The Lesotho Review, 2015). Moloji et al. (2008) also outline the following contributing factors for learners' poor performance in mathematics:

- Teachers' knowledge of mathematics content;

- Interpreting curriculum documents such as syllabi;

Planning and presenting a lesson;

Classroom language and communication (teacher-learner interaction and learner-to-learner interaction).

Table 2.1: Lesotho primary teachers' performance in national numeracy assessment

National Results by gender

Primary Teachers Numeracy			
Gender of the learner	Mean	Std. Deviation	N
Male	33.77	10.752	40
Female	30.07	10.271	204
Total	30.68	10.419	244

Source: AIR (2019)

Nyabanyaba's study (2006) emphasised limited access to meaningful mathematics learning in classrooms in Lesotho. According to this study, access to meaningful teaching and learning of mathematics is compromised by the high stakes assessment practices that appear to favour summative over formative assessment. It is also claimed in this study that these high stakes assessment practices are often driven by standards-based curricula and policies, which offer minimal support to teachers when reforms are introduced.

1.2.4 The role of the Ministry of Education and Training in supporting education in Lesotho

The Lesotho Ministry of Education and Training (MOET) has been making efforts to improve education in schools in Lesotho through addressing challenges such as insufficient instructional materials, limited infrastructure in schools and chronic hunger

and ill-health among learners. The efforts included a policy on free primary education and a school feeding program, which provides lunch to learners to ensure that every learner has at least one meal a day. Schools were also provided with learning materials, such as free stationery for learners, mathematics and science kits per school for use by teachers and learners.

The MOET also introduced the Curriculum and Assessment Policy (MOET, 2009) which has reorganised and grouped subjects into five learning areas that are: “Linguistic and Literacy; Numerical and Mathematical; Personal, Spiritual and Social; Scientific and Technological; and Creativity and Entrepreneurial” (MOET, 2009: vi). The Numerical and Mathematical area was the focus of this study.

The curriculum policy also advocates for strategies that involve learners as the main active participants in their own learning and proposes new ways of assessing learners. Learners are assigned authentic tasks for assessment, which is continuous and includes learner portfolios, research or any task that requires a learner to create, analyse, judge, evaluate, assess, recall knowledge for application and invent. High-stake examinations are no longer encouraged. Schools are supplied with basic teaching and learning materials to be used to promote learning and assessment (MOET, 2009).

The efforts by the MOET to improve education have been directed at learners’ physical access to education to improve learners’ motivation to learn and perform well. However, access to education does not mean only being present in a school or a classroom but is viewed as “formal” and “epistemological” (Du Plooy & Zilindile, 2014). Formal access means that a learner is physically present in a school or a classroom. The assumption associated with this type of access is that the learners’ physical presence in the classroom will provide them with opportunities to engage actively in his/her learning. However, for epistemological access, physical presence is not sufficient without appropriate teaching and learning strategies (Westbrook et al., 2013). Therefore, formal access to the classroom may not be effective on its own. It can only become effective if it is supported by pedagogical access.

So far, there is little evidence that the MOET's efforts have been directed at the improvement of epistemological access in the classroom. Assisting teachers to use strategies that make learning accessible, particularly in mathematics, has been minimal. For example, providing teaching and learning resources to a school with the hope that teachers will use them to improve their teaching and strategies is not enough. If teachers lack skill in this area or hold different beliefs on how learners should be engaged in the classroom, they are likely to use these resources in ways that suit their beliefs. For example, Artzt et al. (2008) observed that the practices that dominate mathematics classrooms are knowledge transmission and the explanation of mathematical procedures and that learners need to listen carefully to absorb this knowledge. Policymakers in Lesotho are faced with the challenge of influencing teachers to change these strategies, which appear to dominate the classrooms (Moru et al., 2014; Moloji et al., 2008) leaving learners struggling to learn mathematics.

The Lesotho Curriculum and Assessment Policy (MOET, 2009) proposes alternative ways of assessing learners that include continuous assessment using authentic tasks and learner portfolios which provide learners with opportunities to carry out research or tasks that require them to engage skills at various levels of achievement as ranked in Bloom's Taxonomy. The required levels of Bloom's Taxonomy are recalling information, applying knowledge, inventing and creating, analysing and evaluating, and making a judgement. According to the Lesotho Curriculum and Assessment Policy, learner performance should be based on continuous assessment and not only on the performance in the high-stake examinations.

However, Moloji et al. (2008) note that there is very little evidence that the efforts of the government of Lesotho to improve teaching conditions in Lesotho have been directed to improving access to teaching and learning of mathematics. For example, the policymakers in Lesotho have not focused on influencing teachers to use effective teaching strategies and, as a result, ineffective teaching strategies dominate Lesotho's mathematics classrooms (Moloji et al., 2008).

Research has shown that curriculum changes that are made without providing teachers

with sufficient support that empowers them to use effective teaching strategies are doomed to fail (Jita & Vandeyar, 2006; Raselimo & Mahao, 2015; Raselimo & Wilmont, 2013). Empowering and supporting teachers through training and mentoring to use strategies that make learning accessible, particularly in the mathematics classrooms, appears to be the best way to provide epistemological access (Nyabanyaba, 2015). For example, providing teaching and learning resources to a school with the hope that teachers will use them to improve their teaching and strategies is not enough. If teachers lack skill in this area or hold different beliefs on how learners should be engaged in the classroom, they are likely to ignore reform efforts and to continue to use teaching strategies which they feel comfortable with. According to Artzt et al. (2008), practices that dominate mathematics classrooms that teachers appear to be comfortable using are the knowledge transmission, and the explanation of mathematical procedures that only require learners to listen carefully. The government's efforts, which so far have been directed at improving learning conditions but have not included teacher support, are likely to leave the situation unchanged.

1.2.5 Mathematics classroom practices

There has been a shift in the teaching and learning of mathematics. In the past, mathematics was perceived as a set of procedures and skills that were to be followed and mastered and that teaching would follow a “teach-example-exercise” model (Polaki, 1996 cited in Chitera, 2011). Currently, it is viewed as a body of knowledge that is socially situated (Leonard, Brooks, Barnes-Johnson & Berry, 2010) in which meaning is made in contexts, shared and negotiated among individuals participating in a learning process (Bottle, 2005; Cobb, 2000).

Franke, Kazemi and Battey (2007:226) note that there has not been a universal consensus on what constitutes good teaching. Their view is that “what constitutes good teaching is consistently controversial and will remain controversial”. According to Franke et al. (2007), the foundation of classroom activities should be classroom discourse and the tasks that drive such discourse. Anthony and Walshaw (2009) identify ten principles of effective pedagogy, which could be categorised in four major groups, namely,

classroom community, classroom discourse, tasks that enhance students' thinking and the role of teacher's knowledge. These are similar to Artzt, Armour-Thomas and Curcio's (2008) fundamental components of a lesson that are learning tasks, learning environments and discourse. Van de Walle, Karp and Bay-Williams (2013) outline the components of effective mathematics classrooms as:

An environment that offers all learners an equal opportunity to learn;

Teaching that focuses on balancing learners' conceptual understanding and procedural fluency;

Learning tasks that actively engage a learner in problem-solving, reasoning, communication, connections, and knowledge representation;

Technology integration that enhances learners' understanding;

Incorporation of multiple assessments that are aligned with instructional goals and mathematical practices;

Learner support that recognises the power of sound reasoning and mathematical integrity.

The required changes in the teaching of mathematics have led to the curriculum reforms and innovations in the field of mathematics education and numeracy in many educational systems. For example, in the United States of America (USA) the National Council of Teachers of Mathematics (NCTM) proposed reforms in the teaching of mathematics and numeracy that use teaching approaches that engage learners as active participants in their own learning (Van de Walle et al., 2013). This type of teaching should engage learners to participate in their learning through talk and manipulation of materials (Pratt, 2006; Spitzer & Roddick, 2008).

Accordingly, the Ministry of Education and Training in Lesotho has recently (MOET, 2009) introduced a curriculum and assessment policy (CAP-L) in schools. CAP-L demands that the teaching and learning of mathematics shift towards approaches that help learners to develop creativity, independence and survival skills (MOET, 2009:6). These approaches

should facilitate learning by first changing didactic teaching methods to participatory, activity-centred and interactive teaching methods, and secondly, assist learners to construct knowledge and acquire skills, values and attitudes.

The challenges of teaching mathematics in primary schools have been a concern for many countries around the world. A study undertaken by Li, Ma and Pang (2008) found that East Asian countries have different approaches to teacher preparation but they have a common view of the importance of training primary school teachers to teach mathematics effectively. Effective teaching is aimed at making the learning environment conducive for learners to develop knowledge where learners' levels of anxiety are kept low and learners are well guided and supported by the teacher. One of the key aspects of being an effective teacher, according to Cotton (2016:3), is having good mathematical subject matter knowledge. This quality enables teachers to deal with anxieties or insecurities they may have as when teaching mathematics (Cotton, 2016).

Anthony and Walshaw (2009), Franke et al. (2007) and Van de Walle et al. (2013) note that certain features of classroom practice affect effective teaching and learning of mathematics. For purposes of this study, these features are grouped into the following areas:

1. Teacher knowledge and its role in the classroom;
2. Learning environments and classroom communities;
3. Learning materials and mathematical tasks;
4. Classroom discourse;
5. Learner progress.

Research done (Nordstrum, 2015) in sub-Saharan countries that used classroom observations indicates that classroom practices are dominated by individual learner work in mathematics. The researcher (Nordstrum) indicates that such work is predominantly writing done by learners in their exercise books or learners listening to the teacher explaining concepts. Problem-solving and group work is rarely done in these countries.

The limited literature on mathematics classroom practices in Lesotho reveals that classroom practice has been dominated by learners working individually with the teacher's main role as explaining, with less problem-solving activities used in lessons (Marake, 2013; Moru et al., 2014; Moloji, Morobe & Urwick, 2008). These reported classroom practices are contrary to the objectives as stated in the CAP-L (2009).

1.2.6 Teacher professional identity and classroom practices

Teacher identity is an important factor in understanding teachers' professional performance and behaviours in the classroom (Arpaci & Bardakçi, 2016; Bjuland et al., 2012; Kouhpaenejad & Gholaminejad, 2014). Teacher professional identity encompasses all that defines a teacher or a group of teachers as professionals.

The main focus of this study was not to define teacher professional identity as a concept. Rather, it was to explain aspects of being a professional teacher in order to understand classroom practice. Scholars, such as Arpaci and Bardakçi (2016), Beijaard, Verloop and Vermont (2000), Beijaard, Meijer and Verloop (2004) and Kouhpaenejad and Gholaminejad (2014), agree that there is a lack of consensus on the definition of this concept. For example, Kouhpaenejad and Gholaminejad (2014) point to "a sense of belonging"; "the way we view ourselves and are viewed by others"; and "how a person or a group of people understand(s) or view their relationship with the world, how that relationship is constructed across time and space, and how a person understands possibilities for the future". According to Kouhpaenejad and Gholaminejad (2014:199), identity can be:

multiple, diverse, dynamic, varied, shifting, subject to change and contradictory ...
unstable, flexible, ongoing, negotiated ... a collection of roles or subject positions and
a mixture of individual agency and social influences (p. 199).

Kouhpaenejad and Gholaminejad (2014:199) also indicate that identity is constructed through "a mixture of social practices in which individuals are involved in their daily lives". They also refer to the dynamic ways in which identities are constructed and changed, that is "socially organized, reorganized, constructed, co-constructed, and continually

reconstructed through language and discourse” (Kouhpaenejad & Gholaminejad, 2014:200). These perceptions about identity have departed from the views, which conceived teacher identity in singularity where a teacher’s image is expected to be the same as every other teacher in a community. The various existing perceptions of individuals or groups have the potential to create a conflict of identities in an individual where the teacher sees multiplicity in his or her identities and hence in the roles the teacher assumes. For example, being a teacher and giving a challenging assignment, which extends learners’ critical thinking and deepens their knowledge, may conflict with a teacher’s perceptions of the role teachers have to assume as parents and their need to understand the challenges of a child failing to complete the given task because of problems not related to school. In this case, the teacher must deal with such conflicts and this makes choices about classroom practice challenging. At the classroom level, the teacher may also assume varying identities, which include personal, social as well as professional.

Professional identity is associated with the profession of an individual or a group of people. Beijaard et al. (2000) explain teacher professional identity as teachers’ perceptions of their expertise regarding aspects of classroom practice such as subject matter knowledge and pedagogy. Some of the factors that influence teacher professional identity include the cultural and historical contexts in which teachers live and work (Battey & Franke, 2008:128; Beijaard et al., 2004). Pearce and Morrison (2011) believe that teachers develop professional identities in the early stages of their careers as a result of their interactions with colleagues and students. Botha and Onwu (2013) explain that the formation of professional identity is a complex matter that depends on personal experience and social settings in a school or college. In addition to this explanation, Fajardo Castañeda (2014) notes that teacher professional identity develops from experience gained during the pre-teacher training period.

Hsieh (2013) extends arguments about the development of teacher professional identity by discussing what she terms “sources of teacher professional identity” that fall into three categories. The first source of TPI, according to Hsieh (2013) is teachers’ own

experiences (when they were learners), of teacher behaviours and teaching approaches which learners may want to emulate when they become teachers (Page and Clark, 2010). The second source, highlighted earlier by Komba and Nkumbi, (2008), is classroom experiences that the teacher is exposed to at the workplace which provide frameworks for developing, negotiating and re-developing identities. The third source is teachers' exposure to external discourses related to teaching through engagement in research or professional development programs (Renga, Peck, Feliciano-Semidei, Erickson and Wu, 2020). These teacher professional identity sources provide a basis from which teachers may situate their preferences for good classroom practices. The three sources of identity formation, according to Hsieh (2013), shape teachers' identities into professional inclinations that she refers to as three orientations, which are the self-identity orientation, the classroom identity orientation and the dialogic identity orientation. Teachers in Hsieh's (2013) study showed individual differences in their orientations to the different identity sources, thus developing different identities.

Hsieh's model for conceptualising teacher professional identity has similarities to that proposed by Mockler (2011) which comprises three domains: (1) personal experiences which include teachers' own experiences of school while these teachers were learners; (2) professional contexts which refer to aspects of experience that include professional learning and development and issues of school contexts that influence professionalism; and (3) the external political environment which refers to the external discourses about teaching and learning which emanate from research or policy.

The explanation of what influences teacher professional identity, as seen by different scholars, directed the questions used when data were collected. Ideas emanating from these models, therefore, influenced the conceptual framework developed to guide this study.

Mathematics teachers develop their identities that interact with classroom practice. Spillane's (2000) study established that a lack of confidence in mathematics prevents a teacher realising and creating learning opportunities to respond to the demands of a reformed curriculum. The identity of the teacher in Spillane's (2000) study was

characterised by inadequate confidence and low self-esteem shown by her reliance on the textbook for classroom activities, and her discomfort with mathematics. The teacher followed routine traditional classroom practices that included emphasising correct answers at the expense of the process of inquiry and explanations of how the answers are obtained. Similar challenges were reported by Jita and Vandeyar (2006) where two teachers in their study also had backgrounds that did not give them confidence in handling mathematics. One of the two teachers constructed her identity in ways that reflected a lack of knowledge and skills while the other was more flexible and constructed her identity using reform ideas to experiment and learn with her students. However, these teachers' classroom practices did not change as mathematics was still treated in routine and algorithmic ways.

The two studies referred to above suggest orientations around which teacher professional identities can be developed. First, teachers appear to embrace requirements of the current curriculum by using materials and classroom settings that fit these requirements while they actually employ traditional approaches to handle classroom tasks and discourses. Secondly, teachers become learners of mathematics and learners of how to teach mathematics. Thirdly, teachers create opportunities for themselves to unlearn old practices and incorporate personal experiences as resources to reflect on their own practices.

1.3 Problem Statement

Challenges in teaching primary school mathematics for understanding are encountered in many countries around the world, including Lesotho. These challenges emanate from factors that include a rise in enrolments and insufficient resources in primary schools that impede effective preparation and teaching and in particular in the use of learner-centred approaches in teaching mathematics.

In pursuit of a solution to the challenges of teaching mathematics for understanding, studies have been carried out regarding classroom situations, the role of the teacher (NCTM, 1988; Westbrook, Durrani, Brown, Orr, Pryor, Boddy & Salvi, 2013) and

competencies of learners and teachers (SACMEQ; TIMSS; PISA) to inform policy development. Studies have also been done on teacher identity with a focus mainly on pre-service teachers (Lerseth, 2013). Lerseth (2013) proposes that, for a deeper understanding of how teachers develop identities from their training to their classrooms, research on identity formation should be done over several years.

In this study I investigated teachers' identity in the context of teaching of primary mathematics (and numeracy) as there appears to be a gap in the literature of studies on how qualified primary school teachers with experience in teaching perceive themselves as professionals in teaching mathematics and how their teacher identities influences their classroom practices. The focus of the study was particularly in contexts that are complex in nature in less developed countries such as Lesotho. These contexts experience a number of challenges, such as shortage of qualified teachers, classroom furniture and other infrastructure, and overcrowding especially in primary schools with the introduction of free primary education (FPE) (Ntho and Lesotho Council of NGOs. 2013). This study examined how primary school mathematics teachers (see section 1.12 for the definition of 'primary school mathematics teacher' in the context of this research) in Lesotho develop and express their professional identities in relation to their mathematics classroom practices, in the context of a less developed country.

Problems associated with mathematics teaching and learning in Lesotho schools have been observed by Moloji et al. (2008) who found that learner performance in mathematics (and English) at primary schools in Lesotho has been constantly unsatisfactory. They identified factors, including pedagogical approaches, which negatively influence the learning of mathematics. These pedagogical approaches include teachers' knowledge of professional content, interpreting curriculum documents, such as syllabi, lesson planning, presenting a lesson and classroom language and communication (teacher-learner interaction and learner-to-learner interaction).

Research on teacher professional identities has mainly focused on the formation of these identities with a further focus on new teachers (Fajardo Castañeda, 2014; Morrison, 2013; Pearce & Morrison, 2011), pre-service student teachers (Beltman, Glass, Dinham, Chalk

& Nguyen, 2015; Lerseth, 2013; Olsen, 2008) and continuing professional development programs (Chere-Masopha, 2011; Graven, 2005; Pausigere & Graven, 2013). Contrary to other studies, this study focused on teachers who, based on their length of service, have had a significant amount of exposure to classroom situations. This provided an opportunity for the study to establish the professional identities of experienced primary school mathematics teachers. Even though it is assumed that the identities of these teachers are well developed, it is acknowledged that teacher professional identities are not stable, but rather dynamic and constantly being modified by those who hold them (Kouhpaenejad & Gholaminejad, 2014; Sfard & Prusak, 2005). Many of the previous studies in teacher identities were done in developed countries and few in developing countries. This study was based on experiences of teachers in Lesotho, which is classified among the least developed countries of the world (GOL, 2014). This provided a variety of backgrounds characterised by low socio-economic status among communities within which Lesotho schools are found.

The NCTM (1988) in the USA advocates the retraining of teachers to meet the teaching and learning needs of the 21st century classroom that engage learners in meaningful and authentic learning activities. The MOET (2009: viii) agrees that learners should be engaged in authentic and interesting activities that are a shift from a “didactic” approach to more “participatory, learner-centred and interactive” approaches. Teacher training and development in Lesotho should also be directed towards improving teachers’ attitudes, knowledge and skills that will enable them to use pedagogical strategies for meaningful learning that engage and motivate learners to actively participate in mathematics classrooms. However, to achieve this, they should first have knowledge of the practices used by teachers in the classrooms. This study therefore explored teachers’ pedagogical practices that are used by teachers in mathematics classrooms in Lesotho and how they relate to the teachers’ professional identities. This focus of the study is reflected in the research questions below.

1.4 Research questions and aim and objectives of the study

1.4.1 The research questions

The main research question for the study was:

How does teacher professional identity shape teachers' choices of teaching and learning practices in primary school mathematics classrooms in Lesotho?

The sub-questions that led the study were:

1. What are the critical components of professional identities as expressed by selected primary school mathematics teachers in Lesotho?
2. What are the major features of the mathematics classroom practices that are evident in the selected primary school teachers' classrooms?
3. How do primary school teachers construct and express their identities in relation to their mathematics classroom practices?
4. How can the relationship between the teachers' identities and their classroom practices be described and explained?

1.4.2 The aim and objectives of the study

The aim of this study was to investigate how teacher identity shapes mathematics classroom practices in selected primary schools in Lesotho.

The objectives of the study were to:

1. Uncover and describe the critical components of professional identities as expressed by selected primary school mathematics teachers in Lesotho;
2. Identify and explore major features of the mathematics classroom practices that are evident in the selected primary school teachers' classrooms;
3. Establish how primary school teachers construct and express their identities in relation to their mathematics classroom practices; and

4. Understand and explain the relationship between teachers' identities and their classroom practices.

1.5 Rationale of the study

Earlier in this chapter, the policymakers' efforts that are intended to improve access to education and their effectiveness were discussed. It was also pointed out that formal access to education, which is the main aim of these efforts, does not guarantee access to learning. Access to learning is improved by teachers' choices and the use of appropriate methods that benefit 21st century classrooms, making it important to have information about the pedagogical strategies that teachers use in mathematics classrooms and the factors that influence the teachers' choices.

Moloi et al. (2008) established that teachers lacked professional practices. While some teachers were aware of their deficiencies, others were not. This makes the study of teachers' professional identities and the relationship with classroom practice relevant, particularly for experienced teachers who could provide meaningful guidance to newly recruited teachers.

1.6 Significance of the study

The findings of this study are important to the teacher training institutions and educational research fraternity in Lesotho and beyond. So far, the MOET has directed its efforts towards physical access in primary school classrooms. There is a need for efforts to also be directed towards pedagogical access to mathematics. The information collected by this study could be used to understand how and why teachers teach mathematics in the way they do. This will enable stakeholders to engage in ways in which teaching and learning is supported to promote learners' pedagogical access to learning mathematics. Mathematics and other subject teachers in Lesotho schools can also use the information provided by this study to reflect and improve on their own professional practices. This study further contributes to the existing body of knowledge about classroom practices in the field of primary school mathematics in the African context.

In particular the results of this study will contribute to literature and debates about the relevance of teacher professional identity in teacher development and classroom practice with a focus on the teaching and learning of primary school mathematics. The study first describes how teachers develop and express their professional identities and how these PIs influence classroom practices in teaching mathematics to highlight the relevance of the social identity approach in the field of teaching (Tsakeni, 2014). The results will inform initiatives towards school-based professional teacher developments with support from stakeholders that include the Ministry of Education and Training [MOET], and the two institutions that train teachers, NUL and LCE, in Lesotho. This also includes the primary schools' in-service support staff (the District Resource Teachers and DRTs) who receive little or no training to prepare them to support teachers in Continuing Professional Development (Mulkeen, 2010). The study further contributes to research by confirming the relevance of teacher narratives not only in studying teacher professional identities but also in dealing with identities of experienced teachers in diverse contexts which may be characterised by limited resources for teaching and learning. Lastly, the study adds to the literature on issues of teacher professional identities in the Lesotho context.

1.7 Overview of the Theoretical Framework

The study was grounded in Social Identity Theory (SIT). Hogg, Terry and White (1995:6) explain SIT as “social psychological theory of intergroup relations, group processes, and the social self”. They further indicate that the social category into which individuals fall, or where they feel a sense of belonging, define who these individuals are in terms of the characteristics associated with that category. So, the social groups into which members of society, including teachers, feel they belong give them an identity.

Identity Theory (Hogg et al., 1995), on the other hand, deals with role identity. It emphasises that behaviour is prescribed by the role a person assumes in a social group. Identity Theory is not a social psychological theory and therefore does not explain the socio-cognitive processes associated with identity and role. SIT is preferred because it considers the socio-cognitive processes as well as the socio-historical dimensions of the

intergroup relations. Social identity can, therefore, be seen as a social construct that mediates between an individual and the society.

According to Cable and Welbourne (1994), social identity theory is used to explain individuals' behaviours in the workplace. Gee (2001) and Sfard and Prusak (2005) also argue that identity could be used to study and explain human behaviour and activity. According to this theory, an individual's self-concept is derived from the "knowledge of membership in a social group together with the value and emotional significance attached to that membership" (Cable & Welbourne, 1994:6). Pausigere and Graven (2013) liken SIT to the theory of constructivism. Both theories are of the view that knowledge is socially constructed. This means that all human beings learn by interacting with their social environment. For example, Simon (1995) claims that teachers understand how their learners learn if they see learning as both an individual and a social construct. The same could be said for teachers; their interaction with and experiences in their social environment in schools and in communities contribute to how they define themselves as professionals. Boaler (2000) emphasises that individuals' interactions with their complex social systems ensure the construction of deep and meaningful knowledge.

Social Identity Theory has limitations (Korte, 2007). These include the varying use of the term "identity" in different disciplines, debates on identity as an individual or social and the disconnection between explanation and prediction. These limitations do not limit this study because an individual's identity is studied in relation to the society and context within which the individual operates. So, identity is viewed by this study as both individual as well as social.

1.8 Overview of the Conceptual Framework

Teacher professional identity and mathematics classroom practices are key concepts in this study and therefore become a part of the framework for the analysis of data. Some teacher identity studies (Alsup, 2004; Fajardo Castañeda, 2014; Hsieh, 2013; Spillane, 2000) have shown that identity develops from experiences that teachers had while they were learners themselves prior to, as well as during, teacher training. Studies also

indicate that identities develop at the workplace as teachers interact with other teachers and the school environment (Battey & Franke, 2008; Beijaard et al., 2004; Botha & Onwu, 2013; Pearce & Morrison, 2011).

In order to view teachers' development of their professional identities as they develop into more experienced mathematics teachers, four dimensions of identity factors or sources are considered: personal, professional, school context and external factors. These dimensions of identity factors are related to key areas of classroom practice listed below:

- Teacher learning and knowledge
- Learning environments and classroom communities
- Mathematical tasks
- Classroom discourse
- Learner participation (Adler & Ronda, 2015; Van de Walle et al., 2013).

The study attempted to establish the participants' personal experiences, professional experiences, contextual issues and related external factors with regard to their work and how these four aspects interact to shape teacher professional identities of the participants and how their identities then shape their practices.

Sachs (2001:7) points out that experiences in school and outside school mediate meanings that teachers create as they negotiate their identities. Zembylas's study (2003) on emotions and teacher identity underscored the importance of understanding teachers' emotions as these provide them with opportunities for transformation and hence reshaping of identity. Zembylas's (2003:1) study was a result of his interest in exploring "how teachers' emotions can become sites of resistance and self-transformation". This study established how teachers forge professional identities from aspects of their experiences that could be classified as personal, professional, school context and external factors and how these identities shape the teachers' classroom practices.

1.9 Research design and methodology

This study followed a qualitative research approach in data collection and analysis. The design included case studies of three teachers who were participants in this study. According to Cohen, Manion & Morrison (2011:537), qualitative study generates data that the researcher can make sense of “in terms of the participants’ definitions of the situation, noting patterns, themes, categories and regularities”. Methods of data collection were semi-structured interviews yielding narratives in the form of life-stories (Neuman, 2003) and non-participant lesson observations (Gay, Mills & Alrasian, 2012). This approach to research was preferred because it allowed teachers to discuss their own beliefs, dispositions, devotions, experiences and practices and how they are influenced by the contexts in which they live and work. A qualitative research approach also allows for the analysis of data in the form of teachers’ stories of their experiences and classroom practices in order to derive meaning from patterns, themes, categories and regularities.

Cohen et al. (2011:289), based on Yin’s definition, describe a case study as “a study of a case in its context”, thus providing an opportunity for a general problem to be explored within its natural setting (Van Wyk & Taole, 2015). Glatthorn and Joyner (2005:103) argue that case studies provide “the detailed description of a particular situation, organisation, individual, or event”. Grounded in the theory of social identity, the study intended to collect detailed information about teachers’ perceptions of their profession and how they influence their practices in a mathematics classroom. Therefore, a case study was considered appropriate for collecting data for this type of study.

Case studies can use any or a combination of qualitative methods to explain a problem or a situation. In this study, classroom observations and interviews were used to collect data. The interview method was chosen because it allows participants to tell their stories, which include their personal and professional beliefs, experiences and biographies, in a narrative form. This reasoning is supported by Muylaert, Júnior, Gallo, Neto and Reis (2014) who assert that narrative interviews provide for depth and detail in data collection of life stories, which are combined with socio-cultural situations that allow for the understanding of teachers’ experiences in the teaching of mathematics in their actual and

real contexts. The observation method was used to view and document classroom activity as it unfolded. This provided me with first-hand experience and information about how the teachers enacted with the mathematics curriculum.

It is justifiable that, in order to understand the influence of teachers' identities in the choices of classroom practice, one needs to listen to teachers' stories and to observe teachers teach, just as Kouhpaenejad and Gholaminejad (2014:200) point out that "[i]dentity is regarded as a phenomenon that comes out of a mixture of what is said and done".

1.9.1 Participants

The participants of this study were three primary school teachers from rural and urban schools in Maseru, Lesotho. The different economic regions provided contexts that differed in a number of ways including school facilities, support and motivation afforded to teachers.

The criteria that were used to select these teachers also included the following:

- Teacher qualifications: The teachers were to be holders of any primary school teaching qualification obtained in Lesotho. The reason for this being that the focus of the study was on these teachers' conceptualisation of themselves as teachers of mathematics in Lesotho primary schools and how this relates to their teaching of mathematics. So, the context of the study and that of these teachers' training was not very different.
- Years of teaching experience: Five years or more would give the teacher an opportunity to teach most of the grade levels.
- The teachers should have taught at both junior and senior primary levels in the period of their experience for a wider experience across levels.
- They should have received their school education (primary and/or secondary) in Lesotho.

Identities are said to be life histories, therefore, teachers with more years of experience are more likely to share life histories that reflect more experience in terms of teaching mathematics.

1.9.2 Data analysis

Narrative thematic data analysis (Buttina, 2015) was used to analyse data in this study. A qualitative research approach allows for analysis, which derives meaning from patterns, themes, categories and regularities which appear in narratives obtained from this type of study (Cohen et al., 2011). First, transcriptions of audio and video recordings from interviews and classroom observations were done. The transcripts were read and coded for key issues related to teachers' beliefs, dispositions and experiences. Patterns began to emerge (Creswell, 2013) which suggested teachers' constructions of identities. Patterns of classroom practices also emerged and were noted. Categories were formed from these patterns. Patterns that emerged from the different data sources led to categories that developed into themes based on similarities and differences of elements of these categories. Patterns, themes and meanings were explored within each case as well as across the three cases to generate similarities and differences among the cases, which then indicated the critical components of professional identity and major features of mathematics classroom practices in these teachers' classrooms. The similarities and differences, which included peculiar cases, formed the findings, which were then interpreted using related literature in order to describe and explain the relationship between teachers' identities and their classroom practices.

1.9.3 Ethical considerations

Issues on ethical consideration were observed. I applied for permission to do the study from the Maseru district education office of the Ministry of Education and Training. This letter of permission was used to apply for ethical clearance from UFS and also for requesting permission to conduct research in schools, observing ethical considerations on entry to research sites (Gay et. al., 2012). I then identified participants and their schools and requested permission from the principals of those schools to carry out a

study. This was done by writing letters to the principals of these schools. As part of ethical considerations, I informed the principals and participants that data collected would be used for purposes of this study only. Further, confidentiality (Leedy and Ormrod, 2013) was ensured at all levels of our interactions with the participating teachers and lastly, that the identities of the participating teachers and their schools would be concealed. I further indicated that, if the participating teachers should have concerns about the study as it progressed, they were free to withdraw from the study at any time. Then I requested that the principals and participants who agreed to take part in the study also sign letters of consent (Cresswell, 2014). Lastly, during the classroom observation sessions, I assumed a non-participant observer role. This ensured non-interference in the proceeding of classroom activities.

1.10 Delimitations

The study focused on the exploration of the relationship between teacher professional identity and classroom practice. The study also focused on three participants and this provided a reasonable amount of time to be spent on interviews and lesson observations. This focus enabled me to draw out participants' life stories to understand how teacher professional identities influence classroom practice. These narratives, in the form of life stories, needed to be done collaboratively and be validated for accuracy by the participants, hence the need for the focus on these few participants (Gay et al., 2012).

1.11 Limitations

This study was based on narratives of teachers' experiences which involve personal issues that teachers had to share. This aspect required an element of trust between the participants and the researcher (me), something which the participants may not have been easily convinced of, hence the chance that the participants may have decided to limit sharing their personal experiences. However, the three participants showed openness and willingness to answer the questions in the interviews and willingness that their lessons be observed. The results of this study could not be generalised to a larger population of teachers but could provide indicators of teacher identities and related

practices for particular contexts. The reason is that the focus of the study was on personal experiences of participating teachers where each teacher represented his/her own ways of viewing the world around him/her.

1.12 Definition of terms

Mathematics classroom practices, as used in this thesis, refer to common practices that reflect teaching and learning activities as depicted by observations of mathematics classrooms around the world. In the context of Lesotho, mathematical subject matter is named differently according to levels; Numeracy (Grades 1 to 4), Numerical and Mathematical Learning Area (Grades 5 to 6) and Mathematics (Grade 7). For purposes of this study and consistency herein I use the term Mathematics to refer to subject matter in cases that cut across all levels of the primary school, otherwise appropriate terms for each lower level.

The term *primary school mathematics teacher* refers to the teacher who teaches any of those subject matter areas (Numeracy at Grades 1 to 4, Numerical and Mathematical Learning Areas at Grades 5 to 6 and Mathematics at Grade 7), for consistency. Otherwise appropriate terms such as Numeracy teacher for the appropriate level in specific cases. Primary school teachers in Lesotho are trained to teach all subjects/learning areas. For a brief history of mathematics teacher training for primary schools in Lesotho, see section 1.2.3 above. The study accommodate Gee's (2001) view to identity as comprising multiple ways in which an individual may be perceived.

For the purpose of this study, I adapted Beijaard et al. (2004)'s definition of professional identity to define *teacher professional identity* as an ongoing process of interfacing of the personal, the professional and the contextual factors which help to define a teacher for purposes of understanding the teacher's roles and behaviours when interacting with the school (and out-of-school) community, the environment, as well as the subject matter he has to teach.

Junior secondary school level refers to the lower classes in secondary school education.

According to the Lesotho Qualifications Framework [MOET, 2019:23] this level is currently equivalent to Junior Certificate level.

The senior primary school level extends from Grades 5 up to Grade 7.

1.13 Overview of this thesis

This thesis is structured into six chapters. **Chapter 1** gives an introduction of the study and discusses the background of the study, the research questions that guided the study, the literature reviewed, the conceptual and theoretical frameworks, and the research design and methodology used to collect and analyse the data. **Chapter 2** discusses the literature that was reviewed. The focus of this review is on the studies which investigated the factors influencing teachers' practices in the mathematics classroom. A review of the literature on the influence of teacher professional identities in other disciplines is also reported. The discussion of theoretical and conceptual frameworks forms part of this chapter. The design and methodology of the study are discussed in **Chapter 3**. This includes the discussion of how the participants were selected and the research instruments used. The chapter also reports on how research ethics were considered and dealt with. The descriptions of the tools and methods used to analyse the data collected are also provided. Data are presented and explained in **Chapter 4**. This includes a presentation of cases of the three teachers. **Chapter 5** focuses on the cross-case analysis of the three teachers where the cases are compared and contrasted and the recurring and diverse themes are identified. **Chapter 6** presents a discussion of the findings, the conclusion and recommendations made by the study.

Chapter 2

Literature Review

2.1 Introduction

Conroy, Becker and Menges (2017) argue that the way people define themselves shapes how they perceive and understand the world around them. This study aimed at establishing teacher identities of selected primary school teachers in Lesotho and how these identities influence teachers' classroom practices. Literature on teacher identities indicates that teachers develop certain identities as a result of their experiences as learners (Akkoç & Yeşildere-İmre, 2017; Boaler, William & Zevenbergen, 2000) and also as trained teachers (Beltman et al., 2015). These identities manifest as teachers' views, perceptions, beliefs and experiences about themselves and the teaching profession. Teacher professional identities also explain teacher learning and professional development (Mockler, 2011).

This chapter describes the literature that was reviewed to learn what researchers have so far documented about issues related to identities and classroom practice in general, but also specifically in the context of the primary school mathematics classrooms. The description also includes a theory related to the concept of identity and a discussion of the concept of classroom practice.

The literature review in this study covers the following areas:

- Teacher professional identity: Definition and construction;
- Curriculum reform in Lesotho and beyond;
- Mathematics classroom practices in primary schools in Lesotho and beyond;
- The relationship between teacher professional identity and mathematics classroom practices;
- Effective teaching of primary school mathematics;
- Theoretical and conceptual perspectives related to identities and classroom

practice.

The chapter focuses on the following areas: the introduction (this section), the definition of key terms, the empirical literature which provides a report of expert views and experiences from previous research and an accompanying discussion of the key concepts from the empirical literature, the theoretical framework, the conceptual framework and the summary and conclusion.

2.2 Teacher professional identity

The focus of research on teachers' identities has been teachers' beliefs, behaviour and confidence and also classroom practice and assessment. Battey and Franke (2008:127) have used teachers' identities to study the dilemmas teachers face when implementing what they have learnt from the teacher professional development programs in which the teachers participate in the process of becoming teachers and gaining more experience in the profession.

Teachers regularly receive and are expected to implement curriculum prescriptions proposed by curriculum developers that are reflected in documents such as curriculum policy documents, syllabi and prescribed textbooks. These proposed curriculum prescriptions impact on individual teachers' attitudes and beliefs, sometimes complementing the attitudes and beliefs and at other times contradicting them.

The concept of teacher professional identity is used in this study to understand how teacher identities influence classroom practice in the teaching and learning of mathematics in Lesotho primary schools, in the context of curriculum changes. Hence, the research question was "*How does teacher professional identity shape teachers' choices of teaching and learning practices in primary school mathematics classrooms in Lesotho?*"

2.2.1 Identity and teacher professional identity

The concept of identity has been defined by Olsen (2008:4) as a person's "individualised

self-image” that is autonomous and directed by the owner. Olsen (2008:4) further defines identity as “a more situated, dynamic process of individuals developing conceptions of themselves as rational beings over time”. The definition of the concept of teacher identity has been elusive (Arpaci & Bardakçi, 2016; Beijaard et al., 2004; Beijaard et al., 2000; Bjuland et al., 2012; Kouhpaenejad & Gholaminejad, 2014). In their study, which focused on a review of the literature on the concept of identity, Kouhpaenejad and Gholaminejad (2014) discuss various definitions that include: “the way we view ourselves and are viewed by others” (Wu, 2011 cited in Kouhpaenejad & Gholaminejad, 2014) and also “how one understands one’s relationship to the world; how that relationship is constructed across time and space; and how the person understands possibilities for the future” (Norton, 2000 cited in Kouhpaenejad & Gholaminejad, 2014). Gee (2001:99) believes that it is “being recognised as a certain kind of person”.

Kouhpaenejad and Gholaminejad (2014:200) further indicate characterisation of identity by:

multiple, diverse, dynamic, varied, shifting, subject to change and contradictory, ... unstable, flexible, ongoing, negotiated, it is indeed a collection of roles or subject positions and a mixture of individual agency and social influences.

These characteristics indicate that identities are not stable as they involve roles, responsibilities and status defined by the society to which the participant belongs.

In Komba, Anangisye and Ktabaro (2013)’s study, participants’ narratives pointed to dimensions of teacher professional identity. These dimensions are “identity as negotiated experiences, identity as community membership, identity as learning trajectory and identity as nexus of multi-membership”. Fajardo Castañeda (2014) reaffirms these dimensions of TPI when he remarks that whilst the process of learning is an individual experience, it is socially negotiated. He goes on to highlight that teachers who are new to the profession perceive it differently from those who are close to retirement. In other words how teachers view themselves in relation to the profession may differ depending on experience. Gee (2001), on the other hand, has four categories of identities which

comprise “nature-identities, institution-identities, discourse-identities and affinity-identities”. In the context of a school and the teacher, nature-identity refers to identity assumed from natural being, such as being a male or female teacher. Institution-identity refers to the teacher’s identity linked to institutional accolades such as having a particular office, for instance, the head of the mathematics department or section. Discourse-identity refers to identity linked to how people in this teacher’s environment talk about and characterise the teacher. Affinity-identity refers to identity linked to the working groups that the teacher is associated with, such as being a member of a particular research group which has its own activities and interests. In their study, Beijaard et al. (2004:113) described teacher professional identity as an “ongoing process of integration of the ‘personal’ and the ‘professional’ sides of becoming and being a teacher”. Arguments by these scholars point to an area that has already been alluded to, that identities are viewed, described and defined in various ways. However, some key concepts can be drawn from these arguments, and some of these key concepts are: *contexts, experiences, learning, membership (belonging) and negotiations*. These concepts form part of the key discussions related to identity and teacher professional identities in the latter part of this thesis.

2.2.2 Forms of teacher professional Identities

According to Beijaard et al. (2000), teachers’ professional identities depend on the area of professional engagement and development that the researcher is engaged in because identities are related to subject matter and pedagogy. Beijaard et al. (2000) found that, as mathematics teachers gain experience, they shift their identities from subject matter to other aspects of teaching, such as pedagogy. On the other hand, Bjuland et al. (2012) suggest the use of “identity indicators” that could take the form of themes coming out of experiences shared in teachers’ clustered reflective narratives that relate to how the teacher engages and is aligned with the community of participants. These identity indicators are: (1) Positioning about pupils; (2) Reflecting on developing a workshop model in teaching; (3) Integrating and expanding models of teaching; and (4) Challenging positioning about didacticians (Bjuland et al., 2012; Molino & Ochoviet, 2019). The

authors argue that teacher professional identities relate to teachers' reflections about how they handle subject matter, pedagogical issues and consideration of learners' roles in planned classroom activity.

Alternative to the teacher's classroom practice experience mentioned above, Essien (2014:62) raised another dimension, where identity may be associated with teacher's experiences as a learner. Essien (2014) notes that mathematics teacher trainees can construct multiple identities through experiences they are exposed to in mathematics teacher education classrooms. These identities include:

becoming a teacher of mathematics, becoming learners of mathematics, becoming learners of mathematical practices and becoming proficient English users for teaching or learning mathematics and, finally, in multilingual contexts, becoming teachers of mathematics in multilingual classrooms.

Research dealing with teacher professional identities views identity development as a process of negotiation between the individual and contextual factors (Gellert, 2013; Gormally, 2016; Hsieh, 2010). This process is often a tussle between individual aspirations and contextual factors that hinder the realisation of such aspirations. Hsieh's (2013) study introduces three identity orientations that people follow as they develop their identities – self-orientation, classroom orientation and dialogical orientation. These identity orientations provide insight into how teachers privilege each of the teacher professional identity sources as they adjust or conform to contextual factors.

Hsieh (2013) refers to sources of teacher professional identity by describing three broad areas which are teachers' own experiences as learners, classroom hands-on experiences and theory or research that teachers are exposed to. Teachers' own experiences as learners provide them with opportunities to observe how they are taught and these provide models that they may want to imitate when they become teachers (Page and Clark, 2010). Teachers also come across a variety of experiences in and around their classrooms. These experiences provide teachers with opportunities to develop, negotiate and re-develop their own professional identities (Komba and Nkumbi, 2008). Teachers

are exposed to theories related to teaching and learning during the pre-service period and the sessions for in-service professional development. These theories provide them with opportunities for engagement on discourses (Renga, Peck, Feliciano-Semidei, Erickson and Wu, 2020) about teaching, learning and classroom practice. These sources of teacher professional identity provide a foundation upon which teachers position their classroom practices based on orientations of their professional identities, namely, self, classroom and dialogic identity (Hsieh, 2013). Teachers in Hsieh's study showed individual differences in their orientations to identity sources thus developing different identities.

These views of teacher professional identity by different scholars influenced the development of the questions used in the process of data collection for this study.

2.2.3 Construction of Teacher Professional Identities

Hsieh (2010:6) points out that identity construction starts with a choice as an individual's identity becomes realised through "repeated practice, response and negotiation". Eventually, an individual's identity is constructed as a result of regularised patterns of practice and as the individual begins to understand his/her practice in contexts such as a primary school mathematics classroom.

The construction of identity depends on cultural and historical contexts within which an individual operates, and that identity influences and is, in turn, influenced by knowledge and skills that the individual develops (Battey & Franke, 2008; Beijaard et al., 2004). Kouhpaenejad and Gholaminejad (2014:1) concur as they argue that identity is constructed through "a mixture of social practices in which individuals are involved in their daily lives". They also refer to the dynamic ways in which identities are constructed and changed, when they point out that identity is, "[...] regarded to be socially organized, reorganized, constructed, co-constructed, and continually reconstructed through language and discourse".

Formation of professional identity at the beginning of a teaching career is a complex affair

(Botha & Onwu, 2013) that depends not only on a person's life experiences but also on his/her growth through schooling at different levels and in work-related contexts. These factors include: "individual life histories, the quality of initial teacher education, school context as well as national context" (Botha & Onwu, 2013). These factors could be referred to as the teacher's experiences (life histories as well as school-based experiences), technical knowledge (content and pedagogical) gained from initial teacher training (quality of initial training) and the contexts (school and nation) within which the teacher operates. Fajardo Castañeda (2014) refers to experience and influence gained before teacher training, which includes advice from parents and previous teachers as among the factors that have an influence on an individual's choice to become a teacher. Fajardo Castañeda (2014) also refers to influences emanating from the teaching community in schools as an important factor in developing, shaping and maintaining teacher professional identity. This happens as the trained teacher gains more experience in the teaching profession through interaction with colleagues, learners and materials that include curriculum materials.

The development of professional identity in teaching becomes an ongoing process that starts before a person trains to become a teacher, continues into initial teacher training, then at the workplace. For purposes of this study, various stages that provide sources for teacher professional identity development are considered, and these include:

Before teacher training (where learning is experienced at a level before teacher training; with experiences including or leading to attitudes and beliefs about mathematics, how it is taught and how it is learnt. Other external forces from home and immediate community also have a bearing on the individual experience at this stage);

During initial teacher training (where technical knowledge which includes content and pedagogy is gained);

At the workplace (where an individual gains experience as a teacher; such experience may lead to modifications in attitudes and beliefs and hence teacher professional identity).

Key to these stages is the ability of the teachers and their roles in mathematics

classrooms, related to the teaching and learning processes.

Komba et al. (2013) identified factors that relate to the formation of teacher professional identity among university lecturers in Tanzania. Three factors are referred to in relation to Komba et al. (2013)'s study and these are training in content and pedagogy, practical work experiences and continuing professional development programs. The author has seen a major influence resulting from training in content and pedagogy, as well as practical workplace experiences acquired by academic staff members, agreeing with Hsieh (2010; 2013)'s attestation that one of the identity sources is teacher's professional experiences that include the classroom experiences. The authors, however, established that continuing professional development programs make very little impact because they occurred very infrequently.

Oswald and Perold's (2015:1) study on a primary school in a historically disadvantaged area in South Africa established that teachers' identity development results from, among others, social factors such as the social history which is "re-authored in response to new circumstances". Such circumstances include the political and educational changes that took place in South Africa after 1994. In the case of Lesotho, the educational changes that relate to this issue include the inception of the new curriculum in 2009, which has brought significant changes, particularly at the primary school level. Among these changes and as also proposed by the MOET (2009) is a shift in teaching approaches from teacher-centred to learner-centred approaches that require a significant shift in the teacher's mind-set, especially given the economic challenges that Lesotho faces which impact negatively on the support that the Ministry of Education and Training affords the teachers and schools.

2.2.4 Curriculum reform and teacher identity: An international perspective

Remillard (2005) investigated how researchers view the curriculum. One of the key findings indicates that curriculum use is a complex process due to ways that the roles of teachers are conceptualised in the curriculum and these complexities resulted in the teachers remaining confused about their roles in the reform implementation. Remillard

(2005:29) suggests that teachers “need to learn about the content, goals, approaches, and underlying assumptions of the curriculum they are being asked to use”. Teachers need help to understand the use of various curriculum documents such as the syllabi and the teachers’ guides to the syllabi. Classroom practice of a teacher in Cohen (1990)’s study was a typical case of a primary school teacher who intended to use the reformed curriculum as required by policy-makers. However, her learning at different levels, before and during tertiary education, influenced her classroom practice. She had begun to like mathematics only at the tertiary level when she was studying to be a teacher. She received support from her school and district but not from the state agencies that developed the policy. Although she believed that she had changed her mathematics teaching as a result of the reforms, her classroom practice reflected some elements of the newly introduced reforms but retained remnants of more traditional mathematics teaching practices.

Enyedi et al. (2005) compared classroom enactment of reforms by two teachers who attended the course on the GLOBE curriculum. The findings point to notable differences in classroom practices by these teachers. Even the way they identified themselves was different but consistent with their classroom practices. The findings further indicate that consideration of classroom practice and outcomes alone is not enough to understand the complex processes of teaching and learning. Enyedi et al. (2005) argue that the lens used to look at how to model teaching around teacher knowledge, curricular goals and planning misses the significant aspect of “what it means to be a teacher and how decisions are made on the fly during teaching” (p. 2). Their findings show that practice and identity go hand-in-hand. The authors argue that, if teachers are aware of the connection between their identities and classroom practices, they can manage challenges associated with changes made to their classroom practices. Hodges and Cady (2012) concur with this argument that consideration of teachers’ identities helps to understand decisions about classroom practices.

Hodges and Cady (2012) found that a teacher in their study received support from the communities within which the teacher worked (the school, the district and professional

development communities). This support provided leverage for her to develop an identity that allowed her to provide her learners with learning opportunities in the form of activities in her mathematics classrooms. Hodges and Cady (2012) further suggested that research needs to broaden the focus on what happens in the mathematics classrooms beyond the changes related to teacher practices by including contexts that include “classroom norms, ... school, district, and professional development priorities for Mathematics instruction” (Hodges & Cady, 2012:112). This means that the role of a teacher in a mathematics classroom is more complicated (Enyedi et al., 2005; Hodgen & Askew, 2007) than what is apparent. Hodges and Cady (2012) therefore suggest that more research is needed to investigate specific issues that contribute to teacher identity development aligned to reform documents. For the Lesotho context, such documents include the Lesotho Curriculum and Assessment Policy (MOET, 2009), syllabi and Assessment Packages for various grades.

In the Southern African context, two studies are relevant, Jita and Vandeyar (2006) and Pausigere and Graven (2013). Jita and Vandeyar (2006:50) argue that three aspects related to policy have a role in teacher identity. The scholars indicate that, for reform initiatives in primary school mathematics to succeed, policymakers need to know the teachers’ prior experiences as these act as “filters through which the reform ideas are interpreted”. They further demonstrate that policymakers need to allocate opportunities and time for teachers to “learn and unlearn the context of new reforms” (Jita & Vandeyar, 2006:50) that may be new and unfamiliar experiences. Pausigere and Graven (2013) explored how identities were constructed based on primary mathematics curricular documents in comparison with the documents used in different periods in South African primary schools. The key finding points to different identities constructed as a result of the two successive post-apartheid curriculum documents, Curriculum 2005 (C2005) and Curriculum and Assessment Policy (CAP). The C2005 promoted the “therapeutic” teacher identity while CAP promoted the “market” teacher identity. Pausigere and Graven (2013:31) describe the “therapeutic” identity as projecting “a ‘therapeutic’ primary mathematics teacher identity whose main concern was to promote acceptable societal norms” while the “market” identity was focused on the “progressive development of

fundamental Mathematics concepts and the improvement of learner performance in annual national assessments” (Pausigere & Graven, 2013:31).

The discussion in this section illustrates that while national curriculum reforms are intended to improve classroom practices there are challenges with implementation emanating from limited involvement of teachers who are key stakeholders. Hence need for policy developers to fully engage teachers and other stakeholders in all phases of curriculum reform and in time for all to contribute in the implementation of the reform (Chimbi and Jita, 2020; Kirk and MacDonald, 2001).

2.2.5 Curriculum reform in Lesotho

Lesotho experienced the first curriculum and assessment reform when the British colonial rule ended in 1966 (Raselimo & Mahao, 2015). Other efforts by the Lesotho government on curriculum reform were marked by the inception of two educational policies, the Free Basic and Primary education policy of 2000 and the Lesotho Curriculum and Assessment Policy of 2009. These reforms are described below.

Free basic and primary education

After many reports that indicated that access to education was one of the major problems in the education system in Lesotho, in 2000, the government of Lesotho introduced a free and compulsory basic and primary education policy (UNESCO-IBE, 2010/2011). The Education Act, which was introduced in 2010, supported the implementation of this policy. The intention of this educational policy was that, if the financial burden was reduced for parents, children in Lesotho would have easy access to education. However, it soon became evident that, while children enrolled in large numbers after this policy was implemented, some of the children dropped out of the educational system before they could complete the basic and primary education program (UNESCO-IBE, 2010/2011).

Du Plooy and Zilindile (2014) believe that access to education has two sides, “formal” and “epistemological”. The formal access refers to giving a learner physical access to school, that is, a learner has an opportunity to attend and become a member of a school

community. It is assumed that giving a learner formal access to education guarantees the learner's access to learning. Du Plooy and Zilindile (2014) argue that the learner's presence in a school or a classroom does not guarantee his or her access to learning as the learner also needs epistemological access. This type of access, according to Du Plooy and Zilindile (2014), considers how the teaching and learning strategies that are used in the classroom enhance a learner's access to learning. Du Plooy and Zilindile (2014) suggest that inappropriate teaching and learning strategies used in the classroom could hinder the learner's access to learning. For example, inappropriate teaching strategies can fail to make learning meaningful to the learner and thus fail to arouse the learner's interest in learning. The argument is that formal access to education is not enough to improve a learner's access to education but should be accompanied by pedagogical access. In view of this debate, it could be concluded that the efforts by MOET to improve educational access by providing free and compulsory basic and primary education were not enough to improve access to education in the Lesotho education system. There was also a need for efforts to improve pedagogical access.

Curriculum and Assessment policy

To improve learners' pedagogical access, the Government of Lesotho introduced the Lesotho Curriculum and Assessment Policy in 2009 to guide curricular and assessment reforms at primary and secondary levels of education. The implementation of the policy has resulted in the reorganisation of the educational structure, curricula and assessment approaches in the primary and secondary level education programs as described below.

Education structure

The new structure has re-arranged curricula from Grade 1 up to Grade 4 into learning areas instead of subjects that were used before the reforms and the subject system emerges from Grade 5 upwards. From Grade 1 to Grade 5, learning content is organised into five learning areas, namely, Linguistic and Literacy; Numerical and Mathematical; Personal, Spiritual and Social; Scientific and Technological; and Creativity and Entrepreneurial (MOET, 2009:vi). The focus of this study is on the Numerical and

Mathematical area.

Teaching and learning approaches

The proposed teaching approach in this reform is curriculum integration, which means that, during teaching and learning, concepts and ideas should be integrated within and across learning areas and subjects. Further, teaching and learning strategies should involve learners as the main and active participants in their own learning. Several aspects of the pedagogies are intended to shift. Pedagogy must shift more towards methods that can develop creativity, independence and survival skills of learners. In essence, learners should assume greater responsibility for their own learning processes. Therefore, the expectation is a shift from traditional approaches to more conventional ones as illustrated in Table 2.2.

Table 2.2: Suggested reform in teaching approaches according to CAP-L

Traditional (old) approaches	Conventional (new) approaches
Teaching	Facilitating learning
Transfer of facts	Student construction of knowledge
Memorisation of information	Analysis, synthesis, evaluation and application of information
Knowledge acquisition	Development of knowledge, skills, values and attitudes
Categorised knowledge (traditional subjects)	Integrated knowledge (broader learning areas)
Didactic teaching	Participatory, activity-centred and interactive methodologies

Source: MOET (2009:6)

The pedagogies suggested by the Lesotho Curriculum and Assessment Policy require attributes that the “active learning pedagogies” (Cattaneo, 2017) propose, with activities that are learner-centred, collaborative and intrinsically motivating. These pedagogies are also focused on content and process, and learners’ ability to reflect on progress and

achievement. The pedagogies discussed by Cattaneo (2017) support five approaches to learning: case-based learning, discovery-based learning, inquiry-based learning, problem-based learning and project-based learning, all of which emphasise learner involvement in the learning process. The inquiry-based learning approach, with its particular nature of focusing more on specific ways of engaging learners in the processes of learning and its relevance to the teaching of mathematics, is discussed in more detail under section 2.3.1 on “Mathematics classroom practices”.

Assessment

In the new Lesotho Curriculum and Assessment Policy (MOET, 2009), learner assessment should be continuous and a learner should be assessed through authentic tasks and learner portfolios. For example, learners should be engaged in research activities or tasks that require them to involve various knowledge and skill levels as proposed by Bloom’s Taxonomy. Such assessment tasks should provide learners with the opportunities to recall and apply knowledge to invent, create, analyse, judge and evaluate. The reform discourages learner assessments that use high-stake examinations that dictate learning for certification, which encourages teaching and learning practices that emphasise selection and, in the process, compromise checking learners’ competencies (Nyabanyaba, 2006).

Raselimo and Mahao (2015) are of the view that, although the Lesotho Curriculum and Assessment Policy (MOET, 2009) has the potential to provide pedagogical access to all children in Lesotho if successfully implemented, it is not without structural and pedagogical challenges.

Lesotho Curriculum Challenges

The curriculum challenges discussed here include pedagogical and structural challenges. Raselimo and Wilmont's (2013) study established that teachers' interpretations of the policy intentions are not commensurate with the policy documents. Since teachers are responsible for classroom activities, they are likely to implement the initiatives as per their interpretations and not necessarily what the curriculum prescribes. The implication of this disparity between teacher interpretations and the actual curriculum prescription shows a need for teachers to receive thorough training on curriculum changes as reforms are implemented. This is necessary because research indicates that teachers' orientations towards certain approaches to teaching, which have a bearing on their interpretations of good teaching, influence their classroom practices (Polly, McGee, Wang, Lambert, Pugalee & Johnson, 2013).

Other than the pedagogic challenges that teachers face in implementing the curriculum reforms, there are also the structural challenges. According to Raselimo and Mahao (2015), there is a conflict between the model used to reconfigure the school curriculum in Lesotho and the integrated teaching approach proposed by the same reform. For example, they indicate that the model that has been used to restructure the curriculum perpetuates a fragmented disciplinary approach to teaching (Raselimo & Mahao, 2015:10) that undermines the proposed holistic (integrated) approach to teaching and learning.

Raselimo and Wilmont (2013) had earlier suggested that, for the success and the effectiveness of the reform initiative, stakeholders in the educational system in Lesotho, including the schools and the government ministerial structures, such as the National Curriculum Development Centre (NCDC), should be actively involved in supporting the reforms. Mabejane (2015) asserts that the organs of the education system in Lesotho were disintegrated and uncoordinated during the implementation of the policy reform with teacher educators and education field workers apparently not yet introduced to the Integrated Curriculum when it was rolled out in 2013 (p. 81). Mabejane (2013) recommends collaboration among the stakeholders: the policy-makers, in-service

providers and teacher educators, because each of the stakeholders has a contribution to make based on areas of expertise.

2.3 The teaching of mathematics

This section deals with the teaching practices that are considered to be effective in primary school mathematics classrooms. The section is divided into four sub-sections: effective teaching of mathematics, mathematics classroom practices, mathematics teacher professional identity and teaching and learning of mathematics in Lesotho primary schools.

2.3.1 Mathematics teaching pedagogies

Westbrook et al. (2013:9) liken effective pedagogy to

“teaching and learning activities which make some observable change in students, leading to greater engagement and understanding and/or a measurable impact on student learning”.

This description views observable change in the learning process as resulting from the choices and use of appropriate teaching pedagogies (Polly et al., 2013). Although the presence of activities in a mathematics classroom does not necessarily guarantee learners’ gains in the competences, the absence of the said activities brings about stagnation in terms of the learners’ achievement levels (Bleeker, Stols & Van Puttin, 2013).

According to Westbrook et al. (2013), effectiveness of classroom practice, in terms of learner engagement, is associated with three schools of thought: behaviourism, constructivism and social constructivism. Pedagogies associated with behaviourism are teacher-centred learning pedagogies; those associated with constructivism are characterised by learner-centred approaches to teaching and learning and emphasise the development of subject matter competences; and social constructivism focuses on teacher guided learner-centred pedagogies (Westbrook et al., 2013:12).

Westbrooke et al. (2013) point out that pedagogies used in developing countries differ from those in developed countries for the three schools of thought. Teaching and learning methods related to behaviourism that are commonly used in developing countries include lecturing, demonstration, direct/explicit instruction, rote learning, choral repetition and imitation/copying. Methods related to constructivism include activity-based learning, while those related to social constructivism use small-group, pair and whole class interactive work, extended dialogue with individuals, higher order questioning, teacher modelling, problem-solving and inquiry-based work. These approaches and methods are aligned with those suggested by the Lesotho Curriculum and Assessment Policy (MOET, 2009).

From the listed pedagogies and related schools of thought, it is social constructivist, teacher-guided and learner-centred pedagogy, which recognises interactivity and the use of smaller groups in mathematics classrooms that has been embraced by the Lesotho Curriculum and Assessment Policy (MOET, 2009). The NCTM (1988) suggests that teachers need to be re-skilled to meet the teaching and learning needs of the 21st century classroom that is characterised by teaching approaches that provide learners with opportunities to engage in meaningful and authentic learning activities. This view is in agreement with the Lesotho Curriculum and Assessment Policy proposal. The framework proposes that a teacher should engage learners in authentic and attention-grabbing activities to shift from a didactic approach to a more participatory approach that is interactive and focused on the learner (MOET, 2009:viii).

Brough and Calder (2014) concur by indicating that teachers need to have their approaches to teaching mathematics aligned to problem-solving contexts that learners experience daily. They further indicate that the target of classroom practice should allow for “power-sharing” where the teachers listen and work collaboratively with learners to co-construct learning. The teachers’ roles, in this case, include asking questions that encourage and extend thinking without providing answers. However, this change in approach calls for teachers who are comfortable with their content knowledge, an aspect that literature indicates is a long-standing challenge (Cohen, 1990; Spillane, 2000; Jita & Vandeyar, 2006; Moloji et al., 2008; Venkat & Spaul, 2015).

The implication, therefore, is that there is a need for continued development and improvement of teachers' knowledge, skills and attitudes on the use of pedagogical strategies on teaching for meaningful learning and engaging learners and motivating them to actively participate in mathematics classes. However, for this to be achieved, teachers and other stakeholders that include teacher training institutions need to know the practices used and preferred by teachers in Lesotho's classrooms. It was the aim of this study to raise debates leading to the acquisition of this knowledge. The study was intended to investigate classroom practices used by teachers in mathematics classrooms in Lesotho and how the teachers' professional identities influence these practices.

2.3.2 Effective teaching of mathematics

Attributes of effective teaching of mathematics are discussed in this section. In a study done in the United States of America, Kaboré (2018) discusses several attributes of effective teachers at three different levels, elementary, secondary and tertiary. She points to the qualities of a math teacher that can build learner self-efficacy and encourage success in mathematics. These qualities include

“providing emotional support, believing students can be successful in math regardless of gender, attributing student success to the student, maintaining high expectations in a student-centered, inquiry-based classroom, and having solid content knowledge” (Kaboré, 2018:11).

In New Zealand, Anthony and Walshaw (2009), in a booklet on educational practices focusing on effective mathematics pedagogies, point to various principles that guide effective mathematics pedagogies. These principles are:

- (1) *An ethic of care* – A classroom community based on the principle of caring for one another helps learners focus on mathematical goals in order to develop mathematical proficiencies.
- (2) *Arranging for learning* – Part of classroom preparation takes into account the need to arrange for learners to work independently as well as collaboratively to make sense of ideas.

- (3) *Building on students' thinking* – Planning of mathematics learning experiences is done to enable students to build on their existing experiences, interests, and proficiencies.
- (4) *Worthwhile mathematical tasks* – Tasks and examples selected by the teacher should be relevant to and hence influence learners' development, use and understanding of mathematics.
- (5) *Making connections* – Students are supported in making connections between various solution strategies, between mathematical representations and related representations in other subjects, and between mathematics and everyday experiences.
- (6) *Assessment for learning* – A variety of assessment practices used to make students' thinking discernible and to support students' learning.
- (7) *Mathematical communication* – There is a need to facilitate classroom dialogue that is focused on mathematical argumentation using a variety of strategies.
- (8) *Mathematical language* – Mathematical language is shaped by modelling appropriate terms and communicating their meaning in ways that students understand.
- (9) *Tools and representation* – Careful selection of tools, such as the manipulatives and appropriate mathematical representations, that provide support for students' thinking and visualisation of the concepts.
- (10) *Teacher knowledge* – Teachers need to develop content knowledge and pedagogical content knowledge to use as a basis for initiating learning and responding to the mathematical needs of all their students (Anthony & Walshaw, 2009).

Busler, Kirk, Keeley and Buskit (2017) describe poor teaching by referring to several attributes of “not-so-good” instructors with three of these attributes being “having unrealistic expectations of their students' learning, being less knowledgeable in the content they have to teach and having poor communication skills”. Teacher development

therefore needs to take cognisance of these attributes during initial teacher training and further teacher professional development.

2.3.3 Mathematics classroom practices

Under this sub-section, I discuss ideas on learning environments, classroom discourse, mathematical tasks and examples in mathematics classrooms. These aspects classify teachers' actions and behaviours in the classroom into categories of classroom experiences.

2.3.3.1 Learning environment for primary mathematics

According to Protheroe (2007, 53-54) the following teacher behaviours characterise effective classrooms. The teacher:

- demonstrates acceptance of learners' divergent ideas.
- influences learning by posing challenging and exciting questions.
- projects a positive attitude about the subject mathematics and about solving challenging problems.
- makes interdisciplinary connections and uses examples to teach mathematics.
- helps learners to share their mathematical ideas while working in pairs and groups. providing learners with a variety of opportunities to communicate mathematically.
- provides learners with opportunities to use manipulatives and other tools to involve learners actively in "doing" mathematics.

These behaviours describe a teaching and learning environment that supports learner-centred approaches to teaching. Therefore, the learning environment created in the mathematics classroom should provide time, physical space and appropriate materials that facilitate the learning of mathematics, in what Webb, Franke, Ing, Turrou, Johnson and Zimmerman (2017) label as a high-level learner participation environment. The environment should further provide examples and contexts appropriate for the development of mathematical skills and proficiency. Learners should feel that they learn

in an atmosphere where their ideas and contributions are respected and valued, and where they can freely take intellectual risks in raising questions and formulating mathematical conjectures (Van de Walle et al., 2013). Also key in learner activity should be opportunities for independent and/or collaborative work.

2.3.3.2 Classroom discourse

Classroom discourse refers to the interactions among and between learners and the teacher that take place in the course of the lesson (Van de Walle et al., 2013). Initiating, facilitating and maintaining classroom discourse requires a conducive learning environment and appropriate tasks for the lesson. Herbel-Eisenmann, Steele and Cirillo (2013) in their effort to contribute to development of “research-based professional development materials” (p.181) share ideas on how to support development and facilitation of classroom discourse. They refer to classroom talk moves which they rearticulate as Teacher Discourse Moves (TDMs). These TDMs are described as ways the teacher can use to engage learners in discourse. First, restating, normally in question form, (revoicing) what a learner has stated; second, instructing or asking another learner to restate it in his/her own words (rephrasing) what a learner has said; third, instructing or asking the learner to either agree or disagree with a reason (reasoning) with another learner’s idea; fourth, instructing or asking the learner to “challenge, add on, elaborate, or give an example” (elaborate) with the intention to deepen understanding of an idea; lastly, giving “quiet time” which provides an opportunity for learners to think.

According to Herbel-Eisenmann et al. (2013), and as part of orchestrating discourse in mathematics classrooms, the teacher can do the following: First, pose questions that elicit, engage and challenge learners’ thinking. Second, listen to learners’ ideas and decide what to pursue in depth from those ideas. Third, ask learners to clarify their ideas verbally and in writing. Fourth, decide when and how to attach mathematical notation and language to learners’ ideas. Fifth, accept and encourage learners to use multiple representations when presenting their ideas. Sixth, decide when to use various facilitation approaches (clarifying, using a model, leading, letting learners wrestle with difficulties).

The concept of discourse is used by Adler and Ronda (2015) to describe classroom practice considering three aspects of practice. They look at the use of examples and tasks, use of words and phrases, explanatory approaches that indicate what counts as mathematics and learner participation. Adler and Ronda (2015) suggest a framework for the analysis of mathematics classroom practices with a focus on mathematical discourses. They call these activities Mathematical Discourse in Instructions (MDI).

2.3.3.3 Use of examples in mathematics classrooms

Bills, Dreyfus, Mason, Tsamir, Watson and Zaslavsky (2006:2) describe a mathematical example as

“anything used as raw material for generalising, including intuiting relationships and inductive reasoning; illustrating concepts and principles; indicating a larger class; motivating; exposing possible variation and change, ... and practising technique”.

Ng and Dindyal (2015:461) define an example as an “illustration of a larger class” that covers “geometrical figures, demonstrations of solving problems, tasks, and worked examples, as long as the mathematical object is offered or perceived as an example of something”. Exemplification, on the other hand, is used to “describe any situation in which something specific is being offered to represent a general class to which learners’ attention is to be drawn” (Bills et al., 2006:2).

Examples are usually chosen from a range of possibilities. Hence their appropriateness depends on the concept taught, the level at which it is taught and the context within which such an example is to be used. Attributes that make an example useful include:

“Transparency: making it relatively easy to direct the attention of the target audience to the features that make it exemplary.”

Generalisability: the scope for generalisation afforded by the example or set of examples, in terms of what is necessary to be an example, and what is arbitrary and changeable” (Bills et al., 2006).

Bills et al. (2006) further describe some examples as the reference type of examples. The authors explain these type of examples as those that are transparent in that they provide features that make them exemplary and they are generalisable as they provide what is necessary versus what is not necessary to be examples.

2.3.3.4 Mathematical Tasks

The teacher should design learning experiences (activities) and tasks that are based on mathematics that matters to the learners (Clark, Page and Thornton, 2013), that not only covers the syllabus, but also that have relevance to the learners' daily life experiences. The following are considerations to be noted when designing mathematical tasks: the levels of cognitive demand on the learner (McCormick, 2016; Smith and Stein, 1998), the possibility of multiple entry and exit points when the tasks are attempted by the learner and the relevant contexts for tasks to be interesting to the learners.

There are low and high levels of cognitive demand. Low-level tasks require memorisation or procedures without connections while high-level tasks require procedures with connections where learners are engaged in conceptual ideas that underlie procedures for a successful completion of the task. The entry and exit points refer to the diversity in terms of approaches that are used to work on the task and the variety of ways to represent solution strategies and the solutions. Tasks should be designed in ways that make them attractive to the learners which then makes learning exciting and "fun" to do.

Mathematical tasks and learning experiences designed by the teacher should challenge learners and promote the integration of ideas to develop a coherence of such ideas. These tasks should also call for problem formulation, posing, solving and reasoning and should promote communication about mathematics.

Adler and Ronda (2015) looked at tasks in mathematics by considering how learners are made to engage in activities across the lesson. For instance, learners may be required to "carry out known operations and procedures" which include solving an equation for an

unknown value, multiply/divide and find factors. Learners may also be expected to “apply known skills, and decide on the operation and procedure to use”. For instance, learners may be expected to compare, classify or match representations. Learners may “use multiple concepts and make multiple connections”, for example, be expected to solve problems using various strategies, may use multiple representations, pose problems, prove and reason.

2.3.3.5 Use of mathematics words and phrases

The use of words and phrases in mathematics classrooms, which Adler and Ronda (2015) call “naming”, is one of the key aspects of teaching and learning processes. The focus is whether word use is colloquial or mathematical language that is used appropriately. Examples of the colloquial use of words in everyday language are pronouns, such as “this” or “that” or phrases, such as “this thing” or “that thing” that ambiguously refer to objects in focus. Adler and Ronda (2015) also give examples of mathematics words used in reading strings of symbols in mathematical expressions such as $x + 2 = 5$ which is read as “x plus 2 equals 5”, whose meaning is that the sum of x and 2 is 5. Lastly, the mathematical language can also be used appropriately to refer to other symbols, images, procedures.

2.3.3.6 What counts as mathematics in mathematics classrooms

The legitimating criteria used to assess what counts as mathematics involves either non-mathematical or mathematical statements. The *non-mathematical* (**NM**) could be *visual* (**V**), for example, cues, which are iconic or mnemonic, or *positional* (**P**), for example, a statement or assertion, usually made by the teacher, as if what is said is a “fact” or even the everyday (**E**) use of language. The mathematical criteria identify mathematical statements that reflect specific or single cases of real life, or statements that reflect established shortcuts, or conventions (Local (**L**)) or statements that reflect generalisation of ideas (General (**G**)), for example, equivalent representation, definition, previously established generalisation, principles, structures and properties.

2.3.4 Mathematics teacher professional identity

There is no doubt that the communities of the world see value in their children being taught mathematics in schools. Research in this area pays testimony to this (SACMEQ, 2011; Van de Walle et al., 2013). The importance of mathematics is depicted in statements from the curriculum documents by bodies, such as the Ministry of Education and Training (MOET) of the Kingdom of Lesotho, stating that mathematics equips learners with the knowledge and the skills that are relevant to address problems in learners' daily lives (MOET, 2009). The importance of teaching mathematics has a direct link to the importance of the role-players in the teaching and learning processes, who are the teacher and the learner.

Perceptions of mathematics and how to teach it have begun to change from mathematics as a body of knowledge that is out there to be discovered and consists of rules to be learnt in order to solve problems, to a body of knowledge whose meaning is made in contexts, shared and negotiated among individuals participating in a learning process (Bottle, 2005; Cobb, 2000). The latter view puts the teacher in a critical position hence the need for mathematics teachers to know themselves well, to know their profession and know the roles that they are expected to play in teaching mathematics. However, systems within which teachers (mathematics teachers included) operate tend to lay certain boundaries in terms of what teachers can and should do and what they cannot and should not do (Kirk & MacDonald, 2001), in particular, about curricular changes which happen quite often, in small and large magnitudes, leaving teachers on the peripheries.

Strong observations have been documented in the literature about this peripheral positioning of teachers in issues of curriculum change (Kirk & MacDonald, 2001). Teachers' peripheral involvement in curriculum reform initiatives leads to a possible failure of such reform initiatives (Nyabanyaba, 2006). Therefore, policy-makers need to consider more effective and engaging ways in which teachers share ownership of the process during curriculum reform. In the South African context, Jita and Vandeyar (2006) argue that introducing reforms in mathematics classrooms leads to expectations of teacher identity changes and the development of counter-identities to meet the demands

of these reforms. As teachers' identities change, teachers' existing ideas incorporate new reformed ideas on teaching and learning. This study suggests that teachers are likely to construct their professional identities in different ways while their experiences are based on similarities. Teachers may develop their identities in deficit terms while others may develop mathematics identities as 'learners' of mathematics, which affords them opportunities to learn with their students. A key implication here is that policy-makers have to provide teachers with enough time and opportunities to learn and unlearn in the contexts of a new curriculum. The second key implication is that decisions that policy-makers take should be based on the knowledge they (policy-makers) have gathered about teachers' experiences and needs (Jita & Vandeyar, 2006).

2.4 Theoretical and conceptual frameworks

This study was framed around the concepts of teacher identity and mathematics classroom practice. The study used social identity theory (SIT) to understand teacher identity and how it influences classroom practice. The use of SIT in this study follows attestations from studies by Gee (2001), and Sfard and Prusak (2005) that the concept of identity can help explain human behaviour and activity.

2.4.1 Social Identity Theory and Teacher Identity

Recent research about teacher identity (Bennison, 2014; Rø, 2016; Jaya, 2011) proposes various theoretical underpinnings to explain how teacher identity develops and how it can also be seen as a tool to explain classroom practice. These studies use two approaches. One approach seeks to understand and describe teacher identity by considering categories of its aspects and how they influence classroom practice. The other approach views teacher identity as a product of participation in different communities (Rø, 2016:3235). The latter approach sees identity development as the negotiation of experiences and how they fit into activities of a community of practice as one participates in such activities. Jaya (2011:757) indicates that the key to identity theory is that an individual is defined by identification with and membership in a group. Turner (1982 cited in Jaya, 2011) explains that "patterns of exclusion", that is, "who is a member and who is

not a member”, describe a sense of belonging to a group. Aspects of emotions and social senses are also attached to how members view their membership in a group, which is why some teachers approach and view their profession with emotions.

This study sought to understand classroom practice from the teachers’ point of view, by considering how teachers perceive themselves, their profession and how they express these perceptions through classroom practice. The discussion for this study used the lenses of identity theory and social identity theory to examine and how individuals fit into their communities in relation to their practices, hence use of the term ‘communities of practice’.

Cable and Welbourne (1994) discuss how individuals’ attitudes and beliefs are affected by changes that institutions undergo and suggest that the identity cycle, which is a model that encompasses identity theory and social identity theory, could be used to explain how individuals respond to change at their workplaces. Cable and Welbourne (1994:4) point out that identity theory proposes that, as individuals begin to realise their roles, they also begin to understand themselves and their environments. Social identity theory focuses on, among others, the roles assumed by an individual in the given group context, thus creating an individual’s self-concept about an activity in a group (Jaya, 2011). The individual’s self-concept emanates from his/her association with knowledge of membership in a certain group and the attached value and emotional significance related to the membership (Cable & Welbourne, 1994:6). Social Identity Theory (SIT) therefore proposes that individual groups need to build affirmative identities by showing how they differ from other groups (Hogg, 2016). This process leads to a projection of inclinations within groups and distinctions between groups. Korte (2007) believes that individuals can view and react to organisational situations and challenges from within a group and argues that this happens as these individuals adopt the beliefs, values, and norms of the group.

Social identity theory is one of the theories under the constructivist paradigm (Kouhpaenejad & Gholaminejad, 2014; Pausigere & Graven, 2013). SIT claims that identity is personal as well as social and “provides a pivot between the individual and society” (Reicher, Spears & Alexander Haslam, 2010:2). From the constructivist

paradigm, SIT views knowledge as a social construct in which humans learn by interacting with their social environment. Therefore, teachers' understanding of how learners learn is likely to be enhanced if they view learning as both an individual and a social construct (Simon, 1995).

On the other hand, social identity theory is also concerned with "individual roles within a group context" and therefore social identity is said to be "that part of an individual's self-concept that derives from knowledge of membership in a social group together with the value and emotional significance attached to that membership" (Cable & Welbourne, 1994; Jaya, 2011). Social identity develops within certain social settings such as the school. **Identity development**, on the other hand, may be seen as "**learning as ... becoming**" (Wenger, 1998 cited in Graven, 2015). The concept of communities of practice explains identity formation and development in the sense that *identity develops within certain communities as one becomes part of and begins to identify with practices of such a community*. Teachers, in a certain school community, expect one another to behave in a certain way that a new teacher will learn and identify with, similar to Gee's (2001) affinity-identity. Identity, on the other hand, is a tool that helps explain activity (Battey & Franke, 2008). An experienced teacher who has developed an identity is likely to explain learners' performance differently from a new teacher who still depends on theories when explaining classroom practice.

The following key concepts therefore foreground Social Identity Theory as the theory that informs the conceptual framework (see Figure 3.1) for the analysis of data in this study. These concepts include: activities, beliefs, behaviours, commitment, communities of practice, constructivism, context, emotions, emotional significance, group context, learning environments, membership, professionals, roles, self-concept, school communities, social communities, social construct, social settings, and values.

2.4.1.1 Tenets of Social Identity Theory

In order to make sense of the data collected in this study, I used a conceptual framework that is informed by the tenets of Social Identity Theory and emerging ideas about practices

in the teaching of primary school mathematics. The tenets I used in this study are as follows:

The first tenet indicates that identity is shaped by participants' life stories and histories (Paige, Chartres & Kenyon, 2008; Gubrium & Holstein, 2012; Sandelowski, 1991). This approach allows for an individual's views, beliefs and experiences to be presented in the form of a story. Such a story may reflect traits that describe an individual's identity. The relevance of this tenet in this study is in the methodology where I decided to use teachers' stories to present the views, beliefs and experiences the participants shared with me and the observations I made in the lessons they presented. Teachers' identities could then be drawn from their stories and histories. This study will uncover the life stories of the participants, and these life stories and histories will assist in defining the participants' identities.

The second tenet describes identity as both cognitive and emotional traits of an individual (Zembylas, 2003). This tenet views identities as much more than self-perceptions, that is, how individuals view themselves. It views identities as also having value and emotional significance (Reicher et al., 2010) to those holding them. For instance, in a school setting, teachers may define themselves in terms of their contributions to the academic success and growth of the learners. Teachers may also view themselves as providers of the much needed psycho-social support in a school setting for learners that are always vulnerable for a variety of reasons. In the same vein teachers may define themselves as part of the group, a particular school in this case, with its academic achievements.

The third tenet views identity as comprising the sub-systems/sub-identities of personal identity and social identity (Reicher et. al., 2010). The sub-system of personal identity defines an individual as unique compared to other individuals while the sub-system of social identity defines individuals as members of certain groups as compared to other groups to which they are not members. This makes identity a complex construct where the personal and the social aspects interact to shape a person's professionalism. This tenet may not only define success in the interface between personal and social identities,

but a possibility of clash between the two in a case where the societal interests are at cross-roads with the personal interests. For instance, the school may be upholding certain norms that the individual teacher may not be identifying with, so this may create a situation of clash of interests which the teacher has to handle carefully to maintain effectiveness in his various roles as an employee of that school. This tenet will define and explain how the participants of this study cope in their different schools and contexts.

The fourth tenet indicates that identity can also consist of role identities (Tsui, 2007), several of which an individual can assume at the same time. Examples of role identities include an individual as a teacher, a sportsperson, a member of a school governing body and a life coach (cf. Gee, 2001). Similarly, a teacher can also assume several roles that include a teacher, a father/mother and teachers' representative in the school management committee. The school context, with its complexities, pose a challenge to teachers to assume many roles in order to survive and become effective in teaching and in guiding and grooming the young learners into well rounded individuals and members of the society. The roles the participants may intend to assume or appear to be assuming as teachers in their different schools will be evident from the findings.

The fifth tenet describes identity as (continuously) changing (Heyd-Metzuyanim, 2019) since, other than the personal and professional factors, it is also influenced by contextual factors (Vandeyar, 2010). In the school setting, the personal and professional factors are specific to the individual teachers, while the contextual factors encompass the school conditions and socio-cultural aspects within the school. These factors have been found to influence teachers' professional identities (Chere-Masopha, 2011; Tsakeni, 2014). It is worth finding out, in this study, how the participants view the role of the different factors in shaping their teacher identities as they grew in experience in the teaching profession.

The sixth tenet views identity as a socio-cultural perspective in which a person's identity is shaped and negotiated through everyday activities and experiences (Enyedi et al., 2005). Teaching experiences develop in a school environment through interaction with peers and learners. Interactions with peers provide opportunities for sharing ideas and experiences to improve on practice. Teachers, in their communities of practice, construct

their identities as they talk about their experiences and negotiate what it means to be a teacher (Renga et al., 2020). Interactions with learners provide opportunities for the teacher to experience various challenges posed by the learners' needs to which the teacher has to find solutions, thus continually developing new knowledge and skills to deal with new challenges that the teacher comes across on a daily basis. This study will uncover how the participants' interactions with learners, peers and their environments helped shape their identities.

The seventh tenet describes identity as a construct with many definitions and interpretations (Enyedi et al., 2005; Kouhpaenejad & Gholaminejad, 2014). This is one of the more challenging aspects of identity more especially given the area and settings in which it is applied in this study, that of teaching. If teachers have to continually improve their practice based on how they define themselves and how others define them, then we have to come to terms with striving to make sense of the various definitions and interpretations attached to identity and in particular teacher professional identity, that will emanate from the findings of this study.

2.4.2 Conceptual framework

2.4.2.1 Teacher professional identity and mathematics classroom practices

Teacher professional identity and mathematics classroom practices are the two fundamental concepts for this study and for the analysis of data. Some teacher identity studies (Alsup, 2004; Fajardo Castañeda, 2014; Hsieh, 2013; Spillane, 2000) show that identity develops from experiences that teachers had while they were learners themselves, as well as during teacher training. Some studies also indicate that the workplace becomes an important environment where teacher identities are developed and negotiated as teachers interact with colleagues and the general school environment (Battey & Franke, 2008; Beijgaard et al., 2004; Botha & Onwu, 2013; Pearce & Morrison, 2011).

Hsieh (2013) agrees with other researchers in her categorisation of factors that contribute

towards the development of teacher professional identities by referring to three categories of identity sources which are the teachers' *personal experiences as learners, their classroom practice-related experiences and external discourses that include research*. These categories are useful in viewing mathematics teachers' identification of themselves as professionals as they grow into experienced teachers. These categories are a part of the broader categorisation referred to in the conceptual framework described below.

Bennison and Goos (2013) suggest a framework that considers the analysis of numeracy teacher identity by describing four domains: the knowledge, the affective, the social and the life history domains that provide aspects of a numeracy teacher's life experiences. The knowledge domain is characterised by mathematics content knowledge (MCK), pedagogical content knowledge (PCK) and content knowledge (CK), the affective domain by confidence and beliefs, the social domain by school communities and professional communities, and the life history domain by past experiences of mathematics and teaching.

The elements of Bennison and Goos's (2013) framework have overlaps with the categorisation of identities as suggested by Gee (2001). For instance, the social domain from Bennison and Goos's (2013) framework and affinity identity in Gee's categorisation deal with an individual's association and sense of belonging to particular social groups that differentiate them from others. In the school environment, a teacher may identify with groups, such as the mathematics club, that has certain principles and activities which vary from clubs affiliated to other subjects.

Van de Walle et al. (2013) describe areas of mathematics classroom practice that are vital to understanding the dynamics of teaching and learning in mathematics and form part of the conceptual framework focusing on how classroom practice in mathematics classrooms is organised and realised through the efforts of the teacher. They are:

- knowledge of learners' mathematical learning
- learning environments
- discourse and mathematical language

- worthwhile mathematical tasks
- reflection on learners' mathematical learning
- reflection on teaching practice

(Van de Walle et al., 2013:493–494).

The six key areas mentioned above are summarised below. Aspects of these areas form elements of the framework that was used to guide the analysis of the results of this study. The framework follows this summary.

The knowledge of learners' mathematical learning involves the teacher's knowledge about ways in which learners learn mathematics and how teachers should facilitate and support learners as they engage in the mathematical investigation in the process of learning.

The learning environment created in the mathematics classroom should provide time, physical space and appropriate materials that facilitate meaningful learning of mathematics. It should also provide the contexts appropriate for the development of mathematical skills and proficiency, an atmosphere where learners feel their ideas and contributions are respected and valued, where they can take intellectual risks in raising questions and formulating mathematical conjectures and that provides opportunities for learners to engage in either independent or collaborative work.

Discourse and mathematical language in this study follows Adler and Ronda's (2015) use of examples, tasks, mathematical language, specific terms (naming) and learner participation. Adler and Ronda's (2015) framework is used to anchor the analysis of classroom practices so that the focus is on how teachers facilitate the use of examples, tasks and mathematical language to assist learners in meaning making and how to participate and interact among themselves and with the teacher for meaningful learning. Herbel-Eisenmann's (2013) work on TDMs is also tapped on to further illuminate what transpired in the classroom interactions observed in this study.

Worthwhile mathematical tasks and learning experiences designed by the teacher should challenge learners and promote the integration of ideas to develop a coherent understanding of such ideas. These tasks should also call for problem formulation, posing, solving and reasoning and should promote communication about mathematics.

Reflection on learners' mathematical learning: Learning and teaching should be continuously analysed. Learning should be analysed by observing and gathering information about learners to assess what and how they learn and if they are developing a positive attitude towards mathematics; by challenging and extending learners' ideas; and by providing feedback to both learners, administrators and parents.

Reflection on teaching practice: The teacher should regularly examine and reflect on the impact of activities, tasks, discourses and learning environments provided to learners. Teachers should seek to improve their teaching practice by participating in learning communities beyond their classrooms. They should collaborate with colleagues to develop plans to improve instructional programs.

2.4.2.2 The Mathematics Discourse in Instruction (MDI) framework

Adler and Ronda (2015) suggest the use of Mathematics Discourse in Instruction (MDI) as a framework to study discourses in mathematics classrooms. The focus of the MDI framework allows for an analysis that encompasses aspects of the mathematics classroom related to the areas of classroom interactions and discourse that are mentioned in section 2.3.2.2 above. My choice of the MDI framework is for its ability to bring together the good pedagogies of the traditional approach and the pedagogies of the reform movement in ways that have been suggested by the recent reform movements that include the NCTM. The MDI could be understood from the perspective of the old approach as it stresses the consideration of examples, explanations and interactions between learners and teachers. The framework allows the researcher to scrutinise the teaching practices in mathematics classrooms from the current reform pedagogies that require the use of “active learning pedagogies” (see Cattaneo, 2017) that include inquiry-based teaching approaches. The MDI provides for detailed scrutiny of classroom

experiences as observed by what teachers do and how learners respond. The table below shows the MDI framework as adopted from Adler and Ronda's study of 2015.

Table 2.3: The Mathematics Discourse in Instruction framework

Classroom practices related to mathematics discourse				
Object of learning				
Exemplification		Explanatory talk		Learner participation
Examples	Tasks	Naming	Legitimizing criteria	
Examples provide learning opportunities within an episode or across episodes in a lesson for learners to experience variation in terms of <i>similarity (S)</i> , <i>contrast (C)</i> , <i>fusion (F)</i> .	Across the lesson learners are required to <i>carry out known operations and procedures (K)</i> , e.g. solve for x, multiply, factorise; <i>apply known skills, and/or decide on operation and/or procedure to use (A)</i> , e.g. compare/classify/match representations; <i>use multiple concepts and make multiple connections (C/PS)</i> , e.g. solve problems in different ways, use multiple representations, pose problems, prove, reason, etc.	Within and across episodes word use is: <i>colloquial (NM)</i> , e.g. everyday language and/or ambiguous pronouns such as this, that, thing, to refer to objects in focus; <i>math words used as name only (Ms)</i> , e.g. to read strings of symbols; <i>mathematical language used appropriately (Ma)</i> to refer to other, symbols, images, procedures, etc.	Legitimizing criteria: <i>non-mathematical (NM) visual (V)</i> , e.g. cues are iconic or mnemonic; <i>positional (P)</i> , e.g. a statement or assertion, typically by the teacher, as if “fact”; every day (E). Mathematical criteria: Local (L), e.g. a specific or single case (real life or math), established shortcut, or convention; general (G) equivalent representation, definition, previously established generalisation, principles, structures, properties, which can be partial (GP) or “full” (GF).	Learners answer yes/no questions or offer single words to the teacher’s unfinished sentence (Y/N). Learners answer what/how questions in phrases/sentences (P/S). Learners answer why questions; present ideas; in discussion; teacher re-voices/confirm/asks questions (D).

Adopted from: Adler & Ronda (2015:242-243).

2.4.2.3 Teacher professional identity and mathematics classroom practices

I have used ideas from various studies that include Bennison and Goos (2013), Gee (2001) and Hsieh (2013) and Adler and Ronda's (2015) MDI to develop the conceptual framework that anchored this study. This framework, shown in Figure 3.1 below, suggests the use of three categories of teacher experiences related to teacher professional identity. These are the personal, the professional and the contextual experiences (Tsakeni, 2014). The framework also suggests the use of the elements of classroom practice encompassed in four broad categories which are *learning environment, use of examples, explanation and learner participation*. Mathematics classroom practices represented in these categories dominate mathematics classrooms in various ways (Anthony & Walshaw, 2009; Brodie, 2007a; Brodie, 2007b; Brough & Calder, 2012; Brough & Calder, 2014; Cattaneo, 2017).

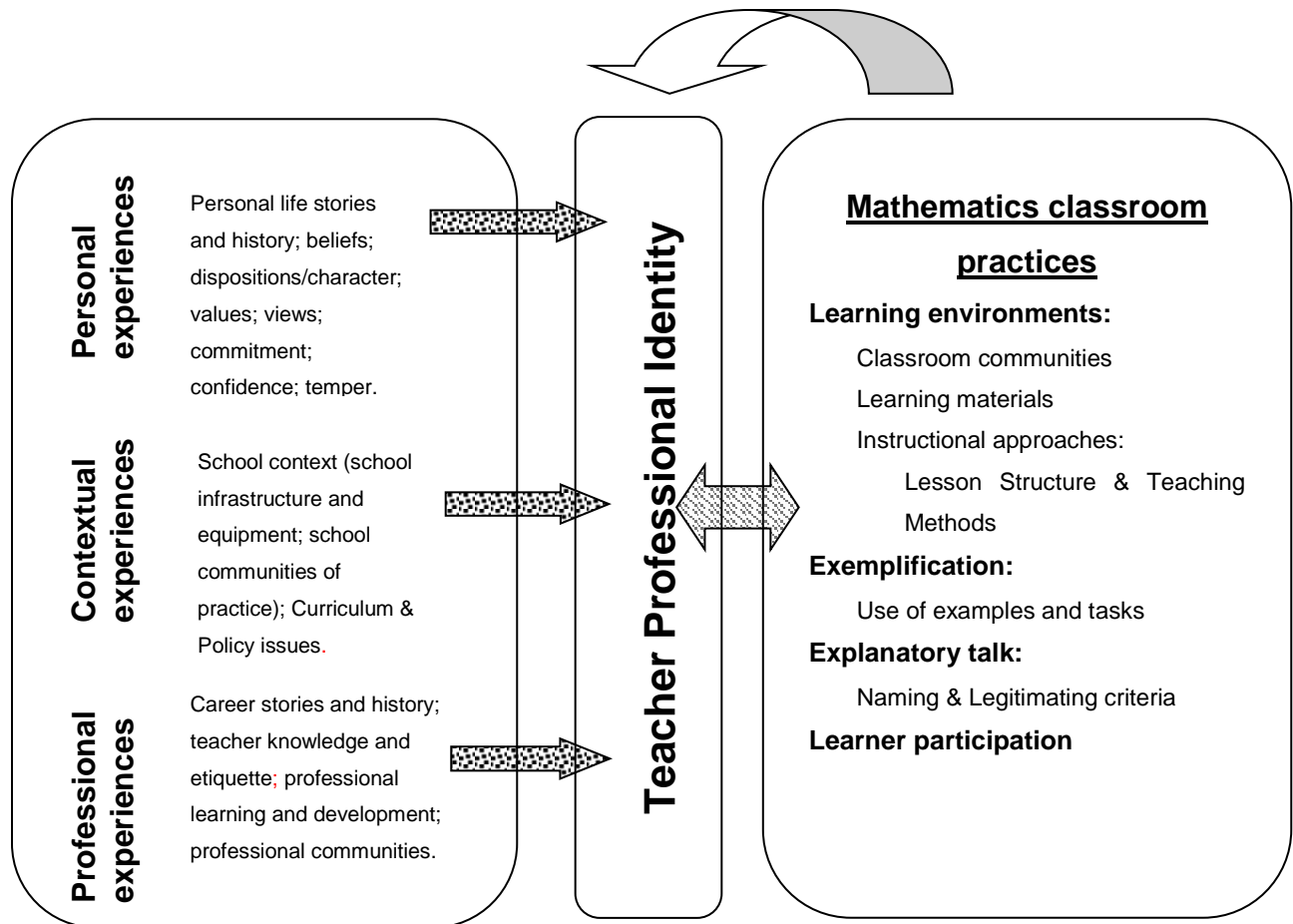


Figure 3.1: The conceptual framework for the relationship between teacher professional identities and classroom practices

The framework seeks to establish the possible relationship between the categories of personal, professional and contextual experiences with teacher professional identity and how this relationship explains the classroom practices of primary school mathematics teachers.

The framework assumes that teacher professional identity comprises teachers' beliefs and perceptions that reflect their personal and professional experiences as well as other external issues that influence classroom practice. The framework further assumes that teacher professional identity development can, therefore, be attributed to factors associated with the teacher's personal and professional background, the school context as well as issues of national policy.

2.5 Summary and conclusion

The literature reviewed was described in four sections: definition of terms, teacher professional identity, the practice of teaching mathematics and theoretical and conceptual frameworks. TPI was discussed from the perspective of how it is developed, considering contributing factors in the context of the curriculum reform. Teacher practices were discussed considering aspects of the classroom such as the type of tasks used in the mathematics classroom at the primary school level.

The literature indicates that the concept of identity is a construct whose definition has been elusive and that teacher professional identity should be viewed from the perspective of teachers and their profession in the context of the environments within which teachers live and work. Literature also points to the frameworks that could be used to make sense of teacher identity, from which social identity theory was chosen as an appropriate lens through which teacher identity and behaviour could be explained.

Chapter 3

Research design

3.1 Introduction

This chapter explains the methodology employed in studying the relationship between selected Lesotho primary school teachers' identities and their mathematics classroom practices. The chapter reiterates the purpose of this study and presents the research questions that guided the study. Justification of the paradigm and design of this study is based on the meta-theoretical underpinnings in the form of ontological, epistemological and axiological stances underpinning the study. The methodology, comprising the paradigm, the approach and the research design, are provided. It also includes the description of the research site, how participants were identified and contacted, the type of data gathered, the methods used in data collection and how the data were analysed. It justifies the theoretical and conceptual frameworks to be used for data analysis and interpretation. Furthermore, it discusses ethical issues, confidentiality, the delimitations and the constraints (limitations) of the study (James, 2014).

The study was guided by the following main research question:

How does teacher professional identity shape teachers' choices of teaching and learning practices in the primary school mathematics classrooms in Lesotho?

The sub-questions that were used to answer the main question were:

1. What are the critical components of professional identities as expressed by selected primary school mathematics teachers in Lesotho?
2. What are the major features of the mathematics classroom practices that are evident in the selected primary school teachers' classrooms?
3. How do primary school teachers construct and express their identities in relation to their mathematics classroom practices?
4. How can the relationship between the teachers' identities and their classroom

practices be described and explained?

Yin (2014:106) justifies the use of interviews as “insightful” because they provide “explanations as well as perceptions, attitudes and meanings”. Gay et al. (2012:333) believe that the use of observations allows the researcher to understand “the natural environment as lived by participants, without altering or manipulating it.” These methods of collecting data were relevant for this study because they provided the opportunity to obtain primary information on specific incidents of instruction, interactions in the classroom, the decisions teachers make as they teach and the explanations for these decisions.

Data to answer these secondary questions were obtained from interviews conducted with three participating teachers and lesson observations made in these teachers’ mathematics classrooms. Secondary questions 1, 2 and 3 were answered using data from all sources, the initial interviews, the lesson observations and follow-up interviews per participant. Participants expressed themselves in interviews as well as through their actions in class and what they emphasised as they conducted their lessons. Participants’ views about good mathematics teaching practices were observed to be features of their lessons. The follow-up interviews held after lesson observations put incidents from the lessons into perspective as teachers reflected on their classroom actions and described the decisions made as the lesson was prepared and also as it progressed. This explained how participants viewed their practices in line with how they viewed themselves as practitioners. Secondary question 4 consolidated findings on the relationships between teachers’ professional identities and classroom practices as found in secondary questions 1, 2 and 3.

3.2 Research paradigm

In this study, details of the experiences of primary school mathematics teachers were obtained through stories that teachers told about their lives growing into and becoming teachers of mathematics in their schools and their experiences in the classroom.

According to Cohen et al. (2011:17) and Al Riyami (2015), the basic unit of research in the interpretivist paradigm is understanding the world from an individual's personal experiences that give a subjective view of the world around him/her. Guba and Lincoln (1994:108) explain that the ontological stance of a research paradigm is based on questions about the nature of reality and what there is to be known about it (Kivunja & Kuyini, 2017). According to the interpretive paradigm, reality is subjective, so realities of classroom practices are individual teachers' understandings of what happens in their classrooms. Therefore, teachers, as participants in this study, are well placed to understand what happens in their classrooms. They also have a better understanding of factors that influence their decisions when it comes to planning for and teaching of mathematics.

The epistemological stance of the interpretivist design considers knowledge to be socially constructed (Al Riyami, 2015; Kamal, 2019). So, knowledge about these teachers' classroom practices is created through speaking about and making sense of their classroom experiences. The ontological and epistemological stances of the interpretivist design recognise that individuals are responsible for making sense of their experiences as they participate in activities where such sense making has to happen (Guba & Lincoln, 1994). Social constructivism recognises the role of participation in a social setting, where several individuals share views, meaning and the co-construction of research findings by the researcher and the participant (Macleod, 2009). The ontological and epistemological positions referred to above influenced my choice of the social constructivist approach to make sense of classroom practices and their relationship to primary school mathematics teachers' identities. I explored the views and experiences of teachers from their own stories, observed their classroom activities to learn from their actual classroom practices and then followed up on their understandings of their experiences by listening to the stories they told me about the lessons I observed. My interpretation was a negotiated understanding that was based on what they told me and what I observed in the classrooms.

3.3 Research design

Creswell (2014:185) indicates that use of interviews and observation methods for data collection characterise a qualitative research approach to data collection and analysis. According to Cohen et al. (2011:537) and Leedy and Ormrod (2013:142), qualitative research methods generate data to be interpreted in terms of the participants' definitions of the situation, using patterns, themes, categories and regularities. This means that the participants, rather than the researcher, give meaning to the findings of this study (Creswell, 2014:186) regarding how teachers view themselves as professionals in the field of teaching, their roles as teachers of mathematics and how social and professional contexts in the workplace shape their identities. Creswell (2014:185) regards as major characteristics of qualitative research, the researcher visiting the research site where participants experience the problem identified, talking to them and observing how they behave in relation to the problem under research.

A qualitative approach also includes narrative research, ethnographic research and case studies (Miles & Huberman, 1994). The current study used an approach that combined narrative research with case study research (Gay et al., 2012:12–14) to investigate cases of three primary school teachers. This allowed me to learn about the relationship between teachers' professional identities and their classroom practices. Firstly, from the participants' stories of their professional growth and related experiences; secondly, by observing the participants teach a particular lesson; and thirdly by listening to the participants explain the classroom activities and behaviours that I observed. This approach provided me with an opportunity to hear teachers talk about their own beliefs, devotions, experiences and practices and how these are influenced by the contexts in which the teachers live and work.

Case studies provide "the detailed description of a particular situation, organisation, individual, or event" (Glatthorn & Joyner, 2005:103) and are used for research that is descriptive (asking the "what" questions) and those that are explanatory (asking the "how" or "why" questions) (Gay et al., 2012:403). This case study research asked both "what" (see research sub-questions 1 and 2) and "how" (see sub-questions 3 and 4), therefore

it was both descriptive as well as explanatory.

As part of analysis of data, the data was checked and compared across the three cases (participants). The process involved organising the data to enable comparisons across the three cases. I made this simpler by organising key areas (of the findings) in a table (Yin, 2014) of themes (see Appendix L), with themes, categories and sub-categories from individual cases. Other than organising and categorising the data, Leedy and Ormrod (2013) suggest interpretation of individual cases to enable comparisons then identifying patterns to make necessary cross case interpretations. According to Leedy and Ormrod (2013), reporting the cross case analysis would involve among a number of things discussion of patterns found to enable connection to the overall study.

The research design was also characterised by use of narratives in organising and making sense of the participants' views and experiences as well as their practices. Narrative research studies are ways in which individuals experience the world around them (Gay et al., 2012:354). The narrative approach engages a methodology that allows participants to tell stories of their experiences. The researcher then develops a written account (narrative) of the participants' stories. This written account includes the stories and the meanings (Conroy et al., 2017; Mathe and Hapazari, 2019) the participants attach to their experiences. These experiences are told mainly in the interviews.

In line with Gay et al.'s (2012:354) and Creswell's (2014) suggestions, this study employed narratives in data presentation. First, the focus and interest was on the experiences of individual participants. Second, an attempt was made to consider and note the chronology of individuals' experiences. This traced the development of the teachers over the period of their schooling, from prior to training as teacher, through their training, up to their experiences working as qualified teachers. Third, I focused on the construction of the life stories of these participants as teachers based on data collected through the various data collection methods. Fourth, I used the technique of re-storying to construct the narrative accounts based on information from all sources of data. Fifth, I noted the context and place in the stories to understand the teacher in relation to context and how the context influences classroom practice. Sixth, the questions such as "... and then what

happened?”, “... and so what followed?” or their equivalents in the form of head nodding were used to prompt further information from the participants (Gubrium & Holstein, 2012).

Grounded in the theory of social identity, the study intended to collect detailed information about teachers' perceptions of their profession and how these perceptions influence their practices in a mathematics classroom.

3.4 Participants

There are three types of schools in Lesotho. Privately owned schools have high school fees; government schools provide free schooling (Jopo, Maema & Ramokoena, 2012); and church schools have affordable school fees. The participants of this study were three primary school teachers from three church schools that are located in Maseru district in Lesotho.

The criteria that were used to select these teachers included teachers' qualifications, teachers' length of teaching experience and the grade levels that teachers had taught. Firstly, the teachers were to be holders of any primary school teaching qualification obtained in Lesotho. This meant that they had similar teacher preparation and workplace experiences. That was necessary because the focus of the study was on these teachers' conceptualisation of themselves as teachers of mathematics in primary schools in Lesotho and how this relates to their teaching of mathematics in contexts that are similar to those they were trained in.

Secondly, the study focused on teachers who had five years or more teaching experience. Research indicates that teacher professional identities are dynamic and may change as a result of their school contexts (Kouhpaenejad & Gholaminejad, 2014; Sfard & Prusak, 2005). More experienced teachers therefore are more likely to have gone through such changes and have had both positive and negative teaching experiences. Identities are said to be reflections of life histories (Bennison, 2014) therefore, teachers with more years of experience are more likely to have life histories that reflect their struggles and achievements with the teaching of mathematics.

Thirdly, the teachers should have taught at both junior and senior primary levels. This meant that they had taught mathematics and numeracy to learners of different ages who had widely differing needs.

I selected the participants by convenience as explained next. However, I still ensured that the participants who would agree had credentials that satisfied the criteria described above. The first case presented is of a teacher recruited when he had visited my former workplace (his former college, LCE) for a service. We happened to meet and talk and I inquired if he could be interested to take part in this study and he agreed. I then followed up to formalise my request with his school principal. I requested both the participant and his principal to sign letters of consent. The second case is of a participant who was my student at the tertiary level of study. I taught the participant at two different levels, firstly, when he was doing his diploma in primary education at LCE and, secondly, when the participant was doing his degree in primary education at NUL. The participant was contacted telephonically and, during a meeting, was verbally requested to take part in the study. That was followed by letters of consent to both the participant and the principal of his school. The third case presented was of a teacher who was recommended by the principal of the school where I had gone to request another one of my former students at the college to participate in this study.

3.5 Data collection

This study intended to find out teachers' views about themselves as professionals, their roles as teachers of mathematics and how professional and social contexts in the workplace model their identities. This allowed the participants, through the use of narratives, to discuss their beliefs, devotions, experiences and practices and how they are influenced by the contexts in which they live and work.

Methods of data collection were classroom observations and semi-structured interviews. The use of these methods, according to interpretivists, recognises that participants in this study are considered as research participants (and not objects of study) who have a role to play in generating knowledge about mathematics classroom practices (Al Riyami,

2015). In using these data collection methods, several considerations were made as described below.

Firstly, the reasons for use of these methods, which included looking for key features, regularities, similarities, patterns and irregularities. Secondly, the research questions I was to answer using the data that I collected. Thirdly, what was to be included and what was to be excluded from the study. Fourthly, how data were to be recorded and what resources were needed, for example, video and audio recorders. Fifthly, the “units” of data collection for this study, which included the teacher, learner, pairs, groups and the whole class. The sixth point considers the challenges that I could have encountered that are related to the methodologies. Last consideration was how this data would be processed and analysed (Cohen et al., 2011:459).

The data collection methods are discussed next.

3.5.1 Interviews

An interview is a form of purposeful interaction between the researcher and the participant with the intention to obtain information (Gay et al., 2012:338). In this study, semi-structured interviews, which were captured on audio-tape, were conducted with all three participants. Semi-structured interviews combine both structured and unstructured questions (Gay et al., 2012:338) that are intended to elicit the same kind of information from each of the participants in an open-ended approach (Corbin & Strauss, 2015). They allowed participants to tell their stories, including their personal and professional beliefs, experiences and biographies, in a narrative form, giving as much detail as they remembered.

The use of the phrase, “*tell me about ...*” (Jacob & Ferguson, 2012) invites the interviewee to tell a story and also leaves room for the question to be taken in different directions to yield data that the interviewer may have not intended to obtain. Gubrium and Holstein (2012) refer to phrases such as “Go on ...” and “Then what happened?” as narrative devices that interviewers use to encourage interviewees to elaborate on what they say,

thus prompting the participant for a narrative that, according to Muylaert et al. (2014), provides for depth and detail in data collection of life stories combined with socio-cultural situations to allow for the understanding of teachers' experiences in the teaching of mathematics in actual and real contexts.

Two interview sessions were held with each participant, one before and another after lesson observation. The first interview focused on the general issues about the teacher, his/her beliefs, attitudes, knowledge and experiences about teaching primary school mathematics. The participants were asked to share their views about what being a teacher entails in general and specifically being a teacher of primary school mathematics. The second interview focused on the participants' reflections on the information I obtained from the classroom observations I made. These interviews provided data to address the aim of this study by answering research sub-questions 1, 2 and 3.

According to Neuman (2003:381), the researcher's main task in the field is to "pay attention, watch and listen carefully" as data are collected. Gay et al. (2012:339) concur and suggest that the following should be considered by the researcher:

- to listen more and talk less as listening is the most important part of interviewing;
- not to interrupt the interviewee;
- to tolerate silence from the interviewee as the interviewee might be thinking;
- to avoid using leading questions, instead ask open-ended questions and probe to seek clarity if information is not clear;
- to keep the interviewee focused and ask for concrete detail;
- to follow up on what the interviewee says and ask questions for clarity;
- not to be judgemental about the participants' views or beliefs but instead keep a neutral position;
- to remember that the purpose is to learn about others' perceptions, regardless of whether the two parties agree or not; and

- not to debate with participants over their responses since the interest is obtaining information, so the interviewer has to be a recorder not a debater.

Two interview protocols were used in this study for each of the three participants. Each interview protocol contains the following components (see Appendices E and G):

“A heading (date, place, names of interviewer and interviewee), instructions for the interviewer to follow so that standard procedures are used from one interview to another, the questions, a closing statement to acknowledge the time spent by the interviewee in the interview, a log showing a list of documents to be collected for analysis following the interview, where needed, and whether the information comes from a primary source (directly from participants)” (Creswell, 2014:194).

The interview method of data collection has its strengths and weaknesses (Yin, 2014). The fact that the method is targeted, it focusses directly on the case study questions. It is also insightful and provides personal views (and their explanations) which includes attitudes, perceptions and meanings. The interview method has some weaknesses which include the following. The method depends on recall of facts by the interviewees which may give inaccurate information due to poor recall. Sometimes the interviewees may feel they need to give what the interviewer wants to hear (reflexivity) and this may also lead to inaccurate or misleading information. In order to mitigate some of these challenges I used probing questions to ensure that I get more detailed response with clarity where needed.

3.5.2 Lesson observations

Cohen et al. (2011:457) indicate that observation is not just looking but systematically looking and noting events, behaviours and settings. This provides opportunities for collecting “live data from naturally occurring social settings” (Cohen et al., 2011:457) such as the classroom situation that this study focused on.

The observation method was used to view and then document classroom activity as it unfolded. This provided me with first-hand experience and information about how the

teacher enacted the mathematics curriculum. Information obtained from these classroom observations addressed the aim of this study by answering the research questions.

This study used semi-structured observations which provided explorations of classroom practice by referring to certain events, behaviours and settings seen in these observations as this study intended. I used video recordings and supplemented them with field notes. There were lessons where I decided to replace a video recording with an audio recording because it gave less potential for disruption given learners' state of excitement. Video recordings assisted in recording the entire lesson in each case the video was taken. Lesson observation sheet recorded detailed notes of incidences of classroom activities, with time-lines. The record was to reflect "time" and "incident" over the period of the lesson observation. The format is shown in Appendix H.

My role in the classroom observations was that of a non-participating (complete) observer (Cohen et al., 2011:458). I observed directly and took detailed notes of activities and interactions. The video recording helped to provide all detailed that I could miss when taking notes of activity and interactions during the lessons. As learners recognised me as an outsider, this research was overt (Cohen et al., 2011:458). My intention was to only observe and not interfere with the teaching and learning processes. My non-interference minimised chances of influencing how the lessons progressed.

The use of video cameras is not without challenges. Stationary cameras may fail to capture incidents in certain areas of the classroom (Leedy & Ormrod, 2013:153) because of the distance and the direction they face. On the other hand, a moving camera may appear to be intrusive and this could have an effect on the natural setting of the lesson which results in changes in the participants' (teachers and learners) behaviours.

Yin (2014) stipulates some strengths and weaknesses of this data collection method. Data is collected in real time (immediacy) thus providing opportunity to collect it in as much detail and accuracy as possible. Direct observation allows for coverage of the case's context thus ensuring that necessary detail and accuracy of contextual matters is paid attention to. Weaknesses of direct observation include amount of time spent by the

human observer, broad coverage is normally challenging because it needs a team of observers with a financial implication, actions may proceed differently because participants realise they are being observed. My mitigation efforts included using a video/audio recorder while I was also writing detailed observation notes with timelines. For some observations I decided to use an audio recorder instead of a video camera because in the earlier observations learners focussed on the camera instead of the classwork given.

3.6 Data analysis

Data analysis, according to Creswell (2013:186), goes hand-in-hand with the processes of data collection and report writing. As I began collecting data, I also started with the analysis to ensure that data collection sessions were still fresh in my mind. Analysing data in a qualitative research approach derives meaning from patterns, themes, categories and regularities which appear in the data (Cohen et al., 2011). Data, in this study, were analysed using both inductive (a priori) and deductive (a posteriori) approaches (Creswell, 2007:108–109) which allowed the back-and-forth movement between themes and data (Creswell, 2014:186). The inductive approach established themes from data. The deductive approach allowed for the checking of data against the already established themes to reinforce them (the themes). The themes drawn from analysis of the data centred on components of professional identities and features of the mathematics classroom practices and their relationships. Key concepts that guided the analysis included teacher learning, teacher knowledge, learning environments, classroom communities, mathematical tasks, classroom discourse, learner progress, psychological factors, social factors and professional factors.

The process of data analysis in this study was done on data obtained from interviews and classroom observations. Once data were collected through interviews and lesson observations, transcriptions were done. These transcriptions were prepared using Microsoft Word to enable working with the data as analysis progressed. The process of transcribing interview audio recordings involved listening to the recordings and typing

what the teachers said, word for word. The same applied to the audio/video recordings from classroom observations where teachers' and learners' conversations were listened to and typed, word for word, on a word document. The transcripts were then checked against the recordings (audio and video tapes) for accuracy to prepare for analysis.

Given the interpretive nature of this study, I made sense of data by breaking up large pieces of information into smaller pieces and labelling (coding) them. In the process of data analysis, the transcriptions were read and sections were identified and coded as categories and patterns emerged (Creswell, 2013:198; Gay et al., 2012:340). Creswell (2013:198) defines codes as abbreviated topics that attach meaning to each piece of data. The data were read in detail to establish the meanings associated with these facts. For coding, paragraphs or sentences from data were separated and labelled with a term or phrase that summarised the meaning that each of these paragraphs or sentences carried. Given the amount of data to be analysed in this study, I used Microsoft Word to store information and to highlight data using different colours and codes.

The process of coding was an act of categorising data, attaching labels for easier identification and also an interpretive act to assist in making sense out of the data. Categories from different data sources were checked for the development of themes. Patterns, themes and meanings were explored within each case as well as across the three cases to generate similarities and differences among the cases which indicated the components of professional identity and major features of these teachers' mathematics classroom practices.

The similarities and differences, which included peculiar cases, formed the findings that were then interpreted using the literature in order to describe and explain the relationship between teachers' identities and their classroom practices. This is the stage where patterns and regularities were identified to answer the fourth research sub-question: "How can the relationship between the teachers' identities and their classroom practices be described and explained?"

This cross case analysis of data used the adapted Framework Method (Gale, Heath,

Cameron, Rashid and Redwood, 2013) to locate the commonalities and differences across the three cases. The defining feature of the Framework Method is the organisation of data into a matrix consisting of rows and columns. The columns show different cases which are participants while the rows show codes as shown in Appendix K (and applied in Appendix L – Table of themes for the three participants). This structure provides a way to systematically reduce the data for analysis by cases and by codes (themes) (Gale et al., 2013:2).

3.7 Quality in research design

3.7.1 Introduction

The quality of research designs should reflect validity and reliability. These concepts are discussed below together with an explanation of how the design of this study addressed issues of quality in relation to each of these concepts.

3.7.2 Validity

Validity in qualitative studies is the degree to which data accurately measure what the researcher intends to measure (Leedy & Ormrod, 2013). One set of criteria defines validity by referring to quality measures related to trustworthiness. This comprises confirmability (neutrality), credibility (truth), dependability (consistency) and transferability (applicability) (Zucker, 2009). Another set of criteria considers trustworthiness and its understanding (Gay et al., 2012:344) and comprises descriptive validity, interpretive validity, theoretical validity, generalisability and evaluative validity (Gay et al., 2012).

Confirmability or neutrality of research data refers to the level of neutrality and objectivity with which the data are presented (Gay et al., 2012) and addressed by the use of triangulation and practising reflexivity in data collection. This study used two methods of data collection semi-structured interviews and lesson observation for triangulation and to create a clear picture of teachers' experiences and cross check information relating to a common research issue.

Credibility of data depends on how well the researcher deals with emerging complexities and how well patterns are accounted for in the study. Triangulation in the use of data collection methods corroborates data collected. Dependability refers to the level of consistency and stability in the research process (Gay et al., 2009). A research process is dependable if it has an audit trail which a critical reader can trace and compile a report on the processes of data collection, analysis and reporting. Transferability of the study is whether it can possibly be replicated in another context and still yield the same results. This study addressed the issue of transferability by providing detail of the context of the study and data collection methodology.

Descriptive validity relates to how accurately the researcher expresses the participant's views. My study observed this measure of quality by the use of an audio/video recorder and rechecking of transcriptions for accuracy in words and statements made by the participants. Interpretive validity deals with accuracy in interpreting data. This was done by auditing the processes of data collection, interpretation and report writing. Theoretical validity refers to a systematic use of theory to anchor the study. This study developed a conceptual framework from theoretical constructs and related those to classroom practice to lay a foundation for interpretation of incidents observed in the classrooms and the accounts that teachers shared about themselves and their growth as primary school teachers who teach mathematics. Generalisability refers to how well the findings of the study could be generalised within the study community. This study was not intended for settings beyond those similar to this study because it was a case study of only three teachers. Evaluative validity was ensured by reporting the findings as objectively as possible without making any judgements on the data obtained (Gay et al., 2012).

Validity in this study has been addressed by consideration of the following aspects of research. Firstly, the use of triangulation in data collection methods; secondly, in practising reflexivity as data collection, analysis and report writing progressed; thirdly, by providing a clear and detailed account of the context of the study; fourthly, by giving detail in the presentation of data and findings; fifthly, audio and video recordings allowed me to capture detail of classroom activity and interactions and to recheck detail and accuracy

of transcripts prepared from these audios and videos; and lastly, instead of relying on the external auditor to prepare an audit (a written description of the processes of data collection, analysis and report writing), I decided to use interactions with the supervisor and the co-supervisor as a yardstick for keeping track of my progress. The interactions included submissions of chapters at different stages followed by comments from supervisors and my own reports of progress written at certain stages of my thesis writing.

3.7.3 Reliability

Reliability refers to how consistently the study data measures what it set out to measure (Leedy & Ormrod, 2013; Neuman, 2003; Zucker, 2009). In other words, whether the data collection procedures could be used by different researchers to obtain the same findings and come to the same conclusions. One way for research to achieve this consistency is through documenting the procedures followed in the study (Yin, 2014:49). This study achieved reliability by indicating procedures followed in planning and carrying out the study (Yin, 2014). These procedures include requisitions for permissions from ethics committee of the university and the Ministry of Education and Training of the Government of the Kingdom of Lesotho and schools in which the study was to be carried out. Detailed descriptions of procedures in collection and analysis of data also helped to achieve reliability.

3.8 Ethical considerations

Neuman (2011:143 cited in Khan, 2014:306) indicates that issues of ethics are a responsibility of the individual researcher by saying: “It is the moral and professional obligation of the individual researcher to be ethical even when research participants are unaware of or unconcerned about ethics”. The issues of ethical considerations are described below.

I applied for and received permission to do the study from the Maseru Regional Inspectorate office of the Ministry of Education and Training of the Government of the Kingdom of Lesotho. I applied for and received ethical clearance from the University of

the Free State. I identified schools in which I would collect data by first contacting teachers either in person or telephonically to find out if they were interested in participating in my study. Based on the responses of these teachers, I then visited the schools identified to present a letter to the principals requesting to carry out a study in their schools. I informed them that the data I would collect would be used for purposes of this study and its publications only. Furthermore, that confidentiality would be ensured at all levels of our interactions with the participating teachers and lastly, that the identities of the participating teachers and their schools would be concealed. I further indicated that if the participating teachers would have concerns about the study as it progressed, they were free to withdraw from the study at any stage. Consent for the teachers to participate in the study was formalised with the principals and the participating teachers. This was done by writing letters for permission to do the study in these schools. Then I requested that the participants who agreed to take part in the study to sign letters of consent. The principals were also requested to sign the letters as to grant permission. Lastly, during the classroom observation sessions, I assumed a non-participant observer role. This ensured non-interference in the classroom activities.

3.9 Delimitations

The study focused on three teachers to allow for more time to be spent on classroom observations. While there are many factors involved in shaping classroom practice, teacher identity has emerged as a personal dimension (Jita, 2004) that is normally neglected. This study sought to delimit its exploration to the relationship between this dimension (teacher identity) and classroom practice.

3.10 Limitations

This study focused on three teachers. One of the reasons for the small number of participants was to provide opportunities for in-depth understanding of the situations primary school teachers work in. Given this small number of participants whose situations become cases that may be peculiar, the results could therefore not be generalised to a larger population of teachers but could provide indicators of teacher identities and related

practices for particular situations. Although measures were taken for validity and reliability in data collection, there were still limitations anticipated in the data collection methods used (Creswell, 2014). There was a possibility that the participants would not fully open up to the researcher or provide biased responses in the interviews. Possible reasons for this could include the researcher's physical presence in the interviews and the possible feeling by participants that the researcher was being intrusive, particularly because narrative inquiry requires participants to tell their personal stories and experiences (Gay et al., 2012), some of which the participants may not feel free to share.

3.11 Conclusion

This chapter provided the methodology employed in this study. This is a qualitative study with an interpretivist paradigm. The design comprised a case study research with three teachers as participants and where data was collected through interviews and classroom observation. Data analysis was narrative thematic.

The methodology described data collection and analysis methods, and ways of observing ethical issues from the data collection stage up to analysis and observation and issues of confidentiality in relation to the participants' particulars and identities. Lastly, the delimitations and limitations of the study were explained.

Chapter 4

Presentation and interpretation of data

4.1 Introduction

This chapter presents the data and interpretations for the study that explored how teacher professional identities shape teachers' choices of teaching and learning practices in mathematics classrooms in Lesotho primary schools. This is in response to the following research sub-questions:

1. What are the critical components of professional identities as expressed by selected primary school mathematics teachers in Lesotho?
2. What are the major features of the mathematics classroom practices that are evident in the selected primary school teachers' classrooms?
3. How do primary school teachers construct and express their identities in relation to their mathematics classroom practices?
4. How can the relationship between the teachers' identities and their classroom practices be described and explained?

I present this chapter in three major sections, which are: the introduction (this section), the narratives of three cases and the summary of the data presented. Data analysis generated patterns, themes, categories and sub-categories. A summary of the themes, related categories and sub-categories for the three cases is included in Appendix L (Table of themes for the three participants). I have used the names Teboho, Khothatso and Carol as fictitious names for the three participants, to conceal their identity.

4.2 Case 1: Teboho: A caring, traditional mathematics teacher

4.2.1 Teboho's biography

Teboho was a male teacher, aged 34 years at the time of data collection. He was born and raised in a semi-urban district, south of the capital, Maseru. He attended both primary

school and secondary school in his home district. Because he did not perform well in the Cambridge Overseas School Certificate (COSC) examinations, he was not immediately able to access tertiary education upon completion of school education. Here is how he talked about his journey into the profession:

I wanted to be an accountant, a soldier as well. When I was a student, I wanted to be a soldier. But you know, if you do not have good career guidance, you might fall into the career that you are not meant to.

According to Teboho, his first options included being a soldier or an accountant. He, however, was not able to follow those careers, as he said, “Really, there are factors like I said I wanted to be an accountant, I applied first but I failed, I didn’t go to school then finally I got school here at LCE.”

Instead, as he explained, he trained to become a teacher. Teboho blamed a lack of career guidance for his failure to join careers of his first choice. This is similar to the point made by Edwards and Quinter (2011:85) when they argue that some learners make career choices based on peer pressure because teachers are overworked and parents spend limited time with their children. Teboho then joined a skills training centre for three months to learn carpentry. He had the following to say about joining the skills training centre:

Once I completed my high school, I went to one of the schools or one of the training centres; I did carpentry then, from there, I went back to high school because that took just three months for training, then from there, I went back to school.

After completing the course at the skills training centre, he went back to secondary school to upgrade the subjects in which he did not perform well at COSC level. His decision to go back to upgrade subjects suggests that he still aspired to pursue further qualifications.

Ball, Hill and Bass (2005) argue that the quality of teaching depends on a teacher’s knowledge of mathematical content for teaching; therefore, a qualification with a strong subject specialisation is likely to improve a teacher’s subject matter knowledge. Between 2007 and 2009, Teboho trained as a primary school teacher obtaining a Diploma in

Education Primary (Dip.Ed. (Prim.)) qualification. Determined to strengthen his subject matter expertise, he furthered his studies between 2011 and 2013 through an Advanced Certificate in Education (A.C.E.) in mathematics in South Africa. Teboho's comment that "the other subjects that I teach I do not give them time like mathematics" suggests that he devoted more time to mathematics relative to other subjects at the advanced certificates qualification level.

Teboho has been working as a primary school teacher since 2010. He has mostly taught Grades 4 to 6 in his school, up to the time of data collection. The next section unpacks Teboho's views and experiences of growing up, as a learner and as a teacher.

4.2.2 Teboho's views about teaching and being a professional mathematics teacher

Three key sets of experiences stand out in Teboho's narrative. First, there are his early personal experiences that included a lack of career guidance; second, is his early exposure to tutoring fellow learners in secondary school and last, are his experiences at the tertiary level.

4.2.2.1 Teboho's experiences as a learner

Teboho still remembers how one of his teachers at primary school told him and the other learners that she (the teacher) was there representing their parents and that a teacher plays the role of the parent:

Since that time, she was giving time, whenever we needed help, she was there for us students, not myself, but most of us whenever we need help from her, she would be available. We can go to her place she will welcome us warmly, without saying this is not the right time and if, when we have our personal problems, she could tell us I am here for your parents, I represent your parents. If there is anything that you need help [with] I am here.

Teboho's comment about his primary school teacher indicates that he viewed his teacher's role in the classroom as going beyond teaching the subjects but also assuming a role of taking care of the learners and their personal problems. Teboho's experience

with his secondary school accounting teacher confirms his view of the teacher's role going beyond teaching subject matter but also assuming the role of caring for the learners. Teboho said the following about his secondary school accounting teacher:

At high school level, I had my Accounting teacher. She was self-motivated. Whenever we needed help from her, she was available; (pause) she wanted to help anytime, anywhere, in any area. That is my best teacher ever.

In this comment, Teboho pointed to two key attributes about his secondary school accounting teacher, self-motivation and availing oneself to assist learners. He viewed his teacher as someone who showed willingness to go an extra mile to provide time for her learners' problems. Teboho's view about a teacher as someone who goes beyond just teaching content but takes good care of his learners is evidenced by his experience with his secondary school English teacher as he described below:

... he used to dodge classes. Whenever he arrived, too much punishment for whatever we did not know. Coming to class, sometimes we thought he was not prepared for class. He was always ..., shouting like he was not happy. Then we were not able to come to him asking for help. So really, he was not friendly, if I may say.

This comment highlights Teboho's dislike for teaching practices of instilling fear in the learners or, worse, by applying corporal punishment. During the lesson observations, the learning environment seemed relaxed given the freedom with which learners talked among themselves and with the teacher as they worked on given tasks and given the freedom of movement as they followed the teacher everywhere when they wanted their work to be marked. This classroom experience suggests that Teboho did not instil any fear in his learners hence confirming his view that a teacher should be friendly to his learners and play a parenting role to give them comfort and care beyond just teaching subject matter.

4.2.2.2 Finding the teaching profession as an alternative

Although Teboho did not originally intend to become a teacher, he explained that he still

found passion in becoming one:

At first, I never thought I would be a teacher, but gradually when I was a student in Form D (Grade 11), I used to help my classmates. Then I discovered my ability in mathematics. Then I said, if I might be a teacher, I may bring a change to the nation. Since then, that is when I started to feel that I could be a teacher. Though there are some professions that I wanted to do, but I ended up being a teacher.

The comment above points to an instance, while in secondary school, which he felt might have influenced his career choice. Teboho's first exposure to teaching was through the tutorials that he conducted during school. He noted that his interest in teaching as a profession had always been there, but he just did not realise it. Teboho also commented about his exposure to teaching while he was senior secondary school learner and college student. He said:

I asked my woodwork teacher when I was supplementing some of the subjects: 'what if when I am free, I help you to teach this Form Es (Grade 12 learners)?' Then it started there, that, if I could be a teacher, I could be able to change the behaviour of the students. ... my maths teacher (Lecturer at LCE) used to leave me with the class. I was helping my [fellow] students, my colleagues ...

According to Teboho, assisting other learners, as he shared above, influenced his choice of career and ultimately his practice as a teacher, as he explained:

... that experience of teaching students while I was a student as well, really, I think it is one of the experiences that made me who I am today because whatever I do, I say I taught before becoming a teacher before I could be trained, but I did the teaching.

Teboho's comments, in this case, agree with Edwards and Quinter (2011:84) that learning experiences at school influence career choices made by learners. Learning experiences, in Teboho's case, included the teaching experience he had as he helped his classmates at both secondary school and tertiary levels.

Teboho said that when he failed to get admission into the accounting program, he turned

to the teacher-training program as an alternative. He then opted to apply to Lesotho College of Education (LCE) to train as a primary school teacher. He was admitted for training there. Even though he ended up in the teaching profession by chance, as he explained, Teboho opted to become a primary school teacher. The fact that Teboho ultimately decided to apply to LCE could be interpreted as having resulted partly from failure to get into his first choice of profession, accounting, and partly by making a personal choice to train as a teacher which is in agreement with another influencing factor as proposed by Edwards and Quinter (2011:83), the personal interest.

4.2.2.3 Teboho's views about teaching and being a teacher

Teboho's experiences with the teaching profession may have helped him to understand what teaching entails as he described below:

I was interested in other professions, but once I entered into the teaching profession, I have seen that we as people, there are some professions, like teaching, [...] is a will, it is a calling. We try to run away from our calling, from our calls (pause) but when you enter in, you will see, wow, this is where I am supposed to be. [...] that is what I have discovered.

Teboho viewed teaching as a "calling" and asserted that teaching is a profession which people sometimes avoid, but end up following it. He indicated that he too had a bad attitude towards being a teacher because of the treatment teachers got from the then Lesotho government when he was still a secondary school learner. This is what he said he told his parents: "How can I be a teacher under this government? The teachers are not treated well." However, Teboho ended up joining the teaching profession and began enjoying it, as he said: "...fortunately when I got into the profession, I have seen that I did not join the profession because I wanted to make money ... I am a teacher, now I am motivated ... what I want to see is to see students achieving". Kramer (2003:23) agrees by stating: "a professional doesn't view his or her profession as just a job, but rather sees it as a calling that is all about caring for children".

The narrative above explains that views and attitudes towards following a certain career

(teaching in the case of Teboho) are not always permanent. They may change, possibly because of factors that include parental influence and school learning experiences, which Njogu, Kibaara and Gichohi (2019:90) argue are some of the key factors that influence career choices.

While Teboho indicated that he views teaching as a calling, he also shared that he views a teacher as a parent. This is what he said:

It's (the teacher) a parent, above all. We left our places, our parents and everybody and we spend more time at school, so when we approach our teachers they represent our parents. ... So, like I am saying, a teacher is a parent, a parent is everything to his or her child, is a provider, is everything ..., when you need help when you are happy anytime, you express your happiness, your emotions to the teacher.

According to Teboho, learners trust and bond with teachers because they spend a lot of time with them and they feel free to talk openly and share their problems with their teachers. His practice reflected this perception in various ways as described below.

Besides rebuking some learners for misbehaviour, Teboho's practice also reflected actions and behaviours a teacher with parental roles would do and show. These behaviours include showing care and intention to nurture learners' knowledge and academic development.

Teboho's question, "Is there anyone who does not understand how to construct two parallel lines?" showed that he cared about the performance of his learners in class. That was in a lesson where Teboho taught them how to construct parallel lines. Towards the end of the same lesson, Teboho further indicated he cares about learning taking place in his class by saying, as he concluded the lesson, "It is time up. What we need to do is, there are some people who have fallen behind. For those who need help, let us meet after lunch".

Another aspect that characterises a good mathematics teacher, according to Teboho, is use of resources, as he explained:

When dealing with a topic area in mathematics, you may come across students who do not understand the concept itself ... Let me take area and perimeter, for example, they may not differentiate between an area and a perimeter. However, if a teacher uses concrete objects to differentiate between the two topics ... they enjoy [it] more.

Teboho's classroom practice involved the use of resources to better facilitate teaching. When he introduced the concept of parallel lines, he referred to examples of parallel lines with materials available in the classroom by pointing to materials, such as the chalkboard, and materials that have edges representing parallel lines.

T: So we are going to construct the parallel lines. Look around the class; just look around. You said you can see the parallel things or parallel lines.

Ls: Yes

T: Where, where are they? (Noise from students) The ceiling

Ls: The ceiling, window, chalkboard, the door, the ceiling, the table.

He went further to attempt to help learners understand why these materials have features that show parallel lines:

T: Yes, how do you know that they are parallel? (Pause) ...

L1: Vertical line.

T: We have a vertical line, horizontal line. *Eea* (Yes)

L1: They have a vertical line, horizontal line and straight line.

T: They are straight lines, Ok? The parallel lines are two lines that never meet. If you look at the board, this is the board.

Ls (chorus): Yes.

The excerpt below shows Teboho's view about the type of teacher he aspired to be:

When we come across a teacher who cares about the students, the students will

respond positively to the subject. So, that made me to try my best to be a motivated teacher even though there would be some challenges, but once the class is motivated, the students won't be afraid ... whatever the problem they come across, they will come to report, cry on, share happiness, everything.

This excerpt emphasises the need for teachers to assume an identity of a friendly and caring teacher so that learning becomes enjoyable for the learners and learners get help to grow academically as they develop their subject matter knowledge. In summary, according to Teboho, the attributes of a professional mathematics teacher include self-motivation, caring for learners, being friendly to learners and valuing the use of concrete learning resources and related strategies to create interactive learning environments.

4.2.2.4 Summary of critical components of Teboho's views and his experiences as a learner

This section summarises Teboho's personal experiences and perceptions about teaching, being a teacher, being a professional mathematics teacher, his understanding of a good teacher and the influence of these experiences on his perceptions.

Teboho's personal experiences influenced his discovery of teaching as a career. These include a lack of career guidance, his performance in COSC examinations and his exposure to teaching through tutorials. Initially, he wanted to become an accountant or a soldier and did not aspire to become a teacher. However, a lack of career guidance coupled with his failure to get admission into an accounting program because he did not meet the admission requirements, made him consider teaching. Teboho therefore opted for a qualification where admission requirements were less demanding. According to Edwards and Quinter (2011), career guidance opportunities clarify to the learners that admission requirements play a major role in admission into the programs and institutions of higher learning and that meeting admission requirements depend on the learners' secondary school level performance. Furthermore, Teboho realised that his exposure to tutoring, while he was in school and at college, also influenced the choice of his career in teaching.

Teboho believed that teaching is a calling and, even if a person has not considered it, the person may end up following the calling. He further viewed a teacher as a parent who represents other parents in the classroom. The data presented above further indicate that Teboho's perceptions about a "good" mathematics teacher were influenced by his experiences at primary and secondary school levels and while he was training as a teacher. Teboho's experiences include the motivation and support he received from his primary school teacher and secondary school accounting teacher.

The next section describes Teboho's experiences as a teacher which, in addition to his experiences as a learner, explain the mathematical practices observed in his classroom.

4.2.3 Teboho's experiences as a teacher

Teboho's professional experiences related to the school curriculum and content knowledge, the practice of teaching, peer collaboration and his perceptions about being a professional mathematics teacher.

4.2.3.1 Teboho's professional experiences

According to Teboho, the current curriculum requires teachers to read and research more "... but this curriculum needs us to research more. There are so many things that you do more so that we can implement them in the class."

Teboho compared the then new primary school curriculum with the old one and with the secondary school level curriculum. He said:

I was looking at what I taught in Grade 6 and I was comparing the prescribed content with what I teach these students. It is appropriate for a junior secondary program. To teach [at the primary level], you need to refer in their [junior secondary textbooks], so if you do not have the background, it is a problem ...

The point that Teboho makes here is that the CAP-L curriculum has brought changes that challenge teachers to the level that, in his view, is comparable to that of secondary school. Teboho laments that his school does not provide for specialised teaching. He said:

“Unfortunately at primary level, I do not know other schools, we are just forced to teach all subjects but this syllabus does not need that, it needs a very strong background of the subject”. His belief in teaching specialised groups of subjects made him appreciate the subject arrangements when he studied further as he said:

Yes, when I was from the college, like I said, we were doing more subjects, I never had time, ... but, fortunately, when I went to varsity, I have experienced that life would be easier when we focus on one subject like mathematics, like I did.

His comments suggest two things. First, that teacher preparation should provide for specialisation in subjects of interest. Second, primary schools should allocate subjects by areas of specialisation. Teboho’s comments further suggest that he strongly believes a good mathematics teacher has a strong mathematics background and that teaching by areas of specialisation could lead to teacher effectiveness and for teacher preparation to allow for subject specialisation.

Teboho shared his initial experience as a new teacher and his involvement in extra-curricular activities at his school. The experiences covered the practice of teaching and peer collaboration. He further gave his perception of the impact of involvement in clubs at school on learners’ performance. Teboho confessed that, in the first year of his teaching career, he did not know how best to start:

My first year, I was not sure where to start from, but gradually I tried to implement what I have learnt from the college then I have seen that students learn (pause) they don’t learn the subject itself, they learn the teacher.

On clarifying a part of the comment above, Teboho gave the following explanation: “They judge you as a teacher before they could take what you are going to tell them”. He tried to implement what he had learnt at the college. He also realised that his identity as a teacher influenced how learning takes place from the point of view of learners. In an effort to become more useful academically, he took part in extra-curricular activities where he led a mathematics club, as he explained:

The people that I am dealing with, their performance is exceptional, all the maths and science club members, their performance is exceptional, their behaviour is exceptional, the conduct, the way they do things in class, they are different from other students or from other learners at school.

He perceived the club to be instrumental in his learners' improved performance in mathematics, in particular, their participation in problem-solving tasks and provision of the much-needed opportunities to enjoy and have fun experiencing mathematics outside the classroom with their peers (Prescott & Pressick-Kilborn, 2015). However, classroom observations suggested otherwise as activities that learners worked on in Teboho's lessons did not explore much mathematics beyond the classroom. For instance, tasks were not in context. For example, the instruction by the teacher on a problem the learners had to work on in the first lesson.

Ok I will be helping others in constructing ... the parallel lines (writing on the board).
The first one should be ... the diagonal line. They should be three centimetres apart.
This should be vertical lines. They should be in four centimetres apart. On your own,
on your own.

Teboho's perceptions of being a professional mathematics teacher include the ability to develop learners' skills to integrate mathematical concepts and strategies to solve problems by themselves in their real-life situations. He said that professional mathematics teachers should be able to teach for the development of an integrated approach to problem solving:

However, if we are able to let learners to (pause) to integrate all these topics or all these concepts to solve the problems in their lives and if we are able to achieve that, I think we are professionals.

Although Teboho believes that mathematics teaching should use problems that learners solve to learn mathematics concepts and he was able to use the immediate environment when reviewing the concepts of parallel lines and non-parallel lines. His classroom practice did not reflect much of that. The questions he used to develop the lesson were

out of context and contradicted the two observations mentioned here. For instance, learners worked with routine questions, which were not in context. An example on constructing parallel lines is above.

Teboho's practice, in this case, showed a disjuncture, of a teacher who is aware that mathematics is not just numbers or measurements to be manipulated following a certain procedure but, in teaching it, he deviated by asking questions and giving tasks that were out of context. This observation suggests that Teboho perceives the subject of mathematics and its teaching in a more decontextualized field.

Teboho also viewed that a professional mathematics teacher should aspire to be "closer" to the subject or learning area of mathematics. Teboho indicated that he wished he had specialised in mathematics only, or in mathematics-related subjects or learning areas:

... sometimes I could say if I was trained when I was a student or if I could have done mathematics only or with other subjects related to mathematics, I could be a better teacher (pause).

In line with this view, Teboho perceived himself to be more inclined to teach mathematics than any other subject because he specialised in mathematics in his other qualification, the Advanced Certificate in Education (ACE).

The next section presents Teboho's experiences with teaching practices that support the effective teaching of mathematics.

4.2.3.2 Teacher practices that enhance effectiveness in mathematics teaching

Teboho said that his engagement with the mathematics and science club at his school was fulfilling because the classroom is more complex than in the club, where he focuses on sub-groups of learners with specific tasks and activities to do. This is what he said about this experience, "The classroom is more complex but, in the club, I will be concentrating on that subgroup or people who are in the club."

He explained that the benefit of engaging learners in the club is the provision of extra

curriculum per level, which helped improve his performance and extend learners' mathematics experiences (Prescott & Pressick-Kilborn, 2015). He said:

... Learning is faster in the club because you have to cover more, for example, I have ... Grades 6, 7 and 5. Grade 5, the concept that they have to cover, they have to do up to Grade 6 syllabus. There are some things they do in Grade 6, they should do in Grade 7. ... Grade 7 needs to do something that they did not do. So it helps me a lot to find some things that I never have or some things that I did in the class that I need to do more [that] I need to explain or give learners more work on them because, in the club, this is where I will find an exposure.

He claimed that he finds learners who need more help in the club but that it was a difficult role:

This is where I will find these people that I have in the club, they need more help and because *akere (Isn't it that)* I will be giving more work. I will be introducing new topics. I have to assess that work. It is true that it is more hectic but I have to and I manage.

Teboho claimed that the club provides platform for working on problem solving that requires deep mathematical thinking in the learners. He said:

At school I am a maths mentor, I train learners in problem solving. So, in the problem-solving category, we base ourselves [using] problems that need people to think, that require deep understanding [sic]. The question may need them to reflect on what they did in class or what they come across in life.

However, Teboho's classroom practice did not reveal an orientation towards a problem solving approach to teaching based on the type of tasks he used to teach mathematics which were non-contextualised and not problem-based (4.2.4.2 below clarifies this observation). Teboho's engagement with the extra-curricular academic activities, in this case, the mathematics club, indicates that he assumes multiple roles and hence multiple identities as a teacher of all learners in his class and as a mentor for the learners in his club.

4.2.4 Teboho's mathematics classroom practices

The data on classroom observations came from Teboho's three lessons, which I observed on 14th May 2018, 16th May 2018 and 21st August 2018.

4.2.4.1 A teacher-centred learning environment

Teboho had 54 learners in Grade 6A and 56 learners in Grade 6C. When asked how he managed to teach mathematics to these large groups he said:

It is hectic, but if you get used to them, like when we do maths, I normally prefer to demonstrate, then mix the sub-groups because, some of them, they track behind. They stay behind; they do not do anything because it is large and you may find that when marking if we are given, for example, four numbers to work out, some people do only two sums instead of all numbers.

During the lessons observed, which was his third lesson, almost all the learners seated at desks facing the front. Learners therefore appeared to work together of their own will. Figure 4.1 below shows the arrangement of learners in the third lesson observed while they were doing classwork and the teacher was moving around marking learners' books.



Figure 4.1: Learners doing classwork (and the teacher marking)

The seating arrangement seen in Figure 4.1 did not allow learners to work together comfortably as a group of more than two. To have groups of three or four, learners had

to stand in front of other learners. Therefore, most learners only managed to help one another in pairs. However, the learners still showed eagerness to have their work marked by the teacher. For instance, in the second lesson, which was for Grade 6C and started at 8:10 am, I noted the following:

8:45 As teacher moved from one part of the classroom to another, some learners who had waited to be marked began moving from their desks to where the teacher is, thus creating a somewhat chaotic situation (Extract from field notes; Lesson Observation 2).

In the other lessons, I observed a similar trend of learners moving towards where the teachers were so that they could be marked. Therefore, it is clear that, in activities where learners worked on exercises given after explanation of concepts by the teacher, most learners in Teboho's classrooms worked either individually or in pairs and then they would follow the teacher around the classroom to have their answers marked. Teboho's approach did not seem to require group work as a standard practice when learners worked on the exercises.

Even though Teboho did not use group work for learners to discuss ideas in the process of construction of meaning in the observed lessons, he explained the benefit of using smaller groups:

... but if I decide to make sub-groups in the class, they will try to help each other, and they make sure that each and every one of them is doing something. Then, if I access the small groups, then I will find which people in those sub-groups need help. Then I help them. I give them the homework and the assignment then individual works then it is when I will see, [that] this one or that one needs some more help. That is how I try, and I manage to.

The benefit specified here is that learners manage to help one another when they work in groups. Teboho further shared his experience working with smaller groups, in his comment below:

I normally enjoy working with them in small groups because they are many. When I

give them the class work, there should be something that I ... I will mark, so that I help the individuals. ... I cannot manage to help [all] individuals within 40 minutes but if I divide them into subgroups, I will be able to see fast and help them quickly so I normally use the subgroups, though not always.

The comment indicated a benefit, which is that the teacher managed to check all work done by groups, which means that all learners got feedback even though it was in groups.

Although Teboho explained his intended approach of using smaller groups to teach in his lessons and have learners help one another, classroom observations suggested that the standard practice was to have learners work from their desks individually, in pairs or in threes with the intention of finishing the work and submitting it for the teacher to mark. This observation illustrates Teboho's classroom practice, which deviates from his beliefs.

However, Teboho's practice did not indicate purposeful use of smaller groups to share ideas for construction of meaning from classroom activities. Instead, learners worked individually on the given exercises and occasionally helped each other to complete them to submit for marking. Hence, group set-ups seemed to work more to enable the teacher to move faster through the class in marking and attending to learners' problems.

With the given learning environment, it helps to understand Teboho's classroom practice first by looking at forms of facilitation he planned and executed in his lessons. I discuss these next.

4.2.4.2 Facilitating learning activities

Teboho's lesson had a generally accepted structure consisting of lesson introduction, lesson development and lesson ending. I focus on lesson introduction and development.

How Teboho began his lessons

The excerpt below shows part of the activity in Teboho's introduction of his first lesson where he taught "construction of parallel lines".

T: First of all how many straight lines do you know?

Ls: one

T: Which are they?

Ls and T (in chorus): horizontal line, vertical line, diagonal line. (Pause and a bit of noise)

T: We have ... the horizontal, vertical and diagonal line *akere (isn't it)?*

Ls: Yes

T: There is no straight line that is not horizontal, that is not vertical, and that is not diagonal ...

Teboho introduced his lessons through a review of prior knowledge by asking learners questions related to the concepts relevant to the current lesson. In the same lesson on “construction of parallel lines”, part of his introduction involved a review of straight lines. When asked why he began the lesson this way, he said:

I was constructing the parallel lines, so I have to review whether they know the types of lines so that it will help us to construct the lines because all the parallel lines are straight lines, so they have to know [that] before they get into what they are going to learn.

Teboho’s response indicated his intention to use learners’ prior knowledge in the lesson to support effective development of the body of the lesson. The importance of learners’ prior knowledge is emphasised by Borich (2012:53) in indicating that prior knowledge is essential for knowing the reasons for differing levels of attainment of the desired lesson outcomes by different learners.

Lesson development

As Teboho proceeded to the body of the lesson, he used a blend of direct instruction, demonstration and question and answer methods. Teboho explained concepts and

demonstrated skills while moving around the classroom helping learners individually or in their groups.

As part of facilitating in the lesson on the “construction of parallel lines”, Teboho described the technique to follow in the construction and he demonstrated how to use the compass as shown in the excerpt below:

I put the compass on the line then I make an arc. This is the first arc *akere ua e bona* (do you see it)? Then I go to another point on the line, I put my compass, I draw another arc Make sure that when you make the arc that your compass moves only on this side where you insert your pencil ...

As part of the skills he developed in that lesson, he gave his learners the techniques of using the compass for constructing parallel lines. When prompted why he chose demonstration as one of the teaching methods in his lessons, Teboho explained:

I will start with the one we just presented. I was teaching construction, which needs the instruments. Then, for pupils to construct, they need to see and observe me as a teacher do it.

This excerpt explains how, according to Teboho, learners benefit from demonstrations done by the teacher. Other than teaching skills related to manipulation of materials and instruments, Teboho also helped his learners develop listening skills in his mathematics classrooms. He said:

One other thing that I normally teach them is to listen; listening skill. If we give them instruction, it depends on them whether they will take it or they will write. If you give them instruction, if there is something that they have to do, they have to put in everything aside then write whatever they are given so that they will keep doing the work even if it is not there on the board.

He indicated that, in order to develop listening skills in his learners, he gave learners verbal instructions, which required them to listen carefully, to note the essential aspects of the instruction and to respond accordingly. However, with his knowledge that learners

sometimes do not have the same concentration span or may have missed the instruction, he indicated that he usually repeats the instructions he gives out to learners:

If you give them instruction, there are some who will do ... the work ... we give [to] them, they will not concentrate. That is why you have to give them [the instructions] from time-to-time.

In summary, Teboho approached the teaching of concepts that require handling and manipulation skills to use the mathematical set of instruments, and those that require calculations in the following manner: The teacher gave an example and explained how it was to be worked out; he gave the learners a similar question or set of questions; he then checked learners' responses as he marked learners' books and gave feedback to the whole class when he deemed it necessary to do so. This approach had the following series of activities: teacher explained a concept and gave a problem; learners worked on the given problem; teacher checked learners' answers and gave comments; the teacher then gave more problems for learners to do.

This section illustrates that there was a predominant use of teacher-centred methods in teaching content and skills to use relevant materials, including mathematical instruments. The approach was generally more teacher-centred than learner-centred since the teacher did more explaining of concepts and the learners participated more in answering the teacher's questions verbally and in writing in their exercise books and they hardly discussed among themselves. Even though Teboho's approach was more teacher-centred than learner-centred, his lessons still had instances that indicated the importance of learner involvement.

4.2.4.3 Use of resources from the immediate environment

Teboho used resources from the immediate environment as illustrated by the excerpt below:

T: The distance between here (teacher points to the top of the board) and this point (teacher points to the bottom of the board); and the distance from here (teacher points

to the top of the board; further right from the previous point) to this point (teacher points to the bottom of the board; further right from the previous point). Even from here to this point (teacher pointing to another two points); they are the same. So we say that they are, these lines from the board here, they make the parallel lines. ...

Ls (chorus): Yes.

T: They make the parallel.

Ls (chorus): Lines.

Teboho used the chalkboard to demonstrate parallel lines, assisted learners to experience parallel lines from materials in their immediate environment. The use of various examples in real life situations, such as structures that are part of the classroom interior, for example, the chalkboard and the ceiling, provided a real-life context to situate mathematical concepts. In introducing the “construction of parallel lines”, Teboho also mentioned that a straight line could be vertical, horizontal or diagonal, which covered all possible orientations of how to draw straight lines. Use of a chalkboard in this case provided an opportunity for Teboho to establish a working example of vertical, horizontal and parallel lines.

The use of the immediate environment for Teboho indicates his belief in mathematical ideas being part of our immediate surroundings and environments. Hence, for Teboho, we cannot separate the teaching and learning of mathematics from the (immediate) environment.

Use of examples and tasks as mediation tools were part of facilitation in Teboho’s lessons. I discuss these in the next section.

4.2.4.4 Use of similar examples and application of tasks in unfamiliar situations

Use of tasks and examples

Teboho gave his learners tasks that covered various purposes. In one lesson where he taught “construction of parallel lines”, he gave learners tasks, which focused on

developing the skill of constructing parallel lines using a ruler and a compass.

Ok I will be helping others in constructing ... the parallel lines. The first one should be ... the diagonal line. They should be three centimetres apart. This should be vertical lines. They should be in four centimetres apart. On your own, on your own.

While the example he used referred to horizontal lines, Teboho gave his learners a task to construct parallel lines placed in a slanting orientation, a situation that was unfamiliar to his learners. He explained his choice of a task involving slanting lines as follows:

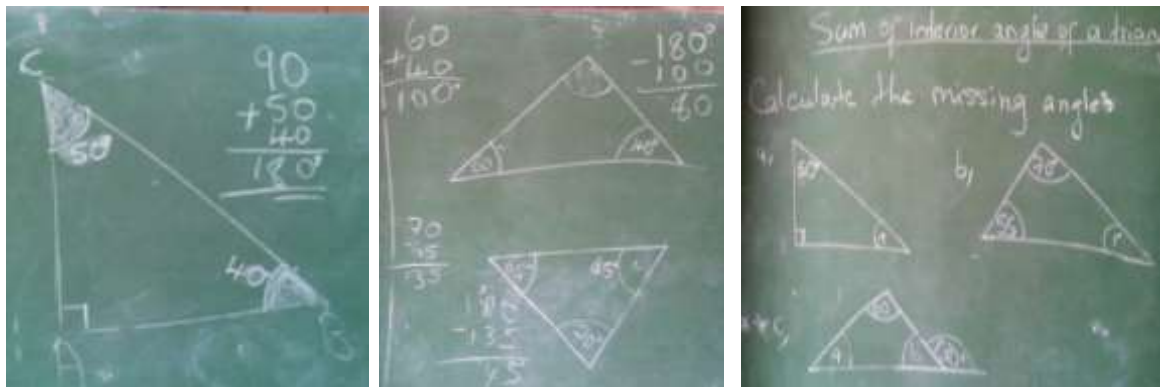
... books that they are using, they have horizontal lines. So, if I decided to use the horizontal lines, some of them, they will draw the lines on their books. They are going to draw on the lines and draw another one then they will try to construct on the lines that they have drawn. Instead, they are supposed to construct, then draw the lines on the arcs. That is why we decided to use the diagonal one, not the vertical nor the horizontal line.

The choice of a task with slanting lines was to deter learners from drawing lines of their choice along the already existing horizontal lines in their exercise books. It appeared that the purpose of the task was to engage learners in deciding on the procedure to use (Adler & Ronda, 2015) to carry out the construction in unfamiliar situations, which was slightly challenging, given the orientation of the lines. The nature of the task also reflected innovation on the part of the teacher to plan to use available materials (lined pages in learners' exercise books) in ways that avoided the confusing situations that have a potential to deter learning.

He gave them several more tasks focusing on the construction of more sets of parallel lines with different distances. For example, in the second lesson, which was for a different group of learners from the first lesson, the task required learners to construct parallel lines where the distances between the lines were 2.5cm, 3.5cm, 4.5cm, 1.5cm and 5cm per pair of parallel lines. The excerpt that follows is a verbal instruction that Teboho gave to his learners "Hei listen, if you did the first one and the second one and the ones I have written on the board, you do 2.5, 3.5, 4.5, 1.5 and 5 centimetres."

This type of task assists retention and develops fluency. The different distances between the lines in each task provided the variation (Watson & Mason, 2006) of an exercise in the particular set of examples, which served as mathematical objects for learning. It was variation, in the sense that different values tested if learners were able to do the work, based on the concept of parallel lines regardless of the distance between the parallel lines.

The type of tasks that Teboho used also provided examples with similar features. In a lesson where he taught “The sum of interior angles of a triangle”, Teboho instructed learners to draw a triangle ABC with $\hat{B}\hat{A}\hat{C} = 90^\circ$. He then instructed learners to measure angles at B and C. The teacher, together with learners, checked and agreed on the different options they had which included a triangle with angles 90° , 45° and 45° and another one with angles 90° , 50° and 40° .



A

B

C

Figure 4.2: Examples of problems given to learners in a lesson on calculating the sum of interior angles of a triangle

The activity provided many options of pairs of angles B and C (Figure 4.2, Picture A) that learners could measure. These options served as examples of right-angled triangles with one common angle (90°) and different other angles from which learners learnt that the sum of angles in a triangle is 180° , which was one aspect of the object of learning in that lesson. The teacher further worked on more options (Figure 4.2, Picture B) and gave learners an exercise (Figure 4.2, Picture C).

The cited lesson episodes suggest a mathematics classroom practice where examples are used to provide opportunities for learners to learn concepts through experiencing invariance (Watson & Mason, 2006) in terms of similarities (Adler & Ronda, 2015) in the examples used. The examples worked by the teacher and the learners were for the consolidation of learners' understanding of the concepts taught.

When asked for clarity on his use of examples, Teboho said the following:

The first thing that I have to check is to check how they did what they were supposed to do. Then if I find a misconception, I rectify it and then, after rectifying it, I normally give them something that they can do together with me. But, if I need to do it with them, I do it then I give them something they have to do on their own. Then I just give them guidance concerning that misconception that I found.

This comment highlights three things about how Teboho used examples. First, the use of an example to clarify concept development as the teacher realises the development of a misconception. Secondly, that the teacher works on the example and then gives exercises to learners to check their understanding following the example the teacher showed them. Lastly, having both the teacher and the learners working on the example, where the teacher guides the learners. The last point indicates the predominance of the teacher role to avoid leaving the learners on their own to work out the answers, instead the teacher works closely with them. This aspect depicts the teacher's role as more of directly assisting and guiding learners through making sense of the mathematical concepts than leaving them on their own.

Language is a key element in facilitation of teaching and learning, as participants communicate ideas. I discuss language use in the next section.

4.2.4.5 Language use and classroom discourse

I discuss one aspect of language in this section, which is the use of mathematical words and phrases in what Adler and Ronda (2015) call "naming". Teboho's use of mathematical language shifted between colloquial use (ordinary, everyday or ambiguous use) and

formal use. The quotation below illustrates this:

If you look at your compass (*pause*), you have ... the black part of your compass, where you hold, you turn here. (*pause*) You do not hold your compass here (Teacher holding the middle parts of the arms of the compass), but there is a black part that you have to hold

This quotation illustrates a situation in Teboho's lessons where he described procedures to follow when using a compass in constructing parallel lines. In the excerpt above, there are statements, "black part of the compass", "where you hold, you turn here" and "do not hold your compass here". The phrase "black part" referred to the hinge of the compass and the word "here" indicated the part or position of the compass in the second instance while, in the third instance, the word "here" referred to the middle part of the arms of the compass. Teboho's practice of shifting between colloquial and formal language provided opportunities for more flexible communication with the learners, without letting language be a barrier of learning in order to appreciate effectiveness of facilitation in any classroom, to examine the nature and extent of learner participation in classroom discourse.

The study considers classroom discourse through aspects that include language usage and learner participation (Adler & Ronda, 2015). In his first and second lessons, Teboho asked questions that mostly required yes or no answers. His use of the demonstration method as described in 4.2.4.2 above meant that Teboho "told" learners the steps in the "construction of parallel lines". At each stage, Teboho asked his learners to confirm their understanding. He commonly used phrases such as "*akere?* (Isn't it?), *rea utloana akere?* (Do you get me?), *akere le ea bona?* (Do you see?)"

In response to these phrases or questions, the learners uttered single words such as "yes" or one-word responses where the teacher's questions required specific answers, not just confirmation. He seldom asked the "how" questions that required responses in phrases.

Teboho did more talking when explaining what parallel lines are, drawing learners' attention to examples of materials that have straight edges that are parallel, and when

explaining the procedure of constructing parallel lines. Among his explanations, he assisted learners in realising that we cannot use the same measurements on paper as on the chalkboard. To do this, he emphasised the use of 2cm on paper compared to the use of 20cm on the chalkboard. The excerpt below is testimony to Teboho's practice as described above:

T: So *e lokile?* (Is it okay?) I said you open your compass two centimetres so now you do as I do. Twenty centimetres, *ua bona akere?* (Do you understand, right?) This is twenty centimetres. In your own compass, you are going to make, how many centimetres ...?

L: Two

T: How many centimetres?

L: Two

T: Two centimetres *akere* (right!)?

L: Yes

It was in his third lesson, on the calculation of the sum of angles in a triangle, that Teboho began engaging his learners with questions that required them to respond using phrases or sentences but there was still hardly any discussion to allow for more reasoning and arguing of points by the learners. For instance, in one episode, Teboho asked learners to explain how they obtain a missing angle in a triangle with two angles, 60° and 40° . One learner shared the procedure as "add 60 and 40, get 100, subtract from 180 to get 80".

In this section, we learn that classroom talk and short answer responses from learners were dominant. We further learn that learner participation was by way of predominantly working individually on classwork and seldom working in pairs or threes. Learners worked in pairs and threes on the teacher's exercises. When the teacher was busy illustrating examples, he expected learners to watch and, at times, to acknowledge that they followed what the teacher was illustrating. Therefore, one can deduce that Teboho believes in

individual work among the learners, which compromises sharing of ideas and learning from one another. Teaching is therefore more teacher centred and Teboho is a provider of explanations and questions (both verbal and written) to check learners' understanding.

4.2.5 A summary of Teboho's case

Teboho shared several expressions about the teaching profession. He characterised a teacher as a role model whose roles include being a parent by teaching and taking good care of the learners. From the lessons I observed, learners in Teboho's classrooms seemed relaxed and not under any duress to behave or perform in any way that might be different from their normal day. Teboho attempted to exercise control in ways that included calling for order when learners were noisy, especially when he was moving around the class marking learners' work. Other than his role as a teacher of certain grades at his school, Teboho was also responsible for the mathematics and science club at his school. He organised and had to oversee all activities of the club at the school and even outside the school. Therefore, Teboho had multiple roles, those of a teacher at his school and a mentor in the mathematics and science club at his school.

The teaching approach by Teboho followed the pattern of explanation-exercise-feedback, with the explanation given to the whole group of learners and feedback directed at smaller groups and, in some cases, individuals. The approach could have been problematic because it engaged learners more in listening to the teacher's explanation and answering the teacher's questions orally and in writing. The approach did not provide learners an opportunity to interrogate, among themselves, ideas raised by the teacher.

Teboho's approach in the lessons I observed showed his firm conviction that, in order to use instruments or other tangible materials to teach mathematics, the teacher first has to teach learners how the materials work. Teboho also held the view that, from time to time, he has to remind learners about instructions and procedures related to the tasks given to them. His approach was more teacher-centred than learner-centred.

4.3 Case 2 – Khothatso: A caring, passionate and explorative teacher

4.3.1 Khothatso's biography

Khothatso is a male teacher, aged 33 years. He was born and raised in a district in the region South West of Maseru, Lesotho. He attended primary and secondary school in the same district where he was born and raised. Both schools are located in a town in that district. He trained as a primary school teacher between 2007 and 2009 and obtained a Diploma in Education Primary (Dip.Ed. (Prim)). At the time of data collection, he was completing his studies towards a Bachelor of Education Primary (B.Ed. (Prim)), a four-year degree program which he started in 2014, and he was enrolled on a part-time basis. His pursuit of a further qualification in education was indication that he intends to develop his professional identity as a teacher.

He has worked as a primary school teacher since 2011. He has taught almost all levels from Grade 2 in 2011 up to his current class of Grade 7, at the time of data collection.

The sections that follow present Khothatso's views and experiences as a learner and a teacher.

4.3.2 Khothatso's views about teaching and a professional mathematics teacher

Khothatso's early personal experiences which include guidance from his mother who was a teacher by profession and his primary and secondary school teachers, seemed to relate to his views about a professional mathematics teacher.

4.3.2.1 Khothatso's experiences as a learner

Khothatso had several teachers, college and university lecturers who were his role models. Firstly, there was his secondary school English literature teacher who instilled a culture of reading in him. Khothatso said the following about being inspired to read by his secondary school literature teacher:

... When I look back, I can say at high school I used to have a literature teacher, *Ntate*

(Mr) ... I forgot his name; he inspired me. He taught this literature books at high school, and he was teaching in such a way that I enjoyed reading; I wanted to continue reading even after classes.

Secondly, his physics lecturer at the College (LCE) whose lessons, according to Khothatso, were enjoyable inspired Khothatso. This lecturer was apparently also involved in extra-curricular activities and this made Khothatso admire him. This is what he said about the lecturer:

Then moving to tertiary, there was a lecturer that taught me physics, he taught while not teaching. By that, I mean I did not feel like I was in a classroom while he was teaching and I enjoyed that very much. The manner in which he approached physics and how he taught and generally everything that he did around the college because he was not confined to the classroom but also sporting activities, he was there. I look up to him a lot.

Thirdly, Khothatso was influenced by his university lecturers on matters that related to the handling of learners. He explained his experience in the following way:

... and from there, I think it is current teachers at the university, the psychology lecturer, the counselling lecturer, the mathematics lecturer. They make us change the manner in which we approach our learners and everything, so those people really have changed me, or they have inspired me.

Khothatso's teachers at school level and lecturers at the college and the university inspired him on matters related to learning and pedagogy. Maasepp and Bobis's (2014) explain Khothatso's experience by indicating that during teacher training mathematics educators influence prospective teachers' beliefs through, among a number of things, establishing rapport with them. The authors also argue that such beliefs further influence how the teachers view themselves as teachers and the teaching approaches they aspire to implement in the future.

While Khothatso had good experiences as a learner at both school level and tertiary level, as presented above, he also pointed out challenging experiences. Khothatso shared

experiences he had with one teacher at primary school level whom he did not consider a role model because of her temperamental attitude. He said the following about his teacher:

I think I can say my primary school teacher who taught me while I was in Grade 7 (*pause*), she had what I now realised to be mood swings and she would punish us severely, so one did not enjoy school that much at that level.

He also had difficulty understanding his secondary school mathematics teacher because of his accent as he explained:

From there, I had another mathematics teacher at high school, when I arrived at Form D, who, for one, I could not understand what he was saying when he was speaking ... the manner in which he pronounced things, I could not understand him. He was not approachable, ...I did not particularly like him, so I ended up failing mathematics at high school level.

Herbel-Eisenmann et al. (2013) highlight the importance of the relationship between those who take part in classroom discourse activities (that is the teacher and the learners). The authors view the relationship as important because it paves way for better understanding between the two since issues of language (including mathematical language) and context are relevant to the way the teacher facilitates through what the authors call Teacher Discourse Moves (TDMs).

In summary, factors that contributed to Khothatso's attitudes towards learning include the kind of relationships his teachers developed with him as a learner. He indicated that his secondary school mathematics teacher was "unapproachable" and created negative attitudes in the learners towards the teacher. In contrast, some of Khothatso's college and university lecturers made him feel at ease, as they were approachable.

The next section presents the influences on Khothatso's choice of career.

4.3.2.2 From a lack of career guidance to opting for job security

Personal experiences that influenced Khothatso's choice of teaching as a career as reflected in his expressions included being undecided about what to do (lack of career guidance) and perception about teaching as a job. Khothatso indicated that he did not know what to do after completing COSC. He also indicated that his mother, who was a teacher by profession, advised him to apply to teacher training at LCE where he got admission to study:

Like any unguided learner at form 5 ... I did not know what to do so I was advised by my mother who is a teacher to just try my luck and apply and see what will happen. That is when I actually decided to apply and I got admitted.

Khothatso's mother was a teacher by profession. Studies by Otwori et al. (2017:496) and Fareo and Garkuwa (2018:6) help explain the parent's career in this case as a possible influence on Khothatso's career choice. The authors established that parents' occupations and the family career preferences influence their children's career choices. Khothatso's other reason for joining teaching was that it was easy for a trained primary school teacher to get a job:

Well, at that time, when I was told to apply, the main issue was that if one studies education, especially primary education, it will be easy ... to get a job, so that is one of the reasons.

This confirms Edwards and Quinter (2011)'s argument, that job security is a factor that influences career choice; a teaching job in the case for Khothatso.

4.3.2.3 Khothatso's view about teaching and about a professional mathematics teacher

Khothatso viewed teaching differently from how Teboho viewed it. He explained:

It was not a calling like people say it is a calling; it just happened that I did not know what to do after the completion of Form 5, so then I decided to go for teaching.

He pointed out that he joined the profession by chance because he did not have any other option to consider. Khothatso, therefore, did not view teaching as a calling, but rather as a last option in his preferred careers. However, it would be interesting to find out how Khothatso fared once he joined the profession as a primary school teacher. He shared his perceptions about being a teacher and his experience as a primary school mathematics teacher.

Before he trained as a teacher, Khothatso perceived a teacher as someone who is strict and someone who is a role model to the community:

Well, according to me, a teacher was supposed to be a strict person always formal, someone to look up to in the community, someone who is very strict, unapproachable, someone you cannot challenge but someone that you can go to for any kind of help.

His perception about a teacher began to change when he began his training as a teacher. His college lecturers influenced the change, as he explained:

I think exposure; I got exposed to different lecturers at the Lesotho College of Education. They gave me different views of life, how we should shy away from stereotyped thinking and do what we want as long as we believe that it is right but still maintaining that respect of being a teacher. That is when I changed when I arrived at the college.

Khothatso's view implied what he thinks teacher-training needs to emphasise on teacher preparation, as he explained in his further statement:

Hmm! I think ethics are the most important things that should be emphasised ... The manner in which we treat learners should change so that they enjoy coming to school and participating in classroom activities, so what the colleges and university can do, I think they should mainly focus on changing the behaviour of teachers.

It seems Khothatso's interest is that colleges and universities mould teacher behaviours so that learners enjoy coming to school and enjoy learning. I view this as defining a role of "caring", which resonates with Ferreira and Bosworth's (2001:28) argument that

teachers' care of learners is not only defined in terms of "helping with and explaining work", but also "checking for understanding, encouraging and guiding". Khothatso argued that he wants to see teacher training that aligns to the needs of the type of learners these trained teachers would teach. He explained:

Changing behaviour and mindset ... since we were lashed at school, insulted and all those, we should not come with that mentality and try to impose that on current learners because the manner in which they are brought up is very different from the manner in which we were brought up. So teachers need to be taught in a different way. I do not know how, but it has to be different to accommodate this new generation of learners.

Khothatso's comment in this case implies that one of the key factors on decisions about how to prepare teachers should be the type of learners the teacher trainees are going to teach.

Knowledge and experience appeared to be other teacher attributes that Khothatso valued in a teacher. He perceived accumulated experiences as one of the attributes that make a good mathematics teacher. He said:

I think experience is the best teacher. The best way to improve with mathematics is to keep practising it.

Shulman (1986:10) labels (teaching) experience as a wisdom of practice accumulated over time, while Rowland, Thwaites and Huckstep (2004:125) observed that one of their participants had experience as one of her main resources and Hurrell (2013:55) argues that experience is the major influence on the development of knowledge (PCK, in particular). Experience, as Khothatso argued, plays a significant role, not only for teaching but even for the development of the teacher.

Researching an area of specialisation is another attribute that Khothatso mentioned. When asked to elaborate, Khothatso referred to researching using the material and human resources:

Researching, finding different ways of doing one thing, finding different books, not relying on textbooks, which are provided to us by the Ministry of Education because, when you go to the internet, you can find numerous resources making mathematics more interesting or different ways of assessing learners.

Khothatso's practice reflected this teacher attribute in that he used a variety of material resources in his classrooms, which included the use of a computer and data projector, advertisement flyers and many other resources that he instructed his learners to bring to class (more detail to follow in section 4.3.4.3 below). He also asserted that asking for assistance from secondary school colleagues is another way that teachers can equip themselves with the necessary knowledge and skills:

... or even going to a high school teacher and saying 'help me out, this concept I did it when I was in form D now it is no longer there. How do I approach it? How do I bring it down to the level of a primary school learner?'

According to Khothatso, research to improve knowledge needs to be done with various types of resources. They include collaboration with other teachers who have more knowledge in mathematics and technological skills for teaching and research.

4.3.2.4 Summary of critical components of Khothatso's views and his experiences as a learner

This section presents Khothatso's expressions of his experiences and perceptions about teaching, a teacher and a professional mathematics teacher. These include how Khothatso's personal experiences influenced his discovery of teaching as a career.

A teaching profession was not Khothatso's first choice of a profession. He was not sure which profession to follow. Personal experiences influenced his choice to become a teacher. He did not have career guidance but, after advice from his parent (his mother), he believed that a primary school teaching qualification held better job opportunities. Therefore, he applied for training to become a teacher.

For Khothatso, teaching is not a calling. He believes that he was led into teaching by

circumstances but that one still has a choice about what career to follow. He understands that a teacher is a role model who should be approachable and predictable.

According to Khothatso, good teachers have the following attributes. Firstly, the teachers have to observe ethical behaviour. Secondly, they have to be techno-savvy. Thirdly, they have to be prepared to research and learn more about their areas of teaching including seeking assistance from colleagues on matters that pertain to teaching; and lastly, they have to be experienced in matters that relate to teaching and learning especially in his/her area of teaching. In particular, a professional mathematics teacher has to show patience and support his learners in developing competencies in the subject area.

Khothatso's interaction with his teachers and lecturers at different levels of learning influenced his perceptions about what teaching entails and the roles the teacher should play in facilitating teaching. The experiences he had with secondary school teachers and lecturers at tertiary level influenced him to use teaching approaches that engaged his learners. However, he indicated his discomfort with the current curriculum, which he said is very challenging for both the teachers and the learners.

4.3.3 Khothatso's professional experiences as a teacher

4.3.3.1 Khothatso's professional experiences

Although he got into teaching by chance, Khothatso developed into a professional mathematics teacher through the experiences he had in the profession over several years in relation to curriculum, extracurricular academic activities and working with learners.

Khothatso viewed the current curriculum as difficult for the learners. He shared that it is also demanding for the teacher as it is at a higher level of understanding for both the learners and the teacher:

The old curriculum that we used to use was ... I do not think it is right to say easy, but we were used to it because it was something that we were taught when we were in primary; something that we went through at the college. Now coming to this new one,

it is new, the content is at a different level than the one that we used to have, and the learners themselves find it hard to grasp the content that is being taught.

Khothatso suggested an explanation for the challenge encountered with the primary school curriculum in Lesotho. He thought that the challenge was based on teachers' competencies because the content was at a higher level than what the teachers were trained.

I do not know whether it is us as teachers; we do not know how to deliver the information (laughing), or the content is of a high level. I do not know, but teaching it (*the current curriculum*) is more demanding than the old one; very demanding because one has to research a lot. For example, concepts like rotation, transformation and all that, they are taught in Grade 7 and it is something that I did at high school and teaching it to someone who is in Grade 7 bringing it down from that complex stage to where a learner can understand, it was not easy at all.

However, Khothatso still had to find a way to deal with these challenges. When asked how he dealt with challenging topics in the current curriculum, Khothatso indicated:

I think it is making sure that what I do not know, I postpone teaching until such a point that I feel confident enough to teach, and if I believe that I am not confident enough to teach a particular thing, I would rather ask for help from someone else to come and teach that particular subject. I mean content that I wanted to teach.

Khothatso indicated he deals with tricky concepts in two ways: to teach the concept at a later stage when he feels prepared or to ask for assistance from colleagues to teach for him. Khothatso's comments suggest that there is need for continuing teacher professional development. Drake and Reid (2018:46) attest to this when they suggest that, over and above encouraging teachers to use an approach to teaching that integrates curriculum, teacher preparation should have direct teaching on competencies as one of the focal areas and that further professional development would benefit teachers.

Part of Khothatso's experience as a professional teacher of mathematics was taking part in extra-curricular academic activities such as playing a role in preparing learners from

his school for activities including competitions with other schools, at the district level. He said:

When we have mathematics competition with other schools, I am the one who is in charge of preparing learners and making sure that everything runs smoothly in as far as mathematics is concerned.

This preparation, according to Khothatso involved:

... a selection of learners, training of learners, preparing them psychologically to go and write and the setting of questions which they will write, marking ... everything.

These experiences illustrate how Khothatso played the role of a teacher, a mentor and a coach in school-based and inter-school academic activities. Such activities contributed to his growth as a professional mathematics teacher.

4.3.3.2 Teacher practices that enhance effective teaching and learning

Khothatso indicated that, the first time he taught, he found himself having to teach all subjects and integrating subjects and concepts:

Then I came to school here, and I was forced to teach a class by myself where I teach everything by myself. So, I had to find ways of making all subjects interesting, not just mathematics. So I would, while I am teaching English, I would talk about something in mathematics, (*pause*) for example, in agriculture we would talk about money which is there in mathematics, the addition of the money (*pause*) ... I would also talk about decimals so that, in a way, changed me.

This approach enabled him to integrate mathematics concepts with other disciplines as he taught. His approach is a practice that is encouraged for the 21st Century classrooms (Van de Walle et al., 2013; Drake & Reid, 2018).

In his early teaching years in his new school, Khothatso witnessed corporal punishment meted out to learners for various reasons including poor performance in class. He said:

Another thing is the use of a stick that one has completely changed. When I first arrived here, learners were lashed a lot, disciplining them, to motivate them to do their work. After some time, I saw that that does not work and I stopped it. Instead using communication is what works.

He indicated that, when he first arrived at his school, teachers used to lash learners to force them to do their work but he stopped corporal punishment of learners in his classroom. As he grew in his profession, he learnt to be patient with learners to allow them to improve in their studies. He further said:

I think the one thing which has changed in me is being patient with learners, not assuming that learners know and that all of them will understand at the same time. (*pause*) I used to assume that once I am standing here, and saying one plus one is two, all of them have understood, and the next time when I give them a test, they will all answer correctly. So that has changed. I saw that each of them needs a teacher to be there, to guide them so that they achieve what is intended.

Khothatso pointed out that previously when he taught a concept, he expected all learners to understand at the same time and that when he asked a question, learners would give correct answers. Beltman's (2015) study points out that the pre-service teachers may perceive their future teacher selves as "positive, confident, capable and happy" (p. 241). However, the author further indicates that the teacher educators and mentor teachers face challenges that include sustaining the pre-service teachers' enthusiasm and providing support and opportunities for them to create a strong, professional teacher identity. Khothatso may have begun developing his teacher identity in being patient with learners, which helped him to develop strategies to teach for understanding and to help his learners avoid relying on memorisation. He shared a strategy he used:

... I give a learner time to work it out, come up with a way of finding nine times nine, so when I taught my learners that, it took some time and, in the end, I saw them getting what I want them to do.

Khothatso's management of his classroom as seen in what transpired in one of his lessons is evidence to his growth as a primary school mathematics teacher:

T: Thakane (pseudonym), this is not a constructed shape. Only one shape that we did on Wednesday? Where is the shape that you were supposed to construct on Friday and over the weekend?

(Teacher is looking at the work of students)

T: Some of you, honestly, both of you have not done what I asked but it is fine. I am not...?

LS: Surprised

T: I am not surprised, it is nothing new. So let us look at the following from your When we talk of a shape, you hold your cube. When we talk of your shape which part are we specifically looking at? *Ntate* Tseko (pseudonym), show us. Aha! I thought you are going to do (learners laugh). How many are there?

The excerpt above indicates the extent of Khothatso's patience with learners who did not do the tasks given by the teacher. From the response of some learners who in chorus said "surprised", it was clear that the learners could share their views about what they observed in class without fear that they would face corporal punishment or any form of reprimand.

To Khothatso, a professional teacher has attributes that include positively influencing learners, being patient with learners and being willing to support learners in their efforts to learn. He mentioned that he had a positive influence on his learners, and that he had the potential to lead his learners to improving their attitudes towards mathematics and the teacher. An example of this was his decision to stop corporal punishment in his classroom, as he explained. This evidence points to changes in beliefs, and how Khothatso viewed himself as a mathematics teacher, because his own experiences as a learner and as a new teacher showed that corporal punishment cannot always make learners learn, instead learners need to be encouraged in their efforts to learn. Khothatso's argument that learners need positive influence and support to learn is in agreement with Rodríguez, Regueiro, Piñeiro, Valle, Sánchez, Vieites, and Rodríguez-Llorente (2020) when they indicate that when working with learners with high academic

anxiety, efforts to increase successful experiences to foster perceived competence help to change the learners' negative academic wellbeing.

This section focused on the perceptions about a professional mathematics teacher from Khothatso's experiences. The next section presents Khothatso's classroom practices. The section further presents critical aspects of professional identity suggested by these practices.

4.3.4 Khothatso's mathematics classroom practices

Data used in this section came from classroom observations and interviews. The classroom observations I made on 26th February 2018, 7th May 2018 and 14th May 2018 contributed to this data.

4.3.4.1 A flexible learning environment

Classroom arrangement for flexible teaching and learning activities

There were 32 learners in Khothatso's classroom. The arrangement of desks was in groups with a flexible seating arrangement to allow learners to face the front when there was a need to do so, and turn around to face each other for discussions amongst themselves.

Khothatso explained how the arrangement of learners in groups helped in the teaching of mathematics. He pointed to three aspects.

Firstly, convenience in marking:

Sometimes I give them a lot of work to do and which I need to mark. So, if they are in groups, that means I will mark per group, I will not mark per learner, so it is easy for me to mark.

Secondly, so that learners help one another:

... and another reason is that they often, not always, they often help each other. So

the manner in which I have placed them, I have tried to put a learner whom I am sure that is capable next to another one who is struggling so that they help each other.

Khothatso appears to use the classroom arrangement to support both teacher activity and learner activity. In particular, learners' potentials and strengths are key factors in determining classroom arrangement as the faster learners assume strategic roles in the classroom to support those that struggle. The arrangement of learners therefore becomes the structural part of classroom practice or norms that support the development of a culture of participation (Bennet, 2016:20).

Stimulating Learning Environment

Khothatso indicated his approach to create a stimulating learning environment:

From there, it is finding different ways of making a lesson interesting, making sure that there is humour in the classroom but not too much and building trust between my learners and myself.

For example, in one of the lessons, he instructed learners to bring materials to use in mock sale of goods to illustrate the concept of sales in percentage calculations. As he instructed them to take out their materials to give them prices, there was a lot of laughter that did not bother Khothatso.

T: We need to move. You have items, which you have brought.

Ls (in chorus): Yes, sir.

T: Take them out (Learners take out their various items as they laugh at each other)

T: Price your items (Khothatso giving out instruction to everybody). Do not tell me you brought a lunch box. (Learners continue laughing at one another, but Khothatso did not mind)

In this lesson, I could discern Khothatso's sense of humour. Learners appeared free to talk and enjoy a few jokes while still seriously engaged in learning activities.

The environment was friendly, with the teacher and learners enjoying a few jokes made by the teacher and enjoyed by learners yet there was a definite degree of control from the teacher. An example was when Khothatso made an example when teaching the concept “*Calculating discount in buying and selling goods*”. He said:

T: So we are saying that when we are talking about a sale, we are selling a particular item but that item we are selling it at a lower price ... probably. I like to make an example with the ... what do I normally make an example with, something that costs 50 Maloti? (*Learners laughing*) A fat cake, how much is it?

Ls: 50 cents

T: So, 50 cents, so you say, I am making a sale today, I want more people to come and buy, so I will sell my fat cakes at 40 cents, so it's a sale (*Teacher pointing at the board*) The price is lower, from normal to low. So it says sale and discount.

When the teacher called for attention to discuss something, he could easily control the levels of noise and the mood in the classroom. It was an observable practice that, when the teacher wanted to clarify something, he went to the front of the class; an act that seemed to call all learners' attention to the point of discussion.

Khothatso taught a manageable class, where the environment was friendly with the teacher exercising a form of control to direct classroom activities and interactions, while allowing learners freedom to talk and share or enjoy a few jokes or amusements. Khothatso could manage to give individual attention to learners as he had reduced numbers of learners (Galton & Pell, 2012) and this further allowed him to be explorative and innovative. Khothatso's ability to vary interactions among learners and between learners and himself had the potential to enable more participation and enhance mathematical thinking (Brodie, 2007a) among the learners. The classroom arrangement reflected Khothatso's intentions to allow flexibility and interactivity as teaching and learning progresses in his mathematics classroom.

4.3.4.2 A blend of teacher-centred and learner-centred approaches

How Khothatso began his lessons

Khothatso introduced and concluded his lessons. It appeared a common practice in his observed lessons to begin the lesson with an introduction that dealt with either a review of previous lessons or treatment of pre-requisite concepts. Below is an excerpt from his first lesson where he taught calculating discount in buying and selling goods.

T: For the last two days we have been focusing on money.

Ls (in chorus): yes, sir.

T: We saw where we were looking at eh what ... uhm percentage in money. What else?

Ls: (in chorus): Profit

T: Profit, we looked at how to calculate when we have profit in a business, then we looked at how we can make a loss in a business ...

T: So, today I want us to look at sales and discount.

Khothatso also gave his learners homework to develop prior knowledge in preparation for lessons that were to follow. Verbal exchanges below indicate an incident when he gave learners work to do at home in preparation for the lesson to follow:

T: (inaudible) I said you should construct them. (Learners laugh) I want them constructed sir (inaudible).

(Students make noise)

T: Thabo (*pseudonym*), this is not a constructed shape. Only one shape that we did on Wednesday? Where is the shape that you were supposed to construct on Friday and over the weekend?

Lesson introduction by review of previous knowledge and provision of homework to

prepare for the next lessons helped Khothatso's learners to build onto knowledge they already had. Khothatso's approach, when beginning his lessons, reflects his belief that learners need to be prepared and sensitised to be able to engage with new knowledge.

Learners' chalkboard work to anchor discussions

In a lesson where Khothatso taught, "calculate discount in buying and selling goods", he instructed learners to price their items and to take turns to share their calculations on the chalkboard (see Figure 4.3) for the rest of the class to see. This approach helped to initiate discussions on the solution strategies.

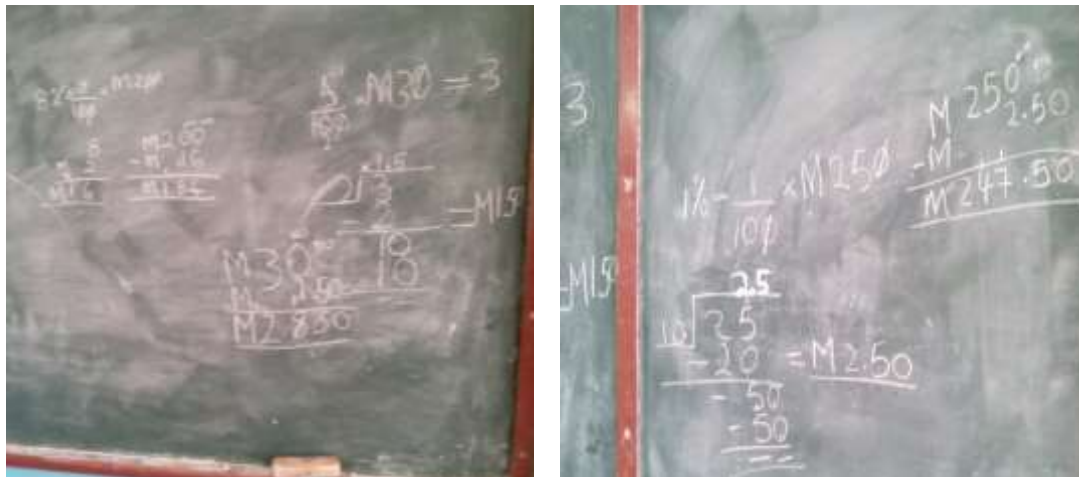


Figure 4.3: Samples of learners' chalkboard work in Khothatso's classroom

Learners were directly engaged in their own learning through giving ideas about concepts dealt with and further providing them with the opportunity to discuss the concepts.

Use of body language as a resource

Khothatso emphasised the meaning of discount by stating the definition in several ways with gestures to indicate key concepts as seen in the following excerpt:

The amount of money that is taken (the *teacher pulling back the hand as if taking away from something*) from the cost of an item or a good? ... discount; money taken from (*teacher pointing to the definition written on the board*) the cost of the goods.

Use of gestures could serve as a form of representation. As Khothatso pulled his hand back in emphasis of “money taken away” this provided learners with an opportunity to discern meaning from this gesture and to associate further terms such as reduce and subtract. This gesture indicated the innovation that Khothatso made to emphasise a learning point in the calculation of discount. Anthony and Walshaw (2009:156) indicate that tools in mathematics classrooms that are used to support and extend mathematical reasoning and sense-making come in many forms that include analogies. Cooperrider and Goldin-Meadow (2017) further argue that the field of analogy and gestures provide researchers who are interested in analogy with “untapped” naturalistic and omnipresent sources of data. Although Sarina and Namukasa (2010:5742) indicate that analogies help learners to connect new knowledge to their existing experiential knowledge, they suggest that the most important criterion for choice of analogy is whether the analogy is meaningful to the teachers’ own understanding of the mathematical conception in question. This data may also benefit educational research to inform curricula on teacher training. Khothatso’s practice, in this case, shows his belief that teachers should use different forms of representation to help learners understand the concepts taught.

The pacing of the lessons related to who was the focus of activity in Khothatso’s lessons, according to his explanation:

If I want to cover a lot of content, then most of the time I will be the one who is dominating to make sure that we move at a fast pace but if I have seen that I have covered enough for this week or this item, I can cover for this week so I can relax. That is when I engage my learners in as many activities as possible.

According to his explanation, his lessons became more learner-centred when he had time to spend on more activities, while they became more teacher-centred when he worked under pressure to cover a lot of material in a short space of time. Khothatso confessed to a practice that recognises a shift between teacher-centred and learner-centred approaches based on convenience.

Khothatso’s facilitation also included guidance given to learners when given tasks to work

on. In a lesson where he taught “sum of interior angles of a polygon” he guided the learners to use their knowledge of the “sum of interior angles of a triangle” to work out the “sum of interior angles of a pentagon”. He followed this by giving them an instruction to draw three shapes, hexagon, heptagon and octagon, and work out the sum of the interior angles of each.

Furthermore, the use of a blend of direct instruction, demonstration and discussion dominated the delivery of Khothatso’s lessons. His explanations of concepts were mostly directed to the whole class. He facilitated his lessons from various positions in the classroom. The teaching approaches that Khothatso used engaged learners actively in learning through acquisition or development of their own learning materials, sharing ideas in class and defending ideas in classroom discussions.

4.3.4.3 Instructional materials

Planned use of writing materials

Khothatso used an approach to teaching that required learners to organise their written work in terms of the books they use for writing. The following is his comment about how his learners managed the use of writing books in the mathematics classroom

What we do is that, during the lesson, they have a spare book where they can do their rough work. Probably someone is working something out so they can do it quickly and check whether what that person has is something they have but, as for notes they write, I check them and sign them.

He indicated that his learners use two writing books. One for the class exercises for the teacher and class notes for the teacher to check and the other called a “spare book” for what Khothatso called “rough work” which he normally does not check as was evident in the three lessons observed. Khothatso explained his practice regarding the two books and their use:

They have one book, which the top part is their classwork, which I mark, then from the bottom part, is their notes and then they can have any spare book aside from this

one which they use where they can write any working. Maybe I can give them a task on the board and say: 'do not use your classroom book, work on it on your spare book quickly so that I can see whether you still remember what we talked about'. So, that is where they will do quickly and they will bring one-by-one and then I check that before they do the formal work.

It appeared that Khothatso's learners knew when to use the two books and how to use them as he explained:

I think (*laughs*) they are used to that system. They are used to me writing 'classwork'. Once I write 'classwork', they know where it goes, 'quiz', they know where it goes; so that once I say, quickly, 'Do this' they do not go there, they come to the rough-work book.

Even though Khothatso's class appeared quite organised and he seemed to engage his learners in a lot of activity, he explained the engagement of learners in a way that deviates from what I observed in his class.

Use of a variety of materials

In a lesson where Khothatso taught "sum of interior angles of a polygon", he used a video played using a laptop and a data projector (Figure 4.4), charts and a dictionary. He used a video to show examples of polygons and their names. Khothatso's belief in the relevance of technology becomes apparent when he suggested that teacher training needs to allow the use of technology for learning in order to develop the pre-service teachers' skills in teaching:

I think they should emphasise its (*technology*) use. They should allow learners to use the internet to get information and also use that information in the class, not discourage learners and say that what you are saying is not there in my book, yet the learner has gone and researched.

Khothatso used charts that reflected different polygons to consolidate learners' conceptual development and a dictionary to find definitions of words. Khothatso's use of

materials further indicated what counts as mathematics. In his first lesson where he taught, “Calculate discount in buying and selling goods”, he brought advertisement flyers. He had also instructed his learners to bring materials, such as old clothes, with which they made mock sales. One of the highlights of his first lesson was the use of an advertisement flyer to demonstrate the difference between the regular price of an item and a reduced price. In the process, he explained to learners:

The item is sold this much (*pointing to a sales flyer*), and you save this much (*pointing to a reduced price on the newspaper flyer*) because it is sold on sale. What is this sale?

This approach of providing learners with access to multiple resources for a variety of representations gives the learners opportunities to “develop conceptual and computational flexibility” (Anthony & Walshaw, 2009:156).



Figure 4.4: Use of a laptop and a data projector in Khothatso's classroom

There was a wider variety and flexibility in the provision of materials or resources for learning. For instance, in his first lesson, learners brought materials of various types, as shown in Figure 4.5 below, which were to be used in mock pricing and discounts in sales. These were materials that Drews (2007:25) calls “Everyday materials” or “Real-world artefacts”.

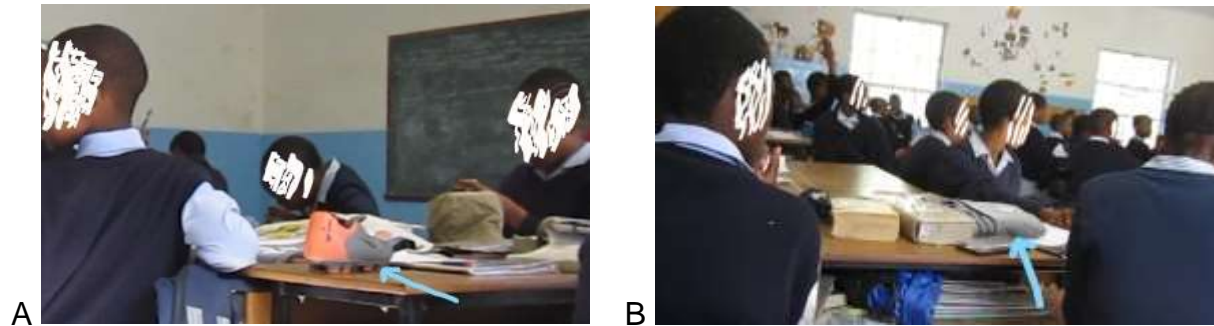


Figure 4.5: A boot on the desk (A) and a cloth on another desk (B) in Khothatso's classroom

Drews (2007) attests that the use of limited examples from fewer resources may lead learners to develop misconceptions. Hence the need for a variety of resources.

When asked to explain his choice of items, which included advertisement flyers for groceries and furniture, his response was:

I used them because I easily found them because I was in town, so they were easily available. Another thing is that they had things in them that are interesting for learners and that learners are familiar with, so I thought they could attract or arouse their interest. That is why I was using them.

Choice of material to use in this case, as explained by Khothatso, included availability and appropriateness to arouse learners' interest in the mathematics to be taught in that lesson. In his second lesson, the teacher brought charts with polygons drawn on them, and he also used a data projector with a laptop to display pictures of polygons and to play a video about naming different polygons.

Khothatso explained his choice of use of a data projector by saying:

To get my learners interested in the lesson. They enjoy [it] when things are projected, either pictures or videos other than when they are written on the board. That is why I sometimes use it.

In the third lesson, learners brought nets of triangular prisms that each had to construct

using the paper/card on the previous weekend. In one instance, Khothatso instructed a learner to post his net of a triangular prism on the chalkboard for display in order for the teacher to explain the calculation of area for one particular rectangular part. Khothatso explained the benefit of this by saying:

On my side, it makes my work very easy because the shape is there so I can be able to use it unlike when it is drawn, and I cannot move it and show them how the sides relate to each other how they meet. On their side, I believe, since they are the ones who made the shape, and they can ... remember, even when they are in the exam room, that I remember that I had constructed this shape like this so when I took this side, placed it like this, it met this one here. Therefore this side equals to this one.

Spontaneous use of dictionaries by learners to find meanings of terms was another observed practice in Khothatso's classroom. He gave the following explanations about the benefits of this practice. First, in empowering learners to learn "how to learn":

They find information for themselves and they sort of remember it better when they are the ones who came up with the definition rather than when telling them that this is a discount, this is a polygon.

He added that:

... finding definitions help. Even if I am not there, they will find a point of reference. I cannot remember what a polygon is – let me use my dictionary since my teacher is not here to ask. But if I had not shown them that they can use the dictionary, probably one would not bother to look at the dictionary and simply guess what a polygon is.

This variety of materials and the flexibility to source them, from both the teacher and learners, contributed to an environment that was rich in resources and that also engaged learners in being resourceful. Khothatso explained the advantage of instructing learners to bring materials themselves:

Talking about abstract things which are not in the classroom sometimes confuses learners. So, if they have an item that they have brought, and they give that item a price, I sometimes find that they get more involved rather than when I bring an item

and say this item costs so much, so its discount is this much, so work on it. They feel a sense of ownership, I think.

Three factors determined the type of materials brought to Khothatso's classroom. These factors were availability of the material, the material's appeal to learners and the teacher's ability to use the material. Khothatso said:

Availability! Whether something that I need is around or whether it will interest learners or whether I can actually use it. I cannot bring something to [the] classroom and then be unable to use it. So that is it. That is, if the material is available, if it will motivate learners and if the teacher can use it.

Data presented in this section suggest that Khothatso believed in the use of learning materials of different forms that included printed and digital materials and even engaged his learners in bringing their own materials. He believed that the use of different forms of materials instilled interest among his learners so that mathematics becomes exciting and enjoyable for them. Khothatso's views about the importance of a variety of materials confirm what Drews (2007:25) points out as the potential of the materials that "motivate learners; provide variety to teaching and learning experiences; connect classroom mathematics with applications to the real world".

4.3.4.4 Use of a variety of examples and tasks

Similar and contrasting examples

Khothatso used examples to provide learning opportunities. In his first lesson where he taught "*calculate discount in buying and selling goods*", he gave two examples of a situation where items are sold with a discount in a sale to illustrate the meaning of discount. He said, in the first example:

Over the weekend I happened to go to Maseru ... yes, I was in Maseru. So while I was there, I was going around in shops, and I saw a lot of such things (*holding up a sales flyer*) from different shops. They were saying that they are having a sale. I thought of bringing them here so that you see that sometimes an item is said to be M2000 and

then you save M500 because it is being sold on sale. So what is this sale?

The following conversation illustrates another example from his first lesson:

T: So we are saying that when we are talking about a sale, we are selling a particular item, but that item we are selling it at a lower price ... probably like to make an example with the ... what do I normally make an example with something that costs 50 Maloti? (*Learners laughing*) A fat cake, how much is it?

L: (*in chorus*): 50 cents

T: So, 50 cents, so you say, I am making a sale today, I want more people to come and buy so I will sell my fat cakes at 40 cents, so it is a sale (*Teacher pointing at the board*). The price is lower, from normal to low. So it says sale and discount.

This example illustrated what “sale” is in order to help learners understand or remember the difference between amounts spent and received when there is a “sale” in a business. It was necessary for learners to be able to link the concept of discount with a sale and then be able to carry out correct calculations when working with amounts in several examples.

Khothatso used a variety of examples in the lessons he taught. In one lesson, he gave examples of polygons through use of a video. Each polygon viewed was associated with its name that also depicted the number of sides and angles for the polygon. Khothatso explained the names of polygons during that lesson by saying, “Penta means five, the ‘gon’ is the shape, Penta means five, Hexa means ...”

The different polygons provided examples showing similarities in what a definition of a polygon is. One of the learners responded by saying, “Sir, a polygon is a closed shape with straight sides.”

Furthermore, considering different polygons provided an opportunity for learners to experience variance in terms of similarity and contrast. On the one hand, there was “similarity” because certain similar features characterise polygons, as they are closed

shapes and they consist of straight sides. On the other hand, there was “contrast” because one polygon differs from the next in terms of the number of sides and sizes of angles and hence the name, as Khothatso said, “So each polygon has a name based on how many sides it has.”

The teacher contrasted the definition of a polygon with an example of a shape that is not a polygon as follows:

T: So closed means there are no gaps. If we have a shape like this (*draws a shape that is not closed, on the chalkboard*), do we consider this a polygon?

Ls: No sir

T: Why

L: Because it is not closed there

T: It is not closed there. There is a gap.

The examples and non-examples that Khothatso shared with his learners on the video included what the following figures illustrate. Figure 4.6 shows an example of a polygon while Figure 4.7 shows non-examples.

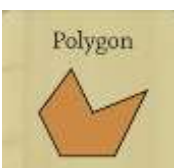


Figure 4.6: Example that Khothatso shared from the video

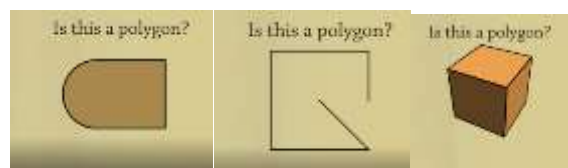


Figure 4.7: Non-examples that Khothatso shared from the video

According to Ng and Dindyal’s (2015) definition of an example as an “illustration of a larger class”, the type of examples referred to here was geometrical figures illustrated through a video.

The examples used in Khothatso's lessons provided an opportunity for at least two forms of variation, similarity and contrast, which helped learners to learn from examples as a depiction of what it is (similarity) and what it is not (contrast). Such use of examples helped learners to identify features of the concept that make it what it is and also features which make it what it is not which also helps learners to develop concepts as they become aware of situations of misconceptions as they learn.

This section indicates that the examples used in Khothatso's lessons provided the opportunity for two forms of variation, similarity and contrast.

Use of a variety of tasks for known mathematical procedures

The tasks used in all three lessons varied in terms of engaging the learners. In the first lesson, Khothatso introduced the concept of discount, distributed sale flyers and instructed learners to work out the selling price of a camp chair at a discount of 10% of its original price of M1700. The excerpt below displays the task given to learners by the teacher:

Now, eh, I want us to have an item here that we will um sell at a discount. We are just going to pick an item and then ... tell you that we are going to sell the item at a sale. Look at an item there, so that we can sell it at 10% discount.

(Teacher issues out flyers to groups and repeats, "10% discount", several times and asks one learner to say what he is looking at.)

T: He is looking at a camp chair. So we are going to sell it at a 10% discount. Remember, discount, we said, is taking away from the cost of a good. Someone to assist us please! I am going to guide you how you work it out, you are not going to stand there and be alone.

(Teacher calls out one learner to the board to work it out).

T: How much is the item? (Teacher asking for the price before discount)

Ls (in chorus) One thousand seven hundred Maloti.

T: Then we are going to sell it at 10% discount. Therefore, we are going to calculate 10% of one thousand seven hundred.

Learner on the chalkboard writes $\frac{10}{100} \times 1700$

T: Yes, work it out.

As a follow-up to this task, Khothatso gave his learners other tasks where he instructed the learners to price their items. He then assigned different percentages to different learners to calculate the discount of the priced items using the given percentages. For instance, he assigned 1% as a discount on an item a learner priced at M250.

The task given to learners in the lesson where they were taught “*Calculate the sum of interior angles of polygons*” was to work in groups and draw three shapes, hexagon, heptagon and octagon and then calculate the sum of interior angles of each.

T: ... now in your groups you are going to draw a hexagon, heptagon and an octagon, are you listening?

T: After you have drawn them then you divide them like we have done here and you find the sum of interior angles of each then I will come and check.

This task involved dividing the polygons into triangles and then working out the sum of angles from the given number of triangles, which followed the same procedure as the class worked on with guidance from the teacher.

However, these tasks followed the examples the teacher worked on with the whole class. The tasks only required the learners to use the skills they already had for carrying out known procedures only thus limiting development of new skills which is contrary to Russo (2016:13)’s argument that tasks help to further advance learners’ knowledge by deepening students’ conceptual understanding and encouraging creativity in mathematical thinking”.

4.3.4.5 Varying language use and emphasising definition of terms and use of resource from environment

Khothatso's use of talk in his lessons included colloquial (everyday) use or formal use of mathematical language.

Shifting between colloquial and formal mathematical languages

Khothatso used naming appropriately in most episodes of his lessons. In one episode, when a learner had a problem understanding why one multiplies two adjacent sides of a rectangle to find the area, the teacher said:

Then you drew, and then you calculated the number of squares inside, gave an answer, and then found that, when you multiply one side by another side, it gave you an answer and that is why we only used two sides and not all the sides. That is what we do. That is what I only did. I do not know who was looking, but I only did that.

This explanation helped learners to realise that to calculate area of a rectangle with small squares inside, they can count the smaller squares as an alternative to multiplying by the adjacent sides of the rectangle.

However, Khothatso still used everyday language (which is not mathematical) and sometimes even ambiguous pronouns ("colloquial" use of language) as he did in the same episode where he dealt with the calculation of areas of the rectangle. He was responding to the learner's question about the use of sides of a rectangle in the calculation. He referred to a cube and said:

The cube here, we have four centimetres, and here we have four centimetres. Did we multiply this one, then this one, then this one, then this one (*teacher referring to four different edges of a cube*) or we only used...?

Some learners appeared to use mathematical language appropriately. For example, when the teacher asked learners to say how the area of a triangle is calculated, one learner indicated, "Base times height divided by two." Another learner clarified what this statement means, by saying, "Sir, I multiply the base by the height, then I divide by two".

The learner further added, “Sir, we divide by two because the triangle is half of the square.”

Generally, Khothatso’s lessons had episodes where word use was colloquial although more often there was appropriate use of mathematical language to refer to operations, measurements, procedures and other aspects of the object of learning.

We therefore learn from this section that word use by learners shifted between colloquial and formal mathematical use. The shift between colloquial and formal mathematical use is a practice that provides learners an opportunity to make sense of mathematical concepts in language genres they can understand.

Mathematics through definition of terms and mathematics from our environment

Khothatso’s approach to the teaching of mathematics was suggestive of what he considered essential mathematics to teach and what is vital in teaching mathematics. For instance, he emphasised the need to know definitions of mathematical terms by urging learners to check their dictionaries for definitions of such words. In his first lesson, Khothatso gave the meaning of the word “sale” and wrote it on the chalkboard. He said, “The selling of goods at a lower price.”

On defining “discount” Khothatso reiterated what one learner said:

L: Discount; an amount of money that is taken from the cost of something.

T: (stretches out his hand as if grabbing something)

T: (repeating what the learner read from the dictionary) The amount of money that is taken (pulling back the hand as if taking away from something) from the cost of an item or a good.

Khothatso even acted out the meaning of discount by illustrating it by stretching out the hand and then pulling back as if taking away from something. He made it a practice in his lessons for learners to use their dictionaries to find definitions or meanings of terms. These reasons include that learners manage to find information by themselves:

So that I do not spoon feed them, I do not tell them. They find information for themselves and they sort of remember it better when they are the ones who came up with the definition rather than when telling them that this is a discount, this is a polygon.

Khothatso also used a dictionary so that his learners experienced the integration of mathematics with English. He added:

It can be likened with other subjects like English because normally we think a dictionary is only used in English lesson, but when they use it in mathematics, you will see that there is that linkage, so mathematics is not learned in isolation.

In his other lesson, where he dealt with polygons and their properties, Khothatso used a data projector to show a video on the properties of polygons and their naming.

It is apparent that Khothatso expected his learners to know the definitions of key mathematical words.

4.3.4.6 Learner participation involves the explanation of views

The types of questions asked in Khothatso's lessons included the "what" questions, the "how" questions and "why" questions, with the intention of learners describing and explaining their thoughts. The following is an excerpt from his third lesson where he taught "*Surface area of a solid shape*":

T: In fact, let me ask you, how do we get the (surface) area of a triangle?

L: Base times height divided by two

T: How do you get that?

The teacher further asked:

T: Why by two? Why not by one ... why not by three, why not by four? Why not by three because there are one, two, three sides? Why by two?

Khothatso often encouraged learners to share their views and explain themselves. Khothatso continued this conversation above in the following manner:

T: The triangle is half of the square. I was about to ask you what can you say the relationship between this shape and this shape is? What is the relationship between this shape and this shape?

L: The Square is made up of two triangles.

Khothatso's further question was an attempt to get learners' explanations of their answers to clarify their understanding of the relationship between a triangle and a square. Khothatso's demands highlighted a mathematical practice that ensures learner engagement in negotiating meaning through explanation and reasoning to support ideas. Khothatso explained why he always encouraged his learners to share ideas both verbally and in writing on the chalkboard:

It is something that I have been doing for years. It helps learners to get involved during the lesson, and when others see their peers working things out, they get more attracted (that is, interested), and they tend to remember rather than when I am the one talking, working things out and then giving them classwork to do. It makes an active class.

Khothatso's learners displayed what I observed as a practice in following up the solutions they wrote on the chalkboard with descriptions of the steps taken in the solution. Khothatso explained how he had developed this practice with his former and current Grade 7 learners:

For the past Grade 7 learners that I taught since I taught them from Grade 2, so I have been with them for a long time, so it is something that we used to practise all the time. These ones I met last year so, from the beginning, when I met them, that is when I started explaining to them that every step we take in mathematics we have to explain what we are doing.

He also indicated the reason he gave his learners for this practice:

... 'so it is best if you explained to us so we can hear, take note and be able to assist you' (Quoting what he would say to his learners in this regard) ... So it is something that has been done for quite some time.

Khothatso seemed to have developed a practice where learners took responsibility over their learning by sharing ideas by explaining their own approaches to solutions of problems.

This section provides evidence that Khothatso's lessons were dominated by the use of "what", "how" and "why" questions, and whole class discussions where learners shared ideas verbally, in writing on the chalkboard and explained their answers.

4.3.5 A summary of Khothatso's case

Khothatso is a teacher who wants his learners to learn in a safe environment where they feel free to talk and where the teacher takes their presence and contributions seriously. He facilitated activities in his lessons in such a way that, when he began engagement on a learning trajectory with his learners, he brought together the learners' ideas and focused them on what to learn. He was not fearful of taking risks in using new technologies when he was teaching, such as projecting videos from a laptop and initiating discussions with periodic talking points aligned to episodes from the video. This use of technologies attracts the learners' attention and makes learning exciting.

4.4 Case 3 – Carol: A compassionate teacher

4.4.1 Carol's biography

Carol is a female teacher aged 54. She grew up in a family of six and was the third of the four children in her family. Her father was a secondary school teacher and her mother a professional nurse. She was born and raised in a district located north-east of the capital, Maseru.

She attended primary school in the Republic of South Africa, a neighbouring country, and had to continue with her secondary education in Lesotho because of political instabilities

and student unrest in South Africa at the time, as she explained:

I was attending in South Africa, and I came back to Lesotho in 1977 when it was very difficult for students to learn in South Africa because of the black power ... I was supposed to be in form A that was the time that I came here.

She trained as a primary school teacher between 1983 and 1985 at the then National Teacher Training College (NTTC) which is now the LCE. She obtained a Primary Teacher's Certificate (PTC). She furthered her studies in BEd (Hons) received from the University of the Free State in RSA. Her area of focus in her degree was special education. She was, at the time of data collection, pursuing her Master of Education (MEd) with the University of South Africa.

Carol had been working as a primary school teacher since 1986. She started teaching in one primary school in the outskirts of her home district, north-east of the country:

I started teaching at (Name of village withheld), closer to home, very far from the town of (Name of district withheld). That is where I enjoyed teaching and I was teaching maths ... I have been teaching maths from, I think, 1986. I have been doing that work till to date. I am still teaching mathematics and it is true that this curriculum that we have is a bit challenging.

Carol indicated she did not specialise in mathematics as a subject when doing her Bachelor's degree:

I was not specialising with maths. I was just specialising with a learning disability. ... I only did the behavioural disorder and disability [at the university]. Those are the areas that I dealt with. So you find that, when you are dealing with a learning disability, there are learners who are struggling with maths, those ones who are said to be having dyscalculia.

This background shares Carol's biography. The background will help clarify certain aspects of Carol's experiences, views, beliefs and her practices as a primary school mathematics teacher.

4.4.2 Carol's views about teaching and a professional mathematics teacher

Carol's early personal experiences, which include her relations with and guidance from her father who was a teacher by profession, her primary school teachers, secondary school teachers and college lecturers and her performance in mathematics at various levels of studying seemed to influence her views.

4.4.2.1 Carol's experience as a learner: Performance in school mathematics and uncertainties about a career

Carol's personal experiences had the potential to influence Carol's choice of teaching as a career. She indicated that she had a background of inconsistent performances in mathematics at various levels of her learning:

At secondary, I obtained a C, but the high school, I did not perform well. I did not pass it at all ... I liked maths and I was so sad the time I realised that I failed maths at high school.

Carol attributed her drop in performance at senior secondary (high school) to the attitude her mathematics teacher at that level had towards her.

We had a teacher when I was in high school; she was teaching maths. I do not know; maybe she is the person who contributed towards my failure in maths because we would be trying. Instead of encouraging us, she would be saying, 'huh, it is a pity, no matter how hard you can try, you see, you do not follow the rules. If you are not following the rules, you are going nowhere'. So there was no time she was encouraging us.

These comments by Carol's teacher could have negatively influenced her attitude towards the subject and the following excerpt indicates how her attitude was affected by this:

That time I hated maths, I did not like it ... I did not like it. I am telling the truth; and when it was time for maths I would be reading comics. I would be reading anything that I want to read and I will not even participate; and at that time, by the time she

comes to class, I used to sit [in the] back seat so that I can read the books that I want to read. ... the time I will be sitting for the tests or exams, the paper will go white ..., and really I did not do anything in maths.

The excerpt indicates that her relationship with the teacher had deteriorated to an extent that she ceased participating in activities during the mathematics lessons. Instead, she read books. However, the behaviour of Carol's former mathematics teacher did not seem to have left a long lasting negative influence on Carol. It is evident that Carol was able to turn her unpleasant experience into a tool to care for and support her learners according to what she said in the excerpt below:

The ones ... who are performing well are the ones who are responsible, and if you have taught them to do that type of work, you need not to bother. They are the ones to come up and say 'Madam you know 'nyeo (so and so) struggles a lot, he struggles even in Sesotho, she cannot write, she struggles', and the time we are learning in class when I am addressing those problems, I don't say 'nyeo and 'nyeo have got a problem', we discuss as the whole class.

Carol's comment suggests she had developed a system of support in place for all learners where those who are ahead assume a responsibility to support and even give feedback to the teacher about the progress of those who are struggling. This is similar to what Anthony and Walshaw (2009) suggest when they argue that an effective mathematics classroom practice results from "an ethic of care" where learners learn to work together and support one another. Her approach in handling those who have challenges indicates that she is mindful not to embarrass them.

Carol had inconsistent performances in mathematics at different levels of her studies. Her attitude towards mathematics and the mathematics teacher at secondary school level led to a point where she stopped participating in daily classroom activities. However, she was able to resuscitate her love for mathematics when she got to college as she described, "I loved it and when I was at NTTTC; that was the time I was able to show that I can do something in maths. That is the reason why I liked to teach maths."

The revitalisation of her performance at the college motivated her to teach it from 1986. Even though Carol joined the college for teacher training, she had struggled to make a career choice, as she explained:

At first, I was not looking at that (*becoming a teacher*); I wanted to be a nurse. When the time goes on [sic], I said *m-m*, most of the time I do not like things that are happening at hospitals. Why do I bother? I said that I am going to join the force (defence force), but by the time I was supposed to go there, I told my father that I do not like to go there. There was a time when I liked to be the police, I was just fiddling up until I said, I settled.

A short stint with teaching when she was still a secondary school learner seemed to have influenced her decision to follow teaching in the view she expressed, “And I think what made me settle is that I once tasted being a teacher before I can become a trained teacher.”

Carol’s uncertainty about her career ended when she decided to become a teacher. She was motivated when training to become a teacher which rekindled her interest in mathematics and hence her confidence in teaching the subject.

She volunteered to teach mathematics during her teaching practice session when she was completing her training at the teacher training college (then known as National Teacher Training College (NTTC)). She described her experience when she got to the teaching practice at one of the primary schools as:

Most of the time, you find out that the principals at the schools where we are allocated, they will ask you: ‘Which subject do you think you can teach or you would like to teach?’ I just volunteered that I will teach mathematics, and the principal said ‘I have been welcoming the student teachers here at our school, I have never found anyone who said they will teach mathematics.’

Carol’s choice to teach this seemingly “unpopular” subject impressed the principal of the school where Carol did her teaching practice. The principal’s reaction apparently made Carol determined to teach mathematics. Carol’s struggles with her performance in

mathematics at school and her negative attitudes did not discourage her from learning from her role models as shared in the next section.

4.4.2.2 Following on the footsteps of the role models

Carol explained how she experienced teaching before training as a teacher when she volunteered to help her father's learners in his absence. She said, "I would always ask my father, 'when are you going to be absent so I can go and replace you during holidays? Are you opening for June holidays?'"

Carol indicated she requested her father to allow her to teach his learners when he went to harvest in the fields during the winter holidays:

If you do not mind I cannot go with you to help you (Carol did not want to go with her father to the fields to harvest), do you mind if I can go to school and ... be there on your behalf? You can do that work of harvesting at your own pace'. He will always allow me.

Carol's career path started with this experience that her father afforded her. She further indicated what she told her father about her choice to become a teacher, further highlighting that she chose teaching over nursing and the defence and police force:

That is when the love for teaching went on, like that, then I even told him (*her father*); 'you know, I no longer like to be a nurse, I no longer like to be a soldier, I no longer like to be a policewoman. I would like to be a teacher and a primary school teacher, not a high school teacher'.

Her choice of being a primary school teacher rather than a secondary school teacher may have been the result of her encounter with her secondary school mathematics teacher who dictated an approach to learning that required "following the rules" as explained in section 4.4.2.1 above. Her other reason could have been her experience with how primary school teachers motivated their learners as compared to secondary school teachers, as she explained:

... when I saw teachers at high school, I saw people who can come to class ... if like we are facing the chalkboard [...] they will just come alongside the chalkboard to just be going alongside the chalkboard from that corner to that corner. ... when the bell rings can just get out, but at primary, you know there was a time when you have ... something correct, your teacher will come and praise you. ... That is where I told myself that, even if I can be a teacher, I cannot teach at high school.

Perlman and Pearson (2012:15) reaffirm Carol's claim that primary school teachers seem to motivate their learners more than the secondary school teachers do.

The apparent relationship between Carol and her father appeared to influence her to become a teacher. She mentioned that her father, who was a teacher, helped her in dealing with mathematics at primary school, secondary school as well as in college. Carol could have followed her mother's career in nursing, but she said she did not like being a nurse and therefore she chose teaching, as she explained:

My father was a teacher, so I was a friend of my father. Then I think I copied everything in him, that is, the only thing that made me be a teacher. My mother was a nurse, but I did not like nursing ... He was also teaching me maths, and I first realised that I can be able to do something in mathematics because of his interest and the way he was kind enough to help me.

She indicated that her father advised her that, to teach mathematics, she had to ensure that she showed workings and avoid rushing to the final answer. She explained:

Most of the time, when I was working or calculating, he was always saying 'No you have to follow this, you do not just jump to the answer. I just want to know how you came to the answer'.

Other important people in Carol's life, who were teachers, also seemed to influence her choice to become a teacher. One was a lecturer who taught Carol when she was doing her third year at the National Teacher Training College (NTTC), currently known as the Lesotho College of Education (LCE). This lecturer influenced Carol in many ways, as she stated:

I am who I am because of the work that she did because she would encourage us that we know that maths is a problem in Lesotho, but when we go out there, those poor kids, they do not even know that we do not know. She (the lecturer) said, '... yours is to be confident.'

Carol further commented that the lecturer motivated her in many ways and made her love mathematics and that made her determined to teach it.

With the background of her experiences as a learner and how following on the steps of the more knowledgeable assisted Carol to decide on her career choice, the next section presents her views about a professional mathematics teacher.

4.4.2.3 Carol's views about a teacher and a professional mathematics teacher

Carol expressed her perceptions about the attributes of a good teacher. Carol's views, before and after training as a teacher, are that a good teacher cares about his/her learners. Carol said about her former lecturer at the teacher training college:

I was researching about the fraction, and I used to go to NTTC ... To my surprise, I was so happy I found that there are so many mathematics books that Doctor Thoko (*real name withheld*) bought for the school. She donated books, and those are good books, and she seems to be doing it every year because the time I went there, that was in 2014, there was a book she donated that was published in 2013.

Carol's former lecturer at the college (LCE, formerly NTTC) impressed Carol by her generosity and continued support of the college even when she was not working there anymore. Carol noted that her former lecturer donated books to the college. This lecturer was a product of the college, and she came back to teach at the college. Carol stated:

I could see that, even though she is out, she is still helping NTTC because she used to tell me that 'I was a student here in 1975 when NTTC was first established'. She came back to be a lecturer at NTTC, so I could see that she has left her heart at NTTC.

Carol was also impressed by her former lecturer's willingness to help her learners even

beyond the completion of their studies, “She (Dr Thoko (*name withheld*)) used to encourage us even when we were out when we have completed; we were still coming to see her.”

Another attribute of a good teacher that Carol identified relates to teaching for understanding. Carol indicated that her father encouraged independent learning of the rules to solve mathematical problems:

So from that time I learned from him (her father) that I should not let the kids be going to the formulas, I have to create the environment which will make these learners get the formula themselves by giving them practical work to do.

Carol mentioned that her father encouraged her to use learner-centred activities and relevant materials to engage her learners in finding formulae (and other generalisations) by themselves:

... he said, ‘No you are not supposed to give them the formula, let us start from the beginning, start from the circumference first, which means they will have to collect all the different circular objects.’ You can use papers, strings to measure them around and then we explain everything. This is where ... they will ... see the circular objects they were using. They did measure about three times and that for some will be 3.2, some 3.3.

Carol learnt from her role models, her father and her college lecturers, that teaching becomes beneficial to the learners if it allows learners to establish meaning and understanding through their efforts with guidance from the teacher. Therefore, Carol perceived the teaching of mathematics as effective if one does not teach rules, but one teaches how to find the rules.

Another attribute of a good teacher, according to Carol, relates to the ability of the teacher to reflect on his/her practice. She shared what her father told her:

... like my father told me: ‘Whenever you present a lesson, when it went well you will know that it went well and the time it did not go well, you will also realise that it did not

go well'.

Carol indicated that she learnt from her father and one of her college lecturers that a teacher will always know if the lesson went well or not. Likewise, her college lecturer advised her that a teacher should know when the lesson is about to be successful or not. According to her, the lecturer said:

Try to gather information before you go in front of them. You, as a teacher, you will know when everything went well but when they went wrong, write in your scheme, show that I taught this, but I think it needs to be retaught.

Van de Walle et al. (2013:494) refer to teacher reflection on their own practice and on the learning process by the learners. These are ways in which the teacher will get a sense of whether or not teaching has been effective.

In summary, Carol views a good teacher and a professional mathematics teacher as having attributes that include caring for learners, teaching for understanding and being reflective on own practice. Carol indicated she was influenced by her father who was a mathematics teacher, her primary school teachers and her college lecturers. I discuss, next, Carol's critical personal experiences as a learner.

4.4.2.4 Summary of critical components of Carol's views and her experiences as a learner

Carol knew long before she could apply to a college that she wanted to be a teacher. Her father gave her opportunities to teach by allowing her to help his learners during the vacations while he was away attending to his household errands. Her experience with mathematics, particularly in secondary school, was not promising as she disliked mathematics and did not do well in the COSC examinations. However, when she joined college, her self-esteem and confidence in mathematics improved due to the efforts and support of her lecturers.

Carol's first choice was a career as a primary school teacher. Carol's interactions with her primary school teachers and her tertiary level lecturers influenced her perceptions about

professional mathematics teachers. Her father played a coaching and mentoring role in guiding her into developing knowledge and skills in teaching primary school mathematics and effective teaching approaches. Carol believes that the current curriculum is challenging for teachers.

For Carol, teaching involves guiding learners into finding information, rules and formulae by themselves. Teaching is not “telling”, and it is not providing formulae or equations for learners to use in solving problems. According to Carol, a good teacher cares about his/her learners and supports their efforts to learn, collaborates with peers for the betterment of the teaching practice, teaches for meaning-making and the discovery of rules, reflects on his/her practice and handles criticism positively.

4.4.3 Carol’s experiences as a teacher

I present the critical components of Carol’s professional experiences and how these experiences influence teaching.

4.4.3.1 Carol’s professional experiences

The areas of professional experiences discussed are the school curriculum and content knowledge and the practice of teaching and peer collaboration.

Curriculum and content knowledge

Carol’s experience with the current primary school curriculum, which was introduced into schools in 2012, is that it is a good curriculum although it has challenges that the Ministry of Education and Training should address. Carol shared that she was part of the curriculum when it began in 2012. She said she learnt a lot from it as she felt that it provided continuous education in the first 12 years to prevent learners who wanted to stop schooling after either Primary School Leaving Examinations (PSLE) in Grade 7 (previously Standard 7) or Junior Certificate (JC) examinations in Grade 10 (previously Form C). She said, “The country has done a very good thing for the introduction of this new integrated curriculum, and I was the part of the curriculum when it started in 2012.”

Carol was one of the few teachers who experienced dealing with the integrated curriculum at its inception in 2012. For Carol, it was an opportunity to develop knowledge and skills in order to guide other teachers and make suggestions to respond to the challenges that the curriculum poses to teachers. Carol shared what they focused on in the early days when the curriculum was developed:

What we have tried to look at, we have tried to look at the good child, and then we wanted a child to be in a school for those 12 years. A child has to be in school for those 12 years so that we would not have learners who will be writing Grade 7 and end up at Grade 7. Learners who write Grade 10 and end up at Grade 10, learners who will write Grade 12 and end up in Grade 12. Where are they going thereafter?

This shows that Carol was defending the inception of a 12-year uninterrupted program of schooling comprising primary schooling and secondary schooling for children in the current curriculum, which was introduced into Lesotho schools in 2012. She argued that this kind of program is more likely to keep children in a school:

Which means I really embrace their point of view that learners should be kept in school for that 12 years so that we know that these learners cannot achieve and acquire at the same time but the thing is, at the end of the journey, we would like them to have acquired something. That is the reason why maybe some people may think that in this new curriculum learners are not failing.

Carol, however, pointed to challenges with the current curriculum, particularly, that Grade 7 has become more difficult for primary school teachers to teach citing an example of topics in mathematics such as probability. Moreover, Carol pointed to the gap in the implementation process in the inception of the curriculum. She said:

There is a lot of work to do in this new curriculum and the way it is introduced to teachers, really, they cannot sit for three months trying to formulate the way they think the curriculum will feed a Mosotho child and when it comes to the consumers who are teachers they are taken there for a week. Those learning outcomes are many. These ... teachers are not [even] introduced to look at the learning outcomes.

Carol further suggested that teachers might dislike the curriculum. She supported this assertion by showing how the curriculum was conveyed to teachers:

I think the way it came to us, it is a little bit imposed; imposed in the sense that teachers will be orientated for a week for something which people took a very long time to establish.

She indicated that workshops were too closely spaced:

It was first held in 2012 and it was Grade 1, Grade 2, Grade 3. So, in 2013, we were looking at Grade 4, 2015 we were looking at Grade 5, 2016 we were looking at Grade 6, 2017 we were looking at Grade 7.

She worried that teachers had a very short time to comprehend the whole concept of a curriculum that should run for the whole year for seven years. Chimbi and Jita (2020:107) endorse Carol's view when they highlight the importance of engaging teachers in activities of curriculum reform as part of their professional development so that they (teachers) are ready to handle and manage the curriculum related changes to be effected in the classroom.

The practice of teaching and peer collaboration

In response to a number of challenges, including challenges dealing with the then new primary school curriculum, Carol became part of the establishment of professional support and collaboration. Her school organised the establishment of the subject (or learning area) based panels, such as the mathematics and science panel, where several teachers were members. Among the tasks of the panel, as Carol explained, was to secure equipment and materials for learning. In the denomination in which Carol's school belongs, the panels encourage cooperation and collaboration in aspects of school activities related to the subjects for which the panels were established. Carol explained the formation of the panels:

It is a panel. English panel, Sesotho panel, mathematics panel, in all the learning areas that we are dealing with. So, I am in the mathematics and science panel and also in the English panel, so we are able to try to get the materials for the kids to make learners be able to use the materials.

She also indicated functions of the panels that included peer collaboration in teaching:

In the panels, there is some guidance that we are given that we are following. When it is time to scheme, we sit together, we plan together, we make sure that the topics that we have planned are the topics that will be able to be presented in classes.

Carol believes that the panels are beneficial as they create platforms for cooperation and collaboration:

I sometimes ask a fellow teacher to come to my class and to present a certain topic for me like this week (the week in which the interview was conducted), I asked one of the teachers to go and present ratio for me.

The challenge of planning for topics in the current curriculum prompted Carol to find other teachers to collaborate with on drawing Schemes of Work (long term plans). This effort recognises what Kramer (2003:4) indicates by saying "The changing nature of schools calls for teachers to collaborate with others and work effectively as a team toward

common goals". Carol opted to join a team from her home district, which is in the north east of the country. Carol found that when the team of primary school teachers met to draw the Scheme of Work and other tasks related to planning, they worked together with the secondary school teachers, as she pointed out, "I was surprised in their scheming, teachers from high schools were there and those who were teaching Grade 7." Collaboration between primary school teachers and secondary teachers is echoed by research (Mudaly & Sukhdeo, 2015; Prendergast, O'Meara, O'Hara, Harbison & Cantley, 2019) as a factor that can raise levels of knowledge about how primary school teachers can better prepare learners in mathematics for transition to secondary. Another aspect of this research is about how secondary mathematics teachers would better handle learners as they get into secondary education.

Carol indicated that this practice of collaboration between the two groups of teachers helped the primary school teachers significantly in terms of the content that is challenging for them.

There are so many topics that we are asking the teachers from high school; and you think of those schools at home, in rural places where there are no high school teachers. ... where they have to take a journey to get information but *'na* I think in (*name of district withheld*) they dealt with it accordingly because I went there in January this year [2018], I found the teachers from high schools, when they were scheming, and the [primary] teachers were writing all the topics which they find challenging. They were listed there on the chalkboard, and the teachers from high school were presenting those topics.

Carol felt that the scheming (planning) activity she usually attended in her home district helped her personally and professionally:

I always attend it when they are scheming. ... and when I go there, the topics that we dealt with last time, when you are looking at this, I will find that there are some new topics, of which even ... I can say this one it needs me to be guided, and helped because I did not major in maths when I was at the university; I was just looking [sic] at special education. So, I was just told that I will have to deal with English so much

that it will be possible for me to do the work. Then I was highlighted that I have to do maths because there is somewhere where I will have to use maths, but I was not specialising with maths I was just specialising with learning disability.

According to Richter, Kleinknecht and Gröschner (2019:8) teacher motivation does not only drive the need for instructional quality and student learning but also for teachers' own learning. Carol could be viewed as a teacher who had motivation as described by Richter et al. (2019) in that she travelled over 100 km to seek professional development when she realised that, in the vicinity of her school, much less was happening. In summary, Carol indicated that she values peer collaboration, as she mentioned that she does not hesitate to ask for assistance and support from colleagues from within her school and elsewhere when she encounters challenges in teaching. Data also indicate that she even seeks assistance from and collaboration with teachers beyond the region and district in which her workplace is located.

Next, I present Carol's classroom practices that enhanced effective teaching.

4.4.3.2 Teacher practices that enhance effectiveness in mathematics teaching

Carol's experiences with teaching mathematics shed light on her position about fulfilling her duty as a mathematics teacher in primary school, that of reinforcing teaching experience through professional development. In addition to consulting with colleagues from her school, Carol also reinforced her teaching experiences by consulting with more knowledgeable people. Those people included lecturers at the LCE, resource persons at MOET and even her colleagues at her school. She said:

I am always somebody who can go out. There is a lecturer at NTTC, Mrs (Name withheld), I would go to her and ask for help. For science, I would go to Mrs (Name withheld); she is also a lecturer at LCE. For maths, I would go to Mr (Name withheld); this was one of the resource persons from the MOET). I happen to have a link with people whom I know they have got an idea in mathematics. This is where, when I come back, I will be able to look at where am I strong, where am I weak, what is it that I can do?

The efforts that Carol made in getting support from colleagues went beyond classroom visits and observations, to checking lesson plans that she prepared:

Sometimes I can go beyond maybe to draw a lesson plan and to try to show it to a person whom I think can be able to tell me 'In here I do not think you went deep, in here I think you were a little bit irrelevant. You could have supposed to start here, not from where you have started'. So I think, this is where I can say I do not trust myself to do this work alone. And even here at school, we have got the panels, as I have told you, and once I realised that it is as if I am going to hit the mountain, I just call upon those people whom I am working together with.

Carol felt that the other professionals, such as MOET officers, lecturers from teacher training institutions and her colleagues, complemented her role as a teacher and mathematics teacher.

4.4.4 Carol's mathematics classroom practices

I observed Carol's lessons on 18th March 2018, 18th May 2018 and 21st May 2018.

4.4.4.1 Learning environment for effective learner support

The learning environment in Carol's case encompasses the classroom learning spaces, learners' seating arrangements and instructional approaches and materials. Carol's two Grade 6 groups had 50 learners each. Learners sat in groups of four, five or six with two rows facing each other in each group. Group membership was mixed in terms of performance. The following excerpt explains reasons for the arrangement mentioned above:

My classroom arrangement, as I teach, I have arranged them in such a way that in each and every group, learners who have experienced difficulty in learning are mixed with other learners. So the time I move around, I wanted to make sure that those whom to me are my targets, I can identify maybe the problems that they encounter and the group will have to see to it that they address that.

Carol also indicated which group of learners she focused on during her lessons. She

mentioned what could have possibly influenced her decision on group set-ups in the following way:

I am always paying attention to the targeted learners which are learners who are experiencing barriers in learning. Maybe I am doing it just because I am a special education teacher so whenever I am teaching, I always cater for those kind of learners.

While maintaining a special arrangement of learners per group, Carol pointed out that she had a role to play in the group activities, which she described in the following way:

Before they can look at it (*the problem encountered*), I look at it first and I need to make them aware: 'Have you realised that this one is having a problem in here? What did you do to help?' So I always make sure that whenever they do group work or the activities that I am giving in class, more especially in science and maths, most of the time, I make sure that I go to the groups individually ... so I will be checking whether they are still on the track.

The arrangement of learners in mixed ability groups helped Carol to assess, in a more organised way, the learning situation and learning difficulties of learners who struggle. She pointed out that better-performing learners give feedback to her on the situations in their different groups, including those who have challenges and how better-performing learners support them. She said:

The ones who are performing well are the ones who are responsible; and if you have taught them to do that type of work, you need not to bother. They are the ones to come up and say 'Madam you know 'nyeo (so and so) struggles a lot, he struggles even in Sesotho, she cannot write, she struggles', and the time we are learning in class when I am addressing those problems, I don't say 'nyeo and 'nyeo have got a problem, we discuss as the whole class.

Carol documented the information provided by the better performing learners by recording in the evaluation section of the lesson plan form, as she explained:

... it becomes easier for me the time I am writing the evaluation on the heading where

it says: 'what went right?' I will be able to write quickly, what went right, and then I go to what went wrong, and I also write what went wrong. So, where I have to tell what started to remediate that problem, it is then that I will be sitting down trying to look at those problems that I have realised or recognised the time I was making rounds per group.

This feedback becomes part of the reflections on how the lesson progressed.

The seating arrangement and interactions in groups in Carol's lessons maximised the benefit of peer learning, cooperation and support, particularly for learners who struggle with learning. Carol's use of mixed ability groupings to provide learning support to struggling learners rendered her role as more of overseeing peer learning and facilitation of related support strategies.

4.4.4.2 Facilitating learning activities

This section explains Carol's approach to facilitating learning and it focuses on teaching and learning activities, and learning materials that were used.

Introduction through learners' activities

Carol began her lessons by dealing with the relevant background information related to the concepts to be taught. For instance, in her first lesson, Carol used a M10 note to show learners a picture of a cosmos flower to illustrate geometrical patterns in naturally occurring materials or objects. She moved around the class to show learners the cosmos flower on the M10 note. She also drew their attention to the poster on the cabinet behind the door of the classroom, likewise, with intention to illustrate geometrical patterns. The picture on the poster on the cabinet showed hexagons and parallelograms. She also explained the patterns on the poster to those who could not see them because they seated far away from the cabinet. Carol instructed learners to consider the picture on the poster in the following way:

Let us start first with geometrical patterns. If you look at this poster here, it has got a geometrical pattern. People, who are closer to it (*poster was small, and learners far*

from it could not see clearly), can you give us the names of the shapes there?

Although the intention to use available materials to illustrate mathematics was good, the materials used were not visible to all of the learners and that could have compromised learners' ability to see and appreciate the existence of the patterns the teacher wanted the learners to see.

In her second lesson, she instructed learners to mention where angles are found, and the learners said that they are in shapes. She then asked for the names of four-sided shapes. They mentioned parallelograms, squares, kites, rhombuses, rectangles and trapeziums. In her third lesson, her introduction included a review of the properties of quadrilaterals. She instructed learners to copy and complete statements about the properties of quadrilaterals, which she wrote on the board. These were:

- (i) A square has
 - (a) _____ sides
 - (b) _____ right angles
 - (c) _____ pair of parallel lines
- (ii) A rectangle has
 - (a) _____ sides
 - (b) _____ right angles
 - (c) _____ pair of parallel lines
- (iii) A parallelogram has
 - (a) _____ pairs of opposite sides that are equal

Carol then marked learners' exercise books to check their understanding of the properties of quadrilaterals. Towards the end of the introductory session in each lesson, Carol would then inform learners about what they were to cover in the lesson. For example:

You take out your mathematical instrument sets; then you take out your protractor. I have [got] mine, and you have ... yours. What are we doing – today we are going to measure the interior angles. Last week, we were just calculating them using the properties of the parallelogram, a square and a rectangle.

Carol added that, at the beginning of the lesson, she gives the lesson objectives so that

they focus on a particular learning point. This is how she stated lesson objectives in the three lessons observed.

1. Today we are going to continue learning about geometrical patterns and numerical patterns (Lesson 1).
2. Do not forget that today we are going to learn about the interior angles (Lesson 2).
3. Today we are going to measure the interior angles (Lesson 3).

Each statement specifies content to be covered. However, the first two do not indicate the knowledge or skills learners were to develop. The implied skill that needs to be developed, according to the last statement, is something different from what learners were taught which is to calculate interior angles of a quadrilateral (when the sum and some of the angles are known). The statements of intent (lesson objectives) missed key action words for skills or competencies to be developed, such as *create*, *state*, *describe* and *predict* (objective 1) and *measure* and *calculate* (objectives 2 and 3) for different Grade 6 streams (MOET, 2016). This identified gap is an indication that Carol was aware that it is important to mention those, but her classroom practice did not convey the implied importance, which is to have the objectives to drive classroom activity and hence what learners should be able to do at the end of each lesson.

Carol indicated her awareness about the importance of stating learning outcomes, as part of the introduction of the lesson:

... if the learner knows that today I dealt with fraction, yesterday we were converting the fractions into percentage and into decimal numbers, then decimal numbers into percentage into fractions, that child shows that he or she is learning something. That is the reason why we are always asked to communicate the learning outcome with them. They have to know exactly what are they doing.

Carol's attempts to start a lesson by engaging learners in a review of previous knowledge or observing materials related to the concept taught indicate her intention to start from what learners know or from related learning contexts. This will allow learners to make

connections with the concepts to teach, a practice emphasised by Killen (2007:7) in referring to a constructivist approach to teaching and learning where knowledge is a personal interpretation of personal experience.

Engaging learners in a variety of instructional strategies

Carol attempted to engage learners through a variety of instructional strategies. Figure 4.8 illustrates four of the incidents in Carol's classroom that suggest varying patterns of instructional strategies. Firstly, where learners seemed to show intention to respond to the teacher's question, secondly, learners appearing to be working in their exercise books, thirdly, the teacher appearing to be checking learners' work in one of the groups and, lastly, one of the learners sharing with others manipulation of multiplication using fingers.



A

B

C

D

Figure 4.8: Learners respond to teacher's question (A); learners work individually (B); teacher marks (C); a learner illustrating a pattern in a strategy of multiplication by 9

As further evidence that Carol tried to engage her learners in developing knowledge, an excerpt below illustrates how Carol guided her learners through a review of an activity they did previously, knowledge of which could help them deal with the new task they were to embark on:

T: Let us remind ourselves What did we do the time we wanted to show how many degrees is in the triangle? What did we do? All the groups, what did we do? What were you given?

L: We were given an activity to cut a ...

T: What do you do first? Let us work together.

L: We first draw the triangle then after we cut off the triangles.

T: After cutting those angles what do we do?

L: In the circle we are working how ...

T: In the circle? What did we do with those pieces? There is something that we did. What did we do?

L: We labelled the angles.

T: Labelled the angles, we said this one is A, this one is B then this one is C so what did we do then?

L: We arranged the angles.

T: We arranged them *eaba 'A' e tla mona* (and then 'A' is placed here) then next angle 'B' then next angle 'C'. What did we come up with? There is something that we came up with. What is it that we came up with? (Teacher showing learners how pieces of angles cut from corners of a triangle are arranged to form a straight angle.)

L: We came up with straight angle.

T: Yes, we came up with a straight angle ... Each and every group you did your work so what I am expecting you to do today is to calculate the missing angle in a quadrilateral so I am going to label some degrees in three angles, yours is to find the missing angle. You get what I am saying?

Carol realised that she had to guide her learners to learn how to relate the interior angles of a quadrilateral to calculate one of the angles given three others and knowing the sum to be 360° . She then decided to remind them of the practical approach in relating angles of a triangle to the sum 180° . She thought it would help learners to relate angles in a quadrilateral to their sum to find the value of one angle when given three other angles.

Carol engaged her learners through guiding questions such as:

What do you do first? Let us work together ... After cutting those angles what do we do? Only two people in this class, only two. E? ... In the circle? What did we do with those pieces? There is something that we did. What did we do?

Guidance provided by Carol helped learners to work together to make sense of mathematics concepts and to help them to rely more on themselves to determine whether their arguments are mathematically meaningful and correct (De Garcia, [sa]). The role of the teacher is to ask probing questions that keep learners engaged in a productive struggle until they reach a solution (Van de Walle et al., 2013:23). The attempt to remind learners about previous activities lacked the connection to the new activity on four-sided shapes. The object of learning in that lesson was to find one angle given three angles and knowing the sum of all four angles, however Carol only asked learners what they did in the activity involving a triangle. She did not make any connection to how to find one angle of a triangle given two angles and knowing the sum of interior angles of a triangle. Carol failed to do what Brodie (2007b:22) calls “pulling a conversation together” which Brodie claims is more difficult than starting a conversation in a mathematics classroom.

The teaching progresses amidst a shortage of materials

Carol’s school appears to be making efforts to acquire learning materials, as she indicated:

We have a television there. If you want to do anything, we are allowed. The computers maybe will be arriving tomorrow or on Thursday or Friday, but this week we are still expecting them.

Other than materials acquired by the school, Carol explained that, to mitigate a shortage of other materials, her school devises strategies that include improvising for the lack of such material resources as she described, “It is true that we improvise most of the time ...”.

The shortage of materials in Carol’s classrooms included basic materials, such as chart

papers, even though she indicated she had the markers for writing on the whiteboard. She said:

It is true that we have got the permanent markers to use, but most of the time we are running short of the chart because the Grade 1s to the Grade 4s, it is three streams per class, so we are running short of materials, more especially the upper classes.

Carol used a limited variety of learning materials in the lessons I observed. For instance, in a lesson on “*Identify geometric patterns in different contexts and represent them numerically*”, she used a M10 note to show learners a cosmos flower (Figure 4.9 shows the cosmos flowers on the M10 note) and a poster on the cabinet by the wall near the door which was visible to only those who were close by. She used protractors and rulers from learners’ mathematical sets of instruments and learners’ textbooks in the lessons on “*Calculate the sum of interior angles of quadrilaterals*”.

Two observations emerge in this regard. Firstly, that there were few materials which compromised the variety of or alternative ways of representing a concept in order to help learners to make sense of the concept through illustrations from numerous examples. Secondly, Carol moved around from group to group to show learners the picture of a cosmos flower on the M10 note. The learners could not hold the M10 note to scrutinise the pictures on the note. Carol also instructed those near the poster on the cabinet behind the classroom door to tell the rest of the class what they see. This compromised the need for each learner to view and witness the implied patterns.



Figure 4.9: Pictures of M10 showing cosmos flowers, with a section zoomed (right)

Amidst these evident shortages, as her comments above indicate, Carol still tried to use some materials in her lessons to facilitate the learning process engaging learners as much as possible. For example, in her lesson on “*sum of interior angles of a quadrilateral*”, Carol drew learners’ attention to the key features of a protractor, asking one of the learners to come to the front and point to the centre mark on the protractor that the teacher was holding up. Carol’s conversation with her learners was as follows:

T: Turn to page 117. Who can brief me about this instrument? What can you say about this instrument? Where do we use it?

L: I think we use it to measure the angles

T: We use it to measure the angles. Can you look at it? Can you look at it? Each and everybody looks at it. From the left, can you see two – can you see two numbers of degrees at the top and at the bottom? Can you see it?

Carol was instructing her learners to study the protractor, which they will use to measure angles. Referring to the centre mark of the protractor, she said, “... who can show me where is – who can come and show us the point on this? Anyone to come and show the zero, which is the point.”

Carol then emphasised the procedure followed when measuring angles:

I told you, you look at your point, and when you start counting, you do not count from 180 degrees. How do you count? We said, zero, then we went on to say where it touches the line of the shape, we then place a ruler and count how many degrees is there. Ok?

Amidst the evident shortage of materials in her lessons, Carol still provided learning experiences through the integration of learning areas or topics. She saw the use of available materials, such as paper for creating patterns, as belonging to Creativity and Entrepreneurship, with ideas coming from the geometric patterns created here being used to teach numerical patterns. Carol appeared to value the learners’ knowledge of materials

and instruments used in learning mathematics such as a protractor. Carol saw the application of integration in a review of prior knowledge, which, she argued, saves teaching time. Carol mentioned that because of the lack of materials, they resort to improvisation.

Key ideas under the facilitation of learning in Carol's classroom suggest that effective instructional approaches encompass teacher recognition of learners' prior knowledge and the use of such knowledge to develop new knowledge. Moreover, learner participation in using materials, amidst shortage of such materials, is important to concept development in Carol's classroom.

4.4.4.3 Use of similar examples and application of tasks in unfamiliar situations

Carol used the mediation tools, examples and tasks, to facilitate the process of learning. In her second lesson, she used examples to illustrate the concept of the sum of angles in a quadrilateral. First, Carol considered the angle properties of quadrilaterals as a basis to find the sum of interior angles. She took examples of a square and a rectangle and compared them to a parallelogram:

In a square and a rectangle, all angles of the rectangle and square are right angles, but a parallelogram is different because the opposite angles of a parallelogram are equal.

Carol and her learners used their reference to angles in a square and a rectangle being right angles as a basis to conclude that the sum of interior angles of a quadrilateral is 360° and that was 90° (a right angle) multiplied by 4 (number of angles in a quadrilateral). Examples in Carol's classroom displayed similar features of various items, such as different shapes, thus helping learners to compare items by their similarities. On the other hand, some of the tasks that Carol used required learners to *carry out* known operations and procedures, others required learners to *apply* known skills or decide on operations or procedures to handle or *use multiple* concepts or make numerous connections.

In a lesson where she taught "*calculation of sum of interior angles of a quadrilateral*",

Carol mentioned that the angles of a square and a rectangle are right angles and that a parallelogram has equal opposite angles. She then gave learners a task that required the calculation of a missing angle in a parallelogram given three of the angles as follows:

Each and every group, you did your work so what I am expecting you to do today is to calculate the missing angle in a quadrilateral. So I am going to label some degrees in three angles, yours is to find the missing angle. You get what I am saying? ... So it is now labelled – we have got 120 degrees. This one is labelled 60 degrees, and this one is labelled 60 degrees, but this one is not labelled. How are we going to work it out? (*Carol refers to the quadrilateral drawn on the whiteboard*)

In this task, Carol required learners to use their knowledge of the sums of angles of a quadrilateral deduced from the right angles of a square or rectangle, to find the missing angle in a quadrilateral if three other angles were given. Carol did not give her learners an example that involved a similar situation, nor did she create an opportunity for learners to explore the relationship between angles of a quadrilateral and the sum of the four angles, although she did it for the relationship between the sum of angles of a triangle and a straight angle. She reminded learners what they did:

Let us remind ourselves the ... that we did. What did we do the time we wanted to show how many degrees is in the triangle? What did we do? All the groups, what did we do? What were you given?

The activity involving the triangle emphasised two key considerations. The first being the sum when all the pieces cut off from the corners of the triangle are then packed together; (sum) on a straight line. The second refers to the associative property of numbers where for instance $(A+B) + C = A + (B+C)$ which helped in having $A + (B+C) = D$ explain $A = D - (B+C)$ and hence $P + (Q+R+S) = T$ explain $P = T - (Q+R+S)$ and working for any angle of the quadrilateral in relation to the sum which is 360° . So learners had to find the fourth angle if three others were given. The tasks, therefore, required learners to decide on the procedure to use to calculate the missing angle, which is quite similar to applying their mathematical knowledge in unfamiliar situations (Adler & Ronda, 2015).

Evidence presented in this section suggests that Carol used the types of tasks that required learners to decide on the mathematical procedures to follow, hence applying their mathematical knowledge in unfamiliar situations in working on such tasks. However, learners were, at times, left with a difficult task of figuring out how they could use previous knowledge to construct new knowledge, which might have left them frustrated and the teacher wanting in terms of relevant and appropriate strategies needed to bridge the learners' knowledge gaps.

4.4.4.4 Language use and emphasis of meaning

Language use in Carol's classroom is considered from two perspectives, use of terms and expressions in communicating mathematical ideas and attempts to develop mathematical language. Language use within or across episodes of Carol's lessons had a blend of colloquial (everyday use) and formal use of words. In one episode, after working with her learners by generating a sequence of triangular numbers, Carol worked on another sequence to generate a sequence from differences of consecutive triangular numbers. She first reviewed the use of terminology related to "difference" by asking the following question:

Aha! We want to know the difference. When we talk of the difference, what comes into our minds? What is it we can expect when we are talking about the difference? When we talk of the term 'difference', when did we get it? Where does it come from?

Carol then guided her learners in a brainstorming activity on words used in the context of subtraction. The excerpt below shows the teacher's summary of the brainstorming session:

You will come across the words minus, borrow from, difference, subtract, subtract and, take away. Those are the terms that you always meet when you are dealing with subtraction, ok? So, I need the difference between three and one. Three take away one.

Although words or phrases such as "borrow from" and "take away" appear to be colloquial

(Adler & Ronda, 2015), they carry mathematical meaning for subtraction in this context. Words or phrases, such as “minus”, “subtract” and “difference”, are formal mathematical terms that carry meaning for subtraction.

This section provides evidence of a mix of colloquial use and formal (appropriate) use of words and phrases in communicating mathematical ideas. The section further suggests attempts made by Carol to help learners to develop mathematical language in her classroom, which included attention to the use of mathematical terms for meaning.

4.4.4.5 Learner participation for peer support

This section focuses on how Carol facilitated activities and how learners participated in these activities. Learner participation depends on the kind of questions the teacher asks. Categories of questions used in the analysis include “yes” or “no” questions, one-word questions, “what” or “how” questions in phrases, and “why” questions where an explanation or reasoning is provided to support the answers given. Use of group work is also part of the focus.

Carol’s lessons were typical of an approach that required learners to answer “what/how” questions. For example, she wanted her learners to generate a sequence of differences between consecutive triangular numbers in a sequence generated earlier. She asked:

Aha! We want to know the difference. When we talk of the difference, what comes into our heads? What is it we can expect when we are talking about the difference?
When we talk of the term ‘difference’, when did we get it? Where does it come from?
People, are you lazy today?

When learners appeared to have difficulty answering the questions above, Carol asked another question that says, “Can you give me the terms you use for subtraction? Can you just list them?”

These questions appeared to simplify what Carol expected from her learners and the learners then gave these terms one-by-one. The terms include “minus, borrow from, subtract, difference and take away”. These questions were illustrations of the type of

questions (“what/how”) asked in Carol’s lessons. Carol asked the “what questions” and the “how questions” but seldom asked the “why questions” so that learners were able to describe and explain their thoughts. Carol’s lessons were typical of the extensive use of probing to engage learners. For example, in the review of the practical approach to finding the sum of angles in a triangle, learners received guidance to recall that they cut corners and put them together to form a straight angle.

While Carol gave her learners a practical reminder about how the sum of angles in a triangle is found, she did not do the same for the quadrilateral; she just went directly to the use of the rule to calculate the sum of the missing angles. Other than guiding the participation of her learners through the mathematics content, Carol also managed and controlled participation by laying out the rules concerning participation and behaviour of members. In one instance, she said, “... if somebody in our team doesn’t do what he has to do, we make sure that we correct that. Akere?”

Group work seemed to serve academic roles as well as to manage and control participation through controlling who talks and when.

4.4.5 A summary of Carol’s case

Carol grew up with the support that shaped her choice of becoming a mathematics teacher at primary school level. Her career choice followed personal experiences, which indicated that she would be more comfortable at the primary school level. She studied further to obtain a degree and a postgraduate qualification. Her specialisation in the area of Special Education influenced her inclination to organise her classroom environment and activities with a focus on learners who struggle to learn. Her passion for growing professionally was also evident in her engagement with school-based professional activities, such as establishing school subject panels intended for professional development. Carol’s classroom performance indicated a consciousness that learning requires support systems, such as children receiving help to appreciate working together in class.

4.5 Summary of the chapter

This chapter presented data on the cases of the three teachers who participated in this study. The data sources included lesson observations and interviews before and after lesson observations. The data presented suggest that teachers hold certain beliefs and dispositions about what a primary school mathematics teacher should be. The attributes of a good teacher and those of teachers who are not favoured formed part of the presentation. Some of these positive attributes could be seen in these participants' classroom practices which is an indication that what they experienced as learners in primary school, secondary school and tertiary levels and their experiences as beginning teachers influenced how they developed as teachers, and could still influence their practices as more experienced teachers. These observations imply that teachers are likely to continue learning from their old experiences as learners and as new teachers and they call on those experiences when confronted with classroom challenges that need to be resolved in order to give support to learners. Analysis of these data continues in Chapter 5 as a cross-case analysis.

Chapter 5

Cross case data analysis and presentation

5.1 Introduction

Chapter 4 presented individual cases of the three participants and their classrooms, describing their views and expressions about the teaching of primary school mathematics. In particular, the chapter also identified and presented:

- (a) the critical components of personal and professional experiences as expressed by selected primary school mathematics teachers in Lesotho;
- (b) the major features of the mathematics classroom practices that are evident in the selected primary school teachers' classrooms; and
- (c) how primary mathematics teachers' personal and professional experiences seemed to influence their classroom practices.

Chapter 5 presents the data as comparisons of the three cases of what appeared to be commonalities among them and what appeared to be unique for each case.

5.2 Expressions of critical personal and professional experiences

The comparison and contrast of the three cases on critical components of professional identities begins with a summary of key findings per case for the indicated sub-themes.

The summary of key findings includes words, phrases or statements reflecting participants' beliefs, dispositions and experiences.

5.2.1 Early personal experiences

The early personal experiences of the three participants highlight similarities and differences in how they became primary school teachers and the perceptions they have about being a good mathematics teacher.

5.2.1.1 Career by choice or by force or constraint

The three participants had different experiences in discovering their careers. Teboho had aspirations of following careers other than teaching. However, failure to get admission elsewhere, other than at LCE, left Teboho with no option other than following teaching as a profession, which meant that he followed a teaching career almost by force or limitation (Shahzad, Fatima & Ahmed, 2018). The experience that Teboho got in helping his classmates with the subject Woodwork when he was in secondary school and mathematics when he was at the college could have influenced his choice of the teaching profession. Evidence shows that Teboho's experiences helped him develop into a motivated teacher. I use the term "career by constraint" to name Teboho's choice of the teaching career because he followed the teaching career when he failed to join a career of his choice which was accounting.

Khothatso, on the other hand, claimed he was encouraged by his mother to apply to the college because he did not know what to do after completing COSC. The literature on career development recognises the influence of parents on their adolescent children's choices and progression in career development (Middleton & Loughhead, 1993; Palmer & Cochran, 1988), which is an experience that Khothatso had. Khothatso also believed that it was much easier to get a job in teaching than in any other profession. Khothatso's choice of a teaching career was therefore also a "career by constraint".

Carol, unlike Teboho and Khothatso, was clear early on that she wanted to be a primary school teacher. She developed a positive attitude towards teaching following the impression she got that primary school teachers treat their learners well compared to secondary school teachers. She also got support from her father, who allowed her to teach his students during the winter break when he was reaping grain from the fields even though she was still a secondary school learner. Hers was a "career by choice". Carol's father continued to mentor Carol as she progressed with her training at teacher training college and even after she began her teaching career. Although it appeared that the parent's career might have influenced Carol's choice of her career, literature suggests that "personal choice" has more impact than the parent's profession on the learner's

career choice (Saleem, Hanan, Saleem & Shamshad, 2014).

Khothatso and Carol's career choices and progression into their teaching careers were influenced by family members, though at differing levels, on their choices of and progression into their teaching careers. For both Teboho and Khothatso, a lack of career guidance led to the choice of a teaching career as they claimed. For Carol, her primary school teachers and her father influenced her to become a teacher. Carol's choice was to be a primary school teacher. The influence on Carol's choice from her primary school teachers may be associated with the apparent motivation learners get from teachers at that level more than at secondary school level, according to Perlman and Pearson (2012:15).

In summary, career choices of the three participants were influenced by factors that included a failure to get admission to institutions of first choice, parents, teachers at primary and secondary school levels and personal choice. Career discovery for these participants is either career by choice or career by force (or by constraint). Nawabi, Javed, Shujauilla and Ulfat's (2019:225) study, which was a narrative literature review, whose objective was to determine the parental influence on their children's career choices, confirms that indeed children's choices of careers are influenced by their parents.

While the three participants had varying factors influencing their career choices, specific experiences during teaching or tutoring when they were still learners (at secondary level) and student teachers (at college) could have had a bigger influence on their choices to be teachers, as described in the next section. Claudia (2015) concurs with the relevance and importance of many factors in motivation of individuals to pursue and sustain a teaching career. The factors cited include "desire for personal growth and continued learning, to have a positive impact on others' lives and contribute to society, and to attain stable, secure employment" (Claudia, 2015:1115). Some authors have identified parental influence as one of the main factors (Otwori, Mutisya & Ndeke, 2018; Xing & Rajewoski, 2018).

5.2.1.2 Interpretation of teaching, of a good teacher, and a professional mathematics teacher

Data in this study point to teaching as either a calling or a career of choice and point to a teacher as a role model, as I describe next.

Teaching as a calling or teaching as a career of choice and purposeful intent

Teboho viewed teaching as a calling and the person whose destiny is to be a teacher cannot avoid it. Khothatso did not view teaching as a calling and Carol viewed teaching as a career of choice to influence learners' education and lives positively.

A teacher as a role model with multiple roles

The multiplicity of roles is observable in the example that Graven (2002) reported about. Graven's study established roles aligned to the curriculum requirements in the context of reform movement in South Africa in the early 2000s. She described roles that include the teacher as "a local curriculum developer and an applier of math in everyday life", "an exemplar mathematician or someone who has an interest in pursuing mathematics for its own sake", "a custodian of mathematical knowledge or a deliverer of mathematical conventions, algorithms, etc." These roles describe various functions a mathematics teacher assumes in relation to teaching for mathematics applicability in real life, modelling learner mathematicians and teaching for pursuance of mathematical conventions, skills and algorithms.

The roles I establish in this thesis go beyond just the teacher's interaction with mathematics, to encompass the teacher's relation with the learners and conduct as a professional. The roles I refer to are parenting or pastoral care role, academic role and professional role.

Two of the participants, Teboho and Carol, viewed a teacher as a person who cares about the feelings of the learners and who fills the gap of parenting in the absence of parents or guardians. Teboho's experience with his secondary school accounting teacher who cared about her learners, about their social lives and their performance at school, made

Teboho believe that a teacher is “a parent”. Carol’s experience with her primary school teacher, in comparison with her secondary school teachers, made her feel that teachers in primary schools care about their learners. Ferreira and Bosworth (2001) point out that learners describe caring in a one-dimensional way, from the teacher to the learners in terms of what teachers can provide in relation to pedagogical practices and content.

One participant also viewed teachers as academics. Khothatso viewed a good teacher as a knowledge seeker, a researcher and a collaborator, the roles assumed by the teacher who understands knowledge to be the product of engagement in a community of practice, where teachers help one another as they collaborate and negotiate meaning making.

The three participants discussed various aspects of a professional mathematics teacher. Teboho viewed self-motivation, caring about learners’ well-being and their performance, use of language for learners’ access to mathematics and use of concrete learning materials as key to a good and a professional teacher. Khothatso viewed it as being approachable and predictable, observing ethical behaviour, having technological expertise, being ready to research and learn from colleagues and having teaching experience. Carol echoed what Teboho mentioned, that is, caring for learners, but Carol also viewed teaching for meaning making and being reflective as key to being a good teacher. Section 5.2.1.3 below describes the influence of critical personal experiences on participants’ perceptions about a good teacher.

5.2.1.3 Experiencing teaching before qualifying and during teacher training

The three participants had a variety of experiences that influenced their perceptions about the attributes of a good teacher and a professional mathematics teacher.

Teboho enjoyed a good experience of emotional support by his accounting teacher at secondary school level. Teboho’s personal experiences, particularly classroom experiences while he was a learner, influenced his perceptions about teaching and teachers. The critical components associated with a good teacher, according to Teboho,

include being friendly to learners, showing a caring attitude and being motivated to carry out the duties of a teacher.

He recalled critical incidents during his school and college days of how he and others judged teachers based on these incidents and how these experiences influenced his professional practice:

When we were students, we judged our teachers ... at the high school level, primary level; we met different teachers with different backgrounds with different emotions. ... [students] judge you as a teacher before they could take what you are going to tell them.

As Teboho narrated his experiences, he gave an account of how he viewed himself as a teacher. For example, he did not want to identify with his English teacher when he was a secondary school learner. In contrast, his positive perception of his accounting teacher, as a model of a good teacher, appears to have influenced Teboho's initial career choice to become an accountant, although he ultimately settled for a teaching career. He described himself as a caring and motivated teacher – the attributes he had attached to his accounting teacher at secondary school level. He identified himself with one teacher but not the other.

Teboho's critical personal experiences in the classroom also reinforced his perception of a good teacher. He explained that his professional attributes of being a caring and motivated teacher have a positive influence on his learners' performance. This is also in line with his descriptions of a good teacher. Teboho however pointed out his limitation in the use of English language, which is the language of instruction, particularly in the upper classes in Lesotho primary schools. He said, "I am not good in English, it is my weakness, but I know that whatever I do, they will get it with this poor English."

Despite his concerns, Teboho remained positive and felt confident about his ability to teach effectively.

Khothatso, on the other hand, had an experience that was more academic. He described

working on an activity that required attention to detail on mathematical content and pedagogy when he was at a teacher training college. They had to pay attention to accuracy on how the instructional materials are developed and whether it would be user-friendly to people with visual impairment.

Khothatso indicated that training at the college (LCE) gave him a new perspective of who a teacher is. He mentioned various attributes. Firstly, observing good ethics in working with learners, teachers and other stakeholders; secondly, knowledge of and skills in the use of technology for teaching and learning; thirdly, willingness to seek knowledge from others who are more knowledgeable and researching the field related to one's teaching subject; and the fourth attribute is having experience in teaching and in the subjects taught.

He pointed to an experience he had in a mathematics curriculum studies course at the college. They were working on a mathematics project where they were to construct mathematical learning materials. He indicated that they struggled to conceptualise their project (the development of a trundle wheel) and to consider the real-life applicability of the material they intended to develop:

I remember (pause) my group-mates and I, we were making a trundle wheel. When we thought about it, it was something very easy, but when it actually came to construction, it was very complex, there were some formulas, which were involved in calculations of everything to make sure that it was precise and we also had to be innovative.

The task they worked on, according to Khothatso, engaged them to think and debate on the mathematics relevant to the appropriate development of the material (trundle wheel) in that project. Another interesting aspect that Khothatso mentioned is the need to engage in the suitability of the material to meet students' various needs, "We were asked 'what if someone is blind, how will they use this?' and we had to go sit down and think."

Khothatso described his engagement with this task as fulfilling in his quest to be a good mathematics teacher as he felt that he had developed new ways of approaching the

teaching and learning of mathematics, “I think then I started changing towards my way of approaching mathematics.”

This narrative from Khothatso sums up the impact of his early experiences related to teaching. It indicates that this kind of experience helped him shape his identity as a teacher.

Carol's experience was unique in that she got exposure to teaching while she was still a secondary school learner, through the support of her father who assisted her in developing good practices in teaching, especially in mathematics, that boosted her confidence that she could be a teacher.

I started teaching at (name of place withheld), closer to home, very far from the town of (name of a town in the district withheld). That is where I enjoyed teaching, and I was teaching maths. This is the place where I practised maths, and I found that, at first, I was struggling, but because my father was on my side, I would always go to him, ‘How do I tackle this, what is it that is needed for me to make it a better lesson.’

Part of what she learnt from her father is to reflect on the lesson taught:

... he would always say that once you have taught a lesson in mathematics, you will know when the lesson went well. Even when the lesson did not go well, you will also know. You are the first person to tell me that it went well.

Carol's father advised her to use the discovery method to engage learners when teaching that contributed towards her professional development.

By the time I interviewed Carol, she had many years' experience teaching and learning about education. Carol attributed her growth as a teacher, in particular, a teacher of mathematics, to the different phases of her learning to be a teacher, from when she was a learner up to when she was a teacher who still got help from more experienced teachers such as her father.

Personal experiences as described above relate to the participants' beliefs about teaching

and being a teacher. This is in agreement with Dalby (2017) who indicates that personal experiences have a link to narratives and working identities of teachers.

5.2.2 Participants' perceptions and professional experiences in a school context

5.2.2.1 A curriculum with content and pedagogic demands

Both Khothatso and Carol believed that the curriculum introduced in 2012 was challenging for both learners and teachers. They felt that teacher preparation for introduction of this curriculum was not adequate. The main reason, they pointed out, was the inclusion of topics and concepts in mathematics, such as rotation in transformation and probability, which they felt are more challenging for primary school teachers. Carol further shared her feeling that the Grade 7 class should be part of secondary school so that primary school ends at Grade 6. Her view was that teachers would be more comfortable handling primary school mathematics up to Grade 6 in the current curriculum. Teboho added that, for the primary school teacher to manage teaching mathematics in the new curriculum, the teacher has to have a strong background in mathematics content knowledge. Literature also refers to the need for teachers to have mathematical knowledge for teaching (Ball, Hill & Baas, 2005; Hine, 2015). Although subject mastery by the participants did not appear as a key attribute to follow up, it kept coming up in interviews. In my observation of the lessons that Teboho taught, there was no indication of erroneous workings or errors in explanations from the teacher. Hence, he was able to handle the content he taught with confidence.

For her own survival in the new curriculum dispensation, Carol explained that she joined a team of teachers in one district North East of the country when they have workshops for scheming and planning. In these workshops, secondary school mathematics teachers assisted the primary school teachers by sharing their more advanced knowledge in handling certain areas of the teaching of mathematics.

Khothatso's experience with effective pedagogy (Anthony & Walshaw, 2009), used by his secondary school teachers and college and university lecturers in various courses,

influenced how he taught mathematics to his primary school learners. Among the key learning points for him, was the need to identify or develop instructional materials as part of the preparation for teaching. He highlighted the importance of the teacher being aware of the relevance and appropriateness of the material for the intended learners.

5.2.2.2 Key attributes of a professional mathematics teacher

The three participants shared what they consider as key attributes of a professional mathematics teacher. According to Teboho, being a professional mathematics teacher involves, among many attributes, being knowledgeable in mathematics, and being able to guide and support learners into developing the love for mathematics. However, literature indicates generally low strength in mathematical knowledge of primary school teachers (see the Iranian study by Saberi and Eraf, 2016 and a Lesotho study by Setoromo, Bansilal and James, 2018) which, for Lesotho, may be a result of poor mathematics background of the teachers (George, Kolobe & Moru, 2018). Khothatso believed that a professional mathematics teacher should have significant job-related experience, should be a knowledge seeker, a researcher and a collaborator. Furthermore, a professional mathematics teacher should be able to influence learners to develop a positive attitude towards mathematics and should exercise patience and care in supporting learners in their efforts to develop mathematical competencies. Carol viewed professionalism as being effective, reflective and being able to handle criticism positively.

The three participants were involved in extra-curricular activities that apparently helped them to strengthen their knowledge and skills. Teboho facilitated the Mathematics and Science Club activities at his school. Khothatso was involved in organising school-based and inter-school academic activities where he set mathematics test items for mathematics competitions his school held with other schools. Carol was involved in her school's subject based panels where her focus was on the Mathematics and Science Panel activities. The participants' engagement in these activities provided them with opportunities to develop professionally for improved learner support. Jaquith (2013:58–59) argues that teachers have a potential to learn the skills and knowledge for effective teaching if they are exposed to the “right structures” and the “right kind of teams”. Hence, successful participation in

activities of this kind partly relies on the teams that include the teachers and on the structures in place at the school.

5.3 Mathematics classroom practices in the three participants' classrooms

This section compares mathematics classroom practices in the three participants' classrooms. The mathematical practices are aligned to the sub-themes "learning environment", classroom discourse comprising "exemplification" and "explanatory talk", and lastly "learner participation".

5.3.1 Setting classroom communities by groups

The learning environments in the three participants' lessons differed in terms of groupings of learners and management of teaching in relation to the groupings, as described in sections 5.3.1.1 and 5.3.1.2 below. Two types of groupings were used, whole class and small (local) groups around desks of five or six learners.

5.3.1.1 Use of groups for teacher convenience or learner peer support

The classrooms of the three participants ranged in terms of numbers of learners from around 35, for Khothatso, to around 55, for Carol and Teboho. These numbers show a learner to teacher ratio that is higher than the average country ratio, according to the 2015 statistics as shown in Figure 5.1.

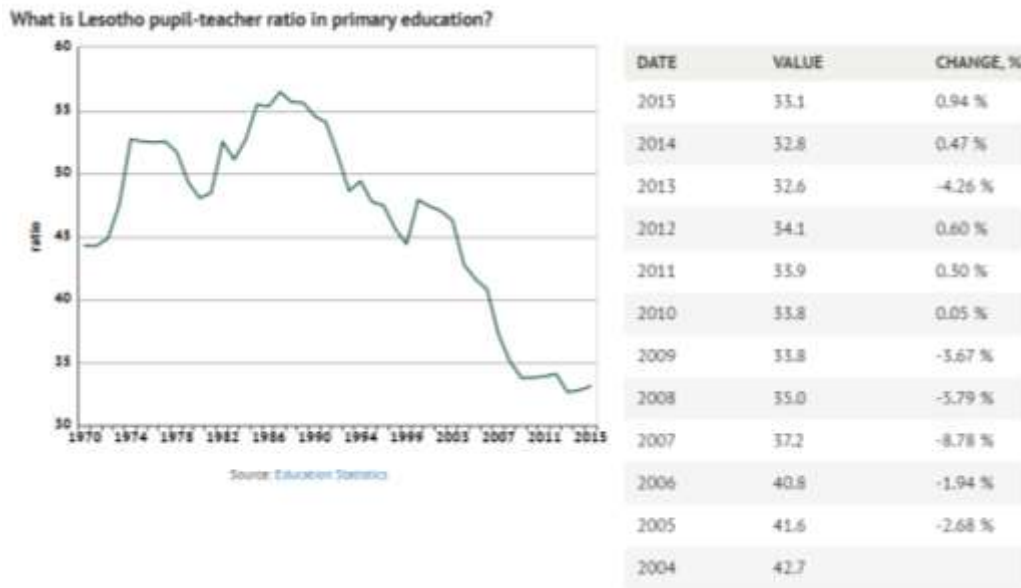


Figure 5.1: Learner to teacher ratio in Lesotho primary schools in the period 1970 to 2015

Source: World Data Atlas <https://knoema.com/atlas/Lesotho/Pupil-teacher-ratio-in-primary-education>

Learner arrangement in classes was in small groups in Carol’s classrooms while, for both Khothatso and Teboho, the arrangements were mostly whole class groupings. Therefore, learners worked either in smaller groups in Carol’s classroom while, in Teboho and Khothatso’s classrooms, they worked either individually or as a whole class.

The set-up in Khothatso’s classroom provided for a manageable class of 32 learners working in a friendly environment with the teacher directing classroom activities and interactions. Khothatso preferred an environment where his learners would feel welcome and free to talk and contribute ideas.

For Carol, the set-up allowed the teacher to direct the classroom activities, while learners, in their small groups, focused on assisting one another and providing support to struggling learners. After the introduction and description of tasks, the teacher moved around to assist learners in their groups. The use of groups, which varied from one participant to

another, happened through unconscious reflection (Grootenboer & Ballantyne, 2010) of the participants' teacher professional identities as viewed from the classroom practices.

5.3.1.2 Instructional approaches for learner participation

A variety of teaching methods and learning materials to establish coherent interaction among the teacher, the learner and the materials (Cohen & Ball, 1999), in order to facilitate learning, were visible in this study.

The three participants used direct teaching, where the teacher explained concepts to learners and also used the question and answer method. However, the teachers differed in other aspects of their approach to teaching. Teboho used demonstrations as another method of teaching while Khothatso used whole-class discussions.

Teboho used sets of mathematical instruments to demonstrate procedures while Khothatso used materials that were brought by learners and materials he brought to class himself, including the laptop and the data projector, to display content to learners. Khothatso's effort to instruct learners to bring or even create some materials (Dewan, 2018:17) and bring them to use at school had advantages in the development of learners' mathematical skills. More importantly, learners were helped to transition from reliance on materials provided by the teacher in order to model some mathematics concepts, to being able to conceptualise the concepts without the materials, which are higher order skills that learners need to develop as they prepare to move to higher grades (senior primary and the lower secondary). Carol used materials, such as a bank note, in class to help learners develop concepts. She also used the learners' books to give learners exercises for practice. All three participants included activities where learners had to use their writing books to answer questions.

All three participants provided an opportunity for learners to write their responses to specific questions on the chalkboard and/or explain their responses to questions from the front of the class. The intention was to share thoughts and explanations with the rest of the class so that others could react to the responses and contribute to further debates

regarding the concepts under study. Herbel-Eisenmann et al (2013) describe the sharing of thoughts and explanations by learners as normally used in contexts where learners have to report to the whole class and where they use language in ways that help them to recount their own experiences dealing with mathematical problems. This practice recognises that learning is a social process as literature indicates (Lave & Wenger, 1991).

5.3.2 Use of mathematical examples and tasks

Use of examples and mathematical tasks in the three participants' classrooms had similarities and differences, as shown below.

5.3.2.1 Mathematical examples for similar and contrasting experiences

The use of mathematical examples provided instances of similarity (Adler & Ronda, 2015; Ng & Dindyal, 2015) in line with the concepts taught. There were, however, also cases where use of examples indicated differences (non-examples). For instance, Khothatso asked a question involving the definition of a polygon as he drew connected line segments that did not complete a shape on the chalkboard, "If we have a shape like this, do we consider this a polygon?" Khothatso's question, in that case, was to provide an opportunity for learners to experience a situation of contrast in exemplification. Carol's use of examples of angles from a rectangle and a square to illustrate the sum of interior angles of a quadrilateral provided an opportunity for learners to realise that, to find the sum, we multiply one value of an angle by the number of angles (the same as the number of sides) in a regular polygon. The application of Carol's example to regular polygons has a potential to provide experiences of variation in terms of similarity. Use of examples by the participants in this study varied between illustrating concepts and illustrating procedures (Bills et al., 2006). Classification of examples can happen through teaching, where the teacher gives examples, and practice where learners work on the exercises given by the teacher to practise their understanding of concepts and procedures.

5.3.2.2 Mathematical tasks for familiar and unfamiliar situations

Tasks used in the three participants' classrooms served various purposes including

providing opportunities for learners to carry out known mathematical procedures. Alternatively, there were tasks, which required learners to determine the procedures to use in unfamiliar situations. For example, Teboho required his learners to construct parallel lines in a slanting orientation, which he had not discussed, with them earlier in the lesson. Khothatso instructed his learners to prepare a net of a triangular prism to use in the next lesson to calculate the total surface area of a prism. The two tasks that learners had to prepare for class required them to engage with and apply mathematical procedures and processes in unfamiliar situations. In one activity, Carol instructed her learners to generate further levels of the pattern of numbers she started, and in another activity, she instructed them to calculate the value of one angle in a parallelogram when given the three other angles. In both activities, she did not provide procedures to follow in carrying out the activities. Providing opportunities for learners to carry out mathematical tasks with application in unfamiliar situations implies that teachers value the challenge that goes with teaching mathematics for application in real life contexts.

5.3.3 Explanatory talk

All three participants reflected a common practice where the use of words and phrases varied through different stages of their lessons. There was a shift between the colloquial use of words and phrases, and the appropriate use of mathematical language in facilitating learning. In some instances, the three participants used everyday terms and expressions when teaching mathematics but the use of mathematical words and phrases in formal ways was also evident.

Other than the focus on the content taught in the three participants' classrooms, they handled aspects of the content in unique ways. Both Teboho and Khothatso used immediate learning environments, including the school and the home, in the examples and tasks to situate the mathematics concepts they taught. For Teboho, the environment encompassed the classroom and its infrastructure such as the chalkboard, the ceiling and the desks. For Khothatso, the environment comprised materials from the learners' homes, such as old clothes and other tangible items. Teboho assisted his learners in viewing the concept of "parallel lines" in materials found in the classroom, which were part of the

infrastructure. Khothatso instructed his learners to bring materials from home while he brought advertisement flyers from the furniture shops. He then worked with his learners through calculations related to selling items at reduced prices when he was teaching the concept of discount and reducing prices by a certain percentage. The various materials in both Teboho and Khothatso's cases exemplified and modelled mathematical concepts. Therefore, the participants' practices in this case depicted mathematics embedded in the environment, both at school and outside school.

What also seemed to count as important mathematics was the mathematical terminology. Both Khothatso and Carol gave attention to language issues. For example, Khothatso required his learners to use their dictionaries to find definitions of keywords they came across in the lessons. Carol further required her learners to practise spelling of keywords such as "parallelogram" and "square". Language development focused on definitions and spelling of mathematical terms.

5.3.4 Learner participation

Engagement of learners on classroom activities was different in the three participants' classrooms. Khothatso and Carol's lessons were dominated by the "what" and "how" types of questions and, in rare cases, the "why" types of questions. The approach in the two participants' classrooms suggests that there were limited opportunities to apply reasoning in discussions hence implying emphasis on the lower levels of Bloom's Taxonomy of cognitive development.

Collaborative learning was evident in Khothatso's lessons. Learners could share ideas verbally and in writing on the chalkboard. Guidance by the teacher and, in other cases, by the learners themselves followed interrogation of ideas. The type of collaboration evident in Carol's lessons was mainly through group work where learners supported one another. Learners with learning challenges benefitted from this system. The kind of support that Carol expected among her learners involved the faster learners giving feedback to the teacher about the progress of the learners who needed support. Khothatso and Carol believed that learning is a socio-cultural activity (Bennet, 2014;

Enyedi et al., 2005) and hence learning should involve working together for a common goal. The teacher's role in this case is to develop a culture of participation (Bennet, 2014:25) where learners know that they can contribute to classroom discussions and that their views are valued and respected.

Unlike in Khothatso and Carol's classrooms where there was evidence of collaborative learning, individual learning dominated Teboho's classroom where the learners listened to and watched the teacher's explanations and examples then followed by practice exercises. Learners tended to work individually to finish the exercises so that the teacher could mark them as he moved quickly through the class. The number of learners, around 55 per stream, in Teboho's Grade 6 classes, could have been a factor that led to his quick movement across the class as he marked learners' classwork. Teboho apparently did not believe in learning as a collaborative and socio-cultural activity. His practice depicts an identity built on individual efforts for learning.

5.4 How personal and professional experiences relate to the participants' classroom practices

This section reports on the interface of participants' personal and professional experiences with their classroom practices and participants' explanations about the teaching and learning incidents as observed from their lessons.

5.4.1 Professional experiences and their influence on teacher identity

The professional experiences discussed in this section relate to the school curriculum and content knowledge, the practice of teaching and peer collaboration and the perceptions of being a professional mathematics teacher.

5.4.1.1 School curriculum and content knowledge

All three participants experienced the current curriculum as demanding in terms of what teachers should know. According to the participants, the reason for the challenge was the addition of new topics to the current curriculum. The added topics include probability and

rotations in transformations (MOET, 1999:112; MOET, 2017:48). Research has established that teachers' mathematical knowledge for teaching influences learning (Ball, Hill & Baas, 2005; Pournara, Hodgen, Adler & Pillay, 2015). On the other hand, a study by Mpalami (2013) has established that the pre-service teachers at a college of education were able to choose appropriate mathematical teaching representations and to use them appropriately because of the foundational mathematical knowledge they had. These studies suggest a need for teachers to be competent in this knowledge.

5.4.1.2 Perceptions of being a professional mathematics teacher

The three participants held perceptions related to teacher professionalism in different categories that are subject matter knowledge and teaching approaches, learners, social and academic support and teacher's self-assessment.

Teboho indicated that a professional mathematics teacher has to have a strong mathematics background and that his/her teaching approaches should help learners develop skills for an integrated approach to problem solving. For Khothatso, a professional mathematics teacher should support learners academically and socially by exercising patience and care towards learners and finding ways to make mathematics interesting for learners. Carol views a professional mathematics teacher as someone who is able to reflect on own practice and who can handle criticism positively. Therefore, data suggests three key areas that describe attributes of a professional mathematics teacher: mathematical content knowledge, knowledge of pedagogical practices and reflecting on own practice. Reflecting on own practice may therefore be a formula for the measure of successful practice of teaching mathematics as it is based on the strength and depth of mathematical knowledge for teaching.

5.4.2 Professional experiences and classroom practice

This section deals with the learning environment and instructional approaches with a focus on aspects of classroom practice that depict identity traits that define each teacher's identity as a primary school mathematics teacher.

5.4.2.1 Learning environment

The learning environment in this section covers classroom size, use of groups, learners' seating arrangement and stimulating the learning environment.

Group arrangements in the three participants' classrooms served different purposes. In Teboho's classroom, learners used pairs more than groups when given classwork to do. Teboho's explanation of using groups was to enable speedy checking of learners' answers to classwork written in their mathematics exercise books. Teboho acknowledged the challenge of reaching all students in a 40-minute lesson due to the large number of learners in his classrooms. Kambuga (2013) argues that increasing enrolments in primary schools compromise the quality of teaching and learning. On the other hand, Galton and Pell (2012) found that, in about 75% of large classes, learners did not receive individual attention. The implication of Teboho's experience in this case is a need to devise strategies to handle a large number of learners in class.

Use of group work in Khothatso's class happened when there was a need for learners to work together on a task or when the teacher wanted to complete the marking of mathematics exercise books (in groups) quickly. Another use, according to Khothatso, was for group competitions on some tasks. In Khothatso's classroom, learners appeared free to talk as the atmosphere was relaxed so that the teacher and his learners could exchange jokes and laughter although this was controlled. In Carol's classroom, the intention to use grouping was to allow learners to collaborate and let faster learners help those who were struggling. There were signs of intention from all the three participants to have learners working independently as well as collaboratively (Anthony & Walshaw, 2009).

5.4.2.2 Instructional approaches

The instructional approaches discussed in this section relate to teaching methods, and teaching and learning resources. The instructional approaches of the three participants had similarities and differences, as discussed below.

First, there were similarities in the way that all three participants introduced their lessons. Teboho and Khothatso showed a pattern of review of prior knowledge while Carol stated lesson objectives. Secondly, there was evidence of the use of materials that included mathematical instruments and exercise books for writing classwork.

Each teacher had unique practices. The general approach in Teboho's classroom followed a traditional pattern of Initiation, Response, and Feedback (IRF). The explanations in the "Initiation" stage targeted the whole class. Learners then worked individually, in pairs or threes on the exercises. Feedback from the teacher targeted individuals, small groups or the whole class. Teboho's belief that learners have to see and observe the teacher demonstrating influenced his approach to teaching the topic that required the use of instruments where he demonstrated how to use the compass to construct parallel lines.

Khothatso's approach included a review of learners' prior knowledge and engagement of learners' ideas by first giving them tasks to do at home and then having the lesson of the day based on ideas learners brought from their homework. This approach is similar to the "*flipped learning*" approach (Ozdamli & Asiksoy, 2016) although, for Khothatso, homework (for the flipped approach) did not require or involve the use of technology. Khothatso further used a data projector to show a video on naming polygons based on their characteristics. In using technology to teach, Khothatso engaged his learners using strategic pauses in the video to allow for discussions and opportunities to clarify certain points for learners' understanding of the content shown in the video. He said:

Some cannot hear properly what this person is saying so I would stop and then see what is being said so that everyone is on the same page. Again, the pace at which it (the video) moves is a little bit too fast so, if I cut it, stop it, go back, it helps learners be at the same level with the video, step-by-step, and explain what is happening here.

He supplemented the use of technology by using charts with drawings of the different polygons from which he challenged learners to name other polygons, given their number of sides. His facilitation with technology helped "support independent inquiry and shared

knowledge building” (Anthony & Walshaw, 2009:158). Khothatso described learners’ enjoyment in watching videos and the current curriculum prescription as reasons for the use of technology.

Carol’s lessons were characterised by introductions that included stating learning outcomes to focus learners. Carol integrated concepts of geometric and numeric patterns and explained her approach as a response to curriculum requirements to base teaching on the integration of Curriculum Aspects¹, Learning Areas² and concepts to develop competencies in the learner (MOET, 2009). This is because the pedagogical prescriptions of the current curriculum include a shift towards the use of learner-centred teaching methods to equip learners with knowledge and skills to be able to “identify, formulate and solve problems by themselves and evaluate their work” (MOET, 2009:22).

Khothatso and Carol’s approaches, which included efforts to ensure that learners explain themselves in discussions, reflected Bjuland, Cestari and Borgersen’s (2012) idea of “positioning in relation to pupils”, thus reflecting who they are as mathematics teachers.

5.4.3 Teacher practices that enhance effectiveness in mathematics teaching

The teacher practices discussed in this section relate to learner engagement in the classroom or extra-curricular activities and reinforcing teaching experiences.

5.4.3.1 Learner engagement in classroom or extra-curricular activities

Learner involvement differed significantly in the three participants’ classrooms. In Teboho’s classrooms, learners often listened to the teacher’s explanations of the concepts and then worked on the tasks the teacher gave. Learners worked individually,

¹ Curriculum Aspects highlight the life challenges and contexts in which the learner is expected to function as an individual and a member of the society (MoET, 2009: vii).

² Learning areas indicate a body of knowledge necessary to equip the learners with competencies necessary to address these life challenges (MoET, 2009: vii).

in pairs or threes. In Khothatso's classes, learners mostly worked as a whole group, sharing ideas in response to the teacher's questions. Learners also responded to other learners' answers. Each time a learner answered a question, the learner had to give an accompanying explanation. Khothatso explained this practice:

For the past Grade 7 learners that I taught since I taught them from Grade 2, so I have been with them for a long time, so it is something that we used to practise all the time. These ones I met last year. So, from the beginning, when I met them, that is when I started explaining to them that every step we take in mathematics we have to explain what we are doing. So it is best if you explained to us so we can hear, take note and be able to assist you, so it is something that has been done for quite some time.

Even though Carol had a classroom arrangement where learners could easily help one another in their groups, she tended to use teacher explanation and questions, where learners would be listening and answering the teacher's questions verbally or in writing.

5.4.3.2 Reinforcing teaching experience through extracurricular academic activities

The participants reinforced their teaching practices through engagement in extracurricular academic activities. Teboho's activities included training and mentoring his learners in solving problems that require thinking and deep understanding. Khothatso was involved in activities such as writing test items for mathematics competitions. He was also involved in coaching the learners in preparation for the competitions. Other than assisting his learners in developing academically, Khothatso was a mentor and a coach to his learners in the school-based and inter-school academic activities. He sought assistance from his colleagues, including teachers from the neighbouring secondary school for his professional development. Carol explained that her willingness to prepare fully for the new school year forced her to get assistance from colleagues in a different district, the Ministry of Education and the college.

5.4.4 Summary of personal and professional experiences and how they interface with participants' classroom practices

5.4.4.1 Participants' professional experiences and mathematics classroom practices

School curriculum and content knowledge

All three participants expressed views that the current curriculum is challenging, as there are topics that were not included in the previous curriculum that are included in the current curriculum. These topics include rotation and probability.

Being a professional mathematics teacher

For Teboho, a professional mathematics teacher should have a strong mathematics background. Teboho identified with an approach to teaching that recognises the integration of topics and concepts in solving mathematical problems. Khothatso viewed a professional mathematics teacher as someone who has patience, care and support for his learners in their efforts to develop mathematical competence. Khothatso's lessons were a testimony to this in that, other than displaying a learner-friendly environment, Khothatso also used interactive activities where the teacher expects learners to explain and defend their answers in class.

5.4.4.2 Professional identity and classroom practice

Learning environment

Issues of learning environment discussed in this section encompass those related to class sizes, learners' groupings, learner seating arrangements and stimulating learning environments.

Class size, groupings and seating arrangements

Teboho's lessons had a minimal use of groupings in teaching. Learners appeared to work mostly in pairs or threes. Teboho cited two benefits of using group work. Firstly, learners' books are marked speedily and, secondly, that learners can help one another when they work in groups.

Both Khothatso and Carol used whole class discussions and small group work but with different objectives. Khothatso indicated two benefits of using group work, which are enabling speedy marking of learners' work and in set ups for group competitions. Carol indicated that she used group work to allow learners to support one another, particularly the learners who struggle. Therefore, the group arrangement in Carol's classes was a mix of faster learners together with those who struggle. Carol's approach recognises Bennet's (2014) argument that mathematics is a social endeavour and requires that teachers create communities of participation where there are flexible social groupings and learners are made to feel they have the right to talk and contribute towards their peers' learning (Westbrook et al., 2013).

Stimulating learning environment

Khothatso created a learning environment that learners felt free to talk and even make mistakes as both the teacher and the learners shared jokes. He indicated that he created humour and built trust between his learners and himself to make his lessons interesting.

Instructional approaches

Instructional approaches discussed in this section focus on teaching methods, resources, handling challenges, integration of concepts, and providing feedback.

Teaching methods

Teboho used demonstrations to teach the “construction of parallel lines”. He expressed a belief that learners have to observe and see the teacher carrying out the procedures in “construction of parallel lines” in order to acquire the skill. Khothatso engaged learners in sharing ideas mostly in one large group. He used questioning to probe and guide learners in explaining their answers to questions asked, where learners answered either verbally or by writing on the chalkboard.

Use of resources

Part of teaching in both Teboho and Carol’s lessons focused on learners knowing about instruments, their parts and how to handle them during use. Khothatso required his learners to be able to manipulate learning materials, such as cutting out nets of a triangular prism given the dimensions, and being able to fold it into the corresponding solid shape.

All three participants used learners’ writing books for classwork as well as homework. Khothatso had a unique arrangement in which he required learners to use different notebooks, one for classwork and notes and the other for rough work.

5.4.4.3 Teacher practices that enhance effective mathematics teaching

Learner engagement in the classroom

In Teboho’s classrooms, learners were mostly engaged in working on the teacher’s classwork in their exercise books, otherwise listening to the teacher’s explanations. Khothatso consistently had learners explaining the answers they gave verbally or in writing on the chalkboard. Learner talk in Carol’s classroom happened in two ways, mostly

when answering the teacher's questions and occasionally when discussing among themselves.

Reinforcing teaching experience through extracurricular academic activities

As part of continuing professional development in and outside the classrooms, the three participants were involved in various activities. Teboho used Mathematics and Science Clubs to support learning where he trained and mentored learners in solving problems that required thinking and deep understanding. He further explained that Mathematics and Science Clubs support learning by providing an opportunity to improve performance and shape learners' conduct. Khothatso was engaged in extracurricular academic activities such as coaching learners in preparation of inter-school mathematics competitions. His responsibility was in helping learners prepare for these competitions.

Both Khothatso and Carol made it part of their practice to seek for help from colleagues (even at secondary school level) when they needed it. Carol's collaboration with her colleagues included classroom visits, and checking of lesson plans. Other than collaborating with colleagues at her school in subject panels on activities related to planning and class visits, Carol took the initiative to join planning groups in her home district, which is different from the district where she teaches. Carol indicated she also consulted lecturers at the teacher training college, which provided an opportunity for further professional growth.

Chapter 6

Discussions, conclusion and recommendations

6.1 Introduction

Chapter 6 presents how the relationship between teacher identities and classroom practice can be described and explained based on the three themes which are:

- (a) the critical components of professional identities drawn from the views and experiences shared by the three participants in this study;
- (b) the major features of the mathematics classroom practices that are evident in the selected primary school teachers' classrooms; and
- (c) how the three primary mathematics teachers seemed to construct and express their teacher identities in relation to their classroom practices.

This chapter comprises the introduction (this section), discussions of the findings, limitations of the study, conclusion, recommendations and the final thoughts.

6.2 Discussion of the findings of the study

6.2.1 Divergent and multiple teacher professional identities

The poststructuralist, postmodern world defines identity as a complex construct. According to Kouhpaenejad and Gholaminejad (2014), in the postmodern world, identity

“is considered to be fluid, multiple, diverse, dynamic, varied, shifting, subject to change and contradictory. It is regarded to be socially organised, reorganised, constructed, co-constructed, and continually reconstructed through language and discourse.”

This definition refers to various ways of viewing identity. First, identity may change depending on the context (Vandeyar, 2010) which could be in the school environment or community surrounding the school. Heyd-Metzuyanım's (2019) study gives an example of an elementary and middle school mathematics teacher who described his teacher

identity in a different way at the end of the teaching year compared to his description at the beginning of the year. Secondly, identity comprises sub-systems of personal and social identities, which interact to define professional identity that, according to Reicher et al. (2010), is a complicated system. Identity is therefore a personal as well as a social construct (Cardoso, Batista & Graça, 2014). Therefore, the socio-cultural activities and experiences that include interactions with the school community influence identity (Enyedi et al., 2005). Thirdly, language and discourse have potential for sharing of views about the teachers' life stories and histories, which in turn shape identities (Sandelowski, 1991).

In this study, I have shared, as narratives, the participants' personal and professional experiences from when they were learners at primary school level up to when they became qualified teachers and beyond. The teacher identities constructed and expressed in this study were derived from the participants' personal and social experiences in the contexts of their different schools. The three participants' life stories spanned from when they were young learners up to when they were qualified. These teachers painted pictures of who they had hoped to be, but due to circumstances, their dreams were not realised. Their stories also indicate how working in a teaching profession, especially as teachers of mathematics, shaped their professional identities. The Social Identity Theory with its central tenets and related essential concepts made it possible for me to make sense of, and understand the participants' narratives of their life stories in order to describe their mathematics teacher professional identities (MTPIs).

Identities tend to depict roles (Tsui, 2007) that individuals play as they function in a particular environment. This study established ways of describing the participants' teacher identities. All the three participants in this study view a teacher as a role model. This view emanates from the participants' interpretations of a good teacher and a professional mathematics teacher. The roles identified include parenting or pastoral care, academic and professional roles. The pastoral care or parental role describes teachers' care of the social being and performance of learners in the classroom.

The academic role encompasses teacher identity concerning the teacher as a learner, a researcher and a collaborator. Khothatso viewed an academic role as including being

keen to researching and learning more from their colleagues about his area of teaching and that of learning (see 5.2.1.2), that is being a lifelong learner. For Carol, professional teachers have to be reflective of their practice in order to be effective in their duties. Teboho's view about his inclination to mathematics as a subject indicates his take on the academic role he identifies with.

Participants' confidence in senior primary school mathematics

The global literature shows that mathematics teachers should have knowledge of mathematics at least at the level they are to teach (Ball, Hill & Bass, 2005; Hill, Ball & Schilling, 2008; Hurrell, 2013; Saberi & Erami, 2016). Research involving other African countries that include Kenya, Mozambique, Nigeria, Tanzania, Togo and Uganda also indicates low levels of performance by teachers in content and pedagogies related to English and mathematics (Bold, Filmer, Martin, Molina, Rockmore, Stacy, Svensson & Wane, 2017). A South African study by Venkat & Spaul (2015) indicates that slightly more than three-quarters of the South African primary school teachers showed content knowledge levels below the Grade 6 and Grade 7 band. The three participants in this study expressed the challenges they had with the current curriculum that include topics, such as probability and transformations, that were new, at the senior primary school level, posing a problem in their mathematics content knowledge and teachers' confidence to teach such topics. Therefore, the participants' expressions reflected low confidence in handling senior primary school, especially Grade 7 mathematics. Carol, in particular, further expressed her belief that to mitigate such challenges Grade 7 class in Lesotho should become part of the secondary school level to have primary school ending at Grade 6, thus shifting challenging topics in Grade 7 to secondary school level. According to Norton (2017), the confidence and competence the mathematics teachers show as they teach mathematics should be a reflection of their capability of working with mathematics content and pedagogy. Graven's (2004) study established that mathematics teachers can refer to their confidence as teachers of mathematics and also their confidence to indicate what they do not know and still need to learn. The latter indicates teacher preparedness to open up to assistance from colleagues and more knowledgeable others to improve

their practice.

Reinforcing effective teaching experience begins with an individual

The three participants expressed different identity positions concerning enhancing effective teaching practices that are a manifestation of the individual efforts made in pursuit of improving teaching practice (see 5.4.3.2). Their initiatives included making efforts to learn from colleagues, collaborating with colleagues and teachers elsewhere, involvement in coaching learners in mathematics content outside classrooms in preparation for mathematics competitions and engagement in extracurricular academic activities that included the use of Mathematics and Science Clubs to teach learners about problem solving. All three participants had a common perception that, in order to gain experience and grow expertise, teachers should be willing to get assistance from their peers and more knowledgeable people, in case of need.

6.2.2 Teacher-centred vs learner-centred pedagogies

Bennett (2014:24) describes mathematics as a social endeavour. Therefore, teachers need to initiate and instil a culture of participation to advance meaningful and rich classroom discourses. Different levels of learner engagement and participation existed in the three participants' classrooms.

Khothatso's perceptions of a good teacher and the teaching approaches observed in his mathematics lessons suggested a teacher who believes in a shift of power in the classroom from the teacher to the learners. That was also evidenced by giving learners tasks to bring learning materials from home and preparing such materials for the upcoming lessons. Khothatso indicated that he followed the teaching approaches he learnt from his college lecturers. He believed that a teacher has to be approachable, predictable and innovative. His approach to teaching gave learners opportunities to contribute ideas and defend them but also to contribute to the provision of learning materials. His learners fully participated in preparation as well as in the lesson activities, an approach that had a potential to make them have full ownership of delivery and

success of the lessons. Khothatso's classroom practice reflected the expected reform oriented practice as described in CAP-L (MOET, 2009:6) document.

For Teboho, a more teacher-centred approach dominated with an explanation followed by exercises and marking of the exercises. However, when he engaged learners in an activity with tasks on solving problems, Teboho indicated a strong conviction to remind learners about instructions and procedures to follow as they worked on the tasks given. Teboho's belief in learners learning by observing the teacher demonstrate seemed to influence his approach to teaching, which followed demonstration and explanation, learners' classroom work and then teacher feedback. This approach is the initiation-response-feedback (I-R-F) (Westbrook et al., 2013). According to Aydogdu and Selanik-Ay (2016), teachers' prior beliefs may hinder the changes that teachers are expected to undergo in order to teach according to the requirements of the new curriculum initiatives which could have been the case with Teboho.

Observations in Carol's classroom indicated her belief in keeping the power with the teacher, even though she claimed to believe in full involvement and engagement of learners in their own learning. According to Carol, group arrangements were for peer support therefore mixed ability grouping was the norm in Carol's classroom activities. Carol's classroom practices portrayed need for a conscious arrangement of learners in class and the facilitation of activities to create support structures among learners for sharing ideas, learning from one another and the more knowledgeable supporting others academically and emotionally.

The patterns of teaching approaches in the three participants' classrooms suggested beliefs that learning happens through observing procedures and processes. These patterns of classroom practices seem to suggest that understanding happens because of repetitive action by learners working on exercises for practice in the classroom. Understanding occurs because of knowledge sharing. The clarity in instructions is vital for meaningful engagement in the given activities, hence the need for repeating such instructions several times to the learners. These strategies are echoed by Rosenshine (2012:12) in his description of instructional principles that effective teachers base their

classroom practices on. These principles include “begin a lesson with a short review of previous learning” and “require and monitor independent practice” (Rosenshine, 2012:12).

6.2.3 Developing classroom cultures of participation

Learner populations have a bearing on classroom interactions and the education systems worldwide strive to keep numbers per class as low as possible. In recent times, the average teacher to learner ratio has decreased significantly at the primary school level in Lesotho (see 5.3.1.1). The three schools in this study had around 55 learners per class in the grades that I observed. This number is more than a national average of about 33 learners per class recorded for the year 2016 in Lesotho. Teboho’s approach to teaching, which was teacher-centred, could have resulted from the high numbers of learners in his classes. Kambuga (2013) indicates that Tanzania also had a similar experience of higher numbers of learners per class where the teacher-learner ratio was around 1:50 in 2012.

Regardless of the numbers in the observed classrooms in this study, participants made their own efforts to establish cultures of participation. I refer to two of these efforts. Bennett (2014:3) views the arrangement of desks in small groups in a classroom as one practice, among many, to establish classroom norms to create cultures of participation. This practice of arranging desks in small groups was more predominant in Carol’s classes than in Teboho and Khothatso’s classes. Carol encouraged learners to appreciate the need to work with one another in groups and for more advanced learners to assist the slower ones. Therefore, learners learn to take responsibility for one another (Boaler, 2006) as they participate in classroom activities and hence influence participation of their peers.

Use of patterns of groupings suggested how each participant wanted to organise and handle classroom activity. Although Teboho attributed easier management of learners’ classwork to the use of groups, he did not arrange his learners in groups in his lessons. Instead, his direct interaction with learners individually or in small groups happened when he moved around the class to mark classwork. For Khothatso, the occasional use of groupings was for specific activities such as to speed up the marking process and provide

a platform for learners' competition in the tasks in groups. Otherwise, Khothatso seemed to favour whole group activities over small group activities. For Carol, groups were essential for learners to support each other but more especially for slower learners to be supported by faster ones. Carol's approach to the use of groups indicated her belief that learning is a social process where learners support one another for their successful learning. Carol indicated she valued the support of learners with learning challenges. Her specialisation at graduate and post-graduate level, special education, could have been a factor that influenced how she valued and worked to support learners with learning needs, hence the way she organised groups and managed group work in her mathematics classrooms.

To encourage learner participation and for learners to engage with concepts before they came to class in one of the lessons, Khothatso gave his learners homework by instructing them to develop a net of a triangular prism to be used in one of his lessons. The use of this net of prism would be for the calculation of a surface area of a given triangular prism. In another incident, Khothatso instructed his learners to bring materials that included old clothes to create a model of a sale of items in a shop. This was in a lesson where he taught "*Calculating discount in buying and selling goods*". Khothatso targeted the creation of cultures of participation (Bennett, 2014; Boylan, 2010) to enable learners to develop trust and confidence in themselves. This effort could contribute to their own learning and meaningful mathematical discourses, as their ideas would emanate from their own contributions, starting from the planning phases of the lessons, where they contributed by the acquisition of learning materials.

Resources used in the three participants' classrooms came from different sources. The extent of use of the resources was also evident in how Khothatso engaged his learners in sourcing learning materials. However, Bedir and Özbek (2016) warn about possible challenges that include a lack of time and money for the teacher to acquire such materials. Khothatso required his learners to prepare and bring learning materials from home. Dewan (2018) echoes Khothatso's practice that learners should prepare and bring learning materials for classroom activities for meaningful engagement with concepts.

Anthony and Walshaw (2009) further indicate that tools do not always need to be ready-made, but learners need to be encouraged to be innovative and prepare their own representations. In the case of Khothatso as I pointed out earlier, learners did that in activities related to two lessons, one where they brought materials to model the sales and the other where they created solids of triangular prisms.

Khothatso's effort to engage his learners in the acquisition of learning materials also remedied the challenges of a lack of materials and lack of time on the part of the teacher to prepare or collect them. Khothatso's approach provided learners with an opportunity to take an active part in preparing for the lessons by collecting and preparing materials for the lessons rather than giving them the resources to manipulate (Dewan, 2018). The approach also allowed learners to engage with the lessons actively through use of the materials they collected or prepared by themselves. Learners are likely to bring materials that they can connect with, hence a high possibility to learn best from such materials (Paolini, 2015).

Khothatso's experience during training at the college, when he worked in a group of fellow students on developing the trundle wheel, which could be adapted for use by learners, including those who have visual impairments, could have influenced his classroom practice as described in this section.

6.2.4 Effective use of the mathematical instrument or equipment starts with knowing about it

Instructional resources were useful for a variety of purposes, depending on the teacher's intention. The three participants used various materials in their lessons, which included the chalkboard, mathematical set of instruments, a computer and data projector, exercise books and textbooks. In all the three participants' lessons, both learners and teachers used the chalkboard to write and share mathematical ideas that included solutions to mathematical problems. Learners' skills in the use of mathematical instruments developed through the "construction of parallel lines" in Teboho's lessons and the measurement of angles in Teboho and Carol's lessons.

What was particularly interesting in Khothatso's lesson where he taught, "*Calculate discount in buying and selling goods*" was his modelling of application of mathematics concepts to real-life situations. His use of advertisement flyers and real materials brought by his learners emulated a real life context of buying and selling to situate classroom mathematics and show its relevance to the learners' everyday lives. There was further variety in use of resources in Khothatso's use of a laptop and data projector to show learners a video on the naming of polygons, which created a stimulating and motivating environment by presenting attractive visuals for the learners as Van Rooyen and Van der Merwe (2007) would concur. The teacher periodically paused the video at strategic points to provide explanation and clarity where he felt it was necessary. This practice ensured that use of the video supported meaning making just as Lombardi (2018:367) points out that technology should add value to good literacy or good mathematical instructional practices rather than just being an addition for excitement and fun. Khothatso's effort to bring technology to his mathematics classroom might have depicted him as a role model to his learners in using what appeals to the way they may engage with content. Anthony and Walshaw (2009) further indicate that an effective teacher selects and organises tools to support learning activities. These tools provide an opportunity for learners to think through the problems they solve and make sense of the concepts they have to learn. The tools also help communicate ideas, which would otherwise be difficult without the tools.

While the three participants indicated a varied use of resources, what also stood out, as practice, was the teaching of the instrument or equipment by the participants before teaching with the instrument or equipment.

The teaching of mathematical equipment such as parts of a compass, or a protractor and how these instruments are used, appeared a common practice in the three participants' mathematics classrooms. Teboho and Carol's approach to the use of instruments by learners in their classrooms indicated their shared viewpoints on the need to teach learners about features of the instruments and how to hold the instruments, before teaching learners how to use these instruments in constructing lines and shapes. Teboho described features of the compass and its use. Carol described features of the protractor

and its use in measuring angles. Teaching of the instruments and their uses reflected the participants' intentions to teach effectively, which is one of the attributes of a good mathematics teacher as Carol indicated.

6.2.5 Mathematical discourse in instruction

Mathematical discourse in instruction in the three participants' classrooms had commonalities and differences. The use of examples seemed an integral part (Bills et al., 2006) of the mathematics discourse in all three participants' classrooms. Although Ng and Dindyal (2015) argue that the choice of examples usually depend on the learners' abilities and the difficulty level of the examples, the mathematical examples used by the participants, predominantly emphasised similarity in providing illustrations to clarify the concepts taught. However, these examples appeared to barely provide an opportunity for learners to learn through non-examples to illustrate situations where the concepts did not apply. It is indeed necessary to consider non-examples in teaching mathematics, according to Yanuarto (2016:3517) as he argues that "[e]xamples alone are insufficient to allow us to decide all cases, because they provide no way of knowing whether or not some perverse exception lurks among the cases that have not been seen".

The words and phrases used by participants reflected a mix of colloquial use and formal use, which appeared to provide opportunities for the reinforcement of learners' understanding of concepts. What counted as mathematical language appeared unique as each participant had a different pedagogical approach as highlighted in the lessons observed. For Teboho, the exemplification linked to the immediate environment by the use of structures such as the chalkboard, the tables and the roof. For Khothatso, instructional materials, some of which learners brought to school, added to ideas about exemplification. The use of materials from outside the school portrayed the environment outside the school as equally rich in providing materials and context to situate mathematics. Hence, it appears that Khothatso viewed the existence of mathematics and its applicability in the environment beyond the classroom, at his learners' homes and elsewhere. The teaching of mathematics also focused on issues of language, in particular, the emphasis placed on learners' spelling of mathematical terms and the

definitions of mathematical terms as part of lesson activities as was observed in both Khothatso and Carol's lessons.

6.2.6 Individualised learning vs collaborative learning

Boylan (2009) proposes a view to learning as part of ecologies of participation, a view that is a departure from Lave and Wenger's (1991) conception of learning as part of legitimate peripheral participation. Boylan (2009:69) argues that

“the concept of legitimate peripheral participation is not sufficient to understand either the forms of participation of participants in usual school mathematics classrooms or the reasons why the available forms of participation are as they are.”

Hence, the need to consider a more encompassing model named “ecologies of participation” which allows for understanding of learning diversities in both formal (school) settings and informal settings.

Individualised learning dominated Teboho's classroom with the teacher's role being to check and mark the learners' written responses to classwork in their exercise books. The learners had the liberty to consult one another as they worked through the exercises given by the teacher, although that happened quite minimally. Collaborative learning among the learners dominated Khothatso and Carol's classrooms. However, there were different patterns of learner participation (see 5.3.4). Carol's approach emphasised the need for learners to focus on uplifting one another, especially the slower learners, as they worked through the tasks given, with the teacher playing a less active role in small group discussions. Collaboration, in Khothatso's lessons, was open to the whole class, where everybody played a part in contributing to knowledge creation and negotiation. Khothatso's role was more of a guide as learners worked through or discussed solution strategies proposed by the learners in turns. A collaborative approach to learning in both Khothatso and Carol's lessons helped to bring those in the peripheries of participation and learning to the fore to improve their performance in mathematics.

The patterns of engagement of learners through listening to other learners enhanced the

collaborative approach in varying levels among the three participants. Learners listened to other learners as they explained their understanding of concepts dealt with and as they presented solution strategies, they proposed for solving the problems, which they would show on the chalkboard. The patterns of learners' participation with learners listening to teachers explaining concepts, as described above, applied to all participants but were of different intensities in their classrooms. Learners presenting their ideas were listened to more in Khothatso's classrooms than in Teboho and Carol's classrooms. Khothatso provided learners who presented ideas with a larger audience.

Different identity positions are discernible for the three participants. While Khothatso's learners worked together to negotiate and create knowledge, Khothatso preferred a more open set-up where learners could share ideas, make sense and negotiate knowledge creation with peers in the presence of the teacher.

6.2.7 The gap between theory and practice

The Curriculum and Assessment Policy document (MOET, 2009) suggests an approach to pedagogy that encourages a shift "from didactic teaching to participatory, activity-centred and interactive methodologies" (MOET, 2009:6). This shift is to follow a learner-centred pedagogy. However, Raselimo and Mahao (2015) caution on the promise made by this policy document by pointing out that learner-centred pedagogy, being a part of the international discourse in education, may not necessarily be adaptable to every context and every country, in other words, what we espouse may not necessarily turn out to be practical. According to Nathan and Knuth (2003), another challenge with implementation of the learner-centred pedagogy is the vagueness in the curricular reform documents which provide only general guidelines to shape teachers' notions of reform-based pedagogy and hence their practices as these leave much room for interpretation of many of the "basic tenets of current educational reform" (Nathan & Knuth, 2003:203). In the South African context, it was evident that there were attempts to reform primary school mathematics but the execution of the reform proposals contradicted the expectations, which failed to meet the goals of the reform process (Jita & Vandeyar, 2006).

The TPIs of the participants, through their perceptions about how primary school mathematics should be taught and how they actually teach, highlighted how the teachers' beliefs, views and dispositions about themselves (their TPIs) interfaced with their classroom practices, indicating a congruence or disparity between theory and practice. Teacher beliefs, according to Maasepp and Bobis (2014), have a potential to influence future classroom practices of primary school mathematics teacher trainees, hence the need for the university and college teachers to develop positive beliefs and conducive learning environments for the prospective teachers.

One of the key findings in this study points to a disparity in what the participants aspired to do when teaching mathematics and what actually transpired in their mathematics classrooms. For example, the participants unilaterally described good teaching as involving the use of appropriate strategies for classroom interactions that support building strong conceptual understanding. However, there were practices that departed from what the participants espoused. For example, as both Teboho and Khothatso indicated, they marked learners' books in groups to reduce the teacher's marking load and for the teacher's convenience in finishing the marking, which in turn, compromised learners support in that the teachers did not check group efforts for learner cooperation and collaboration. Hence, the assessment exercise in such cases could fail in its intention of developing individual learners.

6.3 Limitations of the study

This study cannot provide a sweeping generalisation about TPIs of primary school mathematics teachers based on TPIs of the three participants for the following reasons. First, the study explored cases of three individual primary school teachers with data collection done in a limited period. Data collection involved initial interviews followed by classroom observations and follow-up interviews following classroom observations. This approach provided opportunity for triangulation of data. Secondly, this is a study conducted in Lesotho, which is a less developed country. The schooling system and preparation of teachers may differ greatly from those of other countries. Focus on Lesotho

provided opportunity to understand teacher professional identities of primary school teachers of mathematics in a specific context of a country with a small economy and limited resources in schools. Interpretation of the results in the light of research from other parts of the world helped to better understand the experiences of participants in this study, hence highlighting relevance of their experience in informing teacher-training efforts in contexts similar to Lesotho. Thirdly, the focus was on one subject, mathematics, and therefore findings may not be generalised to other subjects. However, the lessons learnt from this study would go a long way to highlighting challenges and opportunities of teaching mathematics in relation to the participants' mathematics teacher professional identities. Much as this is a study of teacher identities in the context of teaching of mathematics in the primary schools in Lesotho, the findings are on a small scale as they are for only three cases. However, the findings highlight, among a number of considerations, the importance of mathematics teacher training that focuses on student teachers' individual strengths and needs to help them develop necessary knowledge and skills to be competent and confident primary school mathematics teachers.

6.4 Conclusion

The findings in the study indicate that primary school mathematics teachers' professional identities influence their mathematics classroom practices. The study reveals that professional identities are a result of experiences these teachers had when they were learners in primary schools, secondary schools and tertiary institutions where they trained to become primary school teachers. Teacher professional identities continue developing even as teachers gain years of experience. This is particularly so as the study suggests that the three participants' school experiences (as learners at primary and secondary school levels) and experiences from teacher training continued to dominate the beliefs and practices, and how these teachers viewed themselves even after many years of teaching experience. It is worth noting that there similarities and differences in mathematics classroom practices of the three teachers were observed. Those were on aspects related to planning, organisation of learners for classroom activities, engagement of learners in appreciating the mathematics in the immediate environment and engaging

learners in ways that assist them to begin to take responsibility for their own learning. In particular, the study found out the following.

6.4.1 Varying teacher professional identities

The teacher professional identities shown by the three participants, in their own expressions, are varied. These participants viewed a teacher as a role model with attributes that include academic role (a teacher as a learner, a researcher and a collaborator), a pastoral or parenting role (taking care of the social wellbeing of the learners and supporting them to cope with learning) and the professional role (including being reflective about one's practice).

6.4.2 Influence on career choices and classroom practices by family and teachers

The participants' family members, teachers and college and university lecturers influenced not only their choices of career paths but also how they developed as primary school teachers and in particular how they handled teaching of mathematics. For example, Khothatso was influenced by his mother to become a primary school teacher. He was also influenced by his University lecturers to teach mathematics and other subjects using learner-centred approaches. Carol was influenced by her father and her college lecturers into realising the potential she had to develop a new identity of a mathematics teacher with some confidence to teach mathematics at primary school level. People we interact with on a daily basis have a potential to influence how we develop our identities.

6.4.3 Developing TPIs from negative experiences and uncertain beginnings

Experiencing negative experiences and uncertain beginnings do not necessarily mean that one is destined for failure. Carol had negative experiences as a learner in secondary mathematics classrooms which pushed her to the brink of hating mathematics and nearly giving up on possibilities of ever enjoying mathematics in the future. However, her negative experiences turned out to potentially be a key influence on her identity as a mathematics teacher with passion to manage her mathematics lessons in ways that afford

support to struggling learners. Khothatso was uncertain about the career to follow until his mother advised him to try teaching (at the primary school level). Carol's and Khothatso's experiences indicate that development of TPIs for a teacher with positive influence in his job does not necessarily depend on positive beginnings. This means TPI development is a process and not an end in itself.

6.4.4 Relationship between TPIs and classroom practice

Teacher professional identities of experienced teachers have a potential to influence classroom practice. This study established cases of influence on aspects related to emotional and social support of learners. The influence was also observed to be on the teachers' classroom practices in aspects related to the teachers' knowledge of mathematics subject matter, pedagogical approaches in mathematics classrooms, choices and use of materials (including technological equipment and digital materials).

Linked to the use of materials in mathematics classrooms, this study established, as one of the key practices by two of the three teachers, the explicit teaching of how to handle materials such as mathematical sets of instruments, and to use them effectively in learning mathematics. It is worth noting that some of these classroom practices seemed to align to the prescriptions by the CAP-L in suggesting the use of innovative ways to teach mathematics in the primary schools while other areas of the participants' classroom practices seem to have kept to what Molefe and Brodie (2010) describe as the traditional approach to teaching mathematics.

6.4.5 Engagement in continuing professional development

There is evidence that continuing professional development and teacher support can still effectively happen even beyond the school set up, at the regional and national levels. Carol's experience of joining continuing professional development workshops in a different district from her workplace district is testimony to the fact that collaboration for CPD is possible across districts, regions and nationally. Khothatso's involvement in inter-school mathematics learners' competitions gave him an opportunity to interact with

colleagues from other schools on academic and professional matters, with a potential to shape his TPI. Gökmenoğlu and Clark (2015), in their study undertaken in Turkey, argue that success of national educational reforms is compromised if teachers' views and concerns regarding the quality of such an initiative are not taken into consideration. Therefore, a crucial question for the current Lesotho education system concerns the role of the MOET in organising and/or supporting CPD initiatives locally and national, and whether the teachers' concerns and needs are taken into consideration in such plans.

6.5 Recommendations

The following recommendations emanate from this study.

6.5.1 Mathematics Content Knowledge and Knowledge for Teaching Mathematics

Firstly, this study established that some primary school teachers are uncomfortable to teach part of the mathematics content in the primary school curriculum. Thus suggesting limitations in teacher knowledge of mathematics content and mathematical knowledge for teaching. Hence these teachers view themselves as insufficiently equipped to teach mathematics in the senior primary school classrooms. In the context of Lesotho, the challenge of limitations in knowledge of mathematics content and mathematical knowledge for teaching is attested to by Mabejane (2015) and Moloji et al. (2008). This observation is in agreement with Bold et al. (2017) in their observation that many teachers still lack knowledge in the areas of their learners' curriculum and they are weak in pedagogical knowledge. Therefore, the study suggests the need for teacher professional development, both in the pre-service and in-service programmes to strengthen mathematical content knowledge and mathematical knowledge for teaching among primary school teachers to give them confidence to handle mathematics at both the junior and senior primary school levels. George, Kolobe and Moru's (2018) study attests to this need by indicating that some primary school teachers in Lesotho have "never passed Mathematics and Science at any level of education examined nationally, thus making it difficult and uncomfortable for these teachers to teach these subjects effectively" (p. 9). The observation made by these scholars points to further need for teacher training

institutions in the country to consider restructuring their programmes to give candidates options to choose subject groups with inclinations towards either mathematics and science or non-mathematics/science subjects. These choices would allow students who may feel more inclined and stronger in the mathematics and science subjects to train to teach them, thus boosting their chances of viewing and identifying themselves as strong in handling these subject areas.

Secondly, the continuing professional development efforts by the Ministry of Education and Training (MOET) need to strengthen interactions and collaborations among teachers in their small and large groups within districts as well as across several districts. One of the participants in this study showed her conviction to collaborating with colleagues from another district of the country in order to improve on her practice as a mathematics teacher. Literature indicates efforts made to improve classroom practice in school mathematics through providing continuing professional development. Examples include the in-service programmes such as the National Inquiry Community of Leader Educators (NICLE) in Pausigere's (2014) study, the Mpumalanga Secondary Science Initiative (MSSI) Project in Mokhele and Jita (2012) and the INSET project in Graven (2002). Much as these projects were designed and administered with intentions to bring solutions to problems of the teaching of mathematics (and Science) Adler (2002) had earlier on cautioned that no single project can serve as a solution to suit all teachers' needs. Hence, it is worth noting that various factors that include the school context and teachers' personal experiences need consideration for the suggested solutions to be relevant and workable.

Thirdly, teacher training programs in teacher training institutions need to pay attention to student teachers' personal teaching philosophies and use those to assist the student teachers to realise and develop their teacher professional identities.

6.5.2 Admissions Policy into Initial Teacher Training

The study has revealed that teacher identity in primary mathematics teaching continues to be a significant part of classroom practice. Participants in this study have indicated

their awareness about who they are in relation to matters that include mathematics content knowledge and their comfort or discomfort in teaching certain topics in senior primary mathematics. They further indicated their awareness about pedagogical considerations in the teaching of primary school mathematics. Part of teacher performance may result from their background knowledge and experiences from when they were young learners to when they were teacher trainees. Studies by Venkat and Spaul (2015) and George, Kolobe and Moru (2018) imply need by teacher education to strengthen areas of content knowledge. The case of Lesotho, according to George et al. (2018), requires reconsidering of admissions policy as their study points to some teacher training candidates qualifying entry into primary teacher education without passing mathematics at certain levels of their education (see also Admission requirements into LCE and NUL – Table 1.2 in this study) whereas they would be expected to teach the subject once they qualify. The primary school teacher education needs to revisit admissions policies and practices particularly concerning the role of mathematics in teacher preparation to include admission requirement targeting at least pass in mathematics at senior secondary level.

6.5.3 Further research

Teachers' stories and histories reveal detailed information about themselves as teachers and about their practices. Paige et al. (2008) argues that oral histories that are collected using interview and classroom observations could reveal the quality of classroom practices. Drake, Spillane and Hufferd-Ackles's (2001) study was based on a methodology that used teachers' literacy stories and mathematics stories to represent their identities. Drake et al (2001) attest that "mathematics and literacy story interviews seem to be a useful way to understand teachers' beliefs, motivations and perspectives" (p.16). Hence, their study revealed that teachers' stories and histories collected through interviews are a helpful way to get to these teachers' beliefs and perspectives which in turn could explain their practices and their teacher professional identities.

Future research on teacher identities in Lesotho could compare identity development and classroom practices of primary school teachers with teaching experience from schools

considered to be good performing and those with teaching experience from schools considered to be poorly performing. This would give indications about the factors that could be associated with teacher identity development in the two sets of environments. Therefore, teacher identities and classroom practices that seem to be associated with improved learner performances particularly in mathematics and numeracy would be deduced. Another focus for future research could be on the influence of changing teacher identities on classroom practices of experienced primary school teachers who would have been provided with continuing professional development over a reasonable period of time. This focus could help highlight how CPD may influence teacher identities and hence mathematics classroom practices. The third focus I suggest for future research is exploration of factors that lead to disparities in TPIs espoused by the teachers and TPIs enacted and evidence through classroom practices. Knowledge about these disparities would inform teacher training strategies and policy reforms on teacher development.

6.6 Final thoughts about the study

Literature indicates a focus on studies related to teacher professional identities of beginning teachers or student teachers (Akkoç & Yeşildere-İmre, 2017; Arpacı & Bardakçı, 2016; Beltman et al., 2015; Chitera, 2011; Meaney & Lang, 2012). In this study, I have focused on teachers who have a number of years of experience that might have influenced their practices. Teboho and Khothatso's teaching experiences were slightly less than 10 years (nine and eight respectively at the time of data collection) while Carol's experience was over 30 years. The study established that the participants' experiences when they were learners influenced their TPIs. Their classroom practices similarly reflected elements of their learning experiences. This thesis contributes to knowledge in the following ways:

The study has established how both personal and professional experiences influence teacher professional identities (TPIs), as a teacher grows in the teaching profession. The study further established that primary school teachers arrive at their teaching careers in very distinct ways and their teacher professional identities and classroom practices may

not necessarily match how they discovered their career paths. For example, Carol was clear early on that she wanted to be a primary school teacher, however part of her practice was more teacher-centred while Khothatso who ended up as a primary school teacher as a result of advice from his parent had a good part of his practice as learner-centred. These varying teacher experiences and their varying influences on teacher professional identities and classroom practices have significant implications on the teacher-training curriculum. It is apparent that teacher-training institutions should strengthen elements of their curriculum that relate to the development of the teacher in entirety, with focus on supporting student teachers to call on their personal experiences to learn from as they develop as professionals. The teacher training curriculum should also strengthen student teachers' exposure to experiences that develop their confidence, knowledge and skills for effective teaching of mathematics. As the study has established, such experiences have the potential to influence student teachers' personal and professional identities and in particular, the mathematics teacher professional identities. Future studies could explore the elements of TPI factors upon which teachers can reflect on as they work on their professional development. This observation is in agreement with Drake et al.'s (2001) attestation that the design of future policies, curricula, and teacher development activities intended to nurture instructional innovation could be informed by clarity about where teachers are in terms of the development of their mathematics identities and of the differences between mathematics and literacy identities.

Although teaching practice (practicum) has not been an explicit focus of this study, there is a need to refer to the possibilities of considering the effect that the practicum has on the teachers' identities as they progress through that space. Hence, there is also a need to consider the student teachers' experiences during the practicum period in teaching practice at schools and the alignment of teacher education practices and the anticipated teaching practice outcomes (Chigeza, Jackson & Neilson, 2017) which include development of teacher identity by the practising student teachers.

This thesis has argued, in agreement with literature, that teachers' beliefs and personal experiences relate to their professional identities. Dalby (2017:7) concurs by arguing that

“teachers’ personal experiences of mathematics in formal education and the workplace influence their beliefs and are also linked to their narrative and working identities”.

We may not explicitly refer to our approaches to teaching as a reflection of who we are and therefore what mathematics is to the mathematics teacher and what does the teaching of mathematics entail. F. Joe Crosswhite (cited in Newsom, 1969:19) looks at these questions from this perspective, “Many of us may never have consciously attempted to formulate our own philosophy of teaching. Yet all of us reflect our philosophy in our teaching”. Gold (2011) further argues that, regardless of whether we are interested (or not), in the philosophy (of mathematics), when we teach we introduce our learners to the positions in philosophy (of mathematics).”

Though the philosophy (of teaching) does not form the central part of this thesis, it being at the centre of debates on its influence on the teaching practice, it is unavoidable to treat it alongside the concept of identity. Ernest, Skovsmose and Van Bendegem (2016) describe the concept of the philosophy of teaching mathematics as comprising the aims and rationale behind “the practice” of teaching mathematics. Getting the rationale correct might depend on who the teacher is in the teacher’s own view. In other words, the teacher professional identities. This thesis, therefore also raises the need for thoughts and debates about teacher professional identities alongside debates about teachers’ own philosophies of mathematics and philosophies of teaching mathematics. The thesis further challenges teacher-training institutions that, as they consider how best to handle development of student teachers’ teacher professional identities in the teacher-training curriculum, they should pay attention to the curriculum areas related to the “philosophy of teaching” in the mathematics education curriculum. The attention on philosophy of teaching (mathematics) will assist student teachers to appreciate and begin to conceptualise, develop and align their teacher professional identities to their philosophies of teaching (mathematics).

I believe moving from the general debates, about the aims and the rationale behind teaching (that is the philosophies of teaching) to who a teacher is (that is teacher personal and professional identities) would help us achieve improved teaching and learning

through meaningful classroom practices in mathematics classrooms.

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Appendix A: Ethical Clearance Letter



Faculty of Education

22-Aug-2017

Dear **Mr Maboi Mphunyane**

Ethics Clearance: **Teacher identities and mathematics classroom practices in selected primary schools in Lesotho**

Principal Investigator: **Mr Maboi Mphunyane**

Department: **School of Education Studies (Bloemfontein Campus)**

APPLICATION APPROVED

With reference to your application for ethical clearance with the Faculty of Education, I am pleased to inform you on behalf of the Ethics Board of the faculty that you have been granted ethical clearance for your research.

Your ethical clearance number, to be used in all correspondence is: **UFS-HSD2017/0934**

This ethical clearance number is valid for research conducted for one year from issuance. Should you require more time to complete this research, please apply for an extension.

We request that any changes that may take place during the course of your research project be submitted to the ethics office to ensure we are kept up to date with your progress and any ethical implications that may arise.

Thank you for submitting this proposal for ethical clearance and we wish you every success with your research.

Yours faithfully

Prof. MM Mokhele
Chairperson: Ethics Committee

Education Ethics Committee

Office of the Dean: Education

T: +27 (0)51 401 9683 | F: +27 (0)86 546 1113 | E: NkoaneMM@ufs.ac.za
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www.ufs.ac.za



Appendix B: Letter from Language Editor

Barbara Shaw

Editing/proofreading services

18 Balvicar Road, Blairgowrie, 2194

Tel: 011 888 4788 Cell: 072 1233 881

Email: bmshaw@telkomsa.net

Full member of The Professional Editors' Guild

To whom it may concern

This letter serves to inform you that I have done language editing and formatting on the thesis **Teacher identities and mathematics classroom practices in selected primary schools in Lesotho** by Maboï Mphunyane.



Barbara Shaw

05/01/2021

Appendix C: Plagiarism Report

Turnitin Originality Report

Processed on: 14-Dec-2020 12:17 SAST
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Mphunyane M.Z. Thesis Dec 2020 By Maboi Mphunyane

Similarity Index	Similarity by Source
9%	Internet Sources: 7% Publications: 3% Student Papers: 3%

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Appendix D: Confirmation to carry out research study - MOET



THE GOVERNMENT OF THE KINGDOM OF LESOTHO
MINISTRY OF EDUCATION AND TRAINING – MASERU

P.O. BOX 47 MASERU 100
22312240

TEL: 22322816 FAX: 00266
11th July 2017

The Principal

Maseru.

Dear Sir/Madam

RE: PERMISSION TO CARRY OUT RESEARCH STUDY

Permission is hereby granted to Maboi Mphunyane (Mr) to undertake a study relating to the *Teacher identities and mathematics classroom practices in selected primary schools in Lesotho*. It is the hope of the Ministry that the findings of this study will help in the advancement of the Ministry's efforts to provide quality education to Basotho children.

I hope this will reach your favourable considerations

Yours Sincerely

Handwritten signature of Teboho Moneri in black ink.

Teboho Moneri (Mr)
Regional Inspector - Central

MINISTRY OF EDUCATION
AND TRAINING
REGIONAL INSPECTOR - CENTRAL

11 JUL 2017

TEL: 22322816, P.O. BOX 47
MASERU 100 LESOTHO

Appendix E: Request to carry out research study- MOET

P.O. Box 100
Butha-Buthe
Lesotho
29th June 2017

The Regional Inspector – Central
Ministry of Education and Training
Maseru 100
Lesotho

Dear Sir,

REQUEST FOR PERMISSION TO CONDUCT A RESEARCH:

My name is Maboi Mphunyane. I am a PhD student in the School of Education of the University of the Free State.

I wish to request for permission to conduct a research in selected primary schools in the Maseru district. The research I wish to conduct is focussed on primary school Mathematics classroom practices. The research intends to find out how teachers teach Mathematics and/or Numeracy and why they do it the way they do. The title of the research is:

Teacher identities and mathematics classroom practices in selected primary schools in Lesotho.

I intend to conduct at least two interviews and one lesson observation in each of the four schools that I will visit. The participants will be teachers who have taught and are still teaching Mathematics and/or Numeracy in primary schools in Maseru Lesotho. The findings of this research will inform the stakeholders who include policy makers about issues that are pertinent in the teaching of primary school Mathematics which form part of the experiences and challenges teachers have in the teaching of mathematics. This knowledge will be useful in decisions that stakeholders make on policy issues and

teaching practices.

I am aware that this research may take part of the participants' teaching time. I will minimise loss of teaching time by requesting teachers to provide interview time after classes or at any time convenient to them. Identities of schools and participants will be treated with utmost confidentiality. The data gathered from this research will be used for purposes of this research and its publications only. Teachers will be informed that being in this study is voluntary and they are under no obligation to consent to participation. Also if they decide to take part, they will be asked to sign a written consent form. They will further be informed that they are free to withdraw from the study at any time and without giving a reason.

For any further information please contact my supervisor Dr Thuthukile Jita at **JitaT@ufs.ac.za** or +27 51 401 7441.

Yours Sincerely

Maboi Mphunyane _____ Date _____

(Email: mphuzm@gmail.com; Cell Number: +26658755552)

Appendix F: Request for permission to carry out research study - Principals

P.O. Box 100
Butha- Buthe
Lesotho
7th July 2017

The Principal

Dear Sir/Madam,

REQUEST FOR PERMISSION TO CONDUCT A RESEARCH:

My name is Maboi Mphunyane. I am a PhD student at the University of the Free State.

I wish to request for permission to conduct a research in your school. The research is focussed on primary school mathematics classroom practices. The research intends to find out how teachers teach Mathematics and/or Numeracy and why they do it the way they do. The title of the research is:

Teacher identities and mathematics classroom practices in selected primary schools in Lesotho.

I intend to conduct at least two interviews of not more than an hour each and at least one lesson observation of not more than an hour each with one of your teachers. The participants in this research will be teachers who have taught and are still teaching Mathematics and/or Numeracy in primary schools in Maseru Lesotho. The findings of this research will inform the stakeholders who include policy makers about issues that are pertinent in the teaching of primary school Mathematics which form part of the experiences and challenges teachers have in the teaching of mathematics. This knowledge will be useful in decisions that stakeholders make on policy issues and teaching practices.

I am aware that this research may take part of the participants' teaching time. I will

minimise loss of teaching time by requesting the teacher to provide interview time after classes or at any time convenient to him/her. Identity of your school and the participating teacher will be treated with utmost confidentiality. The data gathered from this research will be used for purposes of this research and its publications only. Teachers will be informed that being in this study is voluntary and they are under no obligation to consent to participation. Also if they decide to take part, they will be asked to sign a written consent form. They will further be informed that they are free to withdraw from the study at any time and without giving a reason.

For any further information please contact my supervisor Dr Thuthukile Jita at **JitaT@ufs.ac.za** or +27 51 401 7441.

Yours Sincerely,

Maboi Mphunyane (Email: mphuzm@gmail.com; Cell Number: +26658755552)

If you grant permission for this research to be conducted, please sign below.

The Principal	_____	Date	_____
Researcher	_____	Date	_____
Supervisor	_____	Date	_____

Appendix G: Invitation to participate in a research study - Teachers

P.O. Box 100
Butha- Buthe
Lesotho
7th July 2017

Dear Teacher,

INVITATION TO PARTICIPATE IN A RESEARCH:

My name is Maboi Mphunyane. I am a PhD student at the University of the Free State.

I wish to invite you to participate in the research I am currently conducting. The research is focussed on primary school mathematics classroom practices. The research intends to find out how teachers teach Mathematics and/or Numeracy and why they do it the way they do. The title of the research is:

Teacher identities and mathematics classroom practices in selected primary schools in Lesotho.

I intend to conduct at least two interviews of not more than an hour each and at least one lesson observation with you of not more than an hour each. The participants will be teachers who have taught and are still teaching Mathematics and/or Numeracy in primary schools in Maseru Lesotho. The findings of this research will inform the stakeholders who include policy makers about issues that are pertinent in the teaching of primary school Mathematics which form part of the experiences and challenges teachers have in the teaching of mathematics. This knowledge will be useful in decisions that stakeholders make on policy issues and teaching practices.

I am aware that participating in this research may take part of your teaching time. To minimise loss of teaching time may I request that you consider providing interview time

after classes or at any time convenient to you. Identity of your school and yourself will be treated with utmost confidentiality. The data gathered from this research will be used for purposes of this research and its publications only. If you decide to participate in this research it should voluntarily and you are under no obligation to consent to participation. You will be asked to sign a written consent form when you decide to be part of this research. Please be informed that you are free to withdraw from the research at any time and without giving a reason.

For any further information please contact my supervisor Professor Loyiso Jita at **JitaT@ufs.ac.za** or +27 51 401 7522

Yours Sincerely,

Maboi Mphunyane _____

(Email: mphuzm@gmail.com; Cell Number: +26658755552)

If you consider agreeing to participate in this research, please read and sign the consent letter below:

Consent letter for participants

I _____, have read and understood contents of this consent form. That:

- a) I participate in this research voluntarily and I am not in any way obliged to agree to participate,
- b) I can withdraw from participating in this research at any time, without being required to give a reason,
- c) I am aware that my privacy will be protected and my identity will be concealed,
- d) I agree that audio and video recorders can be used by the researcher (and research assistant where needed) to gather data during my participation in interviews and lesson observations.

I therefore hereby agree to take part in this research.

Signature: _____; Date: _____

Appendix H: Teacher Interview Protocol 1

(Before lesson observation)

Day and date of interview:

A. Interview opening script:

My name is I am a student at the University of the Free State.

I am conducting a study towards a PhD qualification.

I will be asking questions related to your experience in the teaching of primary school mathematics, how you grew to be the mathematics teacher you are today and the kind of challenges you have had and ways you dealt with these challenges.

My use of the term MATHEMATICS in this interview covers even your experiences with NUMERACY.

I have to mention that you are free not to answer any question during the interview process if you feel you do not want to answer it. You are also free to require clarity on the questions that you find unclear.

B. **Background Information** (to be written by researcher at the beginning)

(a) Name of participant:
.....

(b) Gender:

Education				
	Name of School/Institution	Started	Completed	Qualification
Primary				
Secondary				
College				
University				
Work Experience				
Primary School	Grade levels taught	Year(s)	Qualification	

C. Interview Questions:

1. Becoming a teacher:

(a) When did you know you wanted to be a teacher and what factors made you to decide to become a teacher?

(b) Tell me about your favourite teacher at any level of your education and also tell me about what was particularly outstanding and interesting about him or her.

(c) Also tell me about the teacher who was NOT your favourite at any level of your education.

2. Identity Development:

(a) In this set of questions, I am interested in knowing your views about what a teacher is:

- (i) What views did you have about '*what a teacher is*', before you trained to be one?
- (ii) Did these views change when you got trained to be a teacher and when you got more experienced in teaching?

If so, how did they change?

What do you think lead to the change in your views?

(b) In this section I am interested in knowing your own experiences as a Mathematics teacher:

- (i) Please give me some examples of incidents where '*what you did as a teacher*' reflected things you like and value most as a person.
- (ii) Please give me some examples of incidents where '*what you did as a teacher*' reflected things you like and value most as a Mathematics teacher?
- (iii) Tell me about any incidents or events that helped to influence your identity (that is how you see yourself) as a Mathematics teacher.
- (iv) Tell me about major changes in your career as a Mathematics teacher and explain how these contributed to your profession as a teacher of Mathematics.
- (v) Tell me about your own experiences of the primary school curriculum and how the changes in the curriculum may have affected you.

3. Defining good teaching and reflecting on identities:

- (a) What experiences have made you the teacher that you are today? Please include both good and bad experiences here?
- (b) What does being a professional Mathematics teacher entail?
- (c) Tell me about your strengths as a Mathematics teacher.
- (d) Tell me about your weaknesses as a Mathematics teacher.
- (e) What factors contribute to good teaching of Mathematics, especially at primary school level?

Appendix I: Lesson Observation Sheet

Day and date of Observation:

The researcher records, in the space below, incidents observed as the lesson progresses. Comments associated with such incidents are also recorded.

Background Information: (to be written by researcher at the beginning)

(a) Name of participant:

(b) Gender:

Lesson Observation:

Time incident observed	Observed incident and Comment(s) (possible meaning)

Appendix J: Teacher Interview Protocol 2

(After lesson observation)

Day and date of interview:

A. Interview opening script:

My name is I am a student at the University of the Free State. I am conducting a study towards a PhD qualification.

This interview follows on lesson observation(s) I made on the date(s)

My use of the term MATHEMATICS in this interview covers even your experiences with NUMERACY.

I have to mention that you are free not to answer any question during the interview process if you feel you do not want to answer it. You are also free to require clarity on the questions that you find unclear.

B. Background Information (to be written by researcher at the beginning)

(a) Name of participant:
.....

(b) Gender:

Interview Questions:

1. Reflecting on classroom practice:

(a) Materials used

(i) I realised that you used (description of an activity) to engage your learners in some activity/activities. Why did you decide on using this/these material(s)?

(ii) How do you usually decide on which materials to use for your lessons in Mathematics/Numeracy(s)?

(b) Tasks and activities used

(i) I realised that you used the following task/activity in the lesson that I observed (description of a task / an activity). Why did you decide on using this task/activity?

(ii) How do you usually decide on the type of tasks/activities that you give to your learners in teaching Mathematics/Numeracy?

(iii) In your view, how were the tasks/activities that you used useful in this lesson?

(c) Assessment given to learners

(i) Do you usually give home-work to your learners? If so, why?

(ii) Why did you give them a home-work on (Description of the home work; if it was given)

(d) Describe a really good experience you had in the class I observed. How and why was it a positive experience teaching this lesson?

(e) Describe a really bad experience you had in the class I observed. How and why was it a negative experience teaching this lesson?

2. Documents that the participant referred to in the interview: (to be written if necessary)

Appendix K: A template of the analysis table following the Framework Method

Cases Codes	Case 1	Case 2	Case 3
Theme 1			
Theme 2			
Theme 3			
Theme 4			

Appendix L: Table of themes for the three participants

	TEBOHO'S CASE		KHOTHATSO'S CASE		CAROL'S CASE	
Theme	Category	Sub-Category	Category	Sub-Category	Category	Sub-Category
Participants' views about teaching and a professional mathematics teacher	4.2.2		4.3.2		4.4.2	
	4.2.2.1 Teboho's experience as a learner		4.3.2.1 Khothatso's experience as a learner		4.4.2.1 Carol's experience as a learner	
	4.2.2.2 Finding the teaching profession as an alternative		4.3.2.2 From lack of career guidance to opting for job security		4.4.2.2 Following on the footsteps of role models	
	4.2.2.3 Teboho's views about teaching		4.3.2.3 Khothatso's views about teaching		4.4.2.3 Carol's views about a teacher and a professional mathematics teacher	
	4.2.2.4 Teboho's views about a teacher and a professional mathematics teacher		4.3.2.4 Khothatso's views about a teacher and a professional mathematics teacher			

Participants' experience as a teacher	4.2.2.5 Summary of critical components of Teboho's views and his experiences as a learner		4.3.2.5 Summary of critical components of Khothatso's views and his experiences as a learner		4.4.2.4 Summary of critical components of Carol's views and her experiences as a learner	
	4.2.3		4.3.3		4.4.3	
	4.2.3.1 Teboho's professional experiences		4.3.3.1 Khothatso's professional experiences		4.4.3.1 Carol's professional experiences	Curriculum and content knowledge
						The practice of teaching and peer collaboration
						Carol's perceptions of being a professional mathematics teacher
4.2.3.2 Teacher practices that enhance effectiveness in Mathematics		4.3.3.2 Teacher practices that enhance effective teaching and learning		4.4.3.2 Teacher practices that enhance effectiveness in the teaching of		

Participants' mathematics classroom practices	teaching				mathematics	
	4.2.4		4.3.4		4.4.4	
	4.2.4.1 A teacher-centred learning environment		4.3.4.1 A flexible learning environment	Classroom arrangement for flexible use of teacher-centred and learner-centred approaches	4.4.4.1 Learning environment for effective learner support	
				Stimulating learning environment		
	4.2.4.2 Facilitating learning activities	Lesson development	4.3.4.2 A blend of teacher-centred and learner-centred approaches	Lesson development	4.4.4.2 Facilitating learning activities	Engaging learners in a variety of instructional activities
		How Teboho ended his lessons		Use of body language as a resources		Teaching progresses amidst shortage of instructional materials
4.2.4.3 Use of resources from		4.3.4.3 Instructional	Use of writing materials	4.4.4.3 Use of similar examples		

	the immediate environment		materials	Use of other materials	and application of tasks in unfamiliar situations	
				Use of variety of materials per lesson		
	4.2.4.4 Use of similar examples and application of tasks in unfamiliar situations	Use of examples	4.3.4.4 Use of a variety of examples and tasks	Similar and contrasting examples	4.4.4.4 Varying language use and emphasis of definitions and spelling of mathematics terms	
		Use of tasks		Use of a variety of tasks for known mathematical procedures		
	4.2.4.5 Language use		4.3.4.5 Varying language use and emphasising definition of terms and use of resource from environment	Shifting between colloquial and formal mathematical language	4.4.4.5 Learner participation that emphasises explanation of own views and use of groups for peer support	
				Mathematics through definition of terms and mathematics from our environment		
	4.2.4.6 Predominant individual		4.3.4.6 Learner participation involves			

	learner participation		explanation of views			
Summaries of cases	4.2.5		4.3.5		4.4.5	
4.5 SUMMARY OF THE CHAPTER						