UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

DIFFERENCES IN THE QUALITY OF SCHOOL-BASED ASSESSMENT: EVIDENCE FOR GRADE 9 MATHEMATICS ACHIEVEMENT

by

PULENG MOTSAMAI

Submitted in partial fulfilment in accordance with the requirements for the degree of

MAGISTER EDUCATIONIS

in the subject

ASSESSMENT AND QUALITY ASSURANCE

at the

UNIVERSITY OF PRETORIA

PROMOTER: DR S. VAN STADEN

AUGUST 2016

ABSTRACT

This study aimed to investigate whether there was evidence of variation in the quality of School-Based Assessment (SBA), with specific reference to Grade 9 mathematics. Assessment has been a prime focal point for educational reform in recent years. In the South African context, there are common external assessments carried out below Grade 12. However, assessments are placed entirely in the hands of individual teachers. Moderation and monitoring as quality assurance mechanisms are also conducted internally at varying degrees, which raises the issues regarding the validity, reliability, and credibility of SBA tasks. Learner achievement in mathematics had recently been a debated issue in national and international assessments. Furthermore, South Africa's Grade 9 learners have been performing below the expected levels in mathematics as compared to the rest of the world.

A qualitative research approach was used within a case study research design. Purposeful sampling was employed, and five schools with 15 participants were selected. The data were collected through questionnaires, semi-structured interviews, observations and field notes, and were triangulated by document analysis in order to make the findings and conclusions more reliable. This study revealed that there is a varying degree in the quality of mathematics SBA tasks, and a lack of knowledge about quality assurance mechanisms. In addition, the study revealed that the participating teachers lacked knowledge on how to develop high quality SBA tasks.

This study followed Scheeren's input-process-output model (2004), which was further adapted to provide an opportunity to identify enhancing or impeding issues associated with the quality of SBA and learner achievement at Grade 9 level.

Key words: School-Based Assessment, quality assurance, quality, variation in assessment, Grade 9 Mathematics, formative assessment, learner achievement.

DECLARATION OF ORIGINALITY

I, Puleng Motsamai, student number 13150970, hereby declare that this dissertation, "*Differences in the quality of School-Based Assessment: evidence for Grade 9 Mathematics achievement"* is submitted in accordance with the requirements for the Magister Educationis degree at the University of Pretoria. I declare that it is my own original work and has not previously been submitted to any other institution of higher learning. All sources cited or quoted in this research paper are indicated and acknowledged with a comprehensive list of references.

.....

P.Motsamai

29 August 2016

DEDICATION

I dedicate this research to my late grandmother, Kebawetse Sentso, who instilled in me the love and value of education. I also dedicate this research to my life partner, Thwane, and my children Boitshoko and Bontle.

ETHICAL CLEARANCE CERTIFICATE

ACKNOWLEDGEMENTS

To have achieved this milestone in my life, I would like to express my sincere gratitude to the following people:

- My Heavenly Father, who provided me the strength, knowledge and perseverance to complete this study;
- Dr S van Staden, research supervisor, for her invaluable advice, guidance and inspiring motivation during difficult times during the research;
- The editor, Mrs Melissa Labuschagne, for her professional and sterling editorial work on the final product of this study;
- Last, but not least, all of the participants who took part in this study at the John Gaetsewe Taole District; as well as all of my family, friends and colleagues who supported me.

EDITING CERTIFICATE

Exclamation Translations

To whom it may concern

The Master's dissertation, "Difference in the quality of school-based assessment: evidence for Grade 9 mathematics achievement" has been edited and proofread as of 17 August 2016.

Please take note that Exclamation Translations takes no responsibility for any content added to the document(s) after the issuing of this certificate.

Kind regards

Melissa Labuschagne

Melissa Labuschagne trading as Exclamation Translations.

072 995 8740

info@exclamationtranslations.co.za

www.exclamationtranslations.co.za

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS

AaL	Assessment as Learning
ACE	Advanced Certification in Education
AET	Adult Education and Training
AfL	Assessment for Learning
AoL	Assessment of Learning
ANAs	Annual National Assessments
AMESA	Association of Mathematics Educators of South Africa
APS	Admission Point System
ASs	Assessment Standards
ATS	Annual Teaching Plan
C2005	Curriculum 2005
CAPS	Curriculum and Assessment Policy Statement
CASS	Continuous Assessment
CK	Content Knowledge
CTA	Common Task Assessment
DBE	Department of Basic Education
DoE	Department of Education
EEA	Employment of Educators Act
EFAL	English First Additional Language
ELRC	Education Labour Research Council
EMS	Economic and Management Sciences
ENQA	European Network for Quality Assurance
FA	Formative Assessment
FDE	Further Diploma in Education
FET	Further Education and Training
GET	General Education and Training
HDE	Higher Diploma in Education
HoD	Head of Department
IEA	International Association for the Evaluation of Educational Achievement

IPO	Input-Process-Output
IPOC	Input-Process-Output-Context
IQMS	Integrated Quality Management Systems
JTG	John Taolo Gaetsiwe district
LOs	Learning Outcomes
LoLT	Language of Learning and Teaching
LTSM	Learner and Teacher Support Material
ML	Mathematical Literacy
MLA	Monitoring Learner Achievements
MLMMS	Mathematical Literacy, Mathematics and Mathematical Sciences
NCTM	National Council for Teachers of Mathematics
NC	Northern Cape
NCED	Northern Cape Education Department
NPA	National Protocol on Assessment
NPPPR	National Policy Pertaining to Programme and Promotion Requirements
NPFTED	National Policy Framework for Teacher Education and Development
NSC	National Senior Certificate
NSES	National School Effectiveness Study
NQF	National Qualifications Framework
OBE	Outcomes-Based Education
OSD	Occupation Specific Dispensation
PAM	Personnel Administrative Measures
PCK	Pedagogic Content Knowledge
PDE	Provincial Education Department
PGCE	Postgraduate Certificate in Education
PK	Pedagogical Knowledge
PILO	Programme for Implementing Learning Outcomes
PIRLS	Progress in International Reading Literacy Study
PISA	Programme for International Student Assessment
QA	Quality Assurance
RNCS	Revised National Curriculum Statement

SA	Summative Assessment
SACE	South African Council of Educators
SACMEQ	Southern and Eastern Africa Consortium For Monitoring Educational Quality
SADTU	South African Democratic Teachers' Union
SBA	School-Based Assessment
SE	Systemic Evaluation
SKVA	Skills, Knowledge, Values, and Attitudes
SMA	Subject Matter Knowledge
SMT	School Management Team
SOs	Specific Outcomes
SPTD	Senior Primary Teachers' Diploma
STD	Secondary Teachers' Diploma
TIMSS	Trends in Mathematics and Science Study
UNICEF	United Nations Children's Fund

CHAPTER 1 ORIENTATION TO THE STUDY

1.1 INTRODUCTION

> *"It is not uncommon for communities to believe that the assessments used in their schools are of high quality and are therefore accurately portraying their children's achievements. Community members might be surprised to learn that many educators are, in fact, often unsure of assessment quality."* ([1]Chappius, Commodore & Stiggins, 2010, p. 62).

The aim of this study was to investigate whether there was evidence of variance in the quality of School-Based Assessment (SBA) in Grade 9 mathematics achievement. The study was conducted in the Northern Cape (NC) province in the John Taolo Gaetsiwe (JTG) district. NC is geographically the largest, most rural, and the least populated province in South Africa. NC is also characterised by poverty, illiteracy and unemployment. However, in the JTG District, poverty and unemployment are declining consistently due to the mining of iron ore and manganese in the area (Census, 2011). The JTG District has the most rural schools in the area and has the highest number of registered learners in the province.

Assessment is the most important activity for signalling systemic efficiency and accountability (Muller, 2004). Assessment is crucial and is at the heart of the teaching and learning process (Chisholm, 2004; Gipps, 1994; Isaacs, Zara & Hebert, 2013; Muller, 2004). In the South African education system, assessment is made up of School-Based Assessments (SBA) and examinations (DoE, 2002; DBE, 2011). Black and Wiliam (1998a) define SBA as all forms of assessment that are conducted by the teacher at classroom level, although they maintain that assessment is subjective and weak. Gipps (1994) suggests that although SBA is a more valid method of assessment, it has a lower level of reliability. Poliah (2010) further confirms that because SBA is subjective, it reduces the reliability, validity and credibility of learner performance. Reyneke (2010) agrees with Poliah (2010) by noting that when individual teachers

[1]Validity and reliability, for the purposes of this study, refer to trustworthiness and credibility as used in a qualitative context (Maree, 2016).

develop their own assessment, it always leads to a variation in the scoring of the assessment. SBA is also used to cover a wider range of curricular outcomes that are not necessarily assessed in external examinations.

SBA is guided by policy, therefore there is a systemic emphasis placed thereon, which makes assessment a national imperative. However, SBA is one of the policy changes that has not been successfully implemented (Poliah, 2010). South African learners across all grades continue to perform far below the expected standards when compared to their counterparts internationally, regionally, and nationally. There evidence to confirm this low performance through comparative international studies, such as the Trends in Mathematics and Science Study (TIMSS) and the Southern and Eastern Africa Consortium For Monitoring Educational Quality (SACMEQ). Moreover, South Africa also conducts and assesses its own learners through external national assessments known as the Annual National Assessments (ANAs). These studies are conducted in the General Education and Training (GET) band, which comprises Grades 1 to 9, to specifically diagnose and address challenges in languages and mathematics. The most recent ANA results show low performance in Grade 9 mathematics (DBE, 2013). In the 2013 mathematics ANA results, it was revealed that only 2.5% of the NC Grade 9 learners obtained more than 50% (DBE, 2013). A conclusion could be drawn that the achievements between these external assessments suggests disparity between them and SBA achievements.

SBA and internal examinations are known as Continuous Assessment (CASS). CASS is a classroom strategy implemented by teachers to determine the knowledge, skills and understanding attained by learners (Isaacs et al., 2013). In the past, CASS has provided early warning signals to policy makers that curriculum reform would not be a simple matter of implementation (Harley & Wedekind, 2004). There has also been wide spread uncertainty about the message of CASS. In many parts of the world, there remains a disconcerting gap between the achievements of learners from rich and poor families (UNESCO, 2010). The extent of this gap varies significantly between countries. In the South African context, Poliah (2003) argues that SBA varies from province to province, as well as within regions and/or districts, and between schools within the same

province. International external assessment results further reflect this variation, as evidenced by TIMSS 2003 and 2011 (Howie, 2002). According to Black and Wiliam (1998), SBA is, by its very nature, teacher-mediated, co-constructed, multiple and varied, as well as dynamic and evolving. This variation translates into a certain degree of doubt regarding the reliability of SBA. There may also be wide variations in teachers' interpretations of learners' performance. The challenge in SBA is to find approaches that will be fair to all learners' performance and that will provide reliable evidence from which valid inferences can be made about the learning of each learner (Killen & Vandeyar, 2007). School-Based Assessment (SBA) takes place in the classroom and is also known as classroom assessment. Stiggins (2004) argues that classroom assessment is key as it is the teacher's direct assessment that determines what learners learn. In the GET band, learners' promotion and progression depends largely on SBA scores. SBA holds a significant weight in determining the success of learners (World Bank, 2008). According to Isaacs et al. (2013), standards are created at national level, and should state what learners should be achieving at different grades, levels, and stages. However, there is no clear and agreed understanding of what the notion of the "same standard" actually represents (Newton et al., 2007, as cited by Isaacs et al., 2013).

1.2 PROBLEM STATEMENT

Prior to 1994, the racially segregated South African education system used tests, examinations, and year marks for promotion and progression purposes. However, these year marks were abused and controversial (Kanjee, Nkomo & Sayed, 2013). Post-1994, South Africa made major changes in assessment policies and practices. Traditional assessment practices such as tests and examinations were re-conceptualised as a process of Continuous Assessment (CASS). CASS therefore comprises SBA and internal examinations. Conversely, Fleisch (2002) points out that assessment was initially underdeveloped and did not form a key element in the initial training and support within education when implementing the new curriculum. Kanjee (2007) further elaborates that assessment was the most neglected aspect of government's efforts to transform the education system, and was the area that received

the most criticism. The South African Department of Education then presented assessment policies and practices in the form of guidelines. Wilmot (2007) is of the opinion that, because of these guidelines, assessment is most likely to be interpreted and applied differently by teachers of the same subject and the same grade, which in this case is Grade 9 mathematics. Additionally, there are currently no common external assessments in grades below Grade 12 in the South African education system.

The weighting of SBA across the grades and subjects is stipulated in the Assessment Policy (Department of Education (DoE), 2003; Department of Basic Education (DBE), 200). This takes the form of guidelines, which are open to varied interpretations. The policy states that SBA in the GET band carries more weight than in the FET band (Worldbank, 2008). The policy further divides the weighting of the GET into Grades 1 to 8, the SBA of which is 100%, and Grade 9, the SBA of which is 75% and the weighting of examination is 25%. The weighting also varies across various subjects. Mathematics and home language carry the most weight as a learner has to obtain a minimum of 40% (level 3) in mathematics (DoE, 2002; DoE, 2009; DBE, 2011) in order to be promoted to the FET band. Although the Assessment policy gives clear guidelines regarding the number of assessment tasks and forms of assessment to be used, it is silent on the quality of these tasks. The subject teacher determines what and how to assess content, skills, and knowledge in mathematics. The quality of these assessment tasks therefore depends on how each individual Grade 9 mathematics teacher interprets them. However, the weighting and quality of the mathematics percentage or level of these assessments may paint a misleading picture for the parents and learners as the percentage or level may not be a true reflection of mathematical knowledge, skills and understanding.

The final percentage or level that the learner obtains in Grade 9 mathematics, of which 75% is made up of SBA, becomes a determining factor in the promotion of learners to the FET band. One of the core subjects in the FET band is either mathematics or Mathematical Literacy (ML). Depending on the Grade 9 mathematics SBA mark, a learner has to make an important decision between mathematics and ML. This choice is vital as it determines the future career path of learners.

The problem with the weighting of SBA is its quality, reliability, validity, and credibility. Long (2006) confirms that there are no measures and systems in place in the South African education system to ensure that SBA is reliable, valid and credible in the GET band. As Isaacs et al (2013) put it, “It is common for governments worldwide to regulate what learners are taught through common curricula, but the regulation of assessment varies” (p.121). This is the case in South Africa as there is a statutory body (known as Umalusi) that ensures quality assurance, however, this is ensured at Grade 12 level only. There are no agreed standards across Provincial Education Departments (PDEs), across districts within the same PDE, or across schools within the same district (Poliah, 2003). From the work of Poliah (2010), it is evident that there is always a variation in the scoring of assessment tasks among educators, particularly when the assessment tasks are not the same.

According to Killen and Vandeyar (2007), the main challenge in assessment is to find strategies that will be fair to all learners and provide quality, reliable, credible and valid results.

1.3 RATIONALE

Assessment forms the core foundation of the curriculum, therefore it is the most critical feature of education. As discussed above, the quality, credibility, reliability and validity of SBA, specifically in the grades below Grade 12, is under question. The introduction and implementation of the Curriculum and Assessment Policy Statement (CAPS) in the Senior Phase in 2014 also points to a need for research on assessment policies and practices. The issue of quality in assessment in grades below Grade 12 has not been addressed, and is still the most challenging adaptation for teachers and learners (Gouws & Russel, 2013). External assessments, as confirmed by TIMSS, SACMEQ and the ANAs, have revealed a major gap in the quality of achievements within the schooling system. According to Poliah (2010), when teachers set and administer their own assessments, learners then perform excellently. However, when the same learners are tested externally, their performance is poor. Poliah (2010) further suggests that learners obtain high marks in SBA due to the quality of questions set by teachers at school level.

In CAPS, the weightings of SBA and internal examinations have been revised. CAPS stipulates guidelines on what should be taught and assessed, but remains silent on how to assess these. This silence may allow for variance in the interpretation and application of these guidelines (Poliah, 2010). Variations could have serious consequences in terms of the quality of SBA, specifically in grades lower than Grade 12 where there is no process of quality assurance.

On the one hand, researchers and academics have extensively studied the quality of assessment in mathematics in Grade 12. On the other hand, little research has been carried out on the quality of mathematics, particularly in Grade 9. It is thus important to fill this gap in the research as assessment has far-reaching implications for learners in that it could affect their subject choice, and thereby their future careers (Reddy, 2006).

1.4 IMPORTANCE OF THE STUDY

There has been a lot of research and debate regarding the status of mathematics and mathematics achievements in South Africa in general. The quality of mathematics achievement in high-stakes assessments, in particular, has dominated these discussions. However, little has been written on the quality of mathematics achievement in the lower grades, particularly at Grade 9 level. Therefore, there is a gap, or dearth in the literature as far as the quality of SBA in lower grades is concerned. This study will focus on this gap in the literature in an attempt to explore the status quo of SBA at Grade 9 level.

Moreover, the findings of this study could add to the body of knowledge regarding SBA. This study may also contribute to the education profession, educational research, and policy makers in a meaningful way. The findings could also assist the educational fraternity to improve the quality of SBA in Grade 9 mathematics by improving the quality of teaching and learning overall.

1.5 RESEARCH QUESTIONS

The main research question that guided this study was:

What evidence is there in teachers' classroom assessment practices that points to possible variation in the quality of SBA?

The main question was supported by the following sub-questions:

Sub-question 1: *How can sources of variation be unified to make SBA more credible, valid and reliable?*

The literature shows that SBA reduces the reliability and credibility of assessment by inflating scores in some instances (Poliah, 2009; Singh, 2007). Maile (2013) cautions that variations may affect the quality of SBA. In its 2008 National Senior Certificate (NCS) SBA report, Umalusi, the South African quality assurer, highlighted the poor quality and standard of tasks set by teachers, the low validity of internally set assessment tasks, the unreliability of marking instruments, and discrepancies in mark allocation (Meyer, Nel & Reyneke, 2010). Umalusi (2008) further pointed out that there were no agreed upon standards of Continuous Assessment (CASS) at schools (Singh, 2007).

Sub-question 2: *How do* teachers*, Heads of Department, and principals perceive their role in ensuring the quality of SBA?*

Umalusi has revealed that teachers all over the world experience difficulties in finding their role in SBA (Umalusi, 2010). Research into SBA internationally is further complicated by considerable uncertainty and disagreements around the concept. Studies of SBA in Hong Kong, for instance, suggest that there may be wide variations between teachers, interpretations of learner performance, and their role in the assessment process (Davison, 2007). Kanjee, Nkomo and Sayed (2013) further explain that teachers hold a certain set of beliefs relating to the quality of SBA. Hence, it is important to find out what these beliefs are in terms of Grade 9 mathematics in South Africa.

1.6 STRUCTURE OF THE DISSERTATION

This dissertation comprises six chapters. Chapter 2, the literature review, unpacks assessment into themes of School-Based Assessment (SBA), Continuous Assessment (CASS), and variance in quality, reliability and validity, and moderation. Mathematics education is then discussed in the South African context. Lastly, the status quo of the quality of SBA in Grade 9 mathematics is presented.

Chapter 3 provides a full description of the conceptual framework in the South African context. Issues related to the quality of SBA in mathematics are identified and discussed, as per the literature review.

Chapter 4 explains the research design and methodology, paradigm, framework, sampling, instruments, validity issues, data collection, and analysis of this study.

In Chapter 5, the data collected for the study is presented, and the main research question and sub-questions are addressed individually using this data. All issues discussed in the previous chapters are then considered in order to answer the main research question.

The final chapter, Chapter 6, reveals the main findings of the research questions from which the conclusions of this study were drawn. The dissertation comes to a close by consolidating the literature review, research questions, and conceptual framework in order to give recommendations for further research.

CHAPTER 2 LITERATURE REVIEW

2.1 INTRODUCTION

The aim of this study was to investigate whether there was evidence of variance in the quality of School-based assessment (SBA) in Grade 9 mathematics achievement. Assessment is an ever-present reality in the lives of South African teachers, and is viewed by many to refer to the process of determining learner achievement (Reddy, 2004). During the Apartheid era, the South African education system emphasised content, conformity, and high-stakes summative assessment (Jansen, 1999, as cited in Vanderyar & Killen, 2007; Muller, 2004). According to Muller (2004), the only systemic assessment instrument in South Africa at the time was the matriculation examination. Currently in South Africa, the education system has only one main type of assessment where Grade 12 learners write “the same paper, at the same time under the same conditions” (Reddy, 2004, in Vanderyar & Killen, 2007, p.14), which is quality assured by an external independent body. This type of assessment is perceived as being reliable and objective.

Since the era of transformation in South Africa, assessment has been a prime focal point for educational reform (Reddy, 2004). Assessment has been accompanied by widespread political and social changes, which have impacted on the quality of education. The introduction of Outcomes-Based Education (OBE) has changed the way in which assessment is being conducted in a number of ways, which will be discussed in this chapter. The first hint of assessment change was the introduction of Continuous Assessment (CASS) to South Africa classrooms. In CASS, learners are assessed on an ongoing basis, instead of using the once-off examination, which includes School-Based Assessment (SBA) and internal examinations (DoE, 2002). Research suggests that SBA is highly problematic, especially in grades below Grade 12. Many teachers, particularly those teaching mathematics in the General Education and Training (GET) band (Grades R to 9), seemed to have an unclear understanding of what was required of them (Reddy, 2004; Fleisch, 2002). It was assumed that teachers had a common understanding of what constituted learners’ levels of performance (Fleisch, 2002).

Assessment in mathematics, particularly the quality of achievement in mathematics, has recently been a debated issue in research. Against this background, this chapter provides insight into the recent developments in mathematics education, assessment and curriculum, and reflects on the literature consulted pertaining to SBA implementation and practices in South Africa since 1994. The literature focuses on the quality of SBA and the review that led to the implementation of the Curriculum and Assessment Policy Statement (CAPS). The assessment policy and debate concerning educational changes are also analysed. Much of the discussion focuses on the implementation of the new assessment policy. In order to develop a deeper understanding of the research topic, this study draws on extensive literature from books, (mathematics) journal articles, reports, policy documents, dissertations and theses.

This chapter will also present an overview of the mathematics landscape in South Africa. In Section 2.2, mathematics education from a system perspective and in the context of South Africa is discussed. Section 2.3 elaborates on issues around international and national assessments. The concept of quality assurance in relation to SBA is then analysed in Section 2.4, while in Section 2.5, challenges in assessments are discussed. Curricula and assessment policies are explored in Section 2.6, and the tensions between formative and summative assessments will be touched on in Section 2.6. Chapter 2 concludes with a summary in Section 2.8.

2.2 MATHEMATICS EDUCATION

According to Buytenhuys and Graven (2011), and Usiskin (2012), mathematics is a discipline in its own right, and pursues the establishment of knowledge without necessarily requiring applications to real life. Mathematical knowledge is seen as a body of facts and procedures dealing with qualities, magnitudes, formats, and relationships among these. Knowing mathematics is seen as having ‘mastered’ these facts and procedures (Schoenfeld, 1992). Learning mathematics is empowering as mathematically literate learners become quantitatively literate. In other words, these learners are capable of interpreting the vast amounts of quantitative data that they encounter on a daily basis. Such learners use mathematics in practical ways, from simple applications to complex applications (Schoenfeld, 1999). Mathematics is

therefore a critical tool for young people as they confront issues and challenges in the personal, occupational, societal and scientific aspects of their lives (PISA, 2015, p.5)

2.2.1 Mathematics education from a system perspective

The National Council for Teachers of Mathematics (NCTM) challenges the notion that mathematics can only be learned and understood by a selected few. The NCTM (2000) believes that all learners, irrespective of their personal characteristics, backgrounds, or physical challenges can do mathematics. They further state that learners should be afforded the opportunities and support necessary to learn significant mathematics with depth and understanding when they have access to high quality mathematics education. This notion is supported by UNESCO (2012, p.18), “Basic education must provide quality mathematics education for all learners.”

Halmos (1980, p.524, as cited in Schoenfeld, 1992) firmly believes that “problems are at the heart of mathematics”. As such, the main purpose of mathematics is to solve problems, as confirmed by Usiskin (2012), Schoenfeld (1992), and UNESCO (2012), therefore, mathematics consists of problems and solutions. Usiskin (2012) and Schoenfeld (1992) agree that problems have occupied a central place in school mathematics since time immemorial, however, problem-solving has not received much recognition. Schoenfeld (1992) distinguishes between problems in mathematics and problem-solving, which has resulted in a lot of confusion in the mathematics community. Learners who have access to classrooms that provide quality mathematical learning and teaching are challenged to develop deep mathematical understanding and effective problem-solving abilities (Jacobsen & Mistele, 2011). The role of mathematics in learners’ education also contributes to the technological and socio-economic development of society (Skovsmose & Valero, 2009; Vithal & Volmink, 2009), and provides individuals with the prerequisite skills they may need to cope with life.

Mathematics comprises axioms, theorems, formulae, proofs, definitions and methods. Schoenfeld (1992) is of the opinion that mathematics cannot exist without essential attributes, which are equity, the curriculum, teaching, learning, assessment and technology (NCTM, 2000).

According to Leeudertz Blignaut, Niewoudt, Els and Ellis (2014, p.37), the aims of mathematics education is to assist learners:

- To have an acute awareness of mathematical relationships that are used in social, environmental, cultural and economic situations.
- To foster a love for mathematics.
- To recognise that mathematics is a critical part of human activity.
- To obtain profound theoretical understanding in order to make sense of mathematics.
- To apply mathematics in physical, social and mathematical problems.

According to Sjoedjadji (2001), learners are taught mathematics to help them put their logical reasoning in order, and to use mathematics and mathematical reasoning in facing real life situations. The study of mathematics is not only exciting, but important in that mathematicians contribute to society by helping to solve problems in the fields of medicine, economics, management, computer science and psychology (Usiskin, 2012).

2.2.2 Challenges in mathematics education

There are a number of unresolved and unaddressed questions where mathematics instruction and assessment are concerned (Schoenfeld, 1992). These challenges may be caused by the following reasons:

- Learners do not know which needs are met by the mathematics topics introduced or how these are linked to known concepts;
- Links to the real world are weak, generally too artificial to be convincing, and applications thereof are stereotypical;
- There are few experimental practices and modelling activities provided;
- Learners have little autonomy in their mathematical work and often merely reproduce activities (Adapted from UNESCO, 2011. p.21).

The traditional approach to teaching mathematics that has been used over the past couple of decades is based on the transmission and absorption of knowledge (McDermott & Rakgokong, 2013). This approach, according to these authors, has

encouraged learners' negative conception of mathematics, and influences their belief about how mathematics is learned.

There is a body of evidence that suggests that one of the challenges in mathematics education is that mathematics teachers teach mathematical concepts in isolation. Simply put, mathematical concepts are regarded as 'stand-alone' concepts and are taught separately from each other. Schoenfeld (1992) hence recommends to policymakers that lessons should come in large coherent chunks, and take between two to six weeks to teach. Furthermore, lessons should be motivated by meaningful problems and be integrated with regard to subject matter, for instance, simultaneous use of algebra and geometry, rather than having geometry taught separately from algebra. This strategy will dissuade teachers who do not feel comfortable teaching certain topics and concepts from skipping such topics and concepts. Geometry, in particular, in the GET band, as indicated by Usiskin (2012), is a section of the curriculum that mathematics teachers do not feel confident teaching. There is a small body of research that suggests that learners in the Senior Phase (Grade 7-9) are not taught Geometry as in the FET (Grade 10-12) mathematics NCS curriculum. This is optional, and higher institutions of learning, Universities for instance, do not calculate this section in the APS (Admission Point System).

Assessment has a crucial role to play in establishing and providing quality mathematics for all (Vithal, n.d). However, assessment poses a challenge in mathematics education and exerts a lot of pressure on teaching (UNESCO, 2012). There is no simple form of assessment that meets all of these challenges, although there is currently a strong trend towards conducting many assessments. There is also an emphasis on quality large scale scientific assessment (TIMSS, for instance) and quality national assessment (such as the ANAs). Such assessments take the form of standardised tests, which are mainly carried out for accountability purposes. Morgan (1999) argues that standardised tests in mathematics education (such as multiple choice questions) are objective, and scoring procedures are reliable (Schoenfeld, 1992). Gipps (1995) and UNESCO (2011) refer to such standardised tests as "teaching to the test", because "What is tested is what is taught" (Elsner, 2000).

2.2.3 Mathematics education in the South African context

The Apartheid era was characterised by Verwoerd's denial of access to mathematics education by and for black people (Vithal & Volmink, 2005). Ensor and Galant (2005), and Vithal and Volmink (2005, p. 300) are of the opinion that the Apartheid mathematics curriculum for black learners was intended to be functional, practical and concrete, and was designed to equip them for unskilled and semi-skilled work in the mines and in industry. Venkat and Volmink (2005) support Moloi (n.d) regarding the notion that the mathematics curriculum was driven by an ideology that was undemocratic and was not empowering in any way. Moloi (n.d) finds that, besides cognitive challenges in mathematics education, during the Apartheid era, South Africa made access to mathematics difficult in three spheres, namely: Mathematics was based on racial lines whereby the black majority had limited resources; Learner and Teacher Support Material (LTSM) were not adaptable to local knowledge, focusing on teaching rather than learning; and lastly, learning mathematics in another language other than learners' primary language was problematic.

According to Moloi (n.d), the mathematics curriculum was heavily content-laden, it encouraged the rote-learning of mathematical concepts, techniques and algorithms, and lent itself to very little application of mathematics in the everyday experiences of learners. Even now, public concern regarding the status of mathematical skills and knowledge of learners in an increasingly technological society has drawn urgent attention to the mathematical literacy and numeracy competency of learners, especially when they leave school. The mathematics education community has subsequently responded to the challenges experienced prior to 1994 by addressing the pedagogy and teaching and learning of mathematics and the mathematics curriculum, and its relevance in everyday life.

A significant amount of research has taken place in mathematics education internationally and in South Africa (Tshabalala, 2013; Setati, 2009; Ensor & Galant, 2005). However, South African mathematics education has mainly focused on curriculum and pedagogy, and has been dominated by cognition of how learners acquire mathematical understanding. Post-1994, the introduction of Curriculum 2005

(C2005) saw mathematics being replaced with the learning area Mathematical Literacy, Mathematics and Mathematical Sciences (MLMMS) (DoE, 2001). MLMMS represented a major shift in the philosophy of mathematics and mathematics education, and thus demanded a major philosophical shift of both teachers and learners (Graven, 2002). Graven (2002) identified three major shifts:

- The approach to teaching mathematics: emphasis is placed on a constructivist, learner-centred and integrated approach to the teaching and learning of mathematics. This way of teaching moves away from the performance-based approach to the competence-based approach.
- The nature and content of mathematics.
- The role of mathematics education.

The rationale for MLMMS is focused on constructing mathematical meaning in order to understand and make use of that understanding. Specific Outcomes (SOs) for MLMMS indicate changes in the content of school mathematics. However, Vithal and Volmink (2005) argue that MLMMS poses a serious challenge in terms of both content and pedagogy, which are essential foundational competencies.

Makgato and Mji (2006) recount that in the new South Africa, the teaching of mathematics was hit the hardest. Several studies have reported a number of shortcomings in the teaching and learning of mathematics in South Africa. One of the challenges, according to Makgato and Mji (2006), is that not all schools in the South African education system offer mathematics in the Further Education and Training (FET) band. Moreover, many of those schools offering mathematics do not have the necessary facilities and equipment to provide effective teaching and learning. The current picture depicts a South Africa where success in school mathematics is not randomly distributed across the population, with some groups systematically doing better than others (HSRC, 2011). Adler (2002) explains that mathematics needs to become more meaningful for learners, and one way of establishing meaning is by embedding mathematical problems in real world contexts. This practice would invite more learners to continue with mathematics, and thus reduce the inequalities in

mathematics performance that we currently see when comparing learners from varying socio-economic backgrounds.

Spaull (2013) reports that the quality of mathematics teaching in South Africa is the worst in the world, and South African's learners are generally poor when it comes to mathematics (Adendorff, 2014). Studies such as the Trends in International Mathematics and Science Study (TIMMS), and the Annual National Assessments (ANAs) dominate the public's understanding of the status of mathematics education in this country, and shapes policy, political will and actions (Vithal & Volmink, 2005).

In South Africa, teachers are required to interpret their own learners' performance in all of the assessments, and must develop better lessons on the basis of these interpretations. In other words, teachers are expected to use learner data diagnostically (Shalem, Sapire & Sorto, 2014). Schoenfeld (2007) expounds that teachers are expected to be good problem-solvers, and need to be flexible and resourceful.

2.2.4 The role of language in mathematics education

Language in education in South Africa is a political, complex and sensitive issue, yet an important one, as argued by Howie (2002). Prior to 1994, South Africa recognised English and Afrikaans as the only two official languages (Howie, 2002). In the new democratic dispensation, South Africa is a multicultural and multilingual society with eleven official languages, with sign language still to be made an official language. However, the official languages exclude the !Xu and Khwe languages spoken by a small population within communities found about 20 km west of Kimberley in the Northern Cape, South Africa (DoE, 2001; Setati, 2000). The South African official languages are English, Afrikaans, Setswana, Sesotho, Sepedi, IsiZulu, IsiXhosa, IsiNdebele, siSwati, Tshivenda, and Xitsonga.

Presently, English is the dominant language of government, economic power, and political dimension (Setati & Adler, 2000). Adler (2000) states that teaching and learning the mathematics curriculum in multilingual settings has come under the spotlight in post-Apartheid South Africa. The South African context offers a dynamic site for exploring

classroom communication, which comprises the dynamics of teaching and learning mathematics in multilingual classrooms (Adler, 2002).

Schools opt to teach through the medium of English or Afrikaans (monolingual), or teach in both languages at the same time (dual), or have English classes taught separately from Afrikaans classes (parallel medium) in the same school. Schools are either monolingual, dual medium, or parallel medium schools. However, English remains the preferred Language of Learning and Teaching for pragmatic reasons (Taylor & Vinjevold, 1999, cited in Setati & Adler, 2000; Howie, 2002; Fleisch, 2002).

In the majority of South African schools, as a norm, learners are not taught in their primary language (Worldbank, 2008; Fleisch, 2002; Tshabalala, 2013; Setati & Adler, 2000; Adler, 2002). One of the findings in Mji and Makgato's (2006) was that English is generally a problem to learners whose primary language is different from English. As the current study focuses on mathematics, educators are faced with the challenge of teaching in the LoLT and the 'language' of mathematics at the same time (Adler, 2000). A multilingual mathematics classroom is a dilemma-filled terrain. Adler (2000) finds that although this is not an easy task, mathematics teachers have to find ways to solve this dilemma. The complex relationship between multilingualism and mathematics learning has long been recognised because teaching and learning mathematics where the LoLT is not the primary language is complicated (Setati & Adler, 2000). Moloi (n.d, p. 2) states that, "Learning in the LoLT is difficult; learning of mathematics is impossible". Language issues are more complex in rural schools where most of the learners are exposed to their primary language. Studies show that the teaching and learning of mathematics in rural schools is more problematic than in urban schools.

2.2.5 Teacher content knowledge

"A teacher needs specialised knowledge for teaching mathematics" (Shulman, 1986, p. 385).

It is becoming more obvious that teachers' required knowledge for teaching mathematics is multifaceted and topic specific (Pournara, 2013). According to Usiskin

(2012), mathematics is a complex subject that requires an intricate process of teaching and learning, as well as multidimensional understandings. The issue of the mathematical knowledge that teachers require for teaching has been on the agenda since Shulman's work (Shulman, 1986; Shulman, 1987). This section begins with a discussion of Shulman's notions of Content Knowledge (CK), (also referred to as the Subject Matter Knowledge (SMK), as well as Pedagogic Content Knowledge (PCK). For the purposes of this study, Content Knowledge and Subject Matter Knowledge are used interchangeably.

According to Shulman (1987), in terms of Subject Matter Knowledge (SMK), teaching should emphasise comprehension, reasoning, transformation and reflection. Shulman (1987) further posits that CK implies that the teacher should have an understanding of the depth and breadth of the subject being taught. Pournara (2013) makes a clear distinction between the depth and breadth of subject matter:

Depth: the ability to connect a concept or topic with more conceptually powerful ideas of the subject so that the power of a mathematical idea is related in its proximity to the structure of the discipline.

Breadth: the ability to connect a concept or a topic with concepts or topics that are different or similar using conceptual power.

There are general mathematical concepts such as numbers, functions, points, linearity or structures, and specific topics like the Pythagoras Theorem, the solving of linear equations, and the calculation of simple or compound interests in financial mathematics, for instance. A mathematics teacher should possess conceptual understanding in order to teach and eliminate the mathematical misconceptions that learners bring to the classroom (Shulman, 1986; Usiskin, 2012).

There is a body of evidence that confirms that mathematics teachers show misconceptions or misunderstandings in topics that are not part of their expertise. If, for instance, the teacher teaches multiplication of fractions, one cannot begin doing fractions if one has not seen what a fraction looks like, and it is also impossible to understand mathematics discourse associated with fractions, such as improper

fractions, mixed fractions, decimal fractions and the numerator and denominator. Basic operations (+, -, ÷ and ×) must be understood when doing fractions. The depth and breadth of fractions must be covered, and the misconceptions and misunderstandings that learners bring to the classroom must be cleared up by the mathematics teacher.

Pedagogical Knowledge (PK) refers to flexible teaching and learning styles, or teachers' general knowledge of instructional methods, which is used to adapt to different environments, learner backgrounds and complexities (Shulman, 1986; 1987). Shulman (1986) posits that PK also refers to the knowledge of 'how' to teach, which involves planning and assessment. The teacher illuminates procedural understanding when employing different pedagogical strategies (Usiskin, 2012; Shulman, 1987). Shulman (1986) claims that despite a teacher's deep understanding of the subject matter (SMK), he/she should be able to foster an understanding of the subject or concepts in learners. Both teachers' PK (what teachers know about teaching) and their SMK (what teachers know about the actual content) are critical to good mathematics teaching and learners' understanding. In some cases, mathematics teachers have sound SMK to teach certain topics (fractions, for instance), but do not have adequate teaching strategies to teach these topics adequately. Moru, Qhobela, Wetsi and Nchejane (2014) are of the opinion that SMK is a necessary, but insufficient condition.

Shulman therefore introduces the term Pedagogical Concept Knowledge (PCK). PCK is "a form of knowledge that allows mathematics teachers know how SMK is used and organised from a teaching perspective and is used as a basis for helping learners understand specific concepts in mathematics" and is "grounded in the beliefs and practices of the teacher" (Shulman, 1986, p.9). PCK therefore, includes: Conceptual and procedural knowledge; a repertoire of varied techniques or activities (different learning styles); knowledge of techniques for assessing and evaluating; and knowledge of a variety of resources that can be easily accessed for use in the classroom.

When multiplying two fractions, for instance, there are various ways and steps to arrive at the answer, depending on the numbers involved in the fractions. There are various possible algorithms to choose from, and learners are given the opportunity to apply

these different algorithms. The emphasis is therefore not on the correct answer being given, but rather on *how* learners have arrived at that answer.

A good mathematics teacher should possess specialised content knowledge in order to identify errors and interpret them correctly so as to address such errors with the correct mathematical knowledge. Olivier (1989, cited in Moru et al., 2014) defines an error as follows, “Errors are wrong answers due to planning; they are systematic in that they are applied regularly in the same circumstances” (p.12). Error analysis is a complex process because errors are symptoms of misconceptions (misconceptions are the underlying conceptual structures that give rise to errors). Mathematical challenges may be compounded if the teacher lacks PCK and thus addresses an error with the wrong mathematical knowledge.

Table 2.1 Types of knowledge that mathematics teachers require

Type	Sub-domain	Definition
PCK	Knowledge of content and learners.	Knows learners' background, and which errors are likely to be committed. Knowledge of misconceptions and misunderstandings that learners bring to class.
PCK	Knowledge of content and teaching.	Can sequence topics, choose examples to use in deepening learners' understanding, and can evaluate the advantages and disadvantages of representations used to teach a specific area. Can identify what different methods and procedures are appropriate for instruction.
SMK	Common content knowledge.	Mathematical knowledge and skill used in settings other than teaching. This involves knowing the material to be taught and recognising when learners give wrong answers or the LSM gives an inaccurate definition.
SMK	Specialised content knowledge.	To be able to detect errors committed by learners or causes thereof, or predict familiar and unfamiliar errors, misunderstandings or misconceptions, and be able to employ correct mathematical knowledge to address such errors.

2.3 INTERNATIONAL AND NATIONAL ASSESSMENTS

The word "assessment" is derived from the Latin word 'assidere', which means to 'sit beside' (Maree, 2004). According to Singaram (2007), assessment is "the ability to see learners, to perceive what they can do in the hope of understanding how they learn and to assist their learning." Wiliam (2011) claims that assessment refers to all those activities undertaken by teachers, and by their learners in assessing themselves, that

provide feedback. According to the DBE (2012, p. 3), assessment is defined as “a process of collecting, analysing and interpreting information to assist teachers, parents and other stake-holders in making decisions about the progress of learners.” Gipps (1995, p. vii) defines assessment as “a wide range of methods for evaluating pupil performance and attainment, including formal testing and examinations, practical and oral assessment, classroom based assessment carried out by teachers and portfolios.”

In other words, assessment is a systematic, purposeful and planned action (Maree, 2004; DBE, 2011). In Gipps’ (1994, p. vii) words, assessment is “a wide range of methods for evaluating pupil performance and attainment including formal testing and examinations, practical and oral assessment, classroom based assessment carried out by teachers and portfolios.”

Marsh and Willis (2007) posit that assessment and evaluation are often used synonymously in education, yet there are significant differences in their implications. Evaluation is philosophical, meaning that it is an attempt to weigh and appropriately value learners or the curriculum. Assessment is the measurement of learning, usually through formal, paper-and-pencil testing. Furthermore, assessment is central in education and crucial to the teaching-learning process (DBE, 2011; Gipps, 1994; Chisholm, 2004; Harlen, 2003). Its primary role is to help learners learn, rather than giving scores (marks) or grading them.

According to UNESCO (2008, as cited in Best, Knight, Lietz, Lockwood, Nugroho & Tobin, 2013), there has been a global rise in the number of countries undertaking national, regional and international assessments; South Africa is no exception. Currently, different assessment programmes are conducted in many primary and secondary schools in order to monitor and evaluate the quality of learners’ learning outcomes (Best et al., 2013), and to promote learning. Mathematics, science and languages are the main subjects or curricula areas that are assessed in international, regional and national assessments. Albeit that assessments themselves are complex and can be contested in the political terrain, one of the main aims thereof is to provide information regarding a country’s educational outcomes in order to assist policy-makers,

researchers and teachers in the education system to formulate policy. South Africa has embarked on a number of initiatives to monitor its quality of education through such assessments (Spaull, 2013).

Kanjee (2007) outlines the different types of assessments that are currently conducted at different levels within the South African education system, namely: international assessments, regional assessments, national/local assessments, public assessments, provincial assessments and School-Based Assessment (SBA). Public assessments, also referred to as matriculation examinations, are common and are conducted at the end of Grade 12. Regional assessments compare samples of schools in a region of the world in which countries may share similar economic and social conditions, for instance, African countries (Kamens & Benavot, 2011, cited in Best et al., 2013). South Africa participates in a number of regional assessments such as the Monitoring Learner Achievements (MLA) assessment, and the Southern and Eastern African Consortium for Monitoring Educational Quality (SACMEQ) amongst others. MLA and SACMEQ will not be discussed in this study as their focus is on grades below Grade 9. For the purposes of this study, only assessments that focus on Grade 9 will be discussed in detail.

2.3.1 International assessments of mathematics

South Africa's performance in international benchmark tests is a major concern amongst policymakers and teachers (Ndlovu & Mji, 2012; Spaull, 2013). According to UNESCO (2000), international assessments are those studies that assess learners in multiple countries with the aim of comparing levels of performance across these countries. International assessments focus on common aspects pertaining to the curriculum or learning outcomes, and are conducted by international organisations and/or research consortia. Data from international and national studies have signalled that mathematics education faces serious difficulties (Carey, McDonall, Oakes & Shavelson, 1987, cited in Maile, 2013).

There are three major international assessment studies, namely, the Programme for International Student Assessment (PISA), the Trends in International Mathematics and

Science Study (TIMMS), and the Progress in International Reading Literacy Study (PIRLS). South Africa is not amongst the countries that took part in PISA, however, it does participate in TIMSS and PIRLS (Howie & Hughes, 1998; PISA, 2015). The focus of this study is on mathematics and as such, only TIMSS will be discussed.

2.3.1.1 Trends in International Mathematics and Science Study (TIMSS)

TIMSS is an international assessment that is conducted in nearly fifty countries to measure trends in mathematics and science learning (Mullis, Martin, Gonzalez & Chrostowski, 2004). TIMSS is a project of the International Association for the Evaluation of Educational Achievement (IEA), an independent international cooperative of national research institutions and government agencies that has been conducting studies on cross-national achievement since 1959.

TIMSS is conducted every four years and has been running since 1995. The rationale behind the four-year cycle in TIMSS is to provide an opportunity to monitor achievement changes within the age cohort, as the 4th grade becomes 8th grade after four years (HSRC, 2011; Makgato & Mji, 2006). It is for this reason that TIMSS is administered to Grades 4 and 8 mathematics and science learners. However, South Africa, Botswana and Honduras participate at Grade 9 levels for the Grade 8 mathematics and science assessments.

According to Mullis et al. (2004), TIMSS assesses mathematics and science achievements in countries around the world and collects a rich array of information about the educational context for learning mathematics and science. Reddy (2006) is of the opinion that TIMSS is one of the few studies that provides national, quantitative data on the state of a country's education system. Mullis, Martin, Gonzalez, O'Connor, Chrostowski, Gregory, Garden and Smith (2001); Mullis et al. (2004); Beaton, Mullis, Martin, Gonzalez, Kelly and Smith (1996); Howie (2003); Hughes (2004); Reddy (2006; 2012); and Spaull (2013), amongst others, further elaborate that TIMSS is conducted in order to improve the teaching and learning of mathematics and science by providing data about learners' achievements in relation to different types of curriculum, instructional practices and school environments. The findings from TIMSS are used to

inform educational policy and to improve teaching and learning in mathematics and science. The findings in terms of South Africa's performance between 1995 and 2011 in TIMSS is presented in Figure 2.1 below.

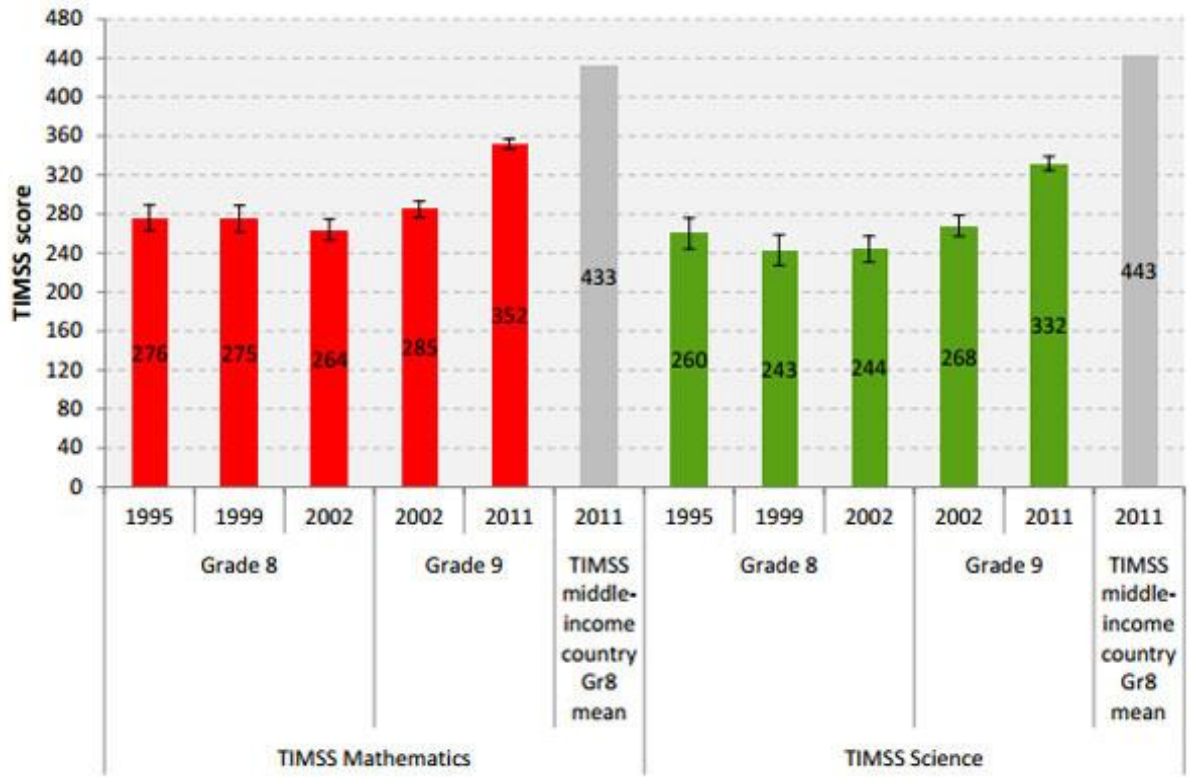

Figure 2.1 South Africa's mathematics and science performance in TIMSS between 1995 and 2011 (Source: TIMSS, 2011)

South Africa, Botswana and Honduras have continued to perform at the lowest end of the benchmark in both mathematics and science. South Africa's results from the TIMSS assessment has demonstrated the lowest performance in mathematics and science amongst all participating countries (HSRC, 2011). Reddy (2012) and Howie (2003) posit that South Africa showed no improvement between 1995, 1999 and 2002 (10.5% scores above 400 points in TIMSS 2003). However, the 2011 results showed that for the first time since South Africa participated in 1995, the national average mathematics score of Grade 9 learners had improved in public schools (24% scores above 400 points). According Reddy (2011), the best performing South African learners approached the average performance of the top performing countries of Singapore,

Chinese Taipei, the Republic of Korea, Japan and Finland. The top performing provinces in both mathematics and science in TIMSS 2011 were the Western Cape (WC), the Gauteng Province (GP) and the Northern Cape (NC); and the lowest performers were the Kwa-Zulu Natal (KZN), Limpopo (LP) and the Eastern Cape (EC) provinces. Reddy (2011) reveals that although learners from well-resourced and affluent schools produce better results than learners from under-resourced and less affluent schools, the most improvement is found in under-resourced and less affluent schools. Such a scenario suggests that the gaps in variation are closing.

2.3.2 National assessments of mathematics

There have been numerous initiatives to monitor the quality of education in South Africa (Spaull, 2013). The results of these initiatives have enabled policymakers, researchers and educators to assess the levels of achievements of South African learners. There was an urgent need to improve the learners' performance in terms of critical skills in mathematics, science, and languages in grades below Grade 12. South Africa thus introduced a number of standardised tests, as there was an increased trend in the international use of such mathematics tests (UNESCO, 2012). Standardised assessments, such as Systemic Evaluation (SE), the National School Effectiveness Study (NSES), and the Annual National Assessments (ANAs), were introduced and implemented in the South African education system. SE and NSES will not be discussed in this study because the study focuses solely on Grade 9 mathematics, which was not included in these assessments.

2.3.2.1 Annual National Assessments (ANAs)

The Annual National Assessment (ANA) is the largest data set of nationally standardised assessment. It is a testing programme that requires all schools in the country to conduct the same grade-specific literacy and language, and numeracy and mathematics tests for the GET band (Pournara, 2015; DBE, 2012). ANA is a strategy that is used to annually measure progress in learners' achievement in mathematics and languages in the GET band as part of one of the aims of the South African government's "Action Plan to 2014: Towards The Realisation of Schooling 2025" (DBE,

2012). ANA is also used as a diagnostic tool to gauge the extent to which the basic education system impacts the critical areas of numeracy and mathematics, and literacy and languages. Pournara (2015) posits that the mathematics ANAs were introduced in response to South Africa's unacceptably low performance in international comparative assessments, such as TIMSS. Therefore, the primary aim of ANA is to support teaching and learning in previously disadvantaged schools. The DBE (2011) further elaborates that ANA seeks to diagnose areas of weakness, curriculum gaps in terms of learner performance, and to expose educators to what constitutes best practices in assessment. This is done in order to allow all the identification of schools and mathematics teachers that need intervention, as well as to give recognition to schools that perform well. According to Spaull (2013), schools that need intervention are classified as dysfunctional schools. ANAs are not to be used for progression and promotion purposes, but rather to give parents better information on the education of their children. Evidence in the research suggests that there are some parents who might not understand the purpose and role of these assessments. Spaull (2013) emphasises that it is imperative that all stakeholders, policymakers, district and provincial officials, teachers, and learners and parents understand the purpose of ANA and its intentions, and should not misconstrue these.

ANA is administered to all learners in Grades 1 to 6, and Grade 9 in all public and private schools to test mathematics and primary languages. These standardised tests are conducted annually in the third term of the school year. According to the South African Democratic Teachers' Union (SADTU), and Pournara (2015), the timing of ANA interferes with the smooth running of the schools' programme. Teachers are also not given enough time to implement intervention strategies, which leads to learners' rote-learning (Adler, 2015). SADTU rejects the ANAs in the form in which they are currently administered annually. SADTU further maintains that the ANAs should take place every three years in order to give teachers enough time to implement intervention strategies. The ANA results for mathematics for 2012 through to 2014 are provided in Figure 2.2 below.

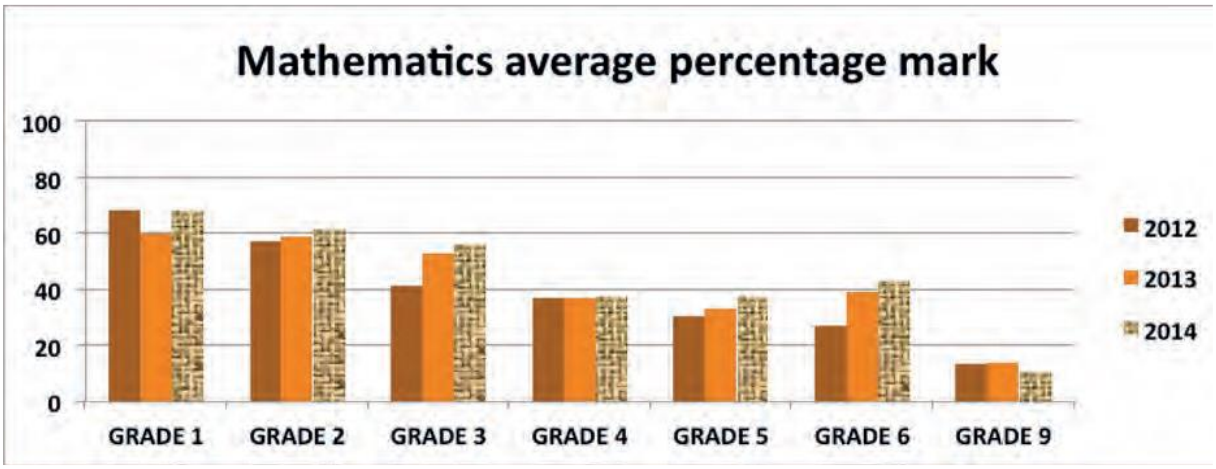

Figure 2.2 Figure 2: National average percentage marks for mathematics in 2012, 2013 and 2014 (Source: DBE, 2014)

Learners' poor performance in the ANAs has been consistently recorded in South Africa (Gitaari, Nyaga, Muthea & Reche, 2013). In her press release statement, the Minister of the Department of Basic Education, Ms Angie Motshekga, pointed out that the overall performance in ANA 2014 showed an upward trend in performance, with average percentage scores increasing by a maximum of 8% in mathematics in Grades 1 to 6, except in Grade 9 (DBE, 2014). Mathematics performance in Grade 9 has been unacceptably low since the inception of ANA in 2012. In 2013, for instance, only 3% of Grade 9 mathematics learners achieved 50%. The Minister acknowledged the fact that there were problems in teaching and learning mathematics throughout the system, and that government was addressing these problems using a range of solutions, such as rigorous teacher-development programmes.

One of ANA's intentions is also to give schools the opportunity to take pride in themselves and their improvement. However, it creates 'unhealthy competition' between provinces, districts and schools (Hoadley & Muller, n.d). As in the case of the Lejweleputswa district in the Free State province, teachers are instructed to teach mathematics for four hours and English First Additional Language (EFAL) for two hours per day two weeks prior to the actual writing of the ANA. The intention of Lejweleputswa was to raise scores so that they could "pride themselves in their own achievement" (DBE, 2012, p. 4). However, it is important to note that, specifically in terms of the

ANAs, raised scores do not reflect what learners know, and scores do not necessarily reflect learners' potential.

2.4 SCHOOL-BASED ASSESSMENT (SBA)

School-Based Assessment (SBA) is the process of measuring the learners' achievements against the defined outcomes conducted by the teacher (Maile, 2013). Black and Wiliam (1998, p.5) define SBA as "being an assessment that is, by its very nature, teacher mediated, co-constructed and dialogic, context-dependent, multiple and varied, and dynamic and evolving". Many researchers define the concept differently, however, common themes such as internal assessment, formative assessment, continuous assessment and informal assessment resonate from different definitions. Lamprianou and Christie (2009, p.1) refer to SBA as an "engine of educational change" that influences teaching. This means that SBA forms an integral component of teaching and learning in the classroom.

SBA is found in the education systems of several countries such as Finland, New Zealand, Australia, and Hong Kong, although the results of these are less trusted than those of the United Kingdom (NCTM). Despite their years of experience in implementing SBA, several researches have been contracted from time to time to investigate the relevance of certain factors of SBA (Majid, 2011). However, at a conference in Thailand in 2010, pleas for more effective use of SBA came up in many discussions. Umalusi, South Africa's quality assurer, finds that teachers the world over experience difficulties in finding their role in assessments (Umalusi, 2010). Research into SBA internationally is further complicated by the considerable uncertainty and disagreement around the concept. Studies of SBA in Hong Kong, for example, suggest that there may be wide variations in teachers' interpretations of learner performance, and of their role in the assessment process (Davison, 2004). One of the findings of a study conducted by Majid (2011) on SBA, was that most teachers still have uncertainties about the demands of SBA. A similar claim made by Vandeyar and Killen (2007) is that some teachers still apply the same pedagogical practices that they used many years ago, some even use practices based on how they were taught and assessed due to their uncertainty of their roles in SBA and not understanding the concept. Poliah (2014) posits that SBA has

been a challenge since its inception in 2001 due to the lack of clarity on its purpose. This further relates to its inclusion as a promotion or progression requirement for all the subjects offered within the schooling system.

Lamprianou and Christie (2009) outline three major challenges of SBA: There is a conflict between psychometric models and classroom assessment practices; different schools are not equally effective; and teachers' judgements are frequently accused of being biased. In the South African context, the weighting of SBA varies considerably across the education system, which poses major challenges. Table 2 provides details of the varied weighting.

Table 2.2 The weighting of SBA across the system

Band	Grade	Curriculum	SBA%	External examination
GET Band	Grade 1-8	C2005	100%	No examination.
	Grade 9	C2005	75%	25% CTA
FET Band	Grade 10-12	NATED	25%	75%
GET Band	Grade 1-8	RNCS	100%	No examinations.
	Grade 9	RNCS	75%	25% CTA 25% int. examinations.
FET Band	Grade 10-12	NCS	25%	75%
GET Band	Grade 1-3	CAPS	100%	No examination.
	Grade 4-6	CAPS	60%	40% internal examination.
	Grade 7-9	CAPS	40	60% internal examination.
FET Band	Grade 10-12	CAPS	25	75% external examination.

SBA is further made up of informal and formal assessments. Informal assessments are formative and prepare learners for formal assessment. Basic mathematical concepts are thus mastered to improve teaching and learning. Regular informal activities such as homework and class work, coupled with regular feedback, provide information to learners and teachers, and may help the educator to gauge what learners' performance would be like in the formal assessment. Learners should be familiar with the type of tasks used for formal assessment and should also be given the opportunity to master mathematical concepts (Davison, 2005).

Formal assessment, also referred to as formative assessment, includes all forms of assessment as appropriate for mathematics, such as investigations, assignments, tests, projects, and examinations. These forms of assessment are employed to achieve different cognitive levels in mathematics. According to Grima (2003, p.4), the following five rules of thumb regarding the quality of assessment are suggested:

> *The assessment should be appropriate to what is being assessed (validity issue).*
>
> *The assessment should enable the learner to demonstrate positive achievement and reflect the learner's strengths.*
>
> *The criteria for successful performance should be clear to all concerned.*
>
> *The assessment should be appropriate to all persons being assessed.*
>
> *The style of assessment should blend with the learning pattern so it contributes to it.*

2.4.1 Challenges in assessments

"The challenge of the 21st century is to achieve some congruence between Formative Assessments and Summative Assessments" (Long et al., 2014, p.7).

Moreover, Harlen (2003, p. 207) expounds that, "All assessments in the context of education involve making decisions about what is relevant evidence, how to collect evidence, how to interpret it and how to communicate it to intended users." However, Stiggins (1998) is of the view that our current assessment systems are harming learners due to a failure to balance the use of standardised tests and classroom assessments in the school improvement plan. Stiggins (1998) warns that if there is political pressure in

the education system, as is the case in South Africa, then there will be an increasingly damaging crisis in terms of assessment. He further finds that standardised tests are, in fact, causing major problems in segments of the learner population. Additionally, there is a body of evidence that suggests that mathematics teachers cannot distinguish between different forms of assessment in mathematics (Stiggins & Chappuis, 2005; Davison, 2007; Stiggins, 2004).

The purposes of assessments, according to Harlen (2003), are to assist in learning and summarising learning, although they are sometimes used for purposes other than what they were designed for, and can have unintended consequences. As Stiggins (1998) correctly puts it, when it comes to assessment, all stakeholders in the education system have been trying to find answers to the wrong questions, for example, learners' test results intended for learners' levels of achievements are then used for setting targets, as well as to evaluate schools and teachers in order to sanction or reward them. It is from these purposes and test designs that there a summative assessment (SA) and formative assessment (FA) are developed.

According to Taras (2005), all assessment begins with SA. Originally, it was though that SA was the same thing as FA. Scriven (1967, as cited in Taras, 2005; Harlen, 2003; Bennett, 2011; Black & Wiliam, 1998) was the first researcher to make a distinction between SA and FA, which is a matter of degree of elaborateness. Since Scriven, there have been both theoretical and practical developments in the area of assessment. FA focuses on the process of assessing and using feedback; while SA tends to focus on the product (Taras, 2005. p.472). Black and Wiliam (1998a) introduced the concept of FA, which refers to two very difficult contexts: first, in a complex, multi-criterion context, and secondly, FA is usually used in the context of classroom teaching pedagogy in order to develop learning, which has been the focus of Black and Wiliam's research. Formative Assessment promotes learning by using evidence about the benchmark that learners reach in relation to the set out goals of learning. This is done to plan the next steps in their learning and to formulate how to take those steps (Black & Wiliam, 2006). Research argues that FA has forged a powerful way to raise standards, and carries a lot

of potential for radical transformation in the teaching and learning process (Black & Wiliam, 1998).

Summative assessment provides a summary of achievements at a particular or specific point, which is an important, necessary part of the assessment system as it provides information to all stakeholders. In SA, the use of tests has an impact on the status of teachers and the schools, as well as the future of learners. Teachers use SA to focus on the content of tests, administration and repeated test practice, training learners in answering questions (as in the case of the ANAs), and adopting transmission styles of teaching (Black & Wiliam, 1998; Stiggins, 1998). This practice, however, does not help the learning process. In mathematics, Bloom's taxonomy is difficult to interpret, making it difficult for mathematics teachers to set valid assessment tasks.

One other challenges is the ANA process. As a diagnostic assessment, it is conducted annually without making time to conduct error analysis and come up with remedial programmes. Whereas in certain assessments, TIMSS, for instance, the study is conducted every 4 years and there actually is enough time to reflect and make improvements based on the TIMSS reports.

The literature informs us that in the GET band, there is no quality assurer (external moderation) to ascertain whether assessments are credible, valid and reliable. Policy documents are also silent on internal moderation and there are no clear guidelines on assessment in the mathematics CAPS document. The document comprises a lot of content, yet there are only a few pages on assessment. Although CAPS guides teachers on what and when to teach and assess, there are no clear guidelines on the mark allocation of tasks, tests and examinations. Each province is thus required to make its own decisions regarding the mark allocation for assessments.

2.4.2 Tensions between formative assessments and summative assessments

Bennett (2011) argues that the relationship between formative assessment (FA) and summative assessment (SA) is a complex one. The role of SA is to provide a summary of achievement to the different stakeholders, and at a particular interval to document what learners know and are able to do (Black & Wiliam, 2006). As such, SA has always

been associated with high-stakes examinations and standardised tests. However, if carefully constructed or developed, SA should also support learning (FA) if the content, format and design of a test offers a sufficiently rich domain representation.

According to Bennett (2011), the term 'FA' is more focused on learners than programmes. This has led to the confusion of the term because there is a split in the use of FA. There are those who believe that FA refers to an instrument that allows one to produce more test scores (test publishers), whereas teachers and test publishers believe FA is not a test, but rather a process.

Because schools are ranked, judged, rewarded or even punished by means of the test scores they produce, the system relies heavily on SA. Such a practice has been the norm in most countries, South Africa is no exception. In the TIMSS results, for instance, the ministry of Education was forced to develop standardised tests in mathematics and languages for the GET band annually (Stiggins, 1998; DBE, 2012). In essence, according to Stiggins (1998), high-stakes examinations enhance the learning of some learners, while the others would be discouraged and could possibly decide to give up. The distinguishing characteristic is that FA results are used to "adapt the teaching to meet student needs" (Black & Wiliam, 1998a, p.140, as cited in Bennett, 2011).

Taras (2005) is of the opinion that FA is the same thing as SA, and further elaborates that the FA process is the same as the process of SA. This means that it is possible for assessment to be uniquely summative where the assessment stops at judgement. However, it is not possible for assessment to be uniquely formative without summative judgement having produced it.

Many educationalists show SA in a negative light in order to promote FA (Broadfoot, 2000, as cited in Taras, 2005). FA has greater importance over SA in most contexts because FA encompasses SA (this is always explicit). Taras (2005) is in agreement with Scriven (1967, as cited in Taras, 2005) that FA justifies SA (what needs to be done). Black et al. (2004) describe that FA and SA are used together to support each other in the classroom situation, and furthermore, teachers refuse to separate the two. Evidence collected from educators may be used for both purposes.

Another perceived tension that exists between FA and SA is that SA has become implicit and unacknowledged in many circles of education. The most detrimental aspect of this is that FA is seen as a magic formula, which is not only separate and distinct from SA, but incompatible with it (Taras, 2005, p. 475). Taras (2005) further warns that all stakeholders in education should refuse to accept the incompatibility of SA and FA. Instead, ways should be sought of mitigating the tension by whatever means. Taras (2005) suggests that the complications and tensions, as discussed by Wiliam (2000b), would disappear if Scriven's idea was followed in accepting that any educational process or assessment requires both FA and SA. It should be recognised that SA is central to all assessment, and not only for judgement, validation, promotion and progression, or for certification, but rather as a stepping stone to learning, particularly if FA is seen as a necessary step that justifies and explains SA.

Because formative and summative assessments have no clear differences in terms of how their evidence and outcomes are used (Isaacs et al., 2013), they are discussed differently only due to their different purposes (Harlen, 2003). It is rather difficult to refer to FA and SA as if they are different types or forms of assessment (Black & Wiliam, 2006; Harlen 2003), although Harlen (2003) argues that data are gathered the same way. Black and Wiliam (2006) further claim that what matters is how information is gathered and used. It is for this reason that Stiggins (1998) stopped using the terms FA and SA, and instead used Assessment for Learning (AfL) and Assessment of Learning (AoL) respectively. Stiggins (1998) maintains that there is a difference between the FA and AfL terminology that is used by Black and Wiliam (2006), amongst others. The tension that exists between AfL and AoL is due to the fact that AfL is used in making decisions that affect teaching and learning in the short term; AfL is also used to record and report what has been learned in the past with no immediate feedback into teaching.

AoL is used for a variety of purposes, such as promotion and progression (e.g. from Grade 9 to Grade 10), to obtain marks or percentages or descriptive levels in Grade 9 mathematics, for instance, certification by examination bodies, monitoring school performance, accountability, setting targets (in ANA), and may also be used for subject choice between mathematics and mathematical literacy in Grade 10 (Isaacs et al.,

2013; Harlen, 2003; Stiggins, 1998). This could potentially put pressure on the entire education system. Isaacs et al. (2013) maintain that it is critical that the FA inferences that are drawn from the outcomes are as reliable, valid and credible as possible. Assessment instruments are crucial as they assess content, skills and understanding. SA measures learners' progress against assessment standards, which should be in line with the curriculum. Assessment standards further refer to the concepts that learners are supposed to know, understand, and related activities that they are thus able to do.

The function of FA, rather than SA, should be of paramount importance in the day-to-day work in the classroom. Record-keeping should be integrated into classroom activities so that evidence of achievement can be re-interpreted for summative purposes (ICME 9).

On the one hand, formative assessment assists learning and teaching. On the other hand, summative assessment is used to record and report what has been achieved in the learning and teaching process. It becomes problematic to refer FA and SA as if they are different forms or types of assessment. Formative assessment may as well serve as summative assessment as the instruments include tests, examinations and homework (for instance, in countries such as the USA, UK in Scotland, Australia, and South Africa). Assessment instruments are crucial as they assess content, skills and understanding, and should be carefully selected.

There is, however, a synergy that exists between FA and SA. Information collected from learning and teaching could be used for both formative and summative purposes. Good formative assessment may support teachers' good judgement of learners' progress and level of attainment. Good summative assessment provides feedback that can be used for learning. The teacher could conduct the same assessment and use it for different purposes. If formative and summative purposes are confused, it is suggested that "good assessment" refer to good Assessment of Learning, and not Assessment for Learning (Harlen & James, 1997, p377).

Bennett (2011) further argues that the tension between FA and SA might be mitigated, for instance, by broadening the basis for assessment, lessening the predictability of the

items, placing the focus on quality assurance rather than control, and basing FA on a new developing theory of learning. Lamprianou and Christie (2009) argue that the tension between AfL and AoL might be mitigated by an external examination body. Currently, AoL is used for accountability purposes at the expense of AfL.

2.4.3 Assessment as learning

Assessment as Learning (AaL) is a process where learners set learning goals, share learning intentions and success criteria, and evaluate their learning through dialogue and self and peer assessment (Clark, 2011, p. 163). Bennett (2010) defines AaL as a process whereby both teachers and learners consider what constitutes a worthwhile experience in terms of what learners have achieved. This is done to help identify how to plan instruction. AaL is an aspect that structures peer engagement and supports autonomous learning and assessment. Clark (2011) further posits that in AaL, emphasis is placed on co-reflection on evidence of learning. According to Clark (2010 a, 2010 b, 2011), in the key principles of AaL, learners are able to build knowledge of themselves as learners and become meta-cognitive, and are also able to take more responsibility for their learning, as well as to participate more in the process of learning with their peers in a climate of mutuality and equality.

2.5 QUALITY ASSURANCE IN SBA

Quality Assurance (QA) is a generic term that lends itself to many interpretations, which means that it is not possible to use one definition to cover all circumstances (European Network for Quality Assurance (ENQA), 2009). This concept also implies that decisions or judgements are made against some background system of standards that are accepted by the relevant bodies. Quality assurance is generally new in education, but has rapidly become very important in recent debates, practice and accountability (Allais, 2009; Sadler, 2012). On the one hand, Maxwell (2006) argues that quality assurance is concerned with establishing the appropriate constructs for assessment to take place, and it improves the quality of education by guaranteeing the quality of assessment thereof. Gipps (1995), on the other hand, finds that quality assurance is an approach that aims towards standardisation or consistency in assessments.

Quality assurance in SBA can be conceptualised as all of the quality control measures put in place in keeping with the required standards (Adler, 2012). Maxwell (2006) explains that these quality control measures are important to address issues of validity, reliability, fairness, authenticity, as well the quality of marking of these assessment tasks. In Grade 9 mathematics, the forms of assessment available are tests and internal examinations, investigations, assignments and projects (Worldbank, 2008; DBE, 2013). The latter three of these assessment tasks are completed by learners under uncontrolled conditions, for example, at home, or even at a library. SBA is an important tool, but when it serves as a component of national educational benchmarking, it needs to be rigorously controlled and quality assured (Poliah, 2014).

According to the European Network for Quality Assurance (ENQA) (2009), institutions should have policies and procedures in place for quality assurance; South Africa is no exception. In the South African context, the Department of Education developed mechanisms in order to address quality assurance in SBA after the reliability and validity thereof were questioned. The Department of Education promulgated a number of policies and Acts, such as the National Protocol on Assessment Grade R-12, General and Further Education Training on Quality Assurance Act No 58 of 2001, Curriculum 2005 (C2005), the Revised National Curriculum Statement (RNCS) (Grade R-9), the Assessment Guidelines in General Education and Training (Grade R-9), Common Assessment Tasks (CTAs) in Grade 9 of the GET band, and the Curriculum and Assessment Policy Statement (CAPS). However, these documents provide no guidelines and are silent on the internal quality assurance processes that schools need to apply (Maile, 2013; DoE, 2001; DoE, 1998; Wilmot, 2005). These policy documents therefore do not provide standardisation among schools. The Department of Education has established a statutory body known as Umalusi that ensures that assessments are quality assured at the exit points of the system. In terms of the South African education system, the exit points are at the end of the GET and FET bands, and are Grades 9 and 12 respectively. While Umalusi (2013, cited in Poliah, 2014) finds that there is huge disparity in the quality of SBA from one school to another across education districts, as Umalusi's responsibilities lie in Grade 12 only, and this study focuses on Grade 9, Umalusi will not be discussed.

Adler (2012) finds that a lack of guidelines leads to variations, which may include:

- The marking standards of teachers (which may be too high or inflated) (Maile, 2013; Poliah, 2010).
- Types of uncontrolled assessment tasks such as investigations, assignments and projects in mathematics. Poliah (2010) highlights the fact that some teachers use homework as part of SBA.
- The degree of guidance and assistance given to learners. Torrance and Pryor (1998) are of the opinion that learners are strategically guided with instructions and assistance for deeper understanding and discussion. This is done to close the gap between their current level of understanding and the desired goal.

According to Yip and Cheung (2005, p. 159), "[SBA] could not provide a valid and reliable assessment of student work because of the great variations among different schools in the conditions under which assessment is made." Griffith (n.d) further posits that quality assurance in SBA be conceptualised as all the quality control strategies put in place in keeping with the required standards. These quality assurance measures are crucial in order to address issues of validity and reliability through the processes of monitoring and moderation (Maile, 2013; Griffith, n.d; Maxwell, 2006).

The following sub-themes constitute the quality of SBA: reliability, validity, monitoring and moderation. These are further embroidered upon below.

Reliability: The reliability of SBA is tested against the consistency of learners' marks when tested by a different assessor who is not the class teacher. Grima (2003), however, argues that external assessments are to be perceived as reliable as all learners take the same assessment task at the same time and under the same conditions, and it is controlled by an external examination body. Although there is a claim that externally set assessment tasks are the only credible method of demonstrating to stakeholders that there is effective teaching and learning in the classroom, Long et al. (2009) contest this based on the notion that the results of external examinations must be considered together with the results of SBA. However,

this notion also creates problems in the South African education system as there are no externally set assessments for grades below Grade 12. Long et al. (2009) strongly believe that the credibility of assessment will always be contested.

The low reliability of the SBA scores has serious negative consequences for the whole education system (Poliah, 2014). Poliah (2014) takes the view that when learners' marks are inflated, they have a false sense of achievement and performance. Despite the unreliability of SBA scores, no moderation by an external independent body takes place at the exit point of the GET band (Grade 9).

Validity: In terms of validity, Grima (2003) explains that it should be asked whether the task does measure what is intended to measure, and it depends on the various mathematics assessment tasks that learners are required to perform. As assessment is embedded in the curriculum, validity may also be referred to as the alignment to content, in other words, that the assessment task assesses what it intends to assess (DBE, 2013). Taylor and Vinjevold (2013) explain that it is not helpful to overwhelm learners with too many assessment tasks (homework, tests, projects and assignments), especially if these tasks do not assess content knowledge to establish learners' competence. For SBA to be valid, cognitive levels that are according to the revised Bloom's taxonomy should be embraced. Cognitive levels specify the depth and breadth within a specific topic. The CAPS document describes four cognitive levels, as well as their weightings, at which mathematics assessment tasks have to be conducted, namely: Knowledge (25%); routine procedures (45%); complex procedures (20%); and problem-solving (10%).

du Plooy and Long (2012) posit that this is a reliable way to comply with the CAPS mathematics requirement at different cognitive levels. Long, Dunne and de Kock (2014), however, contest this as they find that Bloom's taxonomy is difficult to interpret, which makes the setting of any form of assessment in mathematics problematic. If a mathematics teacher is unable to apply the appropriate cognitive levels, the quality of their SBA tasks is poor (Poliah, 2010).

One of the requirements for a valid assessment task is to cover a range of skills and cognitive domains, which also proves to be problematic (Long et al., 2014). In CAPS, for instance, more topics have been added to the mathematics Senior Phase, with reduced contact time. It also becomes problematic to set a standardised assessment task for Grade 9 learners as the CAPS document is silent on what equations to teach.

Moderation: One of the quality assurance procedures aimed at enhancing the validity, reliability, credibility and authenticity of SBA is the process of moderation, as well as ensuring that there is uniform interpretation and application of standards across all schools, districts and provinces. Moderation is the primary tool that ensures fairness in SBA (HKEAA, 2015; Lamprianou & Christie, 2009; Griffith, n.d; DoE, 2006). Moderation is defined as "the quality assurance process which ensures that assessment meets the standards set out in the policy documents" (BankSeta, 2009, p. 5).

Broomes (1997) explains that moderation requires examination standards to be aligned across classes, schools and districts. These standards should be the same regardless of the circumstances (teacher, location, time, and examiner). Maile (2013, p.18), alternatively, posits that "moderation forms a basis for valid and reliable assessment".

Prior to 1994, moderation was in the form of an inspection conducted by inspectors (Allais, 2009). The roles played by the different moderators at school level are of a critical nature, therefore these roles should be clarified in order for the process to unfold as it should. The moderator, for instance, the Head of Department (HoD) for mathematics, needs to be extensively experienced in mathematics teaching, as well as the principles of assessment (Maxwell, 2006). The HoD has to advise and guide the mathematics teacher in unpacking mathematics topics, as well as addressing misunderstandings and misconceptions in mathematics. Moderation is not a once-off process (Grima, 2003; Maile, 2013; Wilmot, 2005) whereby the signature of the HoD, as Maile (2013, p.21) puts it, is the "hallmark" of moderation.

Poliah (2010, p.262) further explains that, "Learners get high marks due to the quality of papers at school. Teachers set papers that are not of the required standard and they pass through the hands of HODs and are not properly moderated." In the findings of a

study conducted by Maile (2003), it emerged that there is no rigorous moderation in schools due to a lack of guidelines, clarity on cognitive level, and no clear guidelines given to mathematics teachers in terms of marks to be allocated for different forms of assessment. Currently, each province develops its own moderation policies, which leads to multiple practices and variations. These, in turn, affect the quality of the SBA of a school; this also means that there is no standardisation in SBA across schools. Each moderator is expected to master the following crucial steps of moderation:

Prior (pre) moderation: Pre moderation plays a critical role in ensuring the validity of the tasks.

Moderation: There are some teachers whose standards are not of a high quality (Broomes, 1997).

Post moderation: In one of Maile's findings (2013), overcrowded classes were found to make it difficult for mathematics teachers to implement other methods of assessment as the curriculum tasks are time-consuming, and alternatively, these conditions force teachers to resort to group work in cases of projects, assignments and investigations.

Monitoring: Grima (2003) posits that moderation is not a passive process, but rather a dialogue between the HoD and the teacher, which extends to monitoring. Monitoring ensures that forms of assessment are carried out efficiently and effectively. The processes of monitoring and moderation are intertwined and inseparable.

Moderation may be controversial and cause tension between the HoD and the teacher as it raises concerns regarding the confidence of the teacher (Adler, 2012). In order to minimise such tension, the moderator should respect and accept the teacher's knowledge. There are several points at which consistency in teaching can be encouraged: the provision of clear guidelines for any assessment tasks, group moderation of assessments, external moderation by visitations, and feedback given to the school, and a record of evidence that is kept for verification (Gipps, 1995, p.137). These procedures are useful for assuring constant quality in SBA. Gipps (1994) concludes by stating that maintaining quality SBA is deeply problematic since teachers vary in how they construe mathematical concepts. Yip & Cheung (2005) recommend a

process of cross-validation amongst teachers and schools during SBA as an important measure for quality assurance. Cross-validation is a valid option as it may speak to the quality assurance challenges in SBA. These challenges are further discussed below.

2.6 ASSESSMENT AND CURRICULUM POLICIES

Policy is a statement of intent, which is implemented as a procedure or protocol. Furthermore, policy merely guides actions towards achieving outcomes. According to Majid (2011), guidelines are not mandatory, not binding, and are not enforced. Majid (2011) further elaborates that educational policies and guidelines are formulated to prepare teachers for the new implementation of what has been intended. According to Spaull and Venkat (2014; Maile, 2013), policymakers in the past systematically dismantled Apartheid-era educational policies and replaced them with non-racial and non-sexist policies aiming to rectify the ills of the past.

2.6.1 Curriculum policies

“A nation’s national curriculum is at the heart of its education system. It is a primary source of support and direction for learning and teaching in the education system, and plays the role of the equalizer in terms of educational standards. There is therefore an imperative on educational authorities to develop curriculum policy that is of a high quality and that communicates the curriculum message widely and with clarity” (Report of the Task Team for the Review of the Implementation of the National Curriculum Statement, 2009, p.11).

Prior to 1994, the South African education system and policies were racially segregated (Harley & Wedekind, 2004). Curriculum and assessment policies were used as a tool of racial, social, and economic segregation, and were in favour of the small minority of learners who would proceed to university training in scarce-skills careers such as engineering, medicine, and technology, amongst others (Moloi, n.d; Mouton et al., 2011). The curriculum was said to be heavily content-laden, examination-driven, teacher centred, it encouraged the rote learning of mathematical techniques and algorithms, and lent itself to very little application of the everyday experience of learners (Moloi, n.d; Harley & Wedekind, 2004).

Post-1994, one of the key strategic challenges was to transform the school curriculum. According to Vandeyar and Killen (2007), one of the most notable changes in South Africa was the implementation of the new curriculum, which was said to be a complete paradigm shift in learning and teaching in South African schools. Curriculum policy is referred to as the 'intended' policy. Spaull and Venkat (2014) outline the following characteristics of curriculum policy – it is prescriptive as it: specifies how much time is allocated to the mathematics curriculum; it specifies what topics are to be covered within the specified time; it decides which learners study what topics; it specifies when and in what order each topic is to be taught; as well as to what standards of achievements a topic is to be taught.

Since the advent of democracy in 1994, three curricula have been implemented, namely, Curriculum 2005 (C2005), the Revised National Curriculum Statement (RNCS), and the Curriculum and Assessment Policy Statement (CAPS). These three curricula are discussed in detail further in the sections below.

2.6.1.1 Curriculum 2005 and Outcomes-Based Education

Curriculum 2005 (C2005) was introduced in 1997 and implemented incrementally in 1998 (Mouton et al., 2011; Vinjevold & Roberts, 1999; Fleisch, 2002; Harley & Wedekind, 2004; Jansen, 1998) so that by the year 2005, all grades within the system were intended to have implemented the new curriculum. Researchers such as Mouton et al. (2011), and Harley and Wedekind (2004) further argue that C2005 was introduced in order to alleviate the challenges brought forward from the Apartheid regime, such as education, poverty, and multilingualism. Chisholm (2004) suggests that C2005 was used as a political tool as the changes were not of a pedagogic development nature. Minister Bhengu of the Department of Education (DoE) believed that C2005 was the best means of achieving transformation (Harley & Wedekind, 2004).

However, further evidence, as presented by Harley and Wedekind (2004), points to the fact that teachers' support of C2005, mainly from disadvantaged schools, was based on political loyalty and support rather than educational change. Hence the implementation was rushed and there was an overwhelming reception and support from these sections

of the community. The main reason for this radical change was that policymakers wanted to move away from the Apartheid curriculum, and to address the shortage of Skills, Knowledge, Values, And Attitudes (SKVAs) to promote social justice (Spreen & Vally, 2008). C2005 was introduced in both well-resourced and poorer schools (Chisholm, 2004).

C2005 consisted of the General Education and Training band (GET) and the Further Education and Training band. The GET band (Grades R to 9) is further made up of three phases, which are the Foundation Phase (Grades R-3), the Intermediate Phase (Grades 4 to 6), and the Senior Phase (Grades 7 to 9). The FET band, alternatively, is made up of Grades 10 to 12 (DoE, 2002). C2005 had three design features, namely, outcomes-based, integrated knowledge systems, and learner-centredness.

Outcomes-based education (OBE) was centrally positioned and was the driver of C2005. In essence, OBE became synonymous with C2005. OBE was also seen as promoting equity, and was said to be the best model (Motala, 2003). OBE focuses on the outcomes and processes of a specific learning area. However, Maile (2013) underlines OBE-based debates in countries such as New Zealand, Australia, Canada, Scotland and many parts of the United States, where it has been severely criticised.

In terms of the integrated knowledge system, subjects were known as learning areas (DoE, 1997). For instance, Economic and Management Sciences (EMS) was a combination of Economics, Accounting and Business studies, and was introduced as early as Grade 4. Mathematics was changed to the learning area Mathematical Literacy, Mathematics and Mathematical Sciences (MLMMS) (DoE, 2002). According to a report of the Review Committee regarding C2005, MLMMS was introduced to empower people to work towards the reconstruction and development of South African society. There is a body of knowledge that defines the mathematics curriculum as obscured or dominated by the non-mathematical consideration, more so than in the previous curriculum (Graven, 2002; Muller, 2012). The non-mathematical tasks grew and resulted in a weaker grasp of the central skills and concepts of mathematics, which in turn jeopardised higher skill acquisition that was meant to prepare learners for the FET band

and beyond. The Review Committee also revealed that C2005 was strong on integration and weak on conceptual coherence and progression.

C2005 policy documents provided no content knowledge and sequencing of content, but rather, Learning Outcomes, Range Statements, Phase Organisers and Assessment criteria (DoE, 1997) to replace content (Fleisch, 2002). Spaull and Venkat (2014) argue that the sparse specification and sequencing of mathematical content proved to be problematic.

Policymakers expected teachers to select, develop and sequence content on their own, hence there were variations and gaps between the nine provinces, their districts, and schools. This was a laissez-faire approach to implementation. These policymakers failed to provide structured guidelines for sequence progression and pacing for higher order thinking that was meant to prepare GET learners for the FET band and higher learning. This practice was supposed to make it possible for teachers make critical decisions in choosing what and how to teach mathematics. This approach was problematic in mathematics in particular as this subject is dependent on selection and the sequencing of content. Evidence suggests that mathematics teachers missed a great deal of content, and lesson plans lost the gist of mathematical knowledge. The range, depth and the quality of learning was compromised. The Department of Education defeated its own attempts and intentions of addressing the inequalities and the quality of education in South Africa. However, while the Association of Mathematics Educators of South Africa (AMESA) welcomed the changes in mathematics, mathematics teachers found C2005's language too complex and confusing. The curriculum consisted of 12 Critical and Developmental Outcomes; as well as 66 Specific Outcomes, which were divided into the eight Learning Areas, Range Statements, Assessment Criteria, Performance indicators and Phase Organisers for the phases in the GET band (DoE, 1997). This meant a highly abstract set of ideas as teachers' and learners' command of English was crucial in understanding all the jargon associated with the curriculum.

In conclusion, ‘what should’ be had undermined the ‘what is’, in other words, the grand idea of the intended curriculum undermined the implemented curriculum.

2.6.1.2 The Revised National Curriculum Statement (RNCS)

The RNCS emanated from a recommendation of the Review Committee that C2005 should be strengthened by streamlining its design features, simplifying its language, aligning curriculum theory and practice in assessment, and improving teachers’ training (DoE, 2000). After much debate, reflection and criticism, RNCS for the GET band and NCS for the FET band were developed (Hendricks, 2010). RNCS, on the one hand, changed terminology (such as Learning Outcomes and Assessment Standards), and on the other hand, introduced new concepts such as tools for teachers to construct the curriculum. Learning Outcomes (LOs) and Assessment Standards (ASs) are two distinct features that describe the goals and outcomes that each learner needs to achieve for progression and promotion (DoE, 2002). Each LO describes the skills, knowledge, values and attitudes (SKVAs) that learners should achieve; whereas each Assessment Standard describes the minimum achievement of these SKVAs (DoE, 2002). ASs have been debated and questioned in terms of what learners should be learning and tested on. However, teachers were again left to interpret Learning Outcomes (LOs), Assessment Standards (ASs) and mathematical concepts on their own. Because RNCS emanates from C2005, OBE was its driving force as well (Lubisi, Parker & Wedekind, 1998, cited in Hendricks, 2010).

The report of the Task Team in charge of reviewing the implementation of the NCS (2009) states that there was lack of content specification and content clarification in the RNCS of the GET band (DoE, 2010). Teachers were left on their own to interpret LOs, ASs and concepts. The varied interpretations and ways of understanding the policy specifics differed from school to school, even between teachers teaching the same subject in the same school (Hendricks, 2010). It was against this background, and with such variations and disparities among schools that led to the failure of the implementation of RNCS.

The Review Committee also revealed that there were numerous policy documents developed in order to guide teachers on specificity and to provide support on what to teach and assess, as well as how to teach and assess. Different phases within the same band had different policy documents, which led to a lot of confusion amongst educators because they varied in terms of content, sequencing and pacing. Language was another aspect that was complex and ambiguous, which resulted in a high level of confusion amongst teachers. According to Chisholm et al. (2005), the planning of lesson plans was quite problematic. Teachers were expected to develop their own learning programme, work schedule, and lesson plans, which limited their teaching time. This aspect of planning confused the roles of teachers, subject advisors and provincial curriculum developers in terms of who was supposed to do what. Most PDE officials and districts officials developed their own policy documents and guidelines to provide additional information. The Review Task Team further found that there was no adequate training, support, or guidance provided by the subject advisors.

2.6.1.3 Curriculum and Assessment Policy Statement (CAPS)

CAPS is not a new curriculum, but rather an amendment to the NCS, as noted by Ndlovu and Mji (2012), and Coetzee (2013), amongst others. CAPS is said to be the re-packaged NCS, which has been made more accessible to teachers, and which gives details regarding each subject in each grade regarding what content to teach and what to assess (Coetzee, 2013; du Plessis, 2013; DBE, 2011). According to the DBE (2011), the ongoing implementation challenges in the RNCS resulted in the development of CAPS. Additionally, CAPS should be read and implemented with the National Policy Pertaining to Programme and Promotion Requirements (NPPPR) and the National Protocol on Assessment (NPA) documents. These two documents will be embroidered on further in this chapter.

The rationale for the implementation of CAPS, as outlined by the Task Team in 2009, addressed four main concerns, namely: (1) Complaints about the implementation of the NCS, (2) T teachers who were overburdened with administrative duties, (3) Different interpretations of curriculum requirements, and (4) The underperformance of learners (du Plessis, 2013).

Moreover, learning areas are now known as subjects. In mathematics for the Senior Phase (Grades 7 to 9), there is too much content, which is combined with reduced time allocation. In the NCS, the time allocated for mathematics for Grades 7 to 9 was five hours of contact time, however, this has been reduced to four and a half hours in CAPS (DBE, 2012; Mouton et al., 2011). A conspicuous feature is that there is 'linear progression', which means that certain topics and concepts must have been dealt with in previous grades before teachers can teach new concepts in the present grade. This approach suggests that sequencing and pacing poses a threat in the classroom should learners not have been taught those concepts in previous grades. It also means that the teacher has to teach the specific content that was supposed to have been taught previously in order to proceed with what has been prescribed for that particular lesson, or week allocated to that content.

Previously in the mathematics NCS curriculum for the FET band, Geometry was optional, and as such was treated as Paper 3 of the NSC examination, which was not awarded any point in the APS system of universities. This point is raised here because it affects the Senior Phase mathematics curriculum. There is evidence (Long et al., 2014; Usiskin, 2012) that suggests that this section of mathematics was not taught at all, or if taught, then not in depth in the Senior Phase as most learners would not take Geometry as an additional subject in the FET band. Usiskin (2012) recounts that teachers experienced challenges in the teaching of geometry in the Senior Phase. Currently, geometry is a compulsory component of mathematics in the FET band, and as such, learners in the Senior Phase are introduced to the content area Space and Shape in order to prepare them for the FET band.

Table 2.3 Changes in the mathematics curriculum from NCS to CAPS

	NCS (R-9)	NCS (R-12)
Design features	Limited Content clarification was provided. Learning programmes and Work Schedules were developed by individual schools.	Content Specification (which resembles a learning programme) and Content Clarification (which resembles a work schedule and also provides clarity on topics, with examples, as well as teaching guidelines) have been built into CAPS.
	Assessment guidelines were general in nature and separate from NCS.	Assessment 'guidelines' with cognitive levels, forms of assessment and assessment tasks have been built into CAPS. The cognitive levels for mathematics comprise 4 levels: Level 1 (knowledge – 25%), Level 2 (routine procedures – 45%), Level 3 (complex procedures – 20%), and Level 4 (problem solving – 10%). These are provided in the CAPS document with level descriptors and examples.
Weighting per Content Area	Not well articulated for Grade 8. The Learning Programme Guideline (p. 21) indicated weightings for Grade 7 and Grade 9, but not for Grade 8.	Well-articulated per grade, the weighting per Content Area is stipulated per grade and time allocation per Content Area is based on this.
		Emphasis on Content Area 2 and Content Area 3 in terms of weighting in the Senior Phase – these two Content areas are of the utmost importance in

	NCS (R-9)	NCS (R-12)
		the FET band.
Teaching time allocation	Approximately 4.77 hrs for Grade 7 and 4.95 hrs for Grades 8 and 9 (18% of 26.5 and 27.5 hours respectively).	4.5 hours for all grades in the Senior Phase.
Content	Global graphs not specified in the curriculum.	Global graphs introduced in CAPS from Grade 7 to enhance the teaching of the straight line graph in Grade 9.
	General reference made to 2D shapes, e.g. triangles and all quadrilaterals (teachers and textbook writers used their discretion).	2D shapes specified, e.g. equilateral, isosceles and right-angled triangles (see p. 27 of CAPS document). Each grade now knows which 2D shapes to explore.
	In transformations, scale factor was not evident.	In transformations, scale factor is explicit in Grade 9 (see p. 147 of CAPS document).
	Algebraic expressions not dealt with in Grade 7.	The "introduction to formal algebraic language is new in the Senior Phase" (CAPS, p. 63).

(Source: Department of Basic Education, 2013)

In Grade 7, distinguishing the characteristics of specified triangles and quadrilaterals are given, as well as the different parts of a circle. In Grade 8, the properties of triangles and quadrilaterals that learners should know are given (p. 96). Also, the general properties of congruent and similar triangles are explained (p. 97). In addition to what is done in Grade 8, the conditions for congruent triangles are investigated in Grade 9 (p.

136). Additional properties of quadrilaterals are also introduced, such as diagonals that bisect each other, some at right angles.

The amount of time allocated to Space and Shape (geometry) topics in Grade 7 is 40 hours - 22 hours in Term 1 and 18 hours in Term 3. This distribution allows learners to do Space and Shape for a second time. The number of hours allocated to Space and Shape (geometry) topics corresponds with the weighting of this content area (p. 11) in terms of teaching and assessment – 40 hours are allocated for teaching and learning and five hours for revision and assessment over the two terms.

Content Specification provides conceptual progression from Grade 7 to 9, while Content Clarification provides pacing per term and clarifies (with examples and, in certain instances, examples of possible misconceptions) the concepts in the Content Specification.

2.6.2 Assessment policy

South Africa transformed its education system immediately after the demise of Apartheid. At the heart of this transformation is assessment policy and assessment practices. An assessment policy is a crucial instrument to regulate learner movement through the system (Muller, 2004), and also to measure how effective and efficient the education system of any country can be (Chisholm, 2004).

The first assessment policy titled “Assessment Policy in the General Education and Training band, Grades R-9, and ABET” was introduced and implemented in line with C2005 (Motala, 2003; Vally, 2003). The rationale for implementing the new assessment policy was to move away from the traditional process of an assessment system that judged learners mainly through end-of-year examinations (Vally, 2003). Chisholm and Petersen (2003) argue that the assessment policy attempts to bring assessment in line with the philosophy and practice of the National Qualifications Framework (NQF) and OBE, which aims to encourage lifelong learning. The new intended assessment policy was said to be more diagnostic and developmental rather than judgemental, and was intended to enable teachers to detect learners’ challenges at early stages.

A combination of formative assessment (FA), summative assessment (SA) and Continuous Assessment (CASS) are advocated to adequately support the learner developmentally and to allow for feedback to monitor the strengths and weaknesses of learner performance. Motala (2003) maintains that CASS is viewed as the best model to assess processes and outcomes of learning throughout. CASS includes written and practical tests, essays, projects, investigations, and assignments, amongst others, and focuses on comprehension, problem-solving and analytical skills (DoE, 2002; Chisholm & Petersen, 2003; Motala, 2003; Motala & Tikly, 2003).

Training on assessment practices did not form a key element in the training of teachers during the implementation of C2005 (Fleisch, 2002). Moreover, assessment training was extremely weak and created lot of confusion (Maphalala, 2006). The assumption was that teachers knew what constituted levels of performance, but there was no common or shared understanding of knowledge amongst teachers. During the implementation of the RNCS, the Task Team of 2009 revealed that the assessment standards were too generic and unclear in terms of what is to be assessed and how it should be assessed (DBE, 2009). Fleisch (2002) and the Task Team (DBE, 2009) concluded in their findings that this practice led to variation, confusion and inconsistent assessment practices between schools, districts and provinces. The assessment policy outlined the requirements and guidelines to plan and conduct assessments at school level, however, there were no clear guidelines.

In C2005 and the RNCS, there was neither content specification nor content clarity in their curriculum documents; it was thus difficult for teachers to align curriculum and assessment in their teaching practice. The lack of clarity and common understanding around content led to provincial and district subject advisors interpreting the policy differently and sending conflicting messages to schools (DBE, 2009). The Task Team further reports that as there were no clear guidelines, provincial and district officials also appear to have taken a highly bureaucratic approach to assessment as a checklist rather than a process of checking the quality of assessment procedures.

Complexities around the administration of assessment were also an obstacle in implementing the assessment policy (Fleisch, 2002; Chisholm, 2003). Teachers need support to improve assessment in schools, specifically from the principal, and Head of mathematics department, whose task it is to support and guide teachers to improve their assessment competencies.

The disparities in weighting that existed across the school system were evident. What was more problematic was the “age cohort” principle within the assessment policy, which stipulated that no learner should remain in a phase for four years except for special or unusual circumstances (Government Notice 2432, 2008).

What is not clear is what these circumstances exactly comprise. This policy becomes open to multiple interpretations and variations as it became a ‘professional judgement’ policy. There were no guidelines regarding under what circumstances a learner should be retained for more than four years in the phase. The principle further suggested that if the learner did not meet the minimum requirements to be promoted to the next phase, the learner would be ‘pushed’ through. The minimum requirement in the Senior Phase, particularly in Grade 9, is the pass requirement of Level 3 in mathematics. What this means is that if a learner did not achieve Level 3 in mathematics, they can still progress to the FET band regarded.

2.7 SUMMARY

The purpose of this chapter was to present literature that is relevant in answering the research questions presented in this study. The main research question of the study is what evidence is there in teachers’ classroom assessment practices that points to possible variation in the quality of SBA. Mathematics education in the South African context was discussed in detail, and a review was carried out of literature on different types of assessment and SBA. There was a specific focus on Grade 9 mathematics, while the background and context of the implementation of curricula and SBA were also provided. The literature was further reviewed regarding curricula policies pertaining to SBA. The background of assessment change in South Africa, its implications, and challenges for mathematics teachers were touched on as these have an impact on the

current curriculum changes that are being made. A discussion of what constitutes quality SBA tasks was also brought to the fore. The implementation of mathematics education and the curricula and assessment policies by teachers in schools has proved to be problematic, however, the changes in these imply changes to teaching and assessment practices. This chapter further showed how each of these problems were dealt with by making revisions to existing policies. Chapter 3 presents an in-depth discussion of all the conceptual framework chosen for this study, as well as all related factors.

CHAPTER 3 CONCEPTUAL FRAMEWORK

3.1 INTRODUCTION

Each time researchers are confronted with the concept of 'quality in education', there is uncertainty about what the term 'quality' means because it is difficult to define (Spaull, 2013; Scheerens, Glas & Thomas, 2007). According to Chua (2004, as cited in Arjomandi, Kestell & Grimshaw, 2009), the word 'quality' lacks definition because the term has different meanings for different stakeholders. Scheerens, Luyten and van Ravens (2012) further conclude that the notion of quality is not without internal tension. Despite the concept 'quality' meaning different things to different stakeholders (for instance, researchers, policymakers, educators and parents), it is important to define 'quality' in the context of education. Some people place emphasis on the unquantifiable outcomes of education (for example, political participation), alternatively, some people place emphasis on the cognitive skills acquired at school, especially in numeracy and literacy (Spaull. 2013).

Scheerens et al. (2012) believe that there is no accepted definition of the term 'quality'. The United Nations Children's Fund (UNICEF) (2000) disputes this notion and brings to the fore the agreed definition of quality in education. According to UNICEF, quality education includes:

- Learners who are healthy, well-nourished and ready to participate and learn, and are supported in learning by their families and communities;
- Environments that are healthy, safe, protective and gender-sensitive, and provide adequate resources and facilities;
- Content that is reflected in relevant curricula and materials for the acquisition of basic skills, especially in the areas of literacy, numeracy and skills for life, and knowledge in areas such as gender, health, nutrition, HIV/AIDS prevention and peace;

- Processes through which trained teachers use child-centred teaching approaches in well-managed classrooms and schools, as well as skilful assessment to facilitate learning and reduce disparities;
- Outcomes that encompass knowledge, skills and attitudes, and are linked to national goals for education and positive participation in society (Adapted from UNICEF, 2000).

This definition allows for an understanding of education as a complex system embedded in a political, cultural and economic context. This definition also takes into account the global and international influences that propel the discussion of educational quality (Motala, 2000; Pipho, 2000 in UNICEF, 2000), while ensuring that national and local educational contexts contribute to definitions of quality in varying countries (Adams, 1993).

The conceptual framework for this study guided the analysis, processing and interpretation of the outcomes. For the purposes of the current study, a decision was made to make adaptations to the original integrated model of school effectiveness, as proposed by Scheerens (2000). Against this background, in Chapter 3, the Input-Process-Output (IPO) framework was chosen and used to describe and categorise the IPO indicators. Section 3.2 begins with a review of Scheerens' integrated model of school effectiveness, and follows with Section 3.3, which elaborates on the conceptual framework of the current study, and a discussion of the various types of indicators that were generated from it. Key IPO variables relating to the quality of School-Based Assessment (SBA) are also touched on, and for each variable, a clear description is provided. A summary of this chapter is found in Section 3.4.

3.2 SCHEERENS' CONCEPTUAL FRAMEWORK

Perspectives on education quality can be clarified on the basis of a conceptual framework that describes education and guides the direction of the study (Scheerens et al., 2011). Scheerens bases this viewpoint on the school of thought that focuses on school effectiveness and school improvement. This view posits a direct link between educational processes and learner achievement (Creemers & Reezigt, 1997).

Scheerens (1990; 2004) introduces the input-process-output framework in terms of education as a basis for defining quality, as well as to categorise measures of quality in education. This framework is used to clarify a broad range of interpretations regarding quality. Scheerens, Glas and Thomas (2007) posit that this model is used as a framework to indicate educational content and generate key objectives in the area of education.

In some research, the quality of education is interpreted in terms of the input-process-output-context framework (Chua, 2004, cited in Arjomandi, Kestell & Grimshaw, 2009). Scheerens' Input-Process-Output-Context (IPOC) framework is quite general and flexible in describing the functioning of education. IPOC is a descriptive conceptual framework that is used to categorise a range of interpretations of educational quality, and has to be looked at more in terms of its valuing of policies aimed at quality enhancement in education (Scheerens, 2004). Scheerens (2004) further clarifies that this framework allows for a broad range of interpretations regarding quality, namely: productivity; effectiveness; equity; and responsiveness.

In Figure 3.1 below, the education system is depicted as a 'black box' or 'central box' where the transformation of policies takes place. This is differentiated into schools and the teaching level (Black & Wiliam, 1998a; Black & Wiliam, 2004; Scheerens et al., 2011). Several levels in the 'black box' or 'central box' are distinguished, for instance, the national education system, the school level and the level group where teaching and learning at school takes place, as well as the classroom level. Scheerens (2014) and Black & Wiliam (1998a) posit that the school and/or the classroom is seen as the 'black box' within which processes take place to transform inputs into outputs. Scheerens (2014) and Scheerens et al. (2011) argue that the inclusion of contexts and constraints as generators of the required outputs that should be produced completes the model.

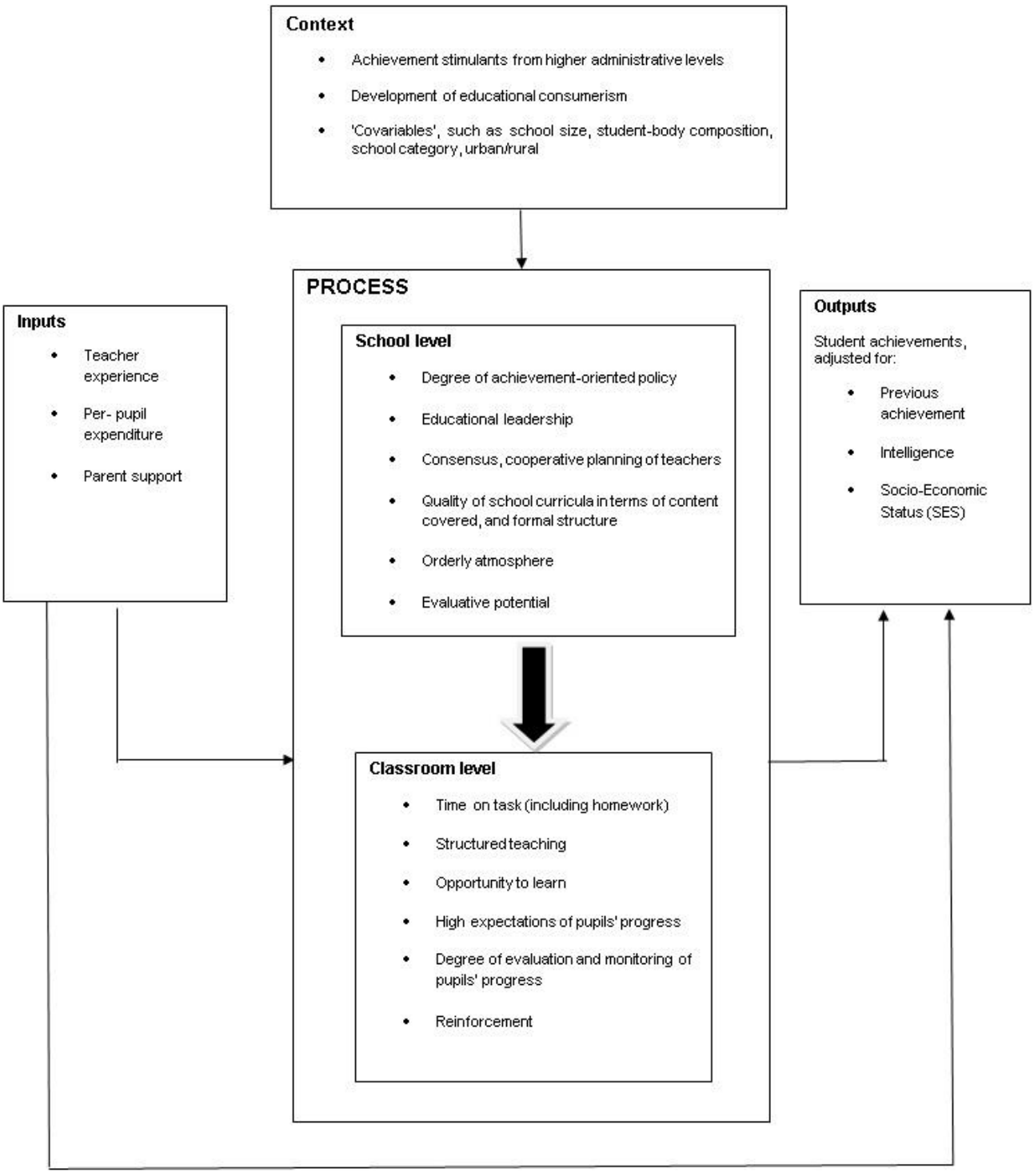

Figure 3.1 An integrated model of school effectiveness (Scheerens, 1990, 2004)

3.3 CONCEPTUAL FRAMEWORK OF THIS STUDY

Rowe (2013) explains that the quality of school education has become a high priority issue in OECD countries, an organisation of which South Africa is a member state. As discussed in the introduction of this chapter, there is no accepted definition of the term 'quality' without internal tensions being present. The Input-Process-Output model became relevant in this study as this model includes different interpretations of quality, different anchoring points, and it offers a broad set of indicators (Scheerens, Luyt & van Ravens, 2011). This model is a viable approach to defining and quantifying educational quality according to which quality is seen as a productive process in which inputs are transformed into outcomes, keeping in mind the contextual dimension (Scheerens et al., 2011, p. 146).

The Input-Process-Output framework is seen as the most useful 'meta-framework' in comparing different perspectives on educational quality (Scheerens et al., 2011, p. 3).

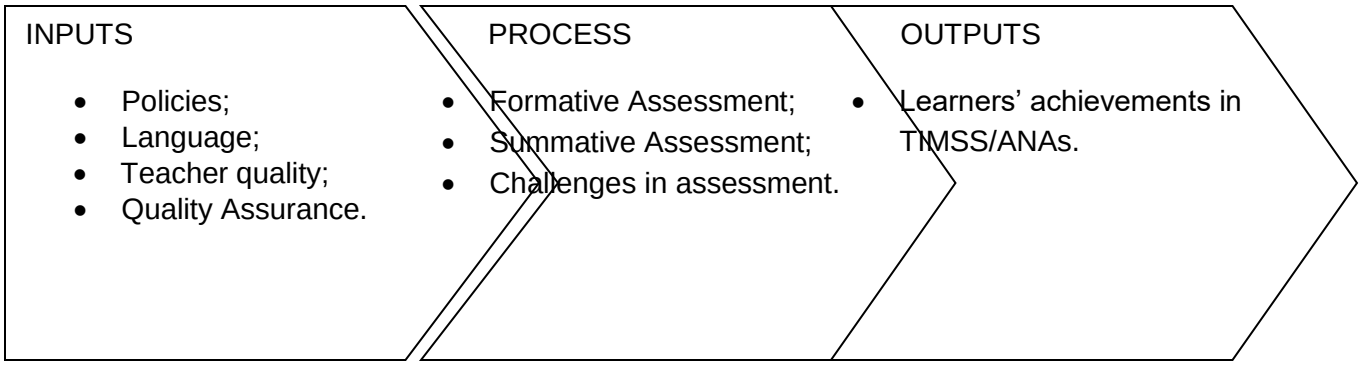

Figure 3.2 The input-process-output framework, which shows the interrelatedness of variables (Adapted from Shavelson et al., 1987)

The interrelatedness of the context, input and process works together to find the combination that provides the best results (outputs). Creemers and Scheerens (1994) make a clear distinction between the different elements of input-process-output-context in education. These distinctions, as well as their variables, are discussed briefly in this section.

3.3.1 Input as conceptualised for this Study

Inputs are independent variables that are 'outside' and 'fed' into the classroom, and come with their own demands (Black & Wiliam, 1998a; Creemers & Scheerens, 1994; Scheerens, 1990; Sadler, 2012; Chua, 2004, cited in Arjomandi et al., 2009), such as assessments creating pressure to score highly. This component includes a range of factors that directly influence and shape the teaching and learning process (UNESCO, 2012).

One of these factors is that the South African education system is still providing inadequate and ambiguous details regarding the construction and administration of SBA tasks (Poliah, 2010). Additionally, there are no clear guidelines in assessment and curricula policies in terms of what constitutes quality and standardised SBA tasks. There is also evidence that suggests that policies are not interpreted in a uniform manner, and teaching practice is often times open to variance in terms of the quality of SBA (Maile, 2013).

Moreover, policies and assessment are in conflict with each other as more emphasis is placed on assessment than on the teaching and learning of mathematics. In the past, Outcomes-Based Education (OBE) and the Common Task Assessment (CTA) in Grade 9 were introduced to provide a new way of teaching, learning and assessing in mathematics (DoE, 2002; AMESA, 2011; Govender, 2013). However, there were serious challenges in the way in which Grade 9 mathematics was assessed. The CTA did not effectively assess what learners needed to know for the FET band, and was subsequently abolished in 2010 (Review Committee, 2010; DBE, 2010; Govender, 2013).

The assessment policy, in particular, places varying demands on the school system. The school system, which comprises the GET and FET bands, also has different SBA weightings, which is problematic. Moreover, the varying demands across the schooling system in terms of the weighting of the examinations versus the SBA persist.

For the purposes of this study, the following input variables were directly related to the quality of School-Based Assessment in Grade 9 mathematics:

- Policies;
- Access to the language used at school;
- Teacher quality;
- Teacher content knowledge;
- Quality assurance; and
- Policies as a variable.

Language as a variable

Mathematical language and register should be appropriately developed and used at the level of the learners. Contentious issues such as race, culture, provincial and regional bias in multilingual classrooms should also be addressed (Setati & Adler, 2000). Learners whose primary language is not the same as the Language of Learning and Teaching (LoLT) should be catered to so as to produce unbiased and fair SBA tasks. This is important as learners whose LoLT is different from the primary language experience more challenges in the classroom.

Teacher *quality as an input variable*

In developed countries, variables such as mathematics teacher qualifications and experience do not appear to make a great difference (Scheerens, 2013). In developing countries, such as South Africa, such variables appear to be more often of significant impact. Well qualified mathematics teachers are expected to develop mathematics SBA tasks that are of high quality and are reliable, valid and fair. Mathematics teachers should possess a higher qualification than a diploma or Bachelor's degree in mathematics in order to teach the subject. Studies by Goldhaber & Brawer (1997, 2000, as cited in Scheerens, 2013) and TIMSS (1999, 2002, 2007 and 2011) reveal that well qualified mathematics teachers produce better results than those who do not hold a formal qualification in mathematics. Well qualified mathematics teachers should be evenly spread across all areas of the country in order to close the gaps in mathematics

education. This is not so easily achieved as Howie (2002) and Chisholm (2000) posit that rural schools are unable to attract well qualified mathematics e teachers.

Mathematics teachers' attitudes, teaching experience in mathematics, beliefs and confidence should be developed to ensure quality teaching in mathematics. Scheerens (1991) argues that teacher attitude is an important variable that corresponds with the high expectations of learners.

Spaull and Venkat (2014), and Poliah (2010), amongst others, maintain that mathematics teachers should be exposed to effective in-service training workshops, courses, seminars and cluster workshops, and should be trained in assessment in order to understand the development of effective assessment procedures.

Teacher *content knowledge as a variable*

Scheerens (2013) explains that Subject Matter Knowledge (SMK), also known as Subject Content Knowledge, is seen as a basic requirement for mathematics education and should be addressed in initial educator training programmes. Scheerens (2013) further finds that Pedagogical Content Knowledge (PCK) has a stronger effect than the mastery of SMK on its own. According to Shulman (1986), PCK is about the selection of mathematics topics (which includes an understanding of what makes the learning of specific topics easy or difficult), the selection of effective teaching strategies, examples, explanations, analogies, illustrations, and presentations. A mathematics teacher who possesses PCK should possess knowledge of the different forms of assessment in mathematics, such as investigations, tests, practical work, and assignments (Poliah, 2010). Why some educators are more effective than others reflects on their mastery of both SMK and PCK. Scheerens (2013) explains that if a mathematics teacher possesses both SMK and PCK, their learners' mathematics results are promising.

In South Africa, these variables appear to more often have a significant impact. The existing body of knowledge suggests that a large proportion of South Africa's mathematics teachers have content knowledge in mathematics that is below basic due to poor training during the Apartheid era, as well as the ineffectiveness of in-service

training initiatives (Spaull, 2013; Chisholm, 2002). At one point, Minister Pandor, South Africa's minister of Science and Technology, reiterated the fact that South African mathematics and science teachers "do not possess desirable levels of mathematics content knowledge" (Spaull, 2013, p. 25). Spaull and Venkat (2014) argue that a lack of Content Knowledge (CK) is a major impediment to learning. Scheerens (2013) posits that the reason why some teachers are more effective than others is due to their mastery of Subject Content Knowledge (SMK) and Pedagogic Content Knowledge (PCK). Shulman (1986) refers to PCK in terms of knowledge on the appropriate use of resources, as well as strategic knowledge of the application of teaching strategies. Although PCK has been identified as an important factor in terms of the impact that teachers may have on improving poor performance in mathematics, SMK is seen as a basic requirement (Makgato & Mji, 2006; Shulman, 1986; Scheerens, 2013). Variance in PCK, teaching quality, and assessment strategies illuminate the impact of disparities among different schools (Makgato & Mji, 2006). Simply put, teacher quality has an impact on learner achievement.

3.3.1.1 Quality assurance as a variable

Scheerens (2013) argues that the monitoring of assessments could be seen as a broader performance lever. Monitoring may include various types of school-based evaluations such as school-based review, school performance feedback, or school aggregate measures of formative assessment at classroom level. Monitoring leads to the moderation of such school-based evaluations, which in turn leads to the quality assurance of school- and classroom- based assessments. The processes of monitoring, moderation and feedback can be seen as a process of improvement at these levels.

Moderation ensures that all cognitive levels (Levels 1 to 4 in mathematics) are covered, and establishes teachers' confidence in SBA (Maxwell, 2006). A further advantage is that poor performance in mathematics could be detected earlier and support given in critical areas. Govender (2013) argues that many mathematics teachers only cover Levels 1 and 2 in their SBA tasks, this is supported by Polia (2010). Poliah (2010) further makes the claim that in many schools in South Africa, the moderation of SBA is non-existent. Govender (2013) reports that many learners in the GET band are

promoted or progressed without proper moderation through SBA. According to the DBE's progression and promotion requirements (DBE, 2012), learners must pass mathematics in Grade 9 in order to be promoted to the next phase, or progressed to the next grade in the same phase. There is a body of evidence that suggests that many learners are progressed or promoted without having passed Grade 9 mathematics due to a lack of proper moderation and quality assurance.

3.3.2 Process as conceptualised for this study

Process indicators have the function of offering hypothetical explanations for why certain schools or school systems perform better than others (Scheerens, 1991). Process is important in monitoring substantive efforts to reform schools and in helping to explain learner output, such as achievement in mathematics (Bechunan & Scheerens, 2011). Process indicators generally refer to the characteristics of education systems that can be manipulated in order to shed some light on what happens "inside the black box" of the schooling system (Scheerens, 1991, 2004; Creemers & Scheerens, 1994; Black & Wiliam, 1998a). Black and Wiliam (1998, p.1) refer to the "black box" as the classroom where the transformation of inputs into outputs is studied (Scheerens, 2011). According to Scheerens (2013), several levels of the "black box" exist and are classified as the national education system, the school level, and the classroom level. Processes comprise all the variables that define procedures, strategies or techniques that take place in the classroom in the form of teaching and learning, and determining the transition of inputs into outputs (Chua, 2004; Scheerens, 2013). Scheerens (1991) explicates that process indicators offer an explanation for certain schools or school systems performing better than others. Process variables include all structures and activities that translate the inputs relating to SBA into valid and reliable outputs (Poliah, 2010). It may thus be perceived that classroom interaction is a vital input variable, which is supported by Barr and Dreeben (as cited in Oakes, 1989), who find that classroom interactions are at the heart of the educational enterprise.

In formative assessment (FA) and summative assessment (SA), verification of what learners have learnt, the identification of strengths and weaknesses in content and skills that can be mastered, giving feedback and diagnosis of outcome patterns, providing

systematic consideration of remedial strategies, and the setting of concrete goals for learners' improvements are to be implemented at classroom and school level (Scheerens, 2013).

Assessment is embedded in the curriculum and forms an integral component of learning and teaching. "Assessment is of the essence in mathematics education, both formatively and summatively" (UNESCO, 2013. p. 23). Different forms and types of assessment should thus be used to determine learner achievement (Isman, 2011).

It is in this context that the following sub-themes are discussed in this section: formative assessment and summative assessment.

Formative Assessment

Formative assessment has always been part of teachers' work, however, this is carried out less systematically than required (Harlen & James, 1997). The role of teachers in the new assessment system is crucial.

Bennette (2011) makes the claim that the definition of formative assessment is so flexible and dynamic that it renders conducting it harder to do in practice. (FA) is known by different terms, such as classroom assessment, school-based assessment, and Assessment for Learning (AFL). Kahl (2005), for instance, defines formative assessment as, "A tool that teachers use to measure students' grasp of specific topics and skills they are teaching" (p. 11).

Looney (2005, p. 21, cited in Black & Wiliam, 2012) further views formative assessment, "As frequent, interactive assessments of students' progress and understanding to identify learning needs and adjust teaching appropriately". This is further supported by Bennet (2011), who explains that, "Formative assessment is a process used by teachers and learners during instruction that provides feedback to adjust ongoing teaching and learning to improve learner achievements of intended instructional outcomes" (Bennett, 2011, p.6).

Bennette (2011) continues by indicating that the lack of clarity in the definition of formative assessment is brought about by the information gathered from such assessment, as well as confusion regarding what to do with such information. There is a general consensus amongst researchers and assessment experts that the general practices of formative assessment can facilitate learning (Black & Wiliam, 2006; Bennette, 2010; Bennette, 2011; Stiggins, 2007; James, 2007; Bennette & Gitomer, 2009). These authors further posit that the purpose of formative assessment is to provide feedback on teaching and learning. It is of critical importance for teachers to understand what the purpose of feedback is in teaching and learning. If feedback is used to inform learning, then formative assessment is known as Assessment for Learning (AfL). For the purpose of this study, formative assessment (FA) and assessment for learning (AfL) will be used interchangeably, as the relevant literature dictates.

In terms of the conceptual model used in this study, teaching, learning and assessment takes place in the classroom ("inside the black box"). What happens in the classroom therefore makes a difference. Individual teachers conduct day-to-day informal and formal assessments, such as class work, which may be expanded to homework; tests; assignments; projects; investigations; and discussions as part of teaching and learning (Black & Wiliam, 2005; DBE, 2013). More forms of assessment in mathematics may be completed over a period of days or weeks (investigations, projects and assignments) to allow for the formative assessment of knowledge and skill integration, collaboration, and other competencies that may not be possible to measure through tests or examinations. Stiggins (2007), however, warns that overwhelming learners with more frequent testing could cause some learners to give up hope of succeeding in mathematics. Formative assessment should therefore not be treated as a test, but rather as a process to improve and promote teaching and learning (Bennette, 2011; Bennette & Gitomer, 2009).

Quality in assessment improves teaching and learning, as well as learner performance. This is supported by Stiggins (2002), whose Theory of Assessment for Learning posits

that teachers use classroom-based assessment processes and the continuous flow of information about learner achievement to advance learners' progress (Maxwell, 2006).

Feedback is a powerful tool, and should be informative and involve learners in classroom assessments as crucial teaching decisions rely on feedback (Maree, 2004; Stiggins 2007, Black & Wiliam, 2006, James, 2006). Teachers need to provide constructive feedback to learners in order to adjust their teaching strategies and methodologies accordingly (Black & Wiliam, 2006; Clark, 2011). When feedback is judgemental, according to James (2006), this encourages interest in performance rather than in learning.

Diagnostic assessment forms part of FA (Bennette & Gitomer, 2009; Maree, 2004; Black & Wiliam, 2006) and ensures that it helps the mathematics teacher to identify specific problem areas in mathematics. This could also possibly allow the teacher to uncover learners' mathematical misconceptions or errors, which provides an opportunity for teachers to clarify concepts for their learners. As an example of what fractions are used for, learners may add two fractions right away even when the denominators of the two fractions are not the same. In some instances, through the interference of a primary language, learners may not know what to do when asked to 'solve for', 'simplify' or 'factorise'. The feedback provided is used to apply remedial programmes to clarify and resolve mathematical problems; learners are helped to reconstruct their learning in a conceptual way. The early identification of learner problems in mathematics is crucial (Maree, 2004) as learners who struggle with certain aspects of mathematical concepts would be assisted through remedial actions.

Different stakeholders benefit from Assessment for Learning (AfL) in the following ways:

- Learners become more confident as they succeed and take responsibility for their own learning;
- Teachers see learners become more motivated to learn, their instructional decisions are then based on the feedback received;

- Parents see higher achievement and greater enthusiasm for learning in their children; and
- Schools and the state benefit when they see the reality of meeting accountability standards.

Summative Assessments

Summative assessments are high stakes assessments that provide a summary of achievements at specific points, such as at the end of the term or year. It is a measurement of success at the end of the unit, programme, year's study and term (Isaacs et al., 2013). However, the disadvantages of SA are that they cannot inform day-to-day instructional decisions, cannot provide immediate feedback, and cannot diagnose challenges in learning as in the case of formative assessment (Stiggins, 2007; Black & Wiliam, 2013). The main purpose of SA is to judge what the learner has achieved at the end of the term or year, and to document or record what the learner knows and can do (Bennette, 2011; Bennett & Gitomer, 2009; Black & Wiliam, 2006). The information gathered shows how much learners have learnt, whether standards are being met, and whether teachers and schools have achieved as expected. This information is provided to all stakeholders such as the public, parents, learners, teachers, and the Department of Education. Schools may thereafter be rewarded or punished, or categorised as performing or non-performing schools based on these assessment results. Put differently, SA is used for recording and reporting what has been learned, hence it is also known as Assessment of Learning (AoL). AoL is "a formal process of and can include teacher judgement as well as testing" (Isaacs et al., 2013, p. 12). It is also criterion-referenced as the teacher applies the same criteria to assess all of the learners to compare these learners based on their achievements.

In the South African context, there are no high-stakes assessments for grades below Grade 12. Summative assessments in the GET band are set and marked internally by the subject teacher as per policy requirement (DBE, 2013, p. 12). For Grade 9 mathematics, learners are expected to write these internal examinations twice a year, one per semester. The scores are used for progression in Grade 7 and 8, and

progression in Grade 9). The policy requires that a Grade 9 learner should obtain a minimum of level 3 (between 40%-49%) in mathematics in order to be progressed to the FET band (DoE, 2002; DBE, 2012). This system is problematic as teachers teach to the test and resort to rote learning and drilling mathematics concepts. Research (DoE, 2001; Fleisch, 2008) suggests that learners who undergo this type of teaching end up taking mathematics not knowing the basic concepts and struggle in the FET band.

3.3.3 Output as conceptualised for this study

Output and outcome indicators have a central place in the education quality debate. Scheerens (2004) makes a distinction between output and outcome indicators. Scheerens (2011, p.37) further states that output indicators "are central to productivity and effectiveness interpretations of education quality, but also play an indispensable role in assessing the equity, effectiveness and responsiveness of schooling", and output indicators are "seen as the more direct outcomes of schooling and most likely to be measured by a means of a form of learner assessment, such as standardised achievement tests." Black and Wiliam (2001) believe that when outputs are mentioned, it means that learners who have the correct knowledge should be able to attain better scores. Poliah (2010) further explains that outputs are short-term goals and outcomes are long-term goals. In this study, while the desired output is that assessment results are reliable, valid, credible, and fair, the desired outcome results would be improved learner performance, which is the ultimate goal of education. Scheerens (2013) argues that to enhance learner performance, there should be a good match between what is tested or assessed and the content that is actually taught. However, Poliah (2010) suggests that schools' and teachers' focus has been on the output, that is, the final SBA mark.

The final results of the SBA, which results in scores being awarded to each learner, should be valid, reliable, credible, fair, and enjoy public confidence (Poliah, 2010). This is vital as inflated SBA marks gives learners and their parents a false sense of achievement in Grade 9 mathematics, which has serious implications for future endeavours.

According to the National Planning Commission Diagnostic Report (2011), it is estimated that approximately 80% of South Africa's schools are underperforming academically. Not only in South Africa, but around the globe there is major concern over the poor performance of learners in mathematics (Gitaari, Nyaga, Muthaa & Reche, 2013; Siyepu, 2013). South Africa's situation is unique as the poor achievement and low performance in mathematics are due to the legacy of Apartheid (Kanjee, 2006). During Apartheid, the South African education system was racially segregated into 18 education departments. Today, there is one education department, however, there are still variations in terms of performance between learners from these former education departments. Wallace (2013) finds that South Africa has an unequal education system with two streams of learners, namely: Learners in typical, well-resourced and affluent schools, better known as ex-Model C schools; and learners in under-resourced, over-crowded classrooms and rural schools, better known as township schools.

Both Kanjee (2006) and van der Berg (2008) agree that performance in mathematics is stratified along class and racial lines. According to van der Berg (2008), there is evidence that the variance in performance between schools is extremely high in South Africa due to the legacy of Apartheid, for instance, Brazil's achievement levels have narrowed faster than in South Africa. Brazil is compared to South Africa because both of these countries have similar income inequality levels (van der Berg, 2008). It has been shown that learners' performance is better in the previously resourced and affluent schools than in historically disadvantaged schools. Studies (HSRC, 2011; Spaull, 2013) show that in international assessments such as TIMSS, there is no significant improvement in mathematics in the historically disadvantaged schools.

Spaull and Venkat (2014) argue that an extensive body of assessment data points to learners' poor performance in mathematics across all levels of the schooling system in South Africa. In this regard, Spaull (2014) warns that the ANAs cannot be used to measure achievements. A key indicator of the performance of the schooling system in South Africa is the achievement of learners in Grade 12 (Poliah, 2014). Although the current study focuses on Grade 9 mathematics, a closer look at Grade 12 mathematics achievement and performance could contextualise the problem even further. Grade 12

mathematics achievement is good in illustrating problems because Grade 12 results provide evidence of performance at the national, provincial, district, and school level (Poliah, 2014). In relation to this, there has been a high failure rate in mathematics in Grade 12 recently as in 2010, there was a decline in achievement in Grade 12, and in 2011 the learners' performance was 47.4% and 46.3% respectively (Siyepu, 2013). Such performance indicates that there are persistent problems in mathematics, not only in Grade 12, but in the grades leading up to Grade 12. Spaull (2013, p. 40) posits that, "The biggest problem in South African education is at the primary level". Reddy, van der Berg, Janse van Rensburg and Taylor (2012, p.1) attest to this notion by arguing that "performance in earlier years predicts later performance".

Despite speculation, there is no single cause of South Africa's poor and diverse performance in mathematics that can be cited as an explanation (Siyepu, 2013; Reddy, 2006; Reddy, 2004; Kupari, 2013). Therefore, several causes are put forward as a possible explanation, these are: language, teacher quality, and attitudes. These are further discussed briefly in this section.

3.3.4 Language as a causal variable in mathematics performance

Poor performance in mathematics points to learners' and teachers' inadequate communication ability in the Language of Teaching and Learning (LoLT) (Howie, 2002). Howie (2003), Makgato and Mji (2013), Reddy (2006), and Siyephu (2013) agree that there is a relationship between learners' proficiency in English and mathematics achievement. Setati and Adler (2002) explain that learners whose primary language is not the same as their LoLT perform poorer in mathematics than those whose primary language is the same as the LoLT. According to Vandeyar and Killen (2003), learners who have problems with English do not perform well in word problems, for instance. Spaull (2013) argues that learner performance in South Africa is of such a nature that there is a minority of learners who perform significantly better than the majority of the learners, who perform extremely poorly in mathematics. There is evidence (Setati & Adler, 2002) that shows that learners whose primary language and LoLT is Afrikaans perform better than all other learners in the country. Furthermore, the majority of learners whose LoLT is English do not speak English at home, therefore, Kanjee (2006)

warns that the impact of language proficiency on achievement scores needs to be seen in relation to other determining factors.

3.3.5 Teacher quality

The quality of teachers, which includes the teaching methods used to present lessons, is the most significant variable that affects learner performance (Gitaari, Nyaga, Muthaa & Reche, 2013). The better qualified and experienced mathematics teachers are, the more significantly scores are raised. According to Siyephu (2013), teachers' demographic characteristics, attitudes, and content knowledge are widely examined in relation to learner achievement. In the South African context, however, gender plays no significant role. Teachers' Pedagogical Content Knowledge (PCK) is an important aspect in terms of the impact teachers may have on improving poor performance in mathematics (Makgato & Mji, 2006). This is supported by Sundai and Sheriff (2015), who find that ineffective teaching methods turn learners into passive participants.

3.3.6 Attitudes

Bloom's taxonomy has both cognitive levels and affective domains, although there has been more focus on cognitive levels. Affective domains are intrinsic values such as feelings, attitudes, beliefs, enthusiasm, motivation and appreciation, and are usually excluded from analyses. Despite this, it has been shown that learners with positive attitudes in mathematics tend to achieve better than those with negative attitudes (Mullis, Martin, Foy & Arora, 2012; Lameva & Chonteva, 2013; Kupari, 2013; Siyepu, 2013; Reddy, 2004; Sundai & Sheriff, 2015). Kupari (2013) maintains that attitude towards mathematics is a critical construct related to learning. In the TIMSS learner questionnaire, it was generally found that learners with negative attitudes towards mathematics tended to perform poorly. This relationship between attitude and performance was, however, not found in South Africa in TIMSS 2003 (Reddy, 2006). Furthermore, in the case of Singapore, learners had a negative attitude towards mathematics but still performed relatively well in terms of international standards. South Africa and Singapore are mentioned here because, to date, Singapore is the best

performing country and South Africa is the worst performing country in international assessments, which means that they are poles opposites of each other.

3.4 ASSESSMENT TECHNIQUES

The majority of mathematics teachers give homework and carry out SBA with their learners on a daily basis. Homework and classwork are treated as formative assessment (FA), and SBA is treated as both formative assessment and summative assessment (SA) (Gitaari, Nyaga, Muthaa & Reche, 2013). SA and FA are good strategies to improve performance in mathematics, raise scores and boost achievement levels.

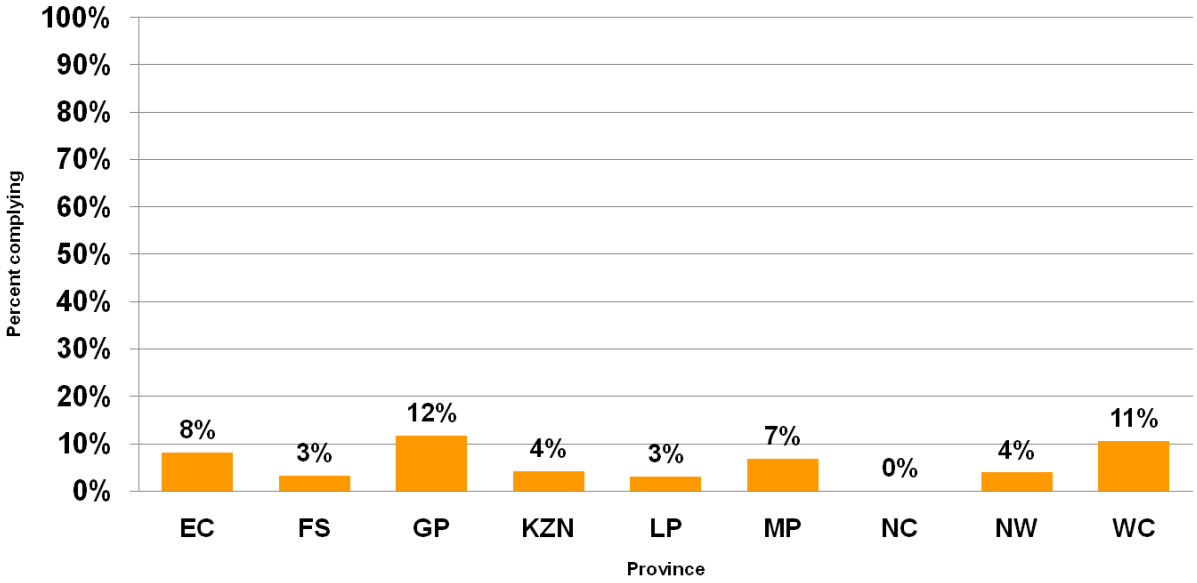

Figure 3.3 Percentage of learners in Grade 9 who cover a minimum of four mathematics exercises a week (Source: DBE, 2013)

This is a gloomy depiction of South African classrooms in terms of homework and/or classwork per week per province. The evidence shows that there is very minimal work being done in mathematics classrooms. On average, the graph shows at least one exercise covered through homework/classwork per day. A striking observation is the case of the Northern Cape Province, where this study was conducted, wherein there was 0% of learners' covering four exercises through classwork and/or homework.

Based on this, this research posits that learners in this province are not being exposed to frequent FA techniques that would boost achievement in mathematics.

Raising learner outcomes in mathematics remains a distant pipe dream in South Africa (Spaull & Venkat, 2014). In the interim, the DBE has implemented rigorous programmes and teacher development strategies to facilitate teaching and learning, to raise scores, and to improve mathematics performance in Grade 9 (Reddy, 2006; Spaull, 2013). Some of these programmes are developed in such a way that they take teachers out of the classroom more than previously, which more detrimental when are considering the overloaded curriculum and reduced content teaching time. Spaull (2013) and Reddy (2006) agree as they find that there is no evidence thus far of the impact that these courses have on performance. In all of the efforts made by the South African government to achieve its own 2010 target of a 60% raise in learner achievement, the key findings above show that Grade 9 mathematics learners have shown wide-ranging differences in basic knowledge and competency, a signal warranting particular attention on the critical transition from the GET to FET band of the school system. This is supported by the fact that none of the provinces and districts have shown improvement in performance in Grade 9 (DBE, 2014).

3.5 SUMMARY

The input-process-output (IPO) framework, adapted from Scheerens' Integrated Model for School Effectiveness, was used to define different perspectives on educational quality. The key IPO variables relating to the quality of SBA were touched on. A discussion was provided of how all these variables are interrelated and overlap so as to illuminate how inputs are being processed into outputs. SBA takes place inside the classroom, which in turn enhances performance while teaching and learning as the primary process of transformation takes place. Of all the interrelated variables, educator quality is seen as one of the most vital assets to educational quality. An alignment between what is taught and what is tested was thus discussed and emphasised as part of the framework. Chapter 4 presents a detailed discussion of the research design and methodology used to gather and analyse the data in this study.

CHAPTER 4 RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

In Chapter 3, a detailed explanation of the theoretical framework that underpinned this study was given, which was based on the relevant literature. This chapter provides insight into the research design and methodology employed to conduct this investigation into the quality of School-Based Assessment (SBA) in Grade 9 mathematics achievement.

Using a qualitative design to plan this study, this chapter briefly discusses the aim of the study in Section 4.2. In Section 4.3, the pragmatic assumptions of this research are explored, followed by a discussion on the research design in Section 4.4. Section 4.5 focuses on the procedures used to collect data, and the manner in which the data was analysed and interpreted is presented in Section 4.6. Finally, in Section 4.7, the ethical nature and trustworthiness of this study is considered and discussed. This is presented diagrammatically below in Figure 4.1.

.

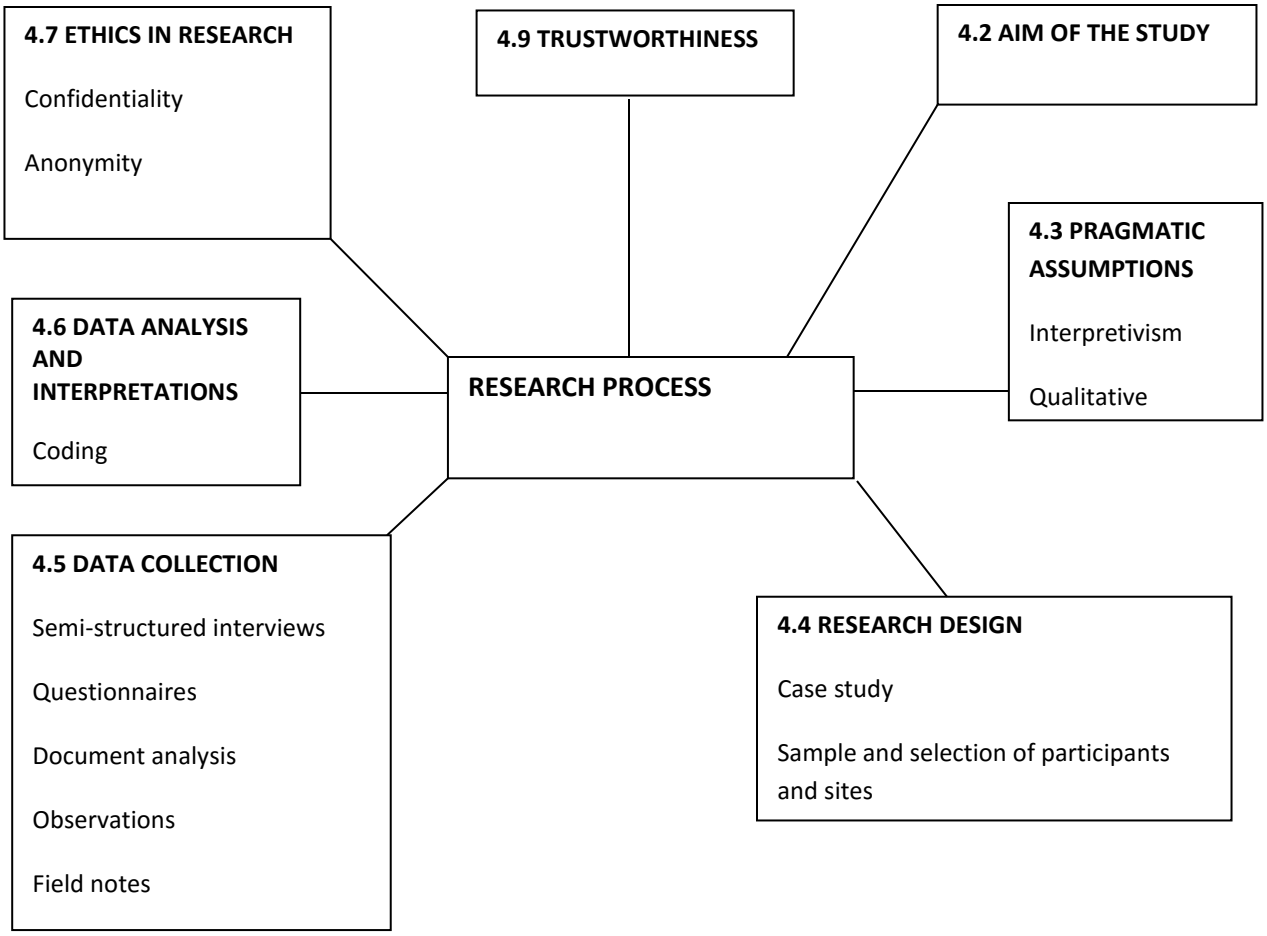

Figure 4.1 The research process

4.2 AIM OF THE STUDY

The aim of this study was to investigate the whether there is evidence in the variance in the quality of School-Based Assessment (SBA) in Grade 9 mathematics achievement. As Grade 9 is an exit point in the GET band, it was imperative to explore the appropriateness of the quality assurance mechanisms applied to SBA in mathematics at this level. The focus of this study is on assessment as the promotion requirement of the FET band is dependent on SBA as an assessment model used in South African schools.

4.3 PRAGMATIC ASSUMPTIONS

Guba and Lincoln (1994, p. 105) define a paradigm as, “the basic beliefs (metaphysics) or worldview that guides the researcher, not only in choices of method but in ontologically and epistemologically fundamental ways.” This view puts into perspective

the context in which teaching, learning, and assessment take place. These ‘beliefs’ are basic in the sense that they must be accepted as truth. Furthermore, it is the choice of paradigm that sets the intent, motivation and expectations of the research. A paradigm includes three elements, namely: a belief about the nature of knowledge, methodology, and criteria for validity. Creswell (2003) and Nieuwman (2000, as cited in Mackenzie, 2006) prefer using terms such as epistemology and ontology rather than paradigms. A paradigm is defined as an individual’s worldview or set of beliefs (Guba & Lincoln, 1995), and there are several paradigms used in research. Table 4.1 indicates the ways in which research methods, epistemology and ontology can cross paradigm boundaries. The research paradigm of this study was pragmatism.

Table 4.1 Evolving research perspectives

Paradigm	Ontology	Epistemology	Methodology	Methods of data collection and analysis	Reporting/style of writing
Objectivism Positivism	The life world of respondents can be discovered in an objective manner.	Interpretation arises from the observations of the researcher. With the right methodology, meaning can be discovered.	For example, classical ethnography and phenomology.	For example, participation, observation, and interviewing.	Descriptions of day-to-day events experienced in the field, realist evidence in an authoritative, supreme voice to represent and interpret others' story.
Interpretivism Modernism Realism	The real world can be discovered by means of a systematic, interactive methodological approach.	Knowledge arises from an understanding of symbols and meaning (Symbolic interactionism).	Grounded theory.	Data are gathered by means of participation, observation, human documents and interviews, and are analysed systematically.	The researcher provides insights into the behaviour displayed and the meanings and interpretations that respondents give to their life worlds.
Constructivism Postmodernism Impressionism	There is no real world or truth out there, only a narrative truth. Reality can thus only be known by those who experience it personally.	Those who have personally experienced it construct knowledge through a process of self-conscious action.	Newer form of ethnography, antethography, collaborative inquiry (PAR), appreciative inquiry, personal reflexive ethnography, and narrative inquiry.	Interviewing, participant observation, human documents, personal narratives, lived experiences, poetic representations, and fictional texts.	The story must be life-like, evocative, believable and possible to enable readers to put themselves in the place of others and have empathy.

Source: Adapted from Fousché and Schurink (2011)

4.3.1 Interpretivism

Ritchie and Lewis (2003, p.7) define interpretivism as "the school of thought that stresses the importance of interpretation as well as observation in understanding the social world". The researcher began with the assumption that contact with reality is only possible through social construction, such as verbal communication, conversational and shared meaning (Creswell, 2003; Nieuwenhuis, 2007). The assumption was made that reality should be interpreted through the meaning that research participants give to their life world (Fousché & Schurink, 2011). Since the aim of this study was to investigate whether there was evidence of variance in the quality of SBA in Grade 9 mathematics achievement, an interpretive paradigm was therefore followed as this epistemology assumes that knowledge is usually constructed by humans to answer the question, "How do we know what we know" (Guba & Lincoln, 1994, p. 109). Ritchie and Lewis (2003), and Creswell (2003) further assert that interpretivism focuses on people's subjective experiences, how they reconstruct the social world by sharing meaning, and how they interact with each other. This study was further concerned with exploring and understanding the participants' social world using both the participants' and my own understanding as a researcher. This was especially relevant in this study as I wanted to explore and understand the participating teachers' perception and understanding of the quality assurance techniques involved in School-Based Assessment (SBA).

Semi-structured interviews were successfully used as a primary data collection method to help discover the participants' experiences, perceptions, views, skills, knowledge, and capabilities with regard to the quality of SBA tasks. Interpretivism proposes that there are multiple realities of a phenomenon, and that these realities differ across time and location. As a result of the existence of multiple realities, mathematics teachers, Heads of Department and principals of the different schools were engaged to participate in this study. This was done to obtain different perspectives and an understanding of their role in ensuring the implementation of quality assurance techniques in developing Grade 9 mathematics SBA tasks. An interpretivism paradigm was therefore chosen as the best approach to use in order to make meaning and draw conclusions (Wilmot,

2010). Interpretivism allows in-depth investigations into a phenomenon and is thus suited to rich interpretation through understanding.

4.3.2 Qualitative research methods

Qualitative research begins with certain assumptions, a worldview and a theoretical framework used to answer in-depth research questions (Brink et al., 2013; Creswell, 2007). Qualitative research employs different philosophical assumptions, strategies and methods of data collection, analysis, and interpretation (Denzin & Lincoln, 2008; Denzin & Lincoln, 2011; Creswell, 2009).

In order to investigate the variance in the quality of SBA in Grade 9 mathematics, this study used qualitative research methodology. In the field of education, the use of qualitative research is appropriate because many aspects of the field use narrative, non-numerical data (Lichtman, 2013, cited in Saudi, 2015). Leech and Ongwuegbuzie (2007) find that qualitative research is extremely useful in obtaining insight into regular or problematic experiences, as well as the meaning attached to the experiences of individuals. According to Creswell (2003), qualitative research focuses on the participants' perceptions and experiences. Qualitative research methodology gives the researcher an opportunity to interact with the participants based on their experiences and understanding of specific phenomena. In this study, the research questions could not be measured in quantitative terms, but were rather used to provide an in-depth understanding of human experience as the research dug deeper (Leedy & Ormrod, 2010, p.135).

This research was non-experimental, explanatory, and descriptive in nature (McMillan & Schumacher, 2011; Babbie, 1998; Babbie & Mouton, 2011). Qualitative research involves the researcher's collecting data themselves (Creswell, 2009), and trying to understand the phenomenon in a particular context. The qualitative research approach was ideal for this study as it aims to provide illumination and understanding of complex issues (Marshall, 1996; Brink, van der Walt & van Rensburg, 2013). Denzin and Lincoln (2005) describe qualitative research as a naturalistic, interpretative approach. The use of this approach was thus the obvious method of choice because it provided me with an

opportunity to interact, through interviews, with the selected participants. Qualitative data often contains some inherent of “richness and holism” with a strong potential to reveal complexity (Miles & Huberman, 1994, as cited in Leech & Ougwenbuzie, p. 560), which yields thick, rich descriptions that are contextualised. Through a qualitative methodological paradigm, I was able to obtain information that provides greater insight into the quality of SBA in Grade 9 mathematics achievement. This approach also provided an understanding of how the participants experienced assessment practices in the South African schooling system.

The qualitative approach is useful in exploring and understanding a central phenomenon and the way in which people interpret their experiences within their world. Qualitative research is flexible, allows for interaction between the researcher and the participants to be more natural, and provides access to information-rich sources to better understand the phenomenon under investigation. In view of the definitions and characteristics of qualitative research and the need to capture the participants’ experiences, as presented in Chapters 2 and 3, the qualitative paradigm was the obvious method of choice for this research (McMillan & Schumacher, 2010).

Denzin and Lincoln (2005) explain that qualitative research involves an interpretative and naturalistic approach. The assumptions identified hold that individuals seek an understanding of the world in which they live and work. They develop subjective meanings of their experiences, which are varied and multiple. The goal of research is thus to rely on the participants’ views of the phenomenon being studied. In qualitative research, the researcher is the main instrument as researchers collect data themselves and adapt to circumstances to obtain rich information.

Participants may interpret subjective meaning of their situations from broad, open-ended questions. The researcher should listen carefully to what participants say or do in their natural setting or specific content in order to understand the historical and cultural settings of the participants. In its limitation, researchers also recognise that their own background shapes their interpretations, and they thus “position themselves” in the

research to acknowledge how their interpretation flows from their own personal, cultural, and historical experiences (Ritchie & Lewis, 2003, p. 69).

Since a qualitative approach focuses on interpreting and understanding the research problem from the participants' perspective, this helped me to fulfil the aim of this study.

4.4 RESEARCH METHODOLOGY

In order to explore and investigate whether there was evidence of variance in the quality of SBA in Grade 9 mathematics achievement, a generic qualitative research design was followed. According to McMillan and Schumacher (2003), and Yin (2003; 2009), research design refers to a detailed plan for selecting participants, research sites, data collection and analysis methods. Mouton (2001) further posits that a research design is a set of guidelines and instructions to be followed in addressing the research questions. A good qualitative research design is one that has a clearly defined purpose, and in which there is coherence between the research questions and methods or approaches proposed. A good qualitative design also generates data that is valid and reliable (Lewis, 2003).

It is against this backdrop that a discussion of the following characteristics and their relation to this study will follow.

4.4.1 Research design: Case study

A case study, according to Hartley (2004, as cited in Skyring, p.2), "is a research strategy which involves detailed investigation of phenomenon where the aim is to understand how behaviour and/or processes are influenced by and influence context, and where context is deliberately part of the design". The term 'case study' is usually associated with qualitative research studies (Lewis, 2003). A case study is a type of ethnographic research that focuses on a single phenomenon (Ary, Jacobs, Sorensen & Walker, 2014). Studies that are usually qualitative in nature, and that aim to provide an in-depth description of a small number, employ case studies (Mouton, 2001).

Since qualitative researchers are primarily interested in the meaning that participants give to their life experiences, they have to use some form of case study to immerse

themselves in these activities, regardless of the number of sites or participants, in order to obtain an intimate familiarity with the participants' social worlds. This also allows the researcher to look for patterns in the participants' lives, words and actions in the context of the case as a whole (Fousché & Schurink, 2011, p.320; Joubert & Omidire, 2013; McMillan & Schumacher, 2006). A case study involves an exploration of a bounded system, and single or multiple cases over a period of time through detailed, in-depth data collection. This involves multiple sources of information that are rich in context (Creswell, 2007; McMillan & Schumacher, 2006; Stake, 1995). Case study research allows in-depth investigation into a single phenomenon and is thus suited to rich interpretation and a thorough understanding of a case in its natural setting. This type of research thus involves people, and multi-dimensional and varied data are often collected (Joubert & Omidire, 2013; McMillan & Schumacher, 2010; Guba & Lincoln, 1994). In this study, these data include interviews, document analysis, questionnaires, field notes, and observation.

Joubert & Omidire (2013) report that case studies are used for high construct validity; in-depth insights; and establishing a rapport with the participants. A case study is an ideal method for investigating and illustrating the influence and impact of assessment policies and practice on learner achievement (McMillan & Schumacher, 2010). This method enables me to position myself and the participants' experiences, perceptions and decisions in relation to both the specific demands presented by their school and district requirements, as well as to the provincial and national legislation that shaped those requirements. Employing a case study design allows the researcher to use narrative vignettes depicting the participants' assessment practices. Given this background, the case study approach was seen as the best strategy to investigate whether there was evidence of variance in the quality of SBA in Grade 9 mathematics in South Africa.

According to Wilmot (2010), case studies are chosen in qualitative research to make meaning and draw conclusions, rather than make generalisable rules and conclusions. Generalisability is rejected for qualitative research studies (Onwuegbuzie & Leech, 2007; Mouton, 2001). The goal of this study was not to generalise the findings, but

rather to obtain insight into the variance in the quality of SBA in mathematics. Guba and Lincoln (1994) assert that such qualitative data provide contextual information and rich insight into human behaviour.

Creswell (2002) recommends three to five case studies to be undertaken. This approach is known as multiple case studies (Goldstein, 2007, as cited in McMillan & Schumacher, 2010; Creswell, 2002; Boeije, 2009). Five schools (cases) were thus chosen for the purposes of this research. According to Saudi (2015), a multiple case study approach may provide confirmation or contradiction regarding commonalities in the quality of SBA in Grade 9 mathematics.

4.5 THE RESEARCH PROCESS

In qualitative studies, rigorous data collection and analysis take place simultaneously (Nieuwenhuis, 2008; Creswell, 2007). The type of qualitative data collected is more text information, recording, and reporting the voice of the participants as the researcher seeks to establish the meaning of a phenomenon from the views of the participants (Creswell, 2003). McMillan and Schumacher (2001, as cited in Taole, 2013) maintain that qualitative methodology presents data as a narration using descriptions that help in understanding the phenomenon from the participants' perspective.

Data collection instruments are carefully selected, adapted, and designed to support the research objectives, which, in this case, involved ascertaining the quality of SBA in mathematics (Hendrick, 2010). The multiple data instruments listed above were selected for the purposes of triangulation. Triangulation involves the use of different methods on the same object of research in order to produce credible, reliable and valid results (Denzin, 1978). The collection of data for this study was carried out through questionnaires; face-to-face, semi-structured interviews; and document analysis (Creswell, 2007; Poliah, 2010; Saudi, 2015). In the following section, I will elaborate on the instruments that were used to collect data for this research, as depicted in Figure 4.2.

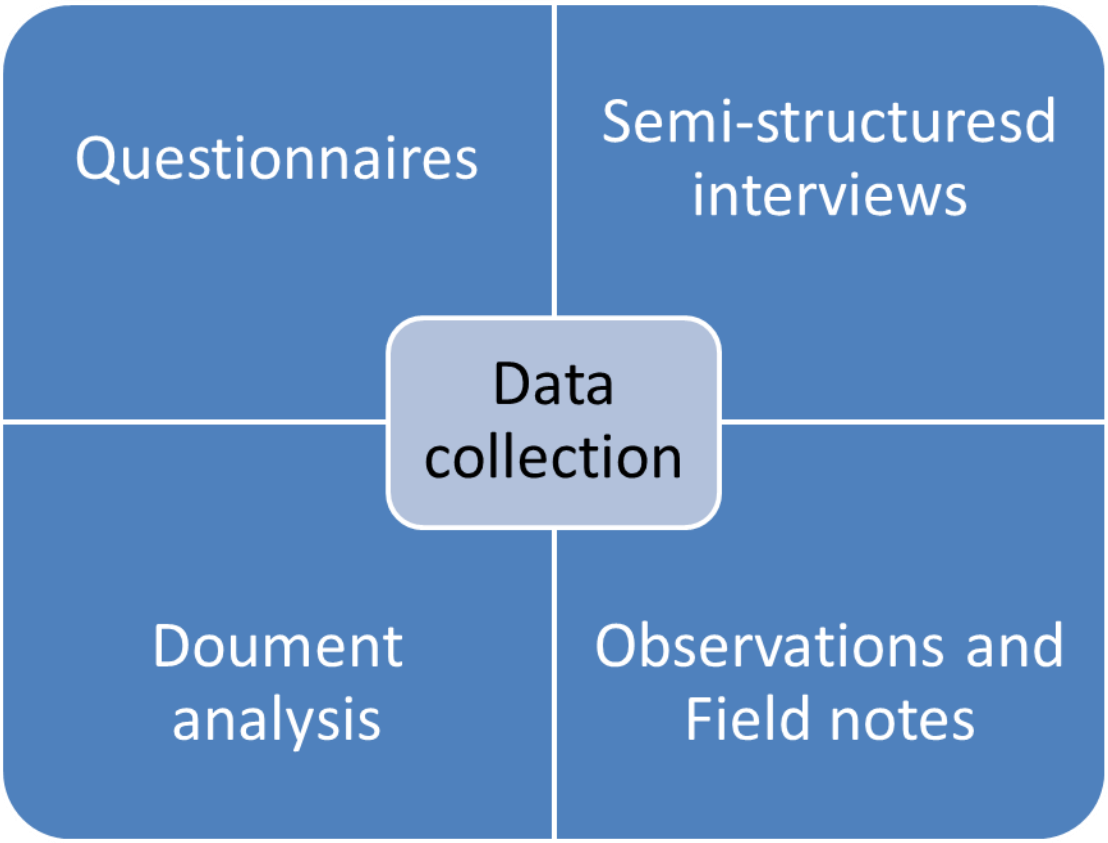

Figure 4.2 An illustration of the data collection methods used in this study

4.5.1 Questionnaires

A questionnaire is “the set of questions dealing with some topics or related groups of individuals for the purpose of gathering data on a problem under investigation” (van der Aardweg & van der Aardweg, 1998, p.190, cited in Maphalala, 2006). Questionnaires were chosen specifically for this study as the responses would determine whether the participants’ biographical data had any association with their implementation of SBA and assessment policy and practice. The questionnaires were completed by all of the participants in their own time prior to the interviews. This was carried out in order to eliminate any bias during the interviews. The questionnaires divided the participants into three ranks (see Appendices A to C), namely: Grade 9 mathematics teachers; mathematics Heads of Department; and school principals.

The completed questionnaires provided the participants’ background information regarding gender, age, mathematics qualifications, experience in their position, the

Language of Learning and Teaching (LoLT), mathematics, and training on assessment principles (McMillan & Schumacher, 2010; Marshall, 1996, Howie, 2003). Although the questions were very clear and relevant to the topic under investigation, a few of the participants misinterpreted the question regarding their mathematics qualifications. When collecting the questionnaires, I explained the question to each participant who had misinterpreted the question.

4.5.2 Semi-structured interviews

Interviews are the most widely used and basic method of obtaining qualitative data (Ary, Jacobs & Sorensen, 2010). Qualitative research is an enquiry in which the researcher collects data in face-to-face situations by interacting with the selected participants in their natural settings (McMillan & Schumacher, 2006; Legard, Keegan & Ward, 2006). Creswell (2003), and Arthur and Nazroo (2003) find that in-depth interviews are a good method for collecting data in exploratory studies. There are three types of interviews, namely, unstructured, structured, and semi-structured interviews. Primary data for the current study was collected through individual semi-structured interviews. Such interviews allow the researcher to alter the sequence of the questions or the way in which the questions are phrased. In this study, I conducted individual semi-structured interviews with the participants in order to extract their views and opinions (Nieuwenhuis, 2006) and to achieve both broad coverage across key issues, as well in-depth coverage within each other's perspectives (Legard, Keegan & Ward, 2003; Wilmot, 2010; Mji & Makgato, 2006). Semi-structured interviews also allow the selected participants to explain the beliefs and experiences that shaped their conception and approach to assessment practices, specifically in relation to SBA (Creswell, Hanson, Clark, Petska & Creswell, 2005; Taole, 2013). Marshall (1996) clarifies that the aim of semi-structured interviews is to develop an understanding of, and an interpretative framework for the process of SBA implementation.

Semi-structured interviews contain a blend of close-ended and open-ended questions (McMillan & Schumacher, 2010). Open-ended questions allow participants to voice their experiences and perspectives (Creswell & Clark, 2008). In this case study, key questions on assessment were planned prior to the interviews. Probing questions were

introduced during the interviews as there were unexpected data that emerged from the participants' responses. Probing questions allowed me to achieve in-depth answers in terms of exploration and explanations (Ritchie, 2003). Ritchie (2003, p. 141) further posits that "follow-up questions […] obtain deeper and fuller understanding", in this case, providing clarity on the implementation, policy, and practice of SBA. The researcher chose this instrument as the best method to capture the complex views of mathematics teachers, mathematics HoDs, and school principals.

An interview protocol (Appendices D to F) was drawn up in advance to use as a guide to identify the key issues and sub-topics to be explored, as well as to avoid the omission of important information during the interviews (McMillan & Schumacher, 2010). This study's interview protocol comprised a heading and instructions for the interviewer (opening statements), the purpose of the interview and procedures to be followed, and key research questions regarding the implementation of quality assurance in SBA, the performance of SBA and other external assessments, strategies on how to improve performance, as well as how to raise scores in external assessments (Creswell, 2007). After the participants had agreed to participate, I scheduled semi-structured interviews by appointment with all 15 participants in this study. In each school, an interview was conducted with the Grade 9 mathematics teacher, mathematics HoD, and the school principal at different times. The interviews were recorded and transcribed verbatim in the field notes and transcriptions, and observation notes were embedded into the transcribed text as they were reviewed. The researcher wrote down field notes as soon as possible, and when possible, wrote down notes during the interviews to the extent that the participants felt comfortable with this note taking. The interviews were recorded to emphasise depth and nuance as a way of understanding meaning in its natural form. Each interview lasted approximately an hour, based on the number of questions; although in some instances where the participant was given the opportunity to give additional information and wished to elaborate further, the interview lasted more than an hour. Interviews with the mathematics teachers and HoDs were conducted after school hours. School principals were interviewed during school hours as per appointment. The interviews were conducted mainly in English, however, the interviewer allowed the

interviewees to respond in their primary language (Afrikaans or Setswana) in order to allow the interviewees to be as candid as possible.

4.5.3 Document analysis

Documents were another source of information in this research. Document analysis is a systematic procedure used to review or evaluate documents (Moodley, 2013). Creswell (2007) is of the opinion that this strategy enables the researcher to compile consistent detailed case research reports on the teachers' assessment practices. Document analysis was required in this study so that the data in the key documents could be compared, examined and interpreted in order to elicit meaning and gain understanding (Corbin & Strauss, 2008, as cited in Taole, 2013; Creswell, 2007; Wilmot, 2010). This also ultimately enabled the corroboration or contradiction of the data in terms of other evidence, such as the questionnaires and semi-structured interviews that had already been collected (McMillan & Schumacher, 2010; Mouton, 2001). The documents collected from the Grade 9 mathematics teachers and HoDs included:

- Grade 9 mathematics SBA tasks.
- Grade 9 mathematics SBA assessment tools.
- Grade 9 mathematics teachers' moderation reports.

Each document was analysed to learn how different Grade 9 mathematics teachers developed SBA tasks, as well as how HoDs moderated these tasks and scrutinised the moderation reports.

Finally, in carrying out the interviews, I relied heavily on my field notes, as suggested by Ary, Jacobs, Sorensen and Walker (2014). Field notes contain information on what the researcher has heard or seen. This narrowed my focus as I consistently integrated and collated the data collected from these sources to conclude the data collection process (Leedy & Ormrod, 2010).

4.5.4 Observations

Nieuwenhuis (2007, p. 83) defines observation as "the systematic process of recording the behavioural patterns of participants, objects and occurrences without necessarily questioning or communicating with the participants". Ary et al. (2010) assert that observation is a basic method for obtaining data in qualitative research. According to Polkinghorne (2005), observations are used to supplement and clarify the data derived from the participants' interviews. They are also used to determine whether what was said matches the participants' actions (Ary et al., 2010). Qualitative observations may take place over a more extended period than quantitative observations. Polkinghorne (2005) further distinguishes between two sources of observational data. The first is in connection with interviewing, and refers to the participants' behaviour, facial expressions, gestures, and body language (Ary et al., 2010). Data from these sources are used to shed light on the meaning of participants' oral comments. Another source is the environment in which the study takes place. For the current study, this comprised the school and the location or offices in which the interviews were conducted.

It is based on this reasoning that I chose observational data as the appropriate and relevant data collection method in this study. The observational notes were recorded immediately after the interviews to allow better recall of the observations and their contribution to understanding the experiences and perceptions of participants when conducting SBA at their schools. The notes, better known as memos, were attached to the interview transcripts as part of the text to be analysed (Nieuwenhuis, 2007).

4.6 DATA ANALYSIS: THEMATIC ANALYSIS

"Qualitative data analysis is a systematic process of coding, categorising, and interpreting data to provide explanations of a single phenomenon of interest" (McMillan & Schumacher, 2010, p. 367). One distinguishing feature of qualitative research is that data analysis is done during data collection as well as after all of the data has been gathered (McMillan & Schumacher, 2010; Nieuwenhuis, 2008; Creswell & Clark, 2003). Data collection and analysis are interwoven, and are simultaneous and on-going in order to build a coherent interpretation of the data (McMillan & Schumacher, 2010;

Nieuwenhuis, 2008; Taole, 2013). Maxwell (2005, p. 95, cited in Corbin & Strauss, 2008) describes this process as follows,

> *The experienced qualitative researcher begins data analysis immediately after finishing the first interview or observation, and continues to analyse the data as long as he or she is working on the research, stopping briefly to write reports and papers.*

This practice allows the researcher to check data and emerging trends or new information from the participants that needs to be followed up. According to Spencer et al. (2003), approaches to data analysis vary in terms of basic epistemological assumptions, this is illustrated in Table 4.3 below.

Table 4.2 Stages of qualitative data analysis

Stage	Creswell (2007)	Marshall & Rossman (2006)	Maxwell (2005)	Wolcott (1994)
Organising and Familiarising.	Data managing/ reading; 'Memoing'.	Organising the data; Immersion in the data.	Reading and listening.	Describe and highlight.
Coding and reducing.	Describing; Classifying.	Generating categories and themes; Coding the data.	Coding; Memoing; Categorising.	Analyse and identify patterns.
Interpreting and representing.	Interpreting; Representing; Visualising.	Offering interpretations through analytic memos; Searching for alternative understandings; Writing the report.	Connecting ideas; Reporting.	Contextualise; Display findings.

(Adapted from Corbin & Strauss, 1998)

In carrying out this study, I followed Creswell's (1998, 2007, as cited in Corbin & Strauss, 2008, supported by Leedy & Ormrod, 2010), description of a data analysis spiral:

I organised the data by breaking down large bodies of text into smaller units and phrases in hard copy form. I then perused the entire data set several times to get a sense of what it contained as a whole. In the process, I wrote a few memos that suggested possible categories or interpretations, and made comments in the margins. I classified each piece of data accordingly, after which general themes and sub-themes were then identified. This gave me a sense of the patterns within the data, as well as the meaning embedded in the data. Finally, I integrated and summarised the data and packaged the data into a coherent narrative report.

I employed a thematic data analysis procedure. Patton and Cochran (2002, p. 24) define thematic analysis as a procedure where the researcher "looks across all the data to identify the common issues that recur, and identify the main themes that summarise all the views the researcher has collected". During the data collection, I transcribed all of the interviews verbatim, and made preliminary observations, especially with the first few transcripts of the interviews. I did this in order to get a feel for the data and to check if more data was needed (Patton & Cochran, 2002; Creswell & Clark, 2003; Silverman, 2000). Silverman (2000) asserts that the analysis of audiotapes and transcripts depends on the generation of research questions out of the theoretical framework, which was the cased in this study. As with the writing of field notes, the preparation of a transcript from an audiotape is a theoretically saturated activity. The interviews on the audiotapes were immediately transcribed verbatim to avoid potential bias in selection and interpretation, which could have occurred when summarising (Corbin & Strauss, 2008). Field notes and gestures were added to the transcripts to add meaning during transcription. Identifiable information, such as names, was stripped to ensure confidentiality.

In this study, data analysis was part of an attempt to comprehend the quality of SBA in Grade 9 mathematics, to synthesise information and explain relationships, to theorise about how and why the relationships that were found existed, and to connect new and

existing knowledge (Corbin & Strauss, 2008). After data collection, the data were broken down into key stages, and were organised and managed.

I familiarised myself with the data through reading and rereading it, and listening attentively to the audiotapes. I also organised the data so that it was easily retrieved. Field notes, audiotapes, and memos were made available for analysis. As I read the transcripts, I continuously made notes in the margins indicating key ideas. When this process was completed, coding then began. Coding comprises developing concepts from the raw data (Creswell & Clark, 2003; Nieuwenhuis, 2007). Codes represent the information that the researcher expected to find, information that the researcher did not expect to find, and interesting and unusual information. After all of the data were coded, I placed all of the units that had the same coding together and merged them into categories. Once the data were sorted into categories, I then looked for patterns and relationships and merged these categories into themes (Spencer et al., 2003; Corbin & Strauss, 2008).

Once the data were completely analysed and themes developed, the next step was to interpret the data to form categories on what was important, why it was important and what could be learned from it.

Data analysis in qualitative research is often done concurrently and simultaneously with data collection through an iterative, recursive and dynamic process (Corbin & Strauss, 2008). I thus began analysing the data immediately after finishing the first interview and observation, and continued to analyse it throughout the research process.

4.7 SAMPLING AND THE SELECTION OF PARTICIPANTS

A sample is “a portion, piece, or segment that is representative of a whole” (Onwuegbuzie & Leech, 2007, p. 105). Creswell (2002, p. 117) defines sampling as “a process that incorporates the number of participants, the number of contacts with each participant and the length of each contact.” In this study, decisions about the selection of the sample were not pre-set, but were driven conceptually by the conceptual framework underpinning this study (Silverman, 2013). Mullis, Martin, Gonzalez and

Chrostowiski (2004) report that the selection of valid and efficient samples is crucial to the quality and success of any study. The sample selection that guided this research was driven by the theoretical framework, which was Scheerens' Input-Process-Output model, as discussed in Chapter 3 (Boeije, 2013; Creswell, 2007; Marshall, 1996). Qualitative research focuses on relatively small and convenient, information-rich samples, which are selected and purposefully undertaken to understand the depth of the research problem (Joubert & Omidire, 2013; Patton, 1990; Marshall, 1996; Onwuegbuzie & Leech, 2007). However, the appropriate sample size for a qualitative study is one that adequately answers the research questions (Patton, 1990; Marshall, 1996). Information-rich samples are those from which information can be drawn about issues of central importance to the purposes of the study (Nieuwenhuis, 2008).

In qualitative research, the most common method of sampling is purposeful sampling (Onwuegbuzie & Leech, 2007; Patton, 2002; Patton, 2009; McMillan & Schumacher, 2010). Purposeful sampling is "designed to generate a sample that will address the research questions" (Teddlie & Yin, 2007, p. 83). It is for this reason that purposeful sampling was ideal for this study. I purposely selected a section of the wider population to include or exclude from the sample based on whether they possessed some feature or process that could answer the research questions. In using purposive sampling, the aim was to use the sample to speak to the purpose of the research rather than to seek generalisability (Hendrick, 2010; Brink et al., 2012).

The aim of purposeful sampling is to "select information-rich cases whose study will illuminate the questions under study" (Patton, 1990, p. 170). Patton (2002) and Boeije (2009) further posit that the logic and power of purposeful sampling lie in selecting information-rich cases for in-depth study.

The research site, participants, and the context in which the research was carried out will be presented in the sections below.

4.7.1 Site selection

Qualitative research studies take place in the participants' natural setting (Creswell, 2007). According to Creswell (2009, p. 175-176), qualitative research is often conducted in the field, allowing direct interaction with the participants being studied in context. In this study, the sites included the purposefully selected public schools that offered Grade 9 education, and implemented SBA. The target sample for this research comprised five schools in the John Taolo Gaetsewe (JTG) district in the Northern Cape (NC) province, South Africa, namely two high schools, a combined school and two "middle schools". The JTG district is a rural and mining area that consists of many small villages. The schools were sparsely scattered and distant from one another, an important characteristic of this province. The schools were in typical suburban, higher class suburban, and rural areas (Teddlie & Yin, 2007). In the current classifications within the South African school system, there are primary schools (Grade R/1 to 7), secondary schools (Grade 8 to 12), and combined schools (Grade R/1 to 12) (SASA, 1996). However, before the democratic government came into power, the JTG district fell under the old Bophuthatswana Bantustan classification, where schools were classified differently. In the Bophuthatswana "government", schools were classified as primary schools (Grade 1-6), middle schools (Grade 7 to 9), and high schools (Grade 10 to 12). At the time of this study, some of the schools in the sample had still not conformed to the new model of classification, and were classified as 'middle schools'.

4.7.2 Selection of participants for this study

Purposeful sampling requires access to key informants in the field who can help in identifying information-rich cases. The participants of this study were drawn from the Grade 9 mathematics teachers, Heads of Department (HODs) and school principals of schools where SBA was implemented in the JTG district, NC province. These participants were carefully and purposefully selected because they taught Grade 9 mathematics, were implementing SBA and the Curriculum and Assessment Policy (CAPS) in the Senior Phase (which was implemented in 2014), experienced the implementation of assessment policy and practices, particularly SBA, and also experienced the implementation of progression and promotion policy and practice. The

selected participants were therefore able to provide relevant information on the quality of SBA in Grade 9 mathematics achievement. The racial makeup of the sample represented a wide range of diversity in South African population.

Table 4.3 The sample of selected participants

School	Principal	Head of Department	Teacher
A	Male	Male	Male
B	Male	Female	Male
C	Male	Female	Female
D	Male	Female	Male
E	Female	Female	Male

Table 4.3 shows the sample of selected participants. A mathematics teacher, mathematics HoD, and a school principal were selected for each of the five schools. There were four male and one female school principals, two male and three female mathematics HoDs, and four male and one female school principals. There were 15 participants in total in this study.

4.8 ETHICAL CONSIDERATION

A good qualitative study is one that has been conducted in an ethical manner" (Merrian, 2002, p. 29, cited in Poliah, 2010).

Prior to the commencement of data collection, approval was sought from and granted by the Research Ethics committee of the University of Pretoria. A subsequent letter requesting permission to conduct the study in the selected schools of the John Taolo Gaetsewe (JTG) district in the Northern Cape Province was sought from the Head of Department (HOD) in the Northern Cape Education Department. Copies of the letter were made available to the school principals of the selected schools. These principals then granted permission by signing the consent form, indicating that the study could be conducted in their respective schools.

I informed the participants of the aims and objectives of the research. Each participant volunteered and was willing to participate in the study. Consent was sought from the participants by having them sign the consent forms prior to carrying out the interviews, consent was again verbally sought before the commencement of the interviews. The participants were informed that they could withdraw from the study at any given time without penalty.

The right to privacy and confidentiality, as well as the protection of identities was maintained at all times. The participants were assured that their names and the names of their schools would not be disclosed in the study, thus pseudonyms were used. Hard copies of data collected and the interviews will be protected by a password known only to myself and my supervisor. The data will also be locked away at the Science, Mathematics and Technology Education (SMTE) department at the University of Pretoria, and only the supervisor and I will have access to the raw data.

Furthermore, the participants were treated with respect and dignity, and were not intimidated in any form. At the conclusion of the study, all of the participants were given a brief summary of the findings.

4.9 METHODS USED TO ENSURE TRUSTWORTHINESS

Trustworthiness in qualitative studies refers to the quality or goodness of an investigation that makes it noteworthy for the audience (Lincoln & Egon, cited in Schwandt, 2001, p. 258). Lincoln and Guba (as cited in Shenton, 2004) identify the four accepted criteria for trustworthiness that are employed throughout qualitative research:

- Credibility (in preference to internal validity);
- Transferability (in preference to external validity/ generalisability);
- Dependability (in preference to reliability); and
- Confirmability (in preference to objectivity).

Credibility is the criterion that ensures that the researcher's study measures what it is actually intended to measure. Lincoln and Guba (as cited in Shenton, 20014) argue that

ensuring credibility is one of the most important factors in establishing trustworthiness. Triangulation was the design that was deemed the best design to measure the credibility of this study.

Silverman (2001) refers to triangulation as the combination of multiple data collection and data analysis methods, theories and empirical materials to produce a more accurate, comprehensive, and objective representation of the object under study. Creswell (2008) identifies triangulation as one of the strategies that qualitative researchers use to determine the credibility and trustworthiness of their findings. McMillan and Schumacher (2006) find that qualitative researchers use triangulation during data collection, data analysis and the interpretation of results to provide a better understanding of the investigation, and to provide a more comprehensive data set. Patton (2002) further posits that triangulation increases the validity and trustworthiness of findings and evidence of sources, and allows a comparison of findings from different sources.

Campell and Fiske (as cited in Johnson & Ougwenbuzie, 2004) refer to triangulation as "'multiple operationalism' in which more than one method is used as part of a validation process" (p. 113). Terre Blanche and Kelly (1999) further explain that triangulation entails collecting data in as many different ways and from as many diverse sources as possible. In this study, data was collected through questionnaires, semi-structured interviews, document analysis and observations. This was done to compare and contrast the different findings to produce well-validated conclusions (Ivankova, Creswell & Clark, 2008). I further validated the information obtained through the interviews by checking the documents and questionnaires to corroborate what the respondents reported in the interviews. Hence, through triangulation, there was greater credibility in the findings of this study (Patton, 2002; McMillan & Schumacher, 2006).

Member checks were also done with the participatns immediately after the conclusion of the interviews and at the end of the data collection dialogue, which was conducted as a measure of credibility in this study (Guba & Lincoln, as cited in Shenton, 2004). Checks were necessary to enhance my understanding of the data (Leedy & Ormrod, 2010).

Transferability, according to Shenton (2004), is the extent to which findings of one study can be applied to other situations in other studies. Since the findings of qualitative research are specific to a small number of particular environments and a small number of participants, it is impossible to demonstrate that the findings and conclusions are applicable to other situations and populations. Although each case is unique, it is also an example within a broader group, and as result, the prospect of transferability should not be immediately rejected. The results of this study should be understood within the context of the particular characteristics of the organisation, and geographical area in which the study was conducted.

In addressing the issue of reliability, I employed techniques to show that if the study were to be repeated in the same context, with the same methods, and with the same participants, similar results would be obtained.

The concept of confirmability in research is compared to objectivity. The role of triangulation is again emphasised in this context to reduce the effect of the researcher's bias. The key factor of confirmability is the extent to which the researcher admits his or her own pre-assumptions (Shenton, 2004). The credibility, transferability, dependability and confirmability of this study are presented and summarised below to demonstrate how this study met the criteria for trustworthiness.

Table 4.4 Guba's four criteria for trustworthiness

Quality criterion	Possible provision made by the researcher
Credibility	Adoption of appropriate, well recognised research methods.
	Development of early familiarity with culture of the participating organisations (in this case, schools).
	Random sampling of individuals serving as informants/participants.
	Triangulation via the use of different methods, different types of informants, and different sites
	Tactics to help ensure honesty in the participants.

Quality criterion	Possible provision made by the researcher
	Iterative questioning in data collection dialogues. Negative case analysis. Debriefing sessions between the researcher and superiors. Peer scrutiny of the project. Use of 'reflective commentary'. Description of background, qualifications and experience of the researcher. Member checks of the data collected and interpretations/theories formed. Thick descriptions of the phenomenon under scrutiny. Examination of previous research to frame the findings.
Transferability	Provision of background data to establish the context of study, and a detailed description of the phenomenon in question to allow comparisons to be made.
Dependability	Employment of 'overlapping methods'. In-depth methodological description to allow the study to be repeated.
Confirmability	Triangulation to reduce the effect of investigator bias. Admission of researcher's beliefs and assumptions. Recognition of shortcomings in the study's methods, and their potential effects. In-depth methodological description to allow the integrity of the research's results to be scrutinised. The use of diagrams to demonstrate an audit trail.

Source: Adapted from Shenton (2004).

4.10 THE ROLE OF THE RESEARCHER

The researcher is also an instrument in qualitative research (Guba & Lincoln, 1998). Therefore, according to Patton (2002), a qualitative report must include information about the researcher, and what experience, training, and perspective the researcher brings to the field. The researcher must also disclose her personal connection, if any, to the participants, how the researcher gained access to the research site, as well as what prior knowledge the researcher brings to the research.

The role of the researcher in this study was to investigate whether there was variance in the quality of SBA in Grade 9 mathematics achievement Guba and Lincoln (2003) again emphasise that the researcher is considered an instrument of data collection and data analysis. This means that data are mediated through this human instrument rather than through inventories, questionnaires or machines. Shenton (2004) further argues that the credibility and trustworthiness of the researcher are important attributes that the researcher should possess.

In this sense, I was involved in collecting and analysing the data, and I conducted semi-structured face-to-face interviews with the participants. Sensitivity to the hierarchy of the participants was taken into account as the participants were from diverse racial, cultural, linguistic, and age groups. This had an impact on the decisions made in selecting the sample and research sites, structuring the interview questions and questionnaires, and conducting the observations. I further provided clear information about the objectives and purpose of the study, and was open and consistent about what was required to promote co-operation (Ritchie, 2003). As a district official employed by the NCED as a subject advisor in the curriculum unit, I interacted with the participants and found myself to be subjective. However, my assumptions and beliefs were kept separate from the research process to reduce bias and subjectivity by conducting member checking and document analysis.

Before this study, I had no extensive experience in research, however, I gained experience as a student as well as through the research process itself. I also brought a

wealth of experience and knowledge on the topic from the environment in which I was employed as a subject advisor.

4.11 CONCLUSION

In the above discussion, I outlined the aim of the study, the qualitative research design, and methodology by touching on the pragmatic nature of this case study. I further elaborated on how the questionnaires, interviews, document analysis, observations, and field notes were used to collect data from the participants. A discussion ensued on the type of sampling used, as well as of the participants who were sampled and their biographical details. The data analysis techniques employed in this study were also provided. Lastly, the ethical issues, methods to ensure trustworthiness, and my role as a researcher were also revealed in this chapter.

In the next chapter, I present the results, findings and interpretation of the data collected in this study.

CHAPTER 5 DATA ANALYSIS, FINDINGS AND INTERPRETATIONS

5.1 INTRODUCTION

The aim of this study was to investigate whether there was evidence of variance in the quality of School-Based Assessment (SBA) in Grade 9 mathematics achievement. It was hoped that a better understanding could be gained of the perceptions of Grade 9 mathematics teachers, HoDs and school principals regarding how SBA other assessments are carried out in different schools within the same district and province.

This research used naturalistic inquiry to collect qualitative data by administering questionnaires, conducting semi-structured interviews, carrying out document analysis and observations. The participants included five Grade 9 mathematics teachers, five HoDs and five school principals. The data were coded, analysed and organised first by the research questions, and then by themes and sub-themes guided by the conceptual framework, as depicted in Chapter 3. The study was based on the following research questions:

What evidence is there in teachers' classroom assessment practices that points to possible variation in the quality of SBA?

The main research question was further divided into the following sub-questions:

How can sources of variation be unified to make SBA more credible, valid and reliable? And,

How do teachers*, Heads of Department, and principals perceive their role in ensuring the quality of SBA?*

In the previous chapter, I searched primarily for connecting patterns within analytical categories, as well as connections or themes that could emerge from the various categories. The themes were further compared with the issues raised in the literature review (Chapter 2). This chapter provides an analysis and interpretation of the data that were collected by means of questionnaires, semi-structured interviews, document

analysis, field notes, and observations. Moreover, this chapter gives an interpretation and analysis of the data, which rendered it intelligible and interpretable in light of answering the research questions and drawing conclusions. The next section looks at the context of the study in order for the findings to be clearly understood.

5.2 CONTEXTUALISING THE STUDY

The target population of this study comprised schools in the John Taolo Gaetsewe (JTG) District in the Northern Cape. The district was previously part of the North West, but was later incorporated into the Northern Cape. This point is raised in order to give an understanding of the classification of schools in this district, namely:

Primary schools (Grade 1 to 6);
Middle schools (Grade 7 to 9);
High schools (Grade 10 to 12);
Secondary schools (Grade 8 to 12); and
Combined schools (Grade R to 12).

Consent to conduct the investigation was given by the authorities of the Northern Cape Education Department (NCED), as well as all of the schools and participants. A convenient sample of five schools was selected: Middle schools, Secondary schools and a Combined school that all offered Grade 9 level education. Furthermore, sampling these five schools allowed for coverage of different areas of the JTG district.

The participants were purposefully sampled, and included males and females across racial, cultural, gender, age and language groups. Before the commencement of data collection, the procedures to be followed were explained to all of the participants. Semi-structured interviews were conducted with the mathematics teachers and their HoDs, and a school principal at each school. The questionnaires were used to obtain the biographical information of the participants, and documents such as mathematics SBA tasks, SBA assessment tools and moderation reports were used as a means of collecting data. Document analysis was also used to triangulate the data to either corroborate or contradict the data that was collected through the interviews.

5.3 BACKGROUND OF THE SELECTED SCHOOLS

The following information was observed and gleaned from the semi-structured interviews, observations, and field notes of the selected sites (schools). It is of vital importance to discuss the physical facilities as they contributed to the learners' academic performance (Munda, Tanui & Kaberia, 2000, as cited in Mbugua et al., 2012).

Table 5.1 provides a summary of the background of the selected schools, which will be followed by a brief description of each school. The five schools that were selected were classified as School A, School B, School C, School D, and School E.

Table 5.1 Background of the selected schools

School	Area	LoLT	Primary Language(s) of learners and educators
A	Sub-urban.	English and Afrikaans.	Setswana and Afrikaans.
B	Semi-rural.	English.	Setswana.
C	Semi-rural.	English and Afrikaans.	Setswana, English and Afrikaans.
D	Rural.	English.	Setswana.
E	Township.	English.	Setswana.

SCHOOL A

This school was situated in a suburban area of the district. The school catered for Grade 8 to 12 within the area and outlying villages. Grade 8 and 9 classes were overcrowded with about 50 learners in each classroom. Few learners who came from the neighbouring villages stayed alone, whilst others travelled to school either by learner

transport offered by the NCED, or through their own private transport. The school's buildings were not maintained. Coming late and absenteeism by both the learners and teachers were rife at the school. Ill-discipline, gangsterism and teenage pregnancy also affected the quality of teaching and learning. At the time of this study, this school was classified as an underperforming school due to the poor Grade 12 and Grade 9 ANA results over the years prior to this study.

The principal and the SMT members held permanent positions. However, most of the teachers held temporary posts, and moreover, a striking feature of this school was that all of the mathematics teachers held temporary posts. The primary languages were Setswana and Afrikaans, and most of the learners and their teachers spoke Afrikaans. The Languages of Learning and Teaching (LoLTs) were English and Afrikaans, however, the school was a parallel-medium school, which meant that English and Afrikaans classes were taught separately.

SCHOOL B

The school was situated in a semi-rural area of the JTG district and catered to Grade 7 to 9 learners only, and only those who were within the same area and outlying villages far away from the school. The learners were chronically late as a result. The buildings were very old, with very few classrooms. The school was overcrowded, with an average of 60 learners per class per grade due to the shortage of classrooms. This area was one of the most volatile in terms of crime and gangsterism, which affected the smooth running of the school. Most of the learners stayed with their grandparents due to either urbanisation or the fact that some of them were orphans, some learners even lived in child-headed households. This status quo resulted in a lack of discipline and parental involvement in the education of the learners.

The primary language of the learners and teachers was Setswana, whilst the LoLT was English. Almost all of the learners were only exposed to English when in class. The principal had just been appointed to the post, and the HoD for mathematics had been acting in the post for three months at the time of the study. There seemed to be a shortage of mathematics teachers at the school and the surrounding area as the school

attracted mathematics teachers who were foreigners. This resulted in the NCED taking longer to appoint such teachers permanently, or making no appointment due to problems with work permits and the vetting of qualifications, amongst other reasons.

SCHOOL C

The school was situated in a semi-rural area of the JTG district. The school's buildings and surroundings were well-maintained. This school catered to Grade 8 to 12 learners within the area and neighbouring towns and villages. The school had a hostel that catered to learners who lived far away from the school. Late coming, a lack of parental involvement, and poor discipline were minimal. The school had smaller classes with up to 40 learners per class. There seemed to be an element of school orderliness, allowing the school to run smoothly.

Almost all of the teaching staff, the SMT, as well as the principal held permanent posts. The primary language for most of the learners and teachers was Afrikaans, although some of the learners spoke English and Setswana. This was a parallel-medium school in the sense that the LoLTs were English and Afrikaans.

The school had a mathematics centre run by the mathematics HoD, which was being used to teach mathematics to learners in the FET band. It was also used independently as a mathematics support centre for Grade 4 to 12 learners who were not necessarily registered at the school. The mathematics HoD taught support classes every afternoon by grade.

SCHOOL D

The school was situated in a rural area of the JTG district and catered to Grade 8 to 12 learners who lived within the area and outlying villages. The school's buildings were old, however, the school had a newly built state-of-the-art library. Most of the learners stayed with their grandparents or alone due to urbanisation, while some learners were orphans. Although the school experienced a lack of parental involvement, there were no major discipline problems. The primary language of all of the learners and almost all of

the teachers was Setswana, whilst the LoLT was English. Almost all of the learners spoke only English during contact time.

More than half of the teaching staff, the principal, and most of the SMT members held temporary posts or were acting in their posts. There were only two HoDs that were permanently appointed, which included the mathematics HoD. At the time of this study, the mathematics HoD was also the acting school principal. There was an internal arrangement within the school that the Grade 12 mathematics teacher was responsible for moderating the school's mathematics SBA tasks. However, there seemed to be a challenge as the Grade 12 teacher was a part-time student who attended classes outside of the JTG district.

SCHOOL E

The school was situated in the township of the JTG district. This school catered to Grade 7 to 9 learners within the immediate area, as well as outlying villages and neighbouring villages. The school's buildings were not maintained, and some classrooms had broken windows. Despite the fact that there were a few prefabricated classrooms, the classrooms were overcrowded with about 60 learners per class per grade. In addition, there were about seven toilets to be used by more than 1000 learners. Some of the major challenges faced by the school included the poor discipline of learners, teenage pregnancy and substance abuse. There seemed to be a lack of school orderliness, which was concluded after observing parents coming in and out of the school at any time of the day, and being assisted by both the principal and some of the SMT members during contact time with the learners.

Most of the SMT members and the principal were in acting capacities, although there were a few teachers who held temporary posts. Although the mathematics teacher held a permanent position, the mathematics HoD had been acting for a few months at the time of data collection.

5.4 THEMES EMERGING FROM THE DATA

In this section, the results are presented based on the themes and sub-themes that emerged from the data that were collected and analysed through a process of thematic content analysis.

The research questions and themes are presented in Table 5.2 below and linked to the Conceptual Framework, as described in Chapter 3.

Table 5.2 Research questions and themes linked to the conceptual framework

Research Question	Theme and sub-themes	Conceptual Framework	Data source
What evidence is there in teachers' classroom assessment practices that points to possible variation in the quality of SBA?	*Theme 1: Teacher quality* 1. Participants' gender and age. 2. Qualifications and experience. 3. Language in teaching mathematics. *Theme 2: Learner performance* 1. Learner performance in SBA. 2. Learner performance in ANA. 3. Learner performance in TIMSS. 4. Strategies to close the gaps.	Inputs. Outputs.	Questionnaires. Semi-structured interviews. Observations.
How can sources of variation be unified to make SBA more credible, valid and reliable?	*Theme 3: Teaching quality* 1.Participants' subject content knowledge. 2.Participants' pedagogical content knowledge. 3. Curriculum coverage. 4. Class size. 5. The role of SBA. 6. Development of SBA tasks. *Theme 4: Quality assurance* 1. Monitoring of curriculum coverage. 2. Moderation of SBA tasks.	Processes. Processes.	Questionnaires. Semi-structured interviews. Observations. Document analysis.

Research Question	Theme and sub-themes	Conceptual Framework	Data source
How do *teachers*, Heads of Department, and principals perceive their role in ensuring the quality of SBA?	*Theme 5: The role of the participants in ensuring quality SBA tasks* 1. Workload.	Inputs.	Semi-structured interviews.

The research questions and themes in Table 5.2 linked to the conceptual framework in terms of how they spoke to the inputs-processes-outputs model.

5.4.1 Theme 1: Teacher quality

Questionnaires were administered to the participants in order to discover the participants' age, experience, gender, language, and academic qualifications. The biographic data helped to contextualise the findings and allowed the formulation of appropriate recommendations to enable the implementation of quality SBA.

Table 5.3 to table 5.5 summarises the profiles of the teachers, HoDs and school principals.

Table 5.3 Profiles of the participating mathematics teachers

School Home language	Gender	Age	Qualification in mathematics	Teaching experience
School A Afrikaans	M	26 - 35	Post-graduate	<1
School B Afrikaans	M	26 - 35	Diploma	1 – 5
School C Afrikaans	F	>46	Post-graduate	>10
School D Other	F	36 - 45	Diploma	6 – 10

School E Setswana	M	>46	Diploma	>10

Table 5.4 Profiles of the participating mathematics Heads of Department

School Home language	Gender	Age	Qualification in mathematics	Teaching experience
A	M	>46	Diploma	6 – 10
B	F	>46	Diploma	<1
C	F	>46	Degree	6 - 10
D	M	36 - 45	None	1 – 5
E	F	>46	>10	>1

Table 5.5 Profiles of the participating school principals

School	Gender	Age	Experience as a principal
A	M	>46	1 – 5
B	M	>46	<1
C	M	>46	6 - 10
D	M	36 - 45	None
E	F	36 - 45	None

A brief discussion of the participants' profiles, as summarised in these tables, is provided in the following sub-sections.

5.4.2 Sub-theme: Participants' ages and gender

The participants in the study were drawn from (53%) males and (47%) females. However, there were more female mathematics HoDs and more male mathematics teachers in the study. There was only one female school principal out of the five principals that were selected to participate in the study. There was a diversity of age groups in the sample as it consisted of old and young participants. The participants' ages ranged from 26 to more than 46. In Schools A and B, there were younger and new teachers, who were 35 years and younger, which is in line with DBE's strategy to attract new, younger, and qualified teachers in the system (DBE, 2014).

5.4.3 Sub-theme: Participants' qualifications and experience

The participants' qualifications and experience were important characteristics as an indicator of teacher quality. The clarification of the participants' qualifications and experience contributed to the results as relevant input variables, as discussed in the conceptual framework in Chapter 3. This is vital as the quality of instruction that learners receive is dependent on teachers possessing the appropriate qualification to teach the subject (Spaull, 2013). Scheerens (2011) explains that, "A well-qualified and motivated teaching force is to be seen as one of the most vital assets for educational goal" (p.43).

According to the Employment of Educators Act (EEA) no.76 of 1998, "In order to qualify for appointment as an teacher a person must have at least a recognised three year qualification (REQV 13) which must include appropriate training as a teacher" (DoE, 2009c, p. 10). The EEA is in line with the Personnel Administrative Measures (PAM) Act of 2016, as amended, which stipulates that, "In order to qualify for appointment as a teacher a person must have a recognised three year qualification (REQV 13) which must include appropriate training as an educator and registered with SACE" (Government gazette, 2016, p. 58).

These definitions require that a person must have a qualification of at least three years after completion of Grade 12, but further than that, the qualification must include professional training as a teacher. However, in terms of the Occupation Specific Dispensation (OSD) agreement of 2008, there was a push to raise the basic teacher

qualification level from REQV 13 to REQV 14 as of 2012. This translates to many teachers in the schooling system with a qualification of REQV 13 having to register for the Advanced Certification in Education (ACE) programme in order to develop further specialisation competency, to redress the imbalances of the past (Wessel, 2008), as well as to be placed in REQV 14. ACE is a new qualification on Level 6 that replaces the current Further Diploma in Education (FDE) and Higher Diploma in Education (HDE). ACE is used to upgrade or further training in a specialisation (Norms & Standards, 2000). For the Senior Phase teachers (Grade 7 to 9), specialisation in either mathematics, Natural Sciences, or technology is a requirement for an ACE qualification. Teachers who do not meet the minimum requirements of REQV 14 are regarded as either unqualified or under-qualified. According to the findings of a study conducted by Mji and Makgato (2006), there are a number of unqualified and under-qualified teachers within the system, a finding which is controversial as it is disputed by the Education Labour Research Council (ELRC).

The National Policy Framework for Teacher Education and Development (NPTFED) stipulates that all new recruits should be in a possession of a four-year teacher qualification (REQV 14) in order to meet international standards. Internationally, a well-qualified teacher should have four-year post-secondary education, and in some countries, this can be as high as six years (Beaton, Mullis & Martin, 2002). Teachers must also be registered with the South African Council of Educators (SACE). However, the National Teacher Education Audit noted that provinces were continuing to employ unqualified and under-qualified teachers. In the Northern Cape, where this study was based, the number of unqualified and under-qualified teachers increased from 95 in 2005 to 145 in 2007.

Spaull (2011) suggests that Senior Phase teachers (Grades 7 to 9) who specialise in mathematics have a ‘Primary phase’ qualification, which means that such teachers study all school subjects, and specialise in either mathematical literacy (40%) or mathematics (36%). Reddy (2006) posits that South Africa’s mathematics teachers are among the least qualified in the world.

The principal of School C touched on this topic, explaining,

> *Primary school teachers don't have to be maths teachers, they take a broad course at the universities and they learn how to teach math, science, and language. They are not focused maths teachers like we have in the high schools...so because maths is a very nice subject... They are not qualified maths teachers. So they don't know more than what is in the textbook.*

The views of the principal at School C were supported by the teachers at School E as he responded that, "Diploma was a Senior Primary and in that category we did all the subjects. But maths and science was the key subject."

While most of the teachers appeared to be appropriately qualified to be appointed as teachers, they were not highly qualified in teaching mathematics (AMESA, 2014). The data that was collected showed that almost all of the participants were professionally trained with a minimum of a Teachers' Diploma. Only two mathematics teachers in School A and School C held a Postgraduate Certificate in Education (PGCE), which means that these teachers were highly qualified to teach mathematics in terms of international standards. A PGCE qualification makes it possible for teachers to teach mathematics beyond Grade 9 level. At the time of this study, the mathematics teacher at School C also taught mathematical literacy in Grade 10, whereas the teacher in School A would move with his learners as the learners moved to higher grades. In the remaining three schools of the sample, the mathematics teachers possessed a Senior Primary Teachers' Diploma (SPTD), (REQV 13), and an ACE mathematics qualification.

The HoD at School A taught mathematics to Grades 10 to 12 only, and held a three-year Secondary Teachers' Diploma (STD) with specialisation in mathematics, which translates to REQV 13. Although the HoD at School A was qualified to fill his position in terms of the PAM of 2016, as amended, he was still under-qualified to teach and head the mathematics department according to the NPFTED. HoD B held a SPTD (REQV 13) with no specialisation in mathematics. In terms of international standards, this HoD was being classified as being an under-qualified mathematics teacher. However, her experience in teaching mathematics in the Senior Phase over the years had qualified her to act as the head of mathematics, despite not teaching mathematics at the time of

this study. The HoD at School D had an STD qualification with specialisation in Life Sciences. HoD D was therefore unqualified to head up the mathematics department as the participant neither taught mathematics, nor did he have any mathematics qualifications. HoD D responded as follows regarding his mathematics qualifications, *"I've never taught mathematics in my life. I'm a Life Sciences educator*."

When asked how he was then appointed to head up the mathematics department if he was not qualified to do so, he explained that the "system" allowed him to head up mathematics. By the "system", the participant was referring to the system at his school in which mathematics, Physical Sciences, and Life Sciences were grouped together as one department. Hence, he was appointed to head this department, irrespective of the fact that he was neither a mathematics nor a physical sciences teacher. The status quo created problems in guiding and supporting mathematics teachers in this school.

The HoD from School E held an SPTD coupled with a B.Ed (Hons) degree, majoring in Educational Law, Policies and Management. This translates to the participant holding a REQV 14 qualification, however, this does not meet the requirements of a highly qualified mathematics teacher, as maintained by AMESA (2014), and Mullis et al. (2002), amongst others.

It would thus appear from the sample that there was only one mathematics HoD (in School C) who had a PGCE qualification with mathematics as a major, making her the only appropriately qualified mathematics HoD in terms of international standards. Of major concern was the HoD who had never taught mathematics in his career, but had regardless been appointed as the head of the mathematics department in School D.

Teachers who lack experience appear to find it stressful and difficult to implement assessment policies due to the fact that there is not enough training or support provided. A lack of teaching experience may also be problematic for new teachers because they still lack confidence due to being new to the profession or promotional post. However, an effective education system still requires teachers with no experience to provide high-quality education to their learners through recent education/training,

therefore a teacher with less than two years of experience may be more effective than teachers who are at the end of their career.

In addition to qualifications, teachers' experience plays a vital role in determining teacher quality. There are contrasting views in the literature in terms of teacher experience. On the one hand, research has shown that greater experience in front of a classroom is often considered important to develop the skills required for effective teaching (OECD, 2009). Jensen, Sandovel, Hernádez, Knoll and Gonzalez (2008) argue that more experienced teachers have been found to be more successful at raising learners' achievements. On the other hand, evidence (OECD, 2008) points to the fact those teachers with extensive experience may be less effective as they become less interested and somewhat jaded in their careers. The OECD (2008) also suggests that teachers who are more experienced are no longer adaptable to new policy changes.

Furthermore, there is a relationship between age and experience, for example, a teacher who has less than five years' teaching experience is usually between the ages of 26 and 35. The findings of this study revealed that the participants differ in terms of the nature of their experience in implementing SBA. The majority of the participants had extensive teaching experience and had taught mathematics in the Senior Phase, particularly in Grade 9. There are two contrasting views that played out in the sample of this study. Teachers who were less experienced or who were new in the school were allocated the job of teaching Grade 9 mathematics if the school catered to the FET Band, for instance in Schools A, C and D. In the case where the school did not cater to this education level, with Grade 9 being the highest grade in the school, Grade 9 was taught by the most experienced and highly qualified teachers. The principal at School C added:

> *I have got two brilliant senior teachers, and they are basically teaching my senior maths. And I've got two junior teachers, but they are not juniors. I think you've seen Mrs X now the other day, she is the teacher teaching Grade 9 maths at this stage.*

In this case, Mrs X had extensive experience in teaching mathematics in her previous school, despite being a new teacher at the current school.

It also emerged that the HoDs in Schools B and E possessed no managerial experience, although they had extensive teaching experience in mathematics. Their experience varied between three and seven months, with the HoD with the least being in School B. the HoD at School E explained that she was voted in by other staff members in her school to act in the post due to her extensive experience in mathematics teaching, whilst the HoD at School B was asked to act until the post was to be advertised and filled. Neither of the two HoDs were appointed to act in their positions by the NCED authorities.

The mathematics HoDs in Schools A and C both had more than 10 years of experience in the post. According to their responses, they had extensive managerial experience. Of note is that the HoD at School C had additional experience as a National Senior Certificate (NSC) marker, and was also a senior marker for the NCED. The most challenged HoD was at School D as he had extensive managerial experience as an HoD over the years, however, this was not in mathematics. The school principal at School C was the most experienced school principal, with more than 10 years of experience. Alternatively, the least experienced school principal was at School E, with only a few months of acting in the post at the time that the data was collected.

The findings show that there was wide variation in the participants' profiles in terms of age, gender, qualifications and teaching experience. Of major concern was the HoD who had no training or experience as a mathematics HoD, and no mathematics qualifications whatsoever.

5.4.4 Sub-theme: The language of teaching, learning and assessment in mathematics

Language is an important variable as the teaching, learning and assessment of mathematics education begins in language (Durkin, 1993). Vygotsky (1998) argues that language is critical for cognitive development as it provides the concepts for thinking and is therefore a means for expressing ideas and asking questions. Vast amounts of literature deal with the fact that language is considered to be both a precondition for thought, a bearer of thought, and therefore an influence on the extent to which the

learners' intelligence is actualised. Vygotsky (1998) further posits that inadequate language then results in inefficient actualisation of intelligence.

In the South African context, language is a complex and sensitive issue. The majority of South African learners do not speak the language in which teaching, learning and assessments are conducted (Setati & Adler, 2003). Notwithstanding the fact that there are 11 official languages, formal teaching, learning and assessment are conducted in Afrikaans and English only (Taylor & Coetzee, 2013). The data from the questionnaires, interviews and documents that were analysed revealed that both the mathematics teachers and their learners in the JTG district used two languages for mathematics teaching, learning and assessment, namely, Afrikaans and English. However, the majority of the participants and their learners spoke Setswana, followed by Afrikaans. A small minority of the learners, who were in School C, were English speakers. This corroborates the findings of Naudé, Engelbrecht, Harding and Rogan (2010) that there is less than 10% of the population that is English speaking in South Africa. In Schools B, D and E (Group 1), almost all of the participants were Setswana speaking, whereas in Schools A and C (group 2), the majority of the participants spoke in Afrikaans.

According to Taylor and Coetzee (2013), it is invalid to simply compare the two groups of schools that conduct teaching, learning and assessment in the same primary language with those who speak a different language. This comparison is invalid because these two groups of schools differ systematically in terms of various observable and unobservable characteristics. When I asked how language affects the teaching of mathematics, the teacher at School E seemed to be frustrated by the language issue and remarked, "...don't compare our learners with those learners in the ex-Model C schools. They speak 'die moeder taal' (mother tongue), and being taught '*in die moeder taal'."*

This frustration is further fuelled by the fact that learners cannot be taught and assessed in their primary language as is the case in ex-Model C schools. The school principal at School E added that it is not only that learners do not understand mathematics, it is more a question of the Language of Teaching and Learning (LoLT). Principal E gave

this classical example, “I say to my learners, ‘Mary kicks the ball.’ And then ask them who kicked the ball? And then they stare at me because they don’t understand!” I further asked what impact this example had on teaching and assessing mathematics, to which she replied, “It’s worse, worse, worse in mathematics.” This finding is similar to that of Mji and Makgato (2006) in their study where learners did not understand English and found it difficult to understand mathematical concepts.

The teacher at School A was an Afrikaans speaking teacher who taught both Afrikaans and English classes separately, which is known as parallel-medium teaching. The learners who received instruction in Afrikaans were Afrikaans speaking learners, while the learners who received English instruction comprised predominantly Setswana speaking and a few Afrikaans speaking learners. The teacher at School A reported that his English classes were doing better than the Afrikaans classes. However, the teacher at School A had the following to say about the learners in his class who were Setswana speakers,

> *I’ve got three Setswana learners in my class, who want to ask questions, but can’t express themselves […] no language capabilities, don’t understand the questions [...] at the moment we do 2-Dimensionals, they need to know what classify means. Classify in maths means you have to tell me what type of triangle is...if you don’t know what classify is, you’ll start answering the question, but not answering what is being asked.*

This teacher also conducted afternoon classes by grouping all of the Afrikaans and English learners according to their performance. In other words, he combined both Afrikaans and English classes according to performance and taught in both languages (dual medium) without either group of learners experiencing language barriers. Such practice may be detrimental to both classes and may disadvantage the learners as none of the learners were properly exposed to either LoLT. However, assessment was being conducted in the LoLT of the learners. At School D, where all of the learners spoke Setswana, the teacher reported, “When I try to explain maths in English, they would say let us speak in Setswana. I then translate in Setswana and go back to English again.”

According to Setati and Adler (2003), this is known as code switching and is allowed in the classroom. Code switching is a teaching method where the speaker (teacher)

switches between the primary language and the LoLT during the lesson (Setati & Adler, 2003). Code switching seems to offer a possible solution to a multilingual classroom in the use of everyday language, but not in mathematical concepts. It has been argued that learners who are taught mathematics in a language that is not their primary language probably do not achieve academic excellence, not because they are less able, but due to artificially created linguistic problems that they may not have control over (Botes & Mji, 2010). In this case, the learners and their community spoke very little English and were only exposed to English in their classrooms. The teacher at School D further explained that it was time-consuming to first explain in the primary language and then in the LoLT. When I pointed out that it would be easier to begin with prefixes such as “tri” for three and “di” for two when teaching construction in geometry, the teacher replied that the learners still found it difficult to grasp mathematical content. This begs the question as to whether Grade 9 learners are actually able to distinguish between 2-D objects and triangles at this late stage. According to the teacher, learners in Grade 9 still did not know what a triangle looks like.

Bohlmann (2001, as cited in Naudé et al., 2010; Botes & Mji, 2010) argues that language is the medium through which mathematics teachers introduce and convey mathematical concepts. Furthermore, language comprises the procedures through which texts are read and problems are solved. It is therefore critical for teachers to master two verbal languages, namely, everyday language and mathematical language. The everyday language in this context is the Language of Learning and Teaching (LoLT). Naudé et al. (2010) posit that both are necessary for the construction of mathematical talk. Language proficiency has a strong effect on pupils’ performance in both maths and science (Howie, 2003), therefore, teachers in schools where both Afrikaans and English are being taught still battle with translations. Principal C asserted that, “...the language barrier...Afrikaans to English and translation affects our results.”

Howie (2003) reports that teachers have to be proficient in the LoLT in order to first clarify and then explain concepts in the mathematical language in order to master mathematics. During the interviews, it appeared that not all of the participants were proficient in English as their responses were in some instances in either Afrikaans or

Setswana. I allowed the participants to use their primary language during the interviews to obtain clarity and meaning.

It also emerged from the interviews that another challenge was experienced during the support and training sessions given by departmental officials. Afrikaans speaking teachers appeared to not be comfortable with being trained in English only, which is problematic as all of the learning and teaching material, such as lesson plans and assessment activities, are developed and produced in English. The teacher at School C explained that she had to make time to translate the material, she further expressed her anger by saying, “I refuse to use their lesson plans if they are not in Afrikaans.” She found it time consuming to translate all of the lesson plans and assessment activities from English to Afrikaans.

Many perceive mathematics as a subject that does not need grammar, however, it is important, as suggested by Howie (2003), for teachers and learners to first master the LoLT and mathematical register in order to understand terminology and symbols such as a pie (π), triangles, 2-Dimensional objects, classification; and the differences between ‘equal to’ and ‘equivalent to’, ‘square’ and ‘square root of’.

5.5 THEME 2: LEARNER PERFORMANCE IN MATHEMATICS

Poor learner performance in mathematics, particularly in Grade 9, has been constantly recorded and reported in South Africa over the years. However, according to the HRSC report (2006), this recurring poor performance does not exist in isolation; it reflects a myriad of systemic challenges such as overcrowded classrooms, teacher quality, teaching quality, and quality assurance mechanisms, amongst others (Creemers, 1990). Makgato and Mji (2006) also suggest that outdated teaching and assessment practices, as well as a lack of basic content knowledge in both learners and teachers result in poor learner performance.

Learners’ performance is measured against their participation at school level and in external assessments such as ANA and TIMSS. The findings of Grade 9 learners’

performance in mathematics in the JTG district will therefore be briefly touched on in the following sections.

5.5.1 Sub-theme: Learner performance in SBA

School-Based Assessments (SBA) are developed and marked by subject teachers at school or classroom level. In almost all of the schools selected for the study, the learners had been performing relatively well in their SBA as compared to external assessments. When probed regarding the reason for the higher performance of learners in the SBA, the participants gave varied reasons. It would appear that these teachers explained questions to their learners during tests, which may have led the learners to the answers. The HoD at School B said, "…teachers are explaining questions...telling them what the question wants." Teacher A recounted having shared a similar experience, "…teachers explain questions to the learners in class."

The forms of assessment associated with mathematics made it appear that the learners performed well. Most of the forms of assessment, such as assignments, investigations and projects, were done under uncontrolled conditions and, in some cases, in groups. The principal at School E expressed his views in saying, "...good performance because of group work like assignments, assistance and all the like..." Principal E further elaborated that, "With the help of the parents, because some of the work learners are doing at home and parents will assist and that it's sometimes higher."

It seems that the high learner performance was thus due to a lack of curriculum coverage in the teaching and assessment of certain topics that the teacher and learners may have felt comfortable with. The HoD at School B, for instance, stated that,

> *The teachers are asking the same questions. You find that question 1 is the same as question 2 and is based only on one concept. A lot of marks come from one concept. He identifies one concept that learners are good at.*

The teacher at School C alluded to the fact that learner performance at her school was high due to the fact her learners were familiar with her style of questioning.

At School A, this was not the case as SBA was handled differently. The teacher at School A, reported that he got a lot of his test questions from past ANA question papers and refused to explain questions to his learners. In School C, for instance, the school principal scrutinised all of the SBA marks and compared them to examination marks. According to the principal, if there was a wide mark variation between the SBA and an examination mark, the teacher was called in to explain how the wide variation had occurred. The principal further elaborated that the mark variation between the two sets of marks was usually 5% or less. As a result, although the learners' SBA performance was higher than their examination performance, this gap was kept to a minimum. This practice might be associated with the fact that a few of the staff members at the school, including the mathematics HoD, were involved with the NSC marking processes and were therefore able to filter this knowledge down to other grades.

There was an overall agreement by the participants that their learners performed better in SBA because the standard of SBA, as well as the quality of the questions, was much lower than that of external assessments.

5.5.2 Sub-theme: Learner performance in the Annual National Assessments (ANAs)

The Annual National Assessment (ANA) was introduced as a national measurement tool by the Department of Basic Education (DBE) in 2011 and 2012 for Grades 1 to 6 and 9, respectively, as outlined in the Education Sector plan, Action Plan to 2014: Towards the Realisation of Schooling 2025 (DBE, 2013). The main purpose of the ANA is to enable a systemic evaluation of educational performance, through which learners' skills and their achievement may be enhanced. These nationally standardised assessments measure the skills and knowledge that learners are expected to have acquired as a result of teaching and learning based on the mathematics and languages curriculum.

ANAs are used to monitor progress and performance in the achievements of Learning Outcomes, it also guides the planning of districts and provides resources to help improve the linguistic and mathematical skills and knowledge of learners. The ANA results are therefore not part of SBA and will not be used as part of the requirements for

promotion and progression. The biggest criticism of ANA is that, in reality, the assessment practices of teachers are dominated by a practice of recording and reporting learners' scores. This reinforces the traditional practice of 'teaching to the test' (Gipps, 1999), where educational success is measured by the achievement of high scores.

The national ANA results show that there has been a national decline in achievement in Grade 9 mathematics since its inception. In 2012, about 92% of South Africa's Grade 9 learners achieved less than 30% in the ANA. In 2014, only 3% achieved more than 50%. The data presented here shows that learners are performing below the expected levels. This study further reveals that learner performance in the ANAs in the JTG district is unacceptably low, which corroborates the findings of the literature that was reviewed.

It would appear that most of the participants shared the same findings as those of Pournara (2015) in terms of the difficulty of ANA question papers over the years. The HoD at School C confirmed this, stating that, "2013 ANA question paper was a bad, bad one, but 2014, it was a little bit better." Whereas the principal of School A complained that the 2014 mathematics ANA "…was a disaster. In English they are performing, but in maths ...it was horrible." Moreover, the teacher at School E expressed her views in saying, "ANA 2014 was the easiest."

The teacher at School A reported that only one learner passed the 2014 mathematics ANA, which was corroborated by the HoD at School A, who expressed his anger in saying, "No learner passed; 0.1% ... round it off, it is 0%!" Additionally, at School D, the teacher lamented the fact that "with ANA, it was very, very bad ... no one passed. It was 0%."

The teachers in Schools A and D only found out after the fact that learners' performance in mathematics was dismally low. This was due to the fact that they were not teaching at their respective schools or had been on sick leave for a long duration, respectively. When asked about the reasons for the poor performance of learners, the participants offered varied reasons for the poor mathematical performance in the Grade 9 ANAs.

However, all of the participants were unanimous that the standard of the questions in the ANA was too high. The HoD at School C had strong feelings about the ANAs, “ANA is too difficult. There’s a question that is, according to my knowledge, is not part of the syllabus...they are asking them about exponents of Grade 11.” The teacher at School B further added, “Our learners are scared of any papers with the departmental logo.”

On the one hand, almost all of the participants felt that most of their learners were scared of any external question paper, but on the other hand, the participants felt that the learners did not take the ANAs seriously because they were aware that ANA results did not form part of their Continuous Assessment (CASS) mark. This conclusion is supported by several researchers (AMESA, 2013; Pournara, 2015; SADTU, 2015). From the four schools selected, the general challenge when answering ANA questions was the question of language. The participants found that learners who did not speak the same language as that of the assessment tended to have problems in interpreting the mathematics questions. The principal at School B stated, “…there is nothing wrong with ANA, it’s just that our learners cannot interpret the questions.” While the HoD at School B expressed his frustration, “...it is the language problem...the standard of language is too high...learners do not understand the language. Reading is a problem. With the word sums, out of 30 learners, at least two will get 30%.”

Most of the participants also blamed the DBE in terms of policy as they claimed that learners were admitted to Grade 9 through what is known as ‘age cohort’. Age cohort, which refers to the learners who are over-age in the grade, is defined as those learners who did not meet the promotion requirements of a minimum of Level 3 (40 to 49%) in mathematics in the previous grade. In addition, the policy caters to learners who have been in a phase for more than four years as the policy then requires them to be pushed to a higher grade. Teacher A said that he already had learners who were over 18 and 19 years old in his Grade 9 classes. HoD E added, “...the department does not allow learners to fail.” Such learners, as explained by the participants, have not acquired basic mathematical concepts. The teacher at School C expressed her anger regarding this topic, “The problem is from the primary schools, you find that the learner has not passed a single subject there.”

The teacher at School A gave this account,

> *Performance is lower... only two people passed mathematics in Grade 8 last year. I have 174 Grade 9 learners, it means 172 of them can't do mathematics. They are in Grade 9 because of departmental policy. There are only five Level 7 learners in my class...there are a lot of learners in my class who cannot have the ability to do maths.*

This study has revealed that, according to the responses from the interviews, poor curriculum coverage added to the poor performance of learners in ANA. ANA is written during Term 3, which, according to the participants, only covered Term 1 and 2's work instead of the required curriculum for Terms 1, 2 and 3. Time is wasted on revising work and drilling learners to obtain higher scores without them understanding the work.

In 2014 in the Northern Cape, only 9.6% of the Grade 9 mathematics learners achieved acceptable levels in the ANAs. In addition, in the JTG district, where this study was conducted, 9.3% of its Grade 9 learners achieved acceptable levels, yet these were below the national benchmark of 10.4%. When asked about their learners' performance, the participants admitted that their learners were not performing well in the ANAs.

5.5.3 Sub-theme: Learner performance in International Assessments

Grade 9 mathematics learners participate in international comparative studies such as the Trends in International Mathematics and Science Study (TIMSS). TIMSS (2011) showed that South African learners had the lowest performance among all participating countries (CDE, 2013).

It is was a concern to note that none of the participants had any knowledge of TIMSS, and moreover, they had limited knowledge that South Africa had the poorest performance at international level. While it may seem that these teachers were ignorant about these studies, the national Department of Education may partly be blamed for not filtering through information from TIMSS and other international studies to all teachers.

5.5.4 Sub-theme: Strategies to close the gaps between SBA and external assessments

The findings presented in this study revealed that there is a gap between SBA and external assessments. School Principals and HoDs, as the custodians of curriculum

delivery in their schools, were asked what strategies were in place to close the existing gaps in learner performance between SBA and external assessments. The principal at School C, for instance, explained that he looked for any drastic rise in SBA marks and provincial common examinations. He allowed only 5% of the difference, and should there be a wide disparity between the sets of marks, the mathematics teacher would be required to explain the inconsistencies.

In another strategy to close the gaps, almost all of the principals and HoDs suggested that the ANA questions should be drilled with the learners, set by teachers at the school, and be made part of the requirements for CASS promotion and progression so that learners will take these external assessments seriously. In addition to these suggestions, many believe that mathematical topics and concepts are not adequately taught in school due to time constraints.

5.6 THEME 3: TEACHING QUALITY

Mathematics is a key requirement, not only for entry into higher education, but also for most modern, knowledge-intensive work (CDE, 2103). However, the teaching of mathematics in South African schools is amongst the worst in the world (CDE, 2013; Taylor & Coetzee, 2013; HSRC, 2003). One of the most important factors limiting the quality of mathematics education is the poor quality of mathematics teachers, and mathematics teaching in particular, especially in the GET band (Grade R to 9) (CDE, 2013).

The teaching of mathematics is built on Shulman's theory, which facilitates teaching content knowledge and pedagogical knowledge (Shulman, 2004; Long, Dunne & De Kock, 2014). Subject matter (content) knowledge (SMK) refers to the quality and organisation of knowledge in teachers' thought processes (Shulman, 1996, as cited in Long et al., 2014). Mathematics teachers should have appropriate content knowledge in order to be able to teach mathematics fluently. Pedagogical Knowledge (PK) refers to the expertise of teachers in selecting appropriate teaching methods in teaching particular content to learners (Shulman, 1996). Pedagogical Content Knowledge (PCK) is the interface between, or the synthesis of, teachers' pedagogical knowledge and their

subject matter knowledge, which comprises Pedagogical Content Knowledge (PCK). PCK becomes evident when educators have the ability to build on their learners' prior knowledge and adapt their teaching methods accordingly. However, Mudaly (2014) argues that knowing either the mathematical content well or having good pedagogical knowledge does not necessarily guarantee successful learning.

In the following section, I will discuss teacher subject knowledge, Pedagogical Content Knowledge and curriculum coverage as variables of teaching quality.

5.6.1 Sub-Theme: Teacher Subject Content Knowledge (SCK)

Spaull (2013) finds that most South African mathematics teachers do not possess desirable levels of mathematics content knowledge, and only a small percentage possess desirable levels of mathematics content knowledge. The CED report (2013) concurs with Spaull (2011) in indicating that a number of recent studies have drawn attention to weak teacher content knowledge, particularly in grades lower than Grade 12. When the participants in this study were asked about their levels of subject matter knowledge in mathematics, most of the teachers indicated on the questionnaires that they only had mathematics content knowledge up to Grade 9 level, the grade that they taught. This lack of knowledge is a major concern as some topics, for instance, Content Area 2 (Measurement) and Content Area 3 (geometry) in the Senior Phase need more emphasis as these two content areas are of the utmost importance to mathematics in the FET band. It was only in two of the five schools that the participants were confident in teaching mathematics beyond Grade 9 level. The teacher at School A explained, "Here at our school we move with our learners up to Grade 12. I've divided my Grade 9s in such a way that I prepare the A class for next year."

In other words, the teacher at School A possessed subject knowledge of the entire school mathematics curriculum, while the teacher at School C was teaching mathematical literacy in Grade 10 at the time of this study. From the responses in the interview conducted with the HoD of School C, she seemed to know the content and curriculum from Grade R to Grade 12. Therefore, teachers in both these schools proved to be confident in terms of subject knowledge in mathematics. The principal at School C

seemed to be knowledgeable of what the mathematics curriculum entails as during the interview, he constantly referred to the specific mathematics concepts being taught at school.

The teacher at School E clarified that he had more content knowledge of geometry as he was a qualified Technical College teacher. Usiskin (2012) maintains that mathematics topics and concepts should not be taught in isolation, but should be integrated, for example, geometry should be taught simultaneously with algebra. It is therefore problematic if the mathematics teacher is confident in teaching only one section or some sections of the mathematics curriculum.

The findings in the current study suggest that most teachers possess subject knowledge up to Grade 9 level and teach only what has been prescribed in the CAPS document, or in the textbook, as pointed out by the principal at School C. The data collected also point to the fact that not all mathematics teachers are confident in teaching all of the mathematics topics, particularly geometry. Usiskin (2012) suggests that teachers can only teach what they know, therefore, the available evidence suggests that mathematics teachers spend more time on topics that they know and what could be assessed and evaluated than on teaching.

5.6.2 Sub-theme: Teacher Pedagogical Content Knowledge

Pedagogical Content Knowledge (PCK) is a type of knowledge that is unique to teachers, and is based on the manner in which teachers relate their pedagogical knowledge (what they know about teaching) to their SMK (what they know about what they teach). PCK becomes evident when teachers have the ability to build on their learners' knowledge and adapt their teaching strategies accordingly. However, it emerged from the interviews that the Grade 9 teachers were frustrated that almost none of their learners possessed prior basic mathematical knowledge, they also found it challenging to adapt their teaching strategies. It further emerged from the interviews that the learners did not meet the minimum requirements to be promoted to Grade 9.

The principal at School E emphasised,

> *Learners come to our school has got some serious problems with their knowledge, prior knowledge. So we've, first to build that prior knowledge before we can get to the main part. In addition, learners do not know the simple concept of BODMAS."*

The teacher at School A supported this statement in saying, "All current Grade 9s actually failed Grade 8 mathematics and they are now in Grade 9." This was further corroborated by the principals at Schools B, D and E, "These learners are coming here because of age cohort. They have been pushed through the system and don't know basic mathematics knowledge."

Teachers have to adapt their teaching strategies in order to accommodate learners without basic mathematical prior knowledge. Spaull (2011) argues that "those teachers that lack sufficient conceptual understanding of their subject, are more likely to employ inappropriately concrete techniques when teaching and use methods that undermine the long-term learning trajectories of learners" (p.29). In this regard, the teacher at School D admitted that her strategies were somewhat problematic in her teaching, "...strategies that we are using are not effective. I think we need to change our methods."

According to the Mathematics Subject Policy of the Northern Cape Education Department (NCED, n.d), with the new developments in the school mathematics curriculum, the learner-centred teaching method is considered as the best approach. This means that teaching will put learners first, recognise and build on their knowledge and experience, and respond to their needs. Teachers should therefore strive to use the following methods during their teaching:

- Mathematical investigations: learners will be given opportunities to use various logical processes to formulate, test and justify conjectures;
- Problem-solving exercises;
- Brainstorming;
- Written work done by the learner as an individual; and

- Group work.
- Apply mathematical skills and knowledge in a certain context, in real life situation and make everyday applications of mathematics meaningful
- Research projects

It appears that a few of the teachers lacked PCK in teaching certain topics, such as geometry, as confirmed by the teacher at School D, “I think I must change my teaching methods. My learners do not understand me.”

It is also emerged from the interviews that the NCED conducted ‘empowerment workshops’ in order to empower teachers in the teaching methodology of certain topics in mathematics. Mji and Makgato (2006) claim that outdated teaching practices and a lack of basic content knowledge have resulted in poor teaching standards (p.254). Poor teaching standards may also lead to teachers’ tests encouraging rote learning and superficial learning (Black & Wiliam, 2001).

Although there is evidence in the research that suggests that new teachers may have incomplete or superficial levels of PCK, the findings in this study contradict such evidence. This study found that Teacher A, as a new teacher, brought new teaching strategies, innovation and methodology to his mathematics classroom.

5.6.3 Sub-theme: Curriculum coverage

CAPS provide guidelines on what content to teach and when to teach certain topics and concepts (DBE, 2013). The literature suggests that more topics were added to the mathematics Grade 9 curriculum as compared to the previous curriculum (RNCS). HoD C described the Grade 9 mathematics curriculum as being “bloated” with a lot of topics. The HoD at School C further stated, “There are too many topics for Grades 9...why teach financial mathematics in Grade 9?” While Principal C added, “...mathematics curriculum is too difficult for average learners...” This frustration was shared by the teacher at School B, who exclaimed,

> *Topics and concepts taught in a week are not linked. The sequencing is not properly done, one cannot continue the next day. This hampers teaching....and when we say these things, the officials tell us its policy, and you don't have a choice.*

The teacher at School A also expressed his views, "... CAPS does not give... dates and specific weightings of the topics and those stuff, so these are the areas that CAPS document can be improved on."

The teacher at School C had a different view from that of the teacher at School A, stating, "The NC education department has refined the policy on assessment pieces, content, marks and weighting in exams." This was an interesting finding as from my field notes, it appeared that the teachers at Schools A and C shared their assessment tasks, lesson plans and teaching methodology, as suggested by Black and Wiliam (2001). These views suggest a variation from the national policy. The NCED has interpreted CAPS and drawn up its own 'policy' for assessment marks and weighting as there are no national clear guidelines. Despite some form of guidelines or structure from the NCED, teachers still find it problematic to implement what the NCED has provided. It appears that teachers still have varied interpretations of what the NCED has already interpreted.

In addition to the bloated curriculum, the time allocated to mathematics in the Senior Phase has been reduced from 4.95 hours per week to 4.5 hours (DBE, 2103). All of the participants expressed concern about the time allocated for teaching mathematics in Grade 9. This was seen to have a negative effect on curriculum coverage in implementing the Annual Teaching Plan (ATP), which does not cater to informal assessment. It emerged from the interview conducted with the teacher at School B that he seemed frustrated with the time allocation and the sequencing of the topics that did not follow one another. The teacher at School B explained the situation as follows,

> *The way the curriculum for grade 9 was designed... for example the first topic covered in Grade 9 is the whole numbers... the topic is supposed to be covered in four and a half hours, the sub-topics are types of numbers, there's financial mathematics as well in those few days, and financial mathematics covers budgets, taxes, commissions, simple*

> *and complex interests. And these concepts are supposed to be covered in an hour according to policy. It seems that learners are just revising the work, learners cannot repeat the work the next day...a new concept every day.*

From this description, it is evident that Grade 9 mathematics teachers find it problematic to implement and cover CAPS in their classrooms, which affects their teaching quality and assessment. The views expressed by the participants were that they had to rush over the syllabus in the allocated time, in some instances, leaving the learners behind. The participants is felt that was only being done in order to finish the syllabus. The participants also raised the concern that CAPS does not make provision for formative assessments and revision, as expressed in Afrikaans by both teachers at Schools C and E, "...it hampers teaching to the extent... it means you don't have time to consolidate and reflect on what was done the previous day."

The teacher at School C expressed his frustration, "There are new concepts that were not in RNCS, for example, probabilities were not in detail, proving of angles introduced in grade 9. There are more topics but less time and we are unable to finish the syllabus." It also emerged that teachers in the sample conducted extra classes during the afternoons and on Saturdays in School B in order to cover the curriculum. It was evident that, whilst I was still conducting interviews, the learners were waiting for their teachers for the afternoon session. The mathematics teacher at School B, however, explained that Saturday classes had poor attendance, which complicated the challenge of curriculum coverage.

In addition to CAPS, at the time of this study, there was another programme running concurrently with the implementation of CAPS, which was known as the Programme for Implementing Learning Outcomes (PILO), better known as the 'Tracker'. The 'Tracker' was only implemented in the ten schools of the JTG district in the Northern Cape. However, not all of the schools in the sample were implementing this programme. As described by the participants using it, the programme was similar to CAPS. The 'Tracker', according to the teachers, had dates on which specific content was to be covered, and the teachers were required to follow it to be on track with curriculum coverage. The programme did not take into cognisance learner pace and was being

monitored by a district official. The teachers seemed to understand and follow PILO more than they would with CAPS, however, it was not clear whether the mathematics teachers developed their own lesson plans in addition to the lesson plans provided by this programme. It is also not clear what impact the programme had on the schools utilising the programme as compared to the schools not utilising the programme. Clarity on the criteria used to select the schools using this programme was not shared. Nevertheless, Spaull (2013) argues that no programme was ever evaluated for its effectiveness in the South African education system.

Black and Wiliam (2001) maintain that there is a tendency to emphasise quantity and neglect its quality in relation to learning. From the data collected from the interviews, it was evident that almost all of the mathematics teachers in the sample conducted afternoon classes, and others, as in the case of Teacher B, Saturday classes, which were not well attended. It would thus appear that teachers rush over the curriculum in order to finish on time for the sake of compliance and assessments. When I asked about the time spent on correcting homework, the teachers explained that they felt they did not have the time to correct homework and refer to the previous day's work as they were under tremendous pressure to cover the syllabus. In all of the afternoons that I conducted interviews, there were always learners waiting for their mathematics teachers for afternoon classes. The HoD at School C recounted that she started her day around 06h30 in the winter in order to do what was required of her to do.

Another variable that had an impact on curriculum coverage that emerged from the interviews was the issue of 'one plus four' (1+4). 1+4 literally means one day (every Monday of the week) out of school being dedicated to a day's workshop and four days of teaching in a week. In the workshop day of the programme, the teachers were given lesson plans, as per the ATP stipulated in CAPS, to be implemented for the remaining four days in their respective schools in order to ensure uniformity amongst schools. However, the programme contradicts the DBE's own regulations as per the PAM document, which stipulates that "professional development should be spent outside the formal school hours" (Government Gazette, 2016, p. 18). This strategy is promoted by the national Department of Basic Education in its attempt to close the gap that exists in

the Grade 9 curriculum and in improving ANA results, specifically in Grade 9 mathematics. It is mandatory that all Grade 8 and 9 mathematics teachers attend the 1+4 programme.

As a new programme that had just begun at the time of data collection, it seemed that the participants were not fully conversant regarding its purpose, effectiveness or efficiency. When asked to narrate the challenges and successes of 1+4, it was of major concern to note that almost all of the participants seemed confused about the rationale of the programme and viewed this programme in a bad light. Some of the participants called the programme "4+1" and others "1+4". The responses of all of the principals interviewed revealed that the 1+4 programme hampered the smooth running of their schools as the programme takes mathematics teachers out of the class every Monday to attend the workshop. The teacher at School C felt that this programme was a waste of time and only attended as per compliance requirements. The principal at School C commented,

> *4+1 is really having a negative effect on the teaching of mathematics in schools. The department thinks that they are doing an intervention that will make the results better, I think they are going to achieve exactly the opposite.*

The teacher at School C also shared her frustrations in explaining,

> *Education officials draw up the content and what should be discussed for the day. Few educators, like myself, are far ahead...officials do not know what is going on in the schools. Most educators are far behind with their work. The intention of 1+4 was to prepare lessons for the following week; however, it is not happening. If educators are on track, officials say they must stop. I will never stop. It's ineffective, time-consuming and not according to the pace setter. Educators who are on time, time is wasted, focus is on Grade 8, and Grade 9 educators have nothing to do."*

The HoD at School C agreed with the principal and teacher and stated, "Facilitators are not well prepared. Subject advisor did nothing... it was just a waste of time. Topics are not in line with ATP, not in line with the intention of 1+4."

This was not only the case at School C, however, as the teacher at School B revealed that,

> *Teachers were instructed to leave what they were doing and treat another topic that was discussed by the subject advisor...I had to find an excuse with my class to change the topic, for example, last week we were supposed to cover 2-D shapes and had my planning. But I got lesson plans on straight lines... I had to find an excuse with my class to change the topic because I left work for them to do when I'm not at school.*

From the principals' responses, it was revealed that the DBE requested schools to change their timetables in order to accommodate the 1+4 programme. When changing the timetable, it meant that five days' work needed to be squeezed into four days, which hampered planning, affected the sequencing of topics as per policy guidelines, and affected curriculum coverage, as well as the assessment plan. The teacher at School A further added, "1+4 takes a lot of time. I don't think I'll be able to finish with the curriculum when I want to."

The principal at School E clarified that there were five mathematics teachers from her school attending the 1+4 programme every Monday of the week, excluding those teachers that were absent from school on those days. On a side note, a study conducted by Reddy (2001) found that 11% of teaching time was lost due to teacher absenteeism. According to the participants, their schools were chaotic on Mondays. Moreover, the principal at School C lamented that Grade 9 mathematics teachers not only taught Grade 9 mathematics, but had other classes and other subjects to teach, which the school found very challenging to manage.

The implementation of CAPS resulted in the DBE introducing the use of mathematics workbooks, which, according to the participants, was also a strategy of the DBE to improve ANA results. From the discussions above, it would seem that the Grade 9 mathematics teachers in the JTG district implemented a lot of programmes simultaneously, namely, CAPS, the DBE's workbooks, PILO, and 1+4. Despite their intention to improve mathematics performance, the evidence suggests that these programmes may in fact hamper curriculum coverage, teaching, learning and assessment.

5.6.4 Sub-theme: Class size

Class size was another factor contributing to the quality of mathematics teaching in Grade 9. According to the amended PAM document (2016), the class ratio is 1:35 in secondary schools and 1:40 in primary schools, which means that one teacher has to teach a maximum of 35 and 40 learners per class in secondary and primary schools respectively. The numbers given by the participants translate to overcrowded classrooms, which is typical in township schools. In overcrowded classes, teachers spend more time on administrative duties such as discipline and marking, which impacts the quality of teaching. Furthermore, overcrowded classes impact curriculum coverage, which erodes the actual time given from the already reduced time stipulated in the CAPS document (DBE, 2013).

It emerged from the interviews that there were varied interpretations of what constitutes an overcrowded classroom. In Schools B and E, for instance, the number of learners per grade per classroom was between 50 and 60, whilst the teacher in School C complained about having 40 learners per class. The teacher at School B stated, “Overcrowding makes individual monitoring of learners very difficult.” While the principal at School A responded, “If I say the school is full, the district says no, no you must take that learner.”

The teacher at School A taught all of the Afrikaans and English Grade 9 classes, in contrast with the teacher in School C, who taught Afrikaans classes only. The teacher at School A had to prepare lesson plans and assessment activities in both English and Afrikaans, which was time-consuming. In the remaining three schools, in School E specifically, the three Grade 9 classes, which made up a total of 180 learners, were taught by one teacher. The principal in School E alluded to the fact that large classes were due to a shortage of classes, and not of mathematics teachers. Overcrowded classrooms pose a challenge in terms of discipline, as experienced by most of the participants. However, in School C, the mathematics teacher revealed that there were no major, glaring disciplinary challenges in her classes, a fact disputed by the principal of the same school.

The teachers also expressed some discontent regarding the assessment of overcrowded classes. They recounted that, due to large numbers, they made a lot of mistakes in their marking due to exhaustion. As a result, the marking and scores were not reliable, valid and consistent for all of the learners.

It is evident that the class size and the number of classes taught by the participants impact negatively on their expected core duties. Also, too much time is wasted on addressing disciplinary problems rather than actually teaching.

5.6.5 Sub-theme: The role of SBA

Assessment is a continuously planned process of identifying, gathering and interpreting information regarding the performance of learners by using various forms of assessment. Assessment should be both informal and formal (CAPS, 2011, p.157). Formal assessment comprises School-Based Assessment (SBA) and end of year examinations, which are marked and recorded (NPA, 2013).

Table 5.6 The minimum requirements for mathematics Formal Assessment (number of tasks in the Senior Phase)

	Forms of assessment	Minimum Requirements per Term				Number of tasks per year	Weighting
		Term 1	Term 2	Term 3	Term 4		
SBA	Test	1	1	1		3	40%
	Examination		1			1	
	Assignment	1		1	1	3	
	Investigation		1		1	2	
	Project			1		1	
	Total	2	3	3	2	10+	
End of year examinations						1	60%

Source: DBE (2013)

Table 5.6 shows the minimum requirements for all formal assessment in mathematics in Grades 7 to 9. It can also be seen that the SBA component is capped at 40% and is comprised of different forms of assessment. As part of departmental requirements, the end of year examinations are capped at 60% for the Senior Phase.

The South African education system makes no provision for external common examinations in the GET Band. External examinations refer to tests that are set by external bodies outside of individual schools. These ensure that all learners in the participating schools write the same examination to get obtain the same level of insight into whether they have attained similar levels of education. In the South African context, specifically in the GET Band, School-Based Assessment (SBA) is the main determining factor for the promotion and progression of learners.

The development and implementation of SBA have been a challenge since its inception in 2001 (Poliah, 2012). Poliah (2010) further posits that the primary reason for the ambivalence around SBA is the lack of clarity relating to its purpose and its inclusion as a promotion requirement, specifically in Grade 9 mathematics. SBA is an important formative assessment tool (AfL), but when it is used as a summative assessment tool (AoL), it should be rigorously controlled and quality assured. Umalusi, (2013), the South African quality assurer, argues that there is a huge disparity in the quality of SBA from one school to another and across education districts. A reason for this could be the resource limitations at certain schools and the lack of educator competency relating to the designing of assessment tasks.

During the interviews, I noted with concern that the mathematics teachers in the sample had varied understandings of the role and importance of SBA. Whilst most of the participants agreed that SBA is used for promotion and progression requirements, the educator at School A had a different point of view regarding how SBA is conducted,

> *I feel that the way SBA is done at the moment, its structure, makes the learners lazy. After writing the test, they don't worry anymore. They just focus on passing the test. It should be about learning concepts, understanding concepts.*

The comments made by the teacher at School E corroborated Black and Wiliam's (2001) observation that teachers teach to the test. The comments further confirmed that there was a lack of Assessment As Learning, which is a system in which learners use assessments to learn and reflect on what they have learnt.

The focus of SBA in the GET band plays a major role in the promotion and progression of learners. The previous curricula placed a 75% cap on the weighting of CASS, and most recently in CAPS, the SBA weighting has been reduced to 40% due to the weaknesses in the system. The fact that examinations are internally set compounds the problem as CASS amounts to 100%. The quality of CASS, which is made up of SBA and examinations, is then problematic. The reliability, credibility and validity of promotion become questionable.

5.6.6 Development of SBA tasks

Section 4 of CAPS stipulates the different forms of formative assessments to be carried out in mathematics. In this research, the teachers seemed to experience difficulties of a varied degree in the development of SBA. When asked about the different formal assessment tasks, it appeared that all of the HoDs and teachers knew the forms of assessment associated with mathematics and could recite these, but were not knowledgeable of what constitutes each formal assessment. However, the teachers admitted that they did not know the differences between tests, assignments, projects or investigations, and that they found it challenging to develop the different forms of formative assessment tasks. It was evident from the documents collected that the main form of assessment was tests as there was no evidence of other forms of assessments.

In addition, CAPS is silent on the mark allocation of the different forms of formative assessments, and no clear guidelines are provided. The policy is open to varied interpretations and implementation as far as mark allocation is concerned. This variation was evident from the sample of mathematics teachers in the JTG District, with a total mark allocation of formal tests varying between 25.50 and 60 points.

When asked about the Assessment Programme for mathematics, all of the principals agreed that their schools had assessment programmes, but they admitted that they

were not implementing these. The school principal at School B simply stated, “We’ve failed in that regard.”

It was evident that the five selected schools conducted their SBAs at different times in the term.

When asked about the elements that should go into the SBA tasks for a standardised test, the participants varied in their responses, but they all agreed about the use of Bloom’s taxonomy of cognitive levels. Taxonomies are used to ensure that assessments contain a mix of questions that properly test skills and knowledge of concepts. Bloom’s taxonomy comprises seven levels. In mathematics, there are only four cognitive levels, which may be very confusing for mathematics teachers. These cognitive levels of mathematics are:

Level 1 (knowledge: 25%);
Level 2 (routine procedures: 45%);
Level 3 (complex procedures: 20%); and
Level 4 (problem solving: 10%).

These levels are provided in the CAPS documents with level descriptors and examples. However, it appeared that the mathematics teachers in this study seemed to lack an understanding of the cognitive levels of mathematics. In addition, it appeared that neither the mathematics teachers nor the HoDs knew or understood the cognitive levels prescribed for mathematics. The teacher at School B expressed his frustration, stating, “I don’t understand the application of cognitive levels.” This is supported by Long et al. (2014), who suggest that the cognitive levels of mathematics are problematic to interpret. When I asked the teachers at Schools C and E if they knew the cognitive levels in mathematics, I observed some form of embarrassment from the participants as they both said, “I forgot the cognitive levels today, but when I set a test, I use the document to refer to those levels, which is in my computer.”

A document analysis was conducted to corroborate or contradict the data from the interviews in terms of the cognitive levels. The analysis proved that almost all of the teachers asked Level 1 and Level 2 questions only. The teacher at School A used a few

selected ANA questions, as well as past common provincial questions to develop SBA tasks; all of the cognitive levels were included in the task. The teacher at School A also used an 'analysis grid' to indicate levels, topics and concepts. It seemed that the teacher at School A was knowledgeable about developing an SBA task, thus making it easier for the HoD to moderate the tasks. It appeared that almost none of the mathematics teachers and HoDs were guided or trained appropriately with regard to the development of SBA tasks.

Assessing content and concepts seemed problematic for the teachers. The teacher at School D, for instance, should have exposed the learners to complex composite shapes to assess the geometry of 2D objects, but was not doing so. In addition, congruence and similarity were not assessed, which is problematic as these form part of very important content to be assessed in Grade 9. The implications thereof are that if the learners are not exposed to congruence and similarity, then they will not be able to answer ANA questions. As such, a possible reason why the learners were not able to answer ANA questions could be that the teaching of basic concepts was not scaffolded accurately and the foundations were not laid.

The participating teachers seemed to experience difficulties in developing tasks of high quality, as almost all of the tasks analysed through document analysis assessed knowledge and routine procedures of a lower order level of understanding mathematical concepts. This study revealed that the participating teachers did not make use of educational taxonomies to plan teaching, learning and assessment at various cognitive levels. McAlpine (2002, as cited in Poliah, 2014) suggests that when developing a task of appropriate quality, the level of difficulty of the items must be considered. Evidence from this research shows that most of the selected schools did not comply with this suggestion.

5.7 THEME 4: QUALITY ASSURANCE

Umalusi (2014), South Africa's quality assurer, defines quality assurance as a process that ensures that the degree of excellence, as specified, is achieved. Quality assurance yields credible, fair, reliable and valid results. Umalusi is mandated to quality assure all

assessments at the exit points of the South African education system, which are Grades 6, 9 and 12. Currently, Umalusi quality assures SBA and external common assessments for Grade 12 only. The current assessment policy and assessment practices make no provision for external common assessments for grades lower than Grade 12. In addition, according to the National Protocol on Assessment (NPA), all assessments below Grade 12 are to be internally quality assured by individual schools. Furthermore, the NCED conducts on-site SBA moderation in a sample of schools only. On-site moderation is conducted at the beginning of each term, except for Term 1, for the previous term's assessments.

To determine whether the SBA was credible, fair, reliable and valid at the selected schools, I looked into the development of SBA tasks. I also analysed the monitoring and moderation of such tasks for any discrepancy or variations, or similarities in terms of quality. The following sub-themes will be discussed below, namely, monitoring and moderation.

5.7.1 Sub-Theme: Monitoring

Monitoring involves setting and evaluating targets in terms of curriculum coverage, curriculum quality, learner performance, improvement plans, and teacher performance and weaknesses. Fitz-Gibbon (1996) finds that monitoring is a powerful tool for quality assurance that keeps track of the performance of the system and can be used to measure the degree of excellence in institutions. Curriculum coverage is one key area of school functionality stemming from instructional leadership that could be more effectively monitored. Reviews of learner workbooks can provide telling information about curriculum coverage and the practice of exercises within the classroom. This could therefore be used for the purpose of monitoring. However, no learner workbooks formed part of the documents that were analysed for this study.

Since the macro sequencing and time frames of the curriculum were specified in the CAPS document, prescriptive mathematics workbooks from the DBE, as well as the 'Tracker' for this district that was distributed, scaffolding for the accurate monitoring of curriculum coverage was already in place. There is evidence in the research that there

was a lack of proper training and cascading of information from district officials down to School Management Teams (SMTs). In its report, the DoE admitted that internal and external monitoring processes were ineffective (DBE, 2014).

From the responses gained from the interviews, the field and observation notes, and the documents analysed, there seemed to be a lack of rigorous and credible monitoring processes in the schools selected for this study. When asked if monitoring took place in their schools, the principals, HoDs and teachers gave contradicting responses. The principal at School E responded,

> *Monitoring is taking place at this school. I monitor the deputy principal to check whether he is monitoring the HoDs, so the HoDs must monitor their teachers. It is not easy for the HoD to dodge monitoring. I go around and also have reports from the deputy. As you can see, I am busy with the report from another HoD. After reading the reports, I also have a one-on-one with the HoDs.*

The principal at School A confidently stated, "…mathematics HoD is responsible for all the mathematics teachers, and the language HoD is responsible for all the language teachers and so on. And therefore each HoD is monitoring his subject." However, the HoD at the same school had a different point of view, "I'm appointed as Grade 8 to 12 mathematics HoD, but I'm currently responsible for all Grade 9 subjects, I teach 99% of my school time. I don't find time to do monitoring due to my workloads."

Teachers should be monitored by HoDs through conducting class visits. However, most of the HoDs and teachers in the sample admitted that no formal class visits were being conducted in mathematics in particular. It would also appear that the principals did not perform their role in ensuring that monitoring was taking place. In addition, the principals took for granted that the HoDs were monitoring the teachers in their departments. Although the principal at School B first responded that the monitoring process was being conducted at his school and was successful, he later changed his statement after I asked probing questions pertaining to the issue, admitting, "We have failed in that regard."

The HoD at School C preferred informal supervision and monitoring at her school. The school's buildings were structured in such a way that she could see exactly what the Grade 9 mathematics teachers were doing in each of their classes. Her statement was supported by the principal who confirmed that she made the rounds and made impromptu and unannounced classroom visits. He believed that his staff members were aware of this practice, which "keeps them on their toes all the time". The teachers at School C did not seem to have a problem with the classroom visits.

Gupton (2008) posits that formal monitoring places unnecessary stress and anxiety on the teachers, and instils fear, which impedes the developmental process. This is view is shared by teacher unions, who have thus placed a moratorium on formal class visits. This study revealed that no formal class visits were conducted by the principals because they depended on their HoDs to perform this task. It emerged from the interviews that the 'Tracker', as it provides lesson plans for each day, was monitored by a district official. There were no monitoring tools and/or reports for this programme to support this notion at the time of data collection.

All of the participants admitted that the only time given for formal class visits was through the Integrated Quality Management Systems (IQMS). IQMS is an appraisal process used as a means to identify the specific developmental needs of teachers and the school as a whole. This is done by evaluating teachers based on performance standards and then providing the necessary support. Gupton (2008) emphasises that the monitoring of teachers' performance is more effective when it is carried out for support purposes rather than for evaluative purposes.

It appears that four out of the five participating HoDs were incapable of monitoring teachers' work. They did not have enough free periods to support the teachers, were not trained to monitor, and were burdened with administrative duties. It was disconcerting to note that the principals did not seem to know what was happening in terms of monitoring in their schools and classes, while they stated that the HoDs were the ones carrying out the monitoring. The HoDs, alternatively, admitted that they were not monitoring their teachers.

5.7.2 Moderation of SBA tasks

All formal assessment Tasks are subject to moderation for the purpose of quality assurance and to ensure that appropriate standards are maintained (CAPS, 2011, p.155). Moderation is a quality assurance process of verifying the results of School-Based and external assessments, which consists of internal and external moderation (DoE, 2004). The main purpose of moderation is to ensure the fairness of SBA (HKEAA, 2015). In the South African context, Umalusi has the task of maintaining standards and has put in place processes to make SBA reliable, valid and fair at exit points such as Grades 9 and 12 in the schooling system. However, as explained earlier in this chapter, Umalusi only quality assures assessments in Grade 12 and Adult Education and Training (AET) Level 4. Moderation in Grade 9 is therefore internal, under the direct control of schools, and is conducted by the HoDs and school principals.

HoDs should moderate assessments to ensure that tasks are in line with specific variables, such as the content coverage and cognitive levels as stipulated in the policy documents. Effective moderation is dependent on HoDs' SMK. The Northern Cape Education Department has developed a moderation protocol in which it stipulates that there should be pre-moderation and post-moderation. During pre-moderation, teachers' SBA tasks are first moderated before learners can embark on the task, followed by the HoD moderating a sample of learners' marked scripts (post-moderation). Schools should plan for pre- and post-moderation, however, it was evident from the responses that moderation was not a planned process. The HoD at School A admitted that teachers arrived minutes before the test was to be written, stating "… and stand on my head to sign off the test by attaching my signature and school's stamp. In some instances, I just do it during break."

Almost all of the HoDs, except in School B, admitted to having received the moderation protocol from the District office without any training being provided. However, it was troubling to note that HoD B said that she did not know where she had obtained her moderation protocol from, "I got the moderation tool from my colleague. I also don't know where she got it from. I'm not even sure if it's the official moderation tool." When scrutinising the moderation tool, I established that it was the official moderation tool

obtained from the NCED. It appeared that most of the HoDs in the sample were not provided with any training with regard to the moderation of SBA tasks. It also appeared that most of the HoDs knew the theoretical (policy) part of the moderation process but seemed to experience challenges when it came to the implementation thereof. This became clearer when the HoD at School B responded, "We were only told about moderation two weeks ago... I have an idea of what is pre-moderation and what is post-moderation."

In addition, the HoD at School B explained that it was challenging to moderate mathematics SBA tasks as she did not have the expertise or any experience with moderation and was never inducted, nor taken through the moderation process. In School D, the principal, who was also the mathematics HoD, experienced serious challenges when conducting moderation. The HoD was also not a qualified mathematics teacher, and admitted to having no mathematics SMK, stating,

> "*I've never, never, never, moderated mathematics in my life*."

There was a lack of competent HoDs and mathematics SMT members at this school. The principal at School D depended on another Grade 12 mathematics teacher to moderate all of the mathematics SBA tasks of the whole school. However, during data collection, this teacher was absent from school due to his studies. When asked how the moderation process unfolded at this school, the teacher at School D explained that she submitted her tasks to the principal, who then submitted these to the Grade 12 mathematics teacher for moderation. Verbal feedback and comments were given to the teachers through the principal. Her explanation was confirmed by the principal,

> *We have an arrangement that so and so should moderate these subjects. Here I have the work of so-and-so, please moderate it for me. And after you've finished moderating, please give it back to me so that I take it back to the person who has given it to me... Even if you bring the mathematics memorandum to me, I can't take that risk.*

The situation was different at School C as the HoD at this school seemed to be knowledgeable and skilled due to her expertise and extensive experience in the marking

of National Senior Certificate (NSC). She was able to moderate even when no training was provided.

When analysing documents such as the moderation reports, it emerged that there were different sets of moderation tools used in the selected schools for the study. Some of the schools used these monitoring tools for moderation purposes. In School A, for instance, there were 3 sets of 'monitoring tools' used for monitoring and/or moderation, which were titled:

Monitoring Tool: Assessment tasks;
Monitoring Tool: Learners' books; and
Monitoring Tool: Tests and Exams.

These monitoring tools were for 2008 and were outdated as they were not CAPS compliant, for instance, the previous curriculum (Revised National Curriculum Statement) used terms such as the Learning Programme and Work Schedule, whereas CAPS uses terms such as Year Plan and Annual Teaching Plan (ATP). The monitoring tools used in the school SBA tasks still referred to Learning Programmes and Work Schedules. The HoD at School A utilised these tools to moderate the Grade 9 mathematics SBA tasks. In addition to these monitoring tools, HoD B also used the moderation tool from the NCED. However, the HoD at School B admitted, "… truly speaking, myself, I've never given any copy of the moderation tool, I just call the teacher and says he must rectify the mistakes."

In Schools B, C and E, the moderation protocol was used as a moderation tool. In School D, due to the absence of the Grade 12 teacher, no completed moderation and monitoring tools were submitted. Anecdotal evidence further suggests that moderation was informal and verbal, and moderation tools were only completed when I had requested them. This evidence was corroborated by the fact that none of the teachers had their own copies of the protocols. In addition, the teacher at School D did not have any moderation tools with her. HoD B expressed her frustration, saying, "I'm just idling sometimes. I don't know if I'm right or wrong. I am new in this."

The analysis of the moderation tools was corroborated by the findings provided by the DoE (2004) that a moderation tool is more of a checklist and focuses mainly on the structure of the question paper, and the layout and mark allocation than on the quality of the questions. When asked about moderation processes, most of the mathematics teachers admitted that their HoDs checked for mark allocation, spelling mistakes and omissions. The teacher at School B, in particular, mentioned that his HoD checked if mathematical symbols and language were appropriately used. However, it was of concern to note that the HoD at School B failed to spot glaring technical mistakes, for instance, in the SBA task, the educator at School B used ¾ instead of $\frac{3}{4}$, inappropriately used the symbols '( )' and '[ ]', and used Grade 7 content to be assessed in a Grade 9 SBA task.

This study provided evidence that there was no rigorous moderation in SBA by the mathematics HoDs. The HoDs seemed to have used the tool as a checklist and ticked the boxes without giving constructive feedback in the form of comments and recommendations. The findings of this study also revealed that the teachers and HoDs needed to be capacitated regarding how to conduct moderation effectively and rigorously. The role of district and provincial officials in supporting and guiding these educators and HoDs seemed to be non-existent.

5.8 THEME 5: THE ROLE OF TEACHERS, HODS AND SCHOOL PRINCIPALS IN IMPLEMENTING SBA

5.8.1 Workload of the participants

"Workload is a highly contentious issue internationally" (Chisholm, Hoadley, Kivulu, Brookes, Prinsloo, Kgobe, Mosia, Narsee & Rule, 2005, p.28). A workload is also a complex concept and there are varied ways of measuring it. The term 'workload' in this study refers to the number of Grade 9 mathematics classes taught, the number of learners per classroom that the mathematics teachers taught, and the different activities that the participants carried out (Easthorpe & Easthorpe, 2000). In the South African context, a larger workload may be due to changes in the curriculum coverage, in assessment and marking, and in administrative demands, amongst others.

In terms of the workloads of the participating teachers, HoDs, and principals, as stipulated in the PAM document (government gazette, 2003), it seems that the participants were not coping with their core duties, and had too many responsibilities that were assigned to them. The principals indicated that too many administrative tasks made it difficult to cope with their core duties.

The role of HoDs in implementing SBA

According to the PAM document (2016), HoDs and teachers are to use 85% of contact time to teach. However, the percentages are inconsistent with the formal teaching time specified in the National Education Policy Act (NEPA). All of the HoDs claimed that their teaching periods were not adjusted as per the PAM document. The HoD at School B, for instance, revealed that she had 24 teaching periods instead of 16 teaching periods. This point was confirmed by the HoD at School A, who claimed that, according to the policy of the DBE, HoDs are supposed to have a workload of only 85% teaching periods, while he had 99% of the teaching periods. The HoD at School D had to work extra hours in order to juggle her teaching periods.

The principal at School D taught Natural Science in Grade 7, and Life Sciences in the FET band. Due to his administrative workload, he hardly found time to go to class. On the day of data collection, the principal claimed that he “only got the opportunity to go to class the last period of the day”. Due to the nature of the JTG district, which is mostly rural, most of the principals claimed that their schools were community schools, and therefore community members came and went from the school at any time. In one of the sampled schools, I witnessed high volumes of parents and community members at the door of the principal’s office waiting to be served on a first-come, first-served basis.

In terms of admin, Principal C asserted, “What is also taking a lot of time and making life really difficult is when we get to fill in numerous reports that we don’t really see the aim of what it is.” All of the HoDs in the sample had other administrative duties to perform outside of their core administrative duties. The mathematics teachers in the sample added that they had extra classes in the afternoons and on Saturdays, which added to their workload. All of the participants in the sample complained about the time that they

lost every week from the already reduced time in the CAPS regulations. In addition to the extra classes that were conducted for learners who were not coping with the mathematics content, the teachers still had to make up for this time that was lost every Monday, which added to their workload.

The school principal, together with the School Management Team (SMT), had a particular, yet crucial role to fill. On the one hand, principals who have been trained and have gained experience as teachers should effectively manage fairly large and complex institutions. On the other hand, a purely managerial and administrative focus can distract principals from leading the school in its central task of teaching. A useful analytical framework for understanding the proper function of school management is provided by the notion of instructional leadership. Instructional leadership emphasises the role of principals as leaders of curriculum coverage and teaching in the school. Hoadley, Christie and Ward (2009) find that the majority of South African principals do not regard the overseeing of curriculum and teaching as their main task, but feel that the responsibility for this lies with subject heads and HoDs. Perhaps, as a consequence of this perception, principals spend the majority of their time not on aspects of instructional leadership, but rather on administrative duties and learner discipline (Hoadley et al., 2009, p. 381).

School principals were previously seen mainly as managers of the school and of personnel. However, in recent years, the role of school principals has become more complex and demanding in that addition to handling management, the principal is now seen as a leader whose main focus should be on improving teaching, learning and assessment, and ultimately on learner achievement. Principals need not be experts in curriculum and assessment, but it is necessary that they should have some knowledge of basic concepts that are related to assessment and curriculum practices (Glanz, 2006). The principal at School C boasted, “I’m lucky; I’ve got a very good staff. I’ve got SMT that is well-trained in their jobs, and they know what they need to do”. The principal at School A, alternatively, remarked, “You must have a basic understanding of everything.”

There is evidence in the research that points to the fact that many principals neglect their main focus due to too many interruptions and interferences, and a seemingly endless stream of administrative and managerial issues that divert their attention (Chisholm et al., 2005). When asked to narrate their successes and their challenges, it was disconcerting to note that most of the principals in the selected sample had a very limited understanding of their role in ensuring that there is quality SBA in mathematics. It also appeared that most of the principals focused more on administrative duties than on the quality of teaching and learning. The principals in Schools C, D and E all agreed that there was "too much paperwork". The principal at School D reported that, "...attending to parents, district demands, discipline problems interfere with the completion of tasks." Furthermore, when asked about the roles of school principals in managing SBA, the principal at School C responded, "What makes life difficult is the endless forms that we have to fill in and we don't see any reason to do so."

Based on the interview findings, the emerging pattern is that principals do not take the lead in managing the quality of SBA at their schools and find it difficult to manage the implementation of assessment at their schools.

HoDs play an important role in monitoring teachers' work and supporting, guiding and empowering them. HoDs have the responsibility of securing the high standards of teaching and learning in their subjects (Sindhvad, 2009). They are appointed to assist the principal and have multiple responsibilities within the learning organisation. HoDs should ensure that the central purpose of schools remains teaching, learning and assessment, and thus improved learner performance. Early and Weindling (2004, as cited in Bambi, 2013) report that HoDs are the driving force and the key to improving the quality of teaching and learning. In terms of the Educators' Employment Act (EEA) of 1998, the roles of HoDs include their involvement in class teaching, the effective functioning of the department, and organising extra-curricular activities all to ensure that the subject and the education of the learners is promoted in a proper manner. The PAM document of 2016 also stipulates that HoDs are to assess and record the achievement of learners, evaluate the work of all of the teachers in their departments, provide guidance, and be involved in the appraisal of teachers through the IQMS to improve

teaching, learning and assessment. HoDs should support teachers in managing and coordinating the curriculum and assessment in such a way that instructional time can be used optimally. They also need to support the teaching programme and provide the resources that teachers need to carry out their tasks. The HoD at School B gave this account,

> *You work hard in the classroom. You are loaded again with the teachers' work, you have to go through that...the learners' work...according to me that's a lot of work...I have five teachers falling under me...mathematics, Natural Science and technology...I have six classes to teach...I am responsible for the IQMS, responsible for late coming, the cleaning of the staff room, and...I forgot the others...I have got too many responsibilities.*

The HoD at School A added,

> *I am supposed to be sitting at 85%, but I'm presently now around with 95%, 96%. I don't have time. I teach 99% and 99% administration...I do my work during breaks. I'm the HoD for Grade 9 with all the nine learning areas, discipline all the Grade 9 classes and support the administrative part for Grade 9 educators. I'm also the HoD for all the maths educators, the biggest group in the school.*

The HoD at School C further explained,

> *I also do the administration of sport...disciplinary system, grade head of Grade 12; I have a lot of admin there! I'm also supporting the kids, the IQMS I have to do the whole group... I just do it; you don't even recognise that you're doing something extra. The only thing is I don't have a free period, it's just one here one there. The only problem is if you have to do the class visits you don't have time. It takes me a lot of weeks just to go to everyone.*

In addition to teaching mathematics, HoD E clarified, "I also teach EMS...I need time to plan for that subject...administrative work is hectic, but I have a plan to do my work properly."

From the above responses, it is clear that HoDs find it very challenging to balance their core duties and responsibilities with their additional workload. Furthermore, the participating HoDs claimed that they had spent more time on administrative duties than

on their core responsibilities, which were to monitor and guide mathematics teachers. It appears that the workload of HoDs is beyond their capabilities and may be one of the causes of the underperformance of teachers in many schools.

5.9 CONCLUSION

Chapter 5 presented an analysis of the data, the results gained from this analysis, as well as an interpretation of the findings. The themes were constructed from the results that emanated from the data collected by means of questionnaires, semi-structured interviews, document analysis, observations, and field notes. I have demonstrated the different views of the participants in relation to School-Based Assessment, its development, quality assurance techniques, its implications, and external assessments. In addition, this chapter presented a discussion on the varied learner performance in mathematics and the variables influencing this performance. The possible strategies to close the gaps in the quality of varied assessment practices were touched on.

The following chapter concludes this study in summarising the results and presenting the final conclusions and recommendations for further research.

CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

The preceding chapter provided an analysis of the data and themes that emerged from this research. The purpose of this final chapter is to consolidate the research questions, the research processes, as well as the results, conclusions and recommendations of this study. The aim of this study was to investigate whether there was evidence of variance in the quality of School-Based Assessment (SBA) in Grade 9 mathematics achievement. The main research question for this study was:

What evidence is there in teachers' classroom assessment practices that points to possible variation in the quality of SBA?

The main research question was further divided into the following sub-questions:

How can sources of variation be unified to make SBA more credible, valid and reliable?

How do teachers*, Heads of Department, and principals perceive their role in ensuring the quality of SBA?*

In this final chapter, a summary is given of the findings and conclusions pertaining to the main research question and sub-questions. Each conclusion is based on the substantiated findings from the data presented so as to reveal possible new insights or corroborate existing knowledge (Nieuwenhuis, 2007; Leedy & Ormrod, 2010).

A summary of the research will be presented in Section 6.2, providing the study background that led to the framing of the main research question. This will be followed by a summary of the main results (Section 6.3), taking into account the main research question and each of the research sub-questions developed for this study, a summary of the literature on this topic will also be included. A reflection of Scheeren's (2000; 2005) school effectiveness model of context-input-process-output is discussed in Section 6.4, as well as a discussion on the adaptations of the conceptual framework based on the data collected in Section 6.5. Reflections on the design and methodology applied in this study are presented in Section 6.6. The limitations of the study are

presented in Section 6.7, while recommendations for further research are briefly discussed and presented in Section 6.8. The chapter concludes with Section 6.9.

The following section comprises a summary of the research that was conducted to investigate the varying quality of SBA in Grade 9 mathematics in the JTG district in the Northern Cape.

6.2 SUMMARY OF THE RESEARCH

This study aimed to establish evidence of the varying quality of School-Based Assessment (SBA) in Grade 9 mathematics; South African and international literature was therefore explored to understand the problem better. Chapter 1 was mainly concerned with a general introduction to the research, as well as the rationale for undertaking the study, and a statement of the research problem. This included an exploration of the aims and objectives of this study. Amongst the themes presented, it emerged in the rationale that assessment is a prime focal point for educational reform (Reddy, 2004) and impacts the quality of education. In addition, assessment in mathematics has been a debated issue for a few years (Hoadley, 2012; Long, 2014). In this regard, changes in assessment in the new dispensation led to South Africa adopting a new assessment model known as Continuous Assessment (CASS), which includes SBA and examinations (DBE, 2013). The promotion and progression of learners in the GET band is dependent on the CASS mark, of which 40% is made up of the SBA mark and 60% is made up of the examination mark. One of the promotion requirements is that a learner should obtain Level 3 (40% - 49%) in mathematics. The research questions that guided the study were also provided, followed by a preview of the structure of this dissertation.

In Chapter 2, a review of the relevant literature was undertaken. It reflected and focused on the findings of studies on the quality of SBA in grades below Grade 12 in mathematics in the South African context, as well as in international literature. One of the main points that emerged was that the South African education system does not make provision for common external assessments in the exit point of the General Education and Training (GET) band. Therefore, CASS is entirely in the hands of

individual teachers. It was also revealed that the system further allows all SBA tasks, assessment tools and scores to be moderated internally. Despite the fact that Umalusi, South Africa's quality assurer, has been mandated to quality assure all assessments at the school exit points, Grade 9 CASS is not quality assured. The validity, reliability and credibility, as well as the quality of these assessments are threatened. The literature suggests that SBA, or classroom-based assessment as referred to by Black and Wiliam (1998), faces many challenges in its implementation as poor quality tasks are designed (Reyneke, Meyer & Nel, 2010; Makgato & Mji, 2006; Wenglinskyl, 2002; Hoadley, 2012).

SBA is supposed to be used as formative assessment, should be used throughout the year as assessment for learning, and should provide feedback to teachers to inform and guide their teaching. SBA should also be conducted at the end of each year to determine the promotion and progression of learners. SBA has been deeply problematic since teachers vary in how they construe mathematical concepts. Stiggins (1998) is of the opinion that current assessment systems are harming learners due to a failure to balance the use of standardised tests and classroom tests. Poliah (2010) posits that learners obtain high marks due to the quality of question papers at schools. Teachers set papers that are not of the required standard, which pass through the hands of the Heads of Departments (HoDs), yet they are not properly moderated, which forms the basis for valid and reliable assessment (Mali, 2013). Moreover, Reddy (2004) and Fleisch (2002) argue that many GET mathematics teachers are uncertain of what is expected of them.

The literature also focused on the quality of SBA. The quality assurance of SBA is vital in ensuring its credibility, validity and reliability (Poliah, 2010).The study further sought to examine the appropriateness of the quality control mechanisms used in SBA. Additionally, the credibility, validity and reliability of SBA tasks were also evaluated in order to detect evidence of variations in quality, scores, and the quality of SBA tasks in different schools within a specific district. The literature review further dealt with formative assessment as a vehicle to drive the SBA process.

In Chapter 3, Scheerens' (2000; 2004; 2005) context-input-process-output school effectiveness model was introduced as a basis for defining quality and categorising different measures of quality in education. For the purposes of this study, Scheerens' model was used to conceptualise the study from a qualitative point of view. The model was further adapted to provide an opportunity to identify enhancing or impeding issues associated with the quality of SBA and learner performance. As discussed in Chapter 1, the terms validity and reliability here referred to trustworthiness and credibility. This model indicated the importance of integrating policies, language, teacher quality and quality assurance (inputs) through formative and summative assessments, and the challenges of assessment (processes), as well as how these indicators impact learner achievements (output). The context component described the background of the participating schools and the biographical information of the participants that took part in the study.

In Chapter 4, the research design and paradigm were discussed. The study followed a qualitative research design approach using a case study design. A case study design was employed as the intention of the study was not to generalise the findings, but rather to draw conclusions (Creswell, 1998). Individual interviews were conducted in order to elicit the views, experiences and feeling of the participants, and to engage them in their natural setting. In Chapter 4, I illustrated that 15 participants were purposefully selected, namely, a Grade 9 mathematics teacher, the mathematics HoD and the school principal from each of the five schools. The data collection methods used were questionnaires, interview protocols, document analysis, observation, and field notes. All of the interviews were tape recorded. Ethical issues and strategies to enhance the credibility and trustworthiness of the study were touched on. The interpretive paradigm was employed as I wanted to obtain first-hand information from the participants by having them share their experiences and feelings.

Chapter 5 provided a detailed report on the analysis and interpretations of the interview, document analysis, questionnaire and observational data. The research findings were presented in terms of themes and sub-themes. A thematic data analysis approach was thus employed to analyse the data.

The final chapter provides an overview of the research. Important findings that resulted from both the literature review and qualitative data are discussed and presented. The main conclusions and recommendations, suggestions for further research, the implications for policy and practice, and the limitations of the study will also be discussed.

The next section focuses on the findings from the data analysis.

6.3 THE MAIN RESEARCH CONCLUSIONS

The following sections address the research questions and sub-questions posed in this study and how the three sources of data contributed to answering these questions.

The main research question, as noted in the introduction, was to investigate what evidence there is of teacher classroom assessment practices that point to possible variation in the quality of SBA, followed by two sub-questions. The results are provided by addressing each research question separately.

6.3.1 Main Research question: Evidence of teacher classroom assessment practices that point to possible variation in the quality of SBA

School-Based assessment refers to assessments designed by the teacher. The concept of quality in the context of SBA refers to consistency, which entails both conforming to specifications or standards, and fit for use purposes (Harvey & Green, 1993, as cited in Poliah, 2010). Teachers are key implementers of SBA and must be trained to ensure their competency in designing quality SBA tasks. For the purposes for this main research question, variations of SBA will be described in terms of:

Adherence to policy;
Classroom practice;
Monitoring; and
Moderation.

6.3.1.1 Variation of SBA in terms of adherence to policy

Assessment in the South African context comprises SBA and the end of year examinations. The National Protocol on Assessment (NPA), the National Policy Pertaining to the Programme and Promotion Requirements of the National Curriculum Statement (NPPPR), and the Curriculum and Assessment Policy Statement (CAPS) further state that for the grades below Grade 12, the end of year examinations are to be set internally. The NPA requires every subject teacher to submit an annual assessment plan to the Head of Department (HoD) and the School Management Team (SMT) in order to draw up a school assessment plan (DBE, 2013). The assessment plan will assist in the smooth running of the assessment activities and also in regulating SBA. In addition, the NPA requires that learners and their parents receive the term's assessment plan at the beginning of each term to improve parental involvement. However, evidence from the interviews that were conducted points to the fact that none of the participating schools had assessment plans, except one school, which appeared to have cycle tests in place. The evidence presented here shows that there is variation in adherence to this policy.

In terms of the NPPPR, where the promotion and progression requirements of learners are stipulated, there is evidence of variation in interpretation and implication. This policy stipulates that learners should achieve a minimum of Level 3 (30% to 49%) in mathematics and a minimum of Level 4 (50% to 59%) in home language (HL) in order to be promoted to the next grade. These levels are made up of the SBA mark (40%) and the end of year examination mark (60%). This study reveals that the focus in schools is more on learners' mathematics mark than on their HL mark. According to the NPPPR, learners who do not meet the minimum levels for promotion should be progressed to the next level on the condition that such learners have spent four years in the phase, which is known as 'the age cohort'. Progressions should only be approved by the circuit manager, however, the evidence presented in this study shows that, prior to the circuit manager progressing learners who did not meet the minimum requirements the mathematics teachers had already inflated the learners' scores. The recording of assessment scores is, in many cases, inflated. This is done to accommodate learners'

promotion rather than their progression. I observed the tampered and tweaked SBA score sheets in some of the participating schools. One participant even acknowledged that all of the previous Grade 8 learners, who at the time of the study were in Grade 9, had not achieved between 30% and 49%. The participant further explained that the Grade 8 mathematics scores were tweaked to a Level 3 by the Grade 8 mathematics teacher. This practice translates to non-adherence of the NPPPR policy. Some of the participating school principals admitted that they did not fully understand the NPPPR, as a result, they had variating interpretations and implementations of the policy. This practice gives learners and their parents the false impression that the learners have met the minimum promotion requirements.

Moreover, there was also anecdotal evidence regarding cheating during the writing of SBA tasks. The teachers seemed to explain the questions to the learners and gave them clues to the answers. This led to learners scoring high marks without really understanding the basic mathematical concepts being tested.

6.3.1.2 Variation of SBA in terms of classroom practice

The teachers were given greater responsibility in designing quality assessment tasks that aligned with the content. This was permitted as they were seen to be the best professionals to assess their own learners, and they supposedly had a better understanding of the content and context of the subject matter. The assessment guidelines in the mathematics CAPS policy document are largely generic, with a few specifications for assessment in mathematics. Despite the guidelines in these policy documents and circulars from the NCED, there were indications from the participating schools that there were variations in the interpretation of these guidelines. The evidence provided by different teachers in the different schools suggests that these teachers had not been properly trained to design different forms of assessment in mathematics, particularly with regard to CAPS.

The Senior Phase (Grades 7 to 9) of CAPS stipulates that there is a minimum of nine SBA tasks and one end of year examination. A test and an assignment should have been covered in Term 1, whereas a test, investigation, and mid-year examination

should be covered in Term 2. At the time of data collection, there was no evidence that either an assignment or an investigation had taken place. In this regard, policy was not being adhered to. The participating teachers and HoDs lamented the fact that they did not know the difference between a test and assignment, or the difference between a test and investigation. Ignorance and a lack of knowledge about the different forms of assessment and purposes thereof was confirmed by the participants. At the time of data collection, I observed that the participants were already preparing for their mid-year examination without having done any investigations.

Another finding from this study is that the teachers had difficulties in interpreting the four levels of the revised Bloom's taxonomy of cognitive levels in terms of assessment in mathematics. Long et al. (2014) argue that cognitive levels are problematic to interpret and implement. The evidence was derived from the SBA tasks collected from the participants, and almost all of the teachers in the sample only set poor and Level 1 and Level 2 questions in their tests. In cases where there was some evidence of middle order and higher order questions in two of the five participating schools, such questions were taken verbatim from past ANA question papers. Despite this practice, a very limited number of Level 3 and 4 questions were copied by those teachers. This practice of relying on questions from past question papers proved to be problematic as the educators only chose questions that they thought their learners would be able to answer. It can thus be concluded that these mathematics teachers lacked the expertise to design their own questions, which was demonstrated by the low levels of cognitive demand and poor questions in their tests. This finding is shared by researchers such as Majid (2011), Long, et al. (2014), and AMESA (2013), amongst others.

The CAPS policy is also silent on the uniformity of topics' weightings and forms of assessments. As a result, the variations are evident in terms of the weightings in the different schools from the observed SBA tasks, which had a variation of between 25 and 60 across the five schools. CAPS does not provided clear assessment task specifications, which opens the door to multiple interpretations of the CAPS policy.

The background of the schools was one issue that emerged from the data provided. Scheerens' ideas on school effectiveness, leadership qualities of school principals, and disciplinary environment (Scheerens, 2004) proved to influence classroom practice. I observed time being wasted in the mornings for choir practice in one of the schools, and in most of the schools, an atmosphere of orderliness was conspicuously absent. Most of the learners were outside of their classrooms loitering, some of the classes were unattended, there were broken windows, and dilapidated buildings that were not conducive to quality teaching and learning.

6.3.1.3 Variation of SBA in terms of monitoring

Policies further stipulate that the moderation of assessments should be conducted internally, specifically in Grades 4 to 11 (DBE, 2013). Moderation is conducted in order to ensure that assessment tasks are reliable, valid and fair. Monitoring and moderation are processes that should run parallel in ensuring quality SBA tasks. It would appear that the participating HoDs only focused on the moderation process. Furthermore, the two processes seem to confuse participants, and may therefore point to the variations in their responsibilities. To ensure quality monitoring, class visits may be the only way to know what is "inside the black box" (Black & Wiliam, 1998, p. 1). Currently in South African classrooms, there is a resistance from teaching unions with regard to classroom visits by HoDs, school principals and subject advisors, and as a result, there is a moratorium on classroom visits. In one school, the HoD conducted informal classroom visits by looking out of the window at a distance to see what was being taught. This study revealed that class visits were non-existent, and therefore no monitoring was taking place in these schools.

6.3.1.4 Variation of SBA in terms of moderation

There is evidence in the literature that internal moderation is a neglected aspect of the quality assurance process (Umalusi, 2012). Internal moderation is one of the most important processes used to ensure the quality, reliability and credibility of assessment, which contributes to improved learner performance. The moderation protocol from the NCED focuses on pre-moderation only. In the documents analysed, as discussed in the previous chapter, post-moderation is almost non-existent. During post-moderation,

HoDs should choose a sample of marked scripts to ensure the reliability of marking. However, the participating HoDs admitted to not conducting quality marking due to large classes, exhaustion, and marking under tremendous pressure. There is anecdotal evidence that some scripts or questions were not marked at all, therefore awarding learners scores that could not be accounted for. This practice was made possible by the fact that the HoDs did not choose a random sample of scripts from the whole class for post-moderation, if it was conducted at all. Only the teachers would choose marked scripts for post-moderation, which proved inefficient and problematic.

There was documented evidence that the schools in the JTG district used different moderation tools, although some of the moderation tools dated back to 2008, which is problematic in the sense that such moderation tools are not CAPS compliant. Where such moderation tools were provided, the HoDs used these tools more as a checklist without any constructive comments and feedback. The HoDs in some of the schools admitted to not having sufficient time for moderation due to increased workloads. In one school, the HoD pointed to the fact that he conducted moderation during breaks as the educators were in a hurry to conduct the test. Evidence given by the HoDs during the interviews revealed that the educators were submitting their SBA tasks, in some cases without a marking tool, a few minutes before the task was to be written. This put these HoDs under pressure to provide their signature and the school's stamp as a sign of approval. In most cases, moderation was only done to comply administratively.

There are claims from the interviews that mathematics subject advisors did not often visit the schools to guide and monitor the teachers. Instead, the district officials relied on cluster sessions where there was no individual attention and limited time to provide assistance. There were also claims made that the subject advisors lacked in-depth knowledge, and attending the workshops thus proved to be a waste of time. The teachers admitted that they only attended these in-service training workshops as a matter of compliance as these cluster sessions did not address the challenges experienced in the implementation of SBA.

The participating HoDs' knowledge of quality assurance mechanisms, such as monitoring and moderation, was at a very low level. This study therefore concludes that these HoDs possessed very limited knowledge of quality assurance strategies. The system allows the designing of SBA tasks to rest completely in the hands of individual educators, who, in many cases, lack subject expertise and assessment knowledge, resulting in the varying quality of SBA and poor quality of SBA tasks (Poliah, 2010).

6.3.2 Research Sub-question 1: The unification of sources of variation that could make SBA more credible, valid and reliable

Mathematics is a complex subject that requires the intricate processes of teaching, leaning and assessment (Long et al., 2014). The mathematics CAPS document (DBE, 2013) describes Bloom's taxonomy of cognitive levels, which is the basis for conducting assessment as cognitive levels have to be interpreted and applied in SBA. These categories of cognitive levels leave room for individual interpretations when an assessment is developed. In the data analysis in the previous chapter, the teachers' expressions of frustrations in interpreting the cognitive levels were revealed. This is in line with AMESA (2013), who reports that mathematics cognitive levels are difficult to interpret. As a result, the participating educators set SBA tasks that were of poor quality.

Sources of variations in SBA in this context, as suggested by the participants, included:

- The degree of guidance or assistance given to educators and learners;
- The types of SBA tasks;
- Marking standards; and
- The role of SBA.

6.3.2.1 The degree of guidance or assistance given to teachers

This study found that the degree of assistance given to teachers by the School Management Team (SMT), which in turn should be supported by the department, varied from one school to another. Due to a lack of monitoring of curriculum coverage, guidance was not offered to the educators to improve their teaching methodology. There was no evidence of written feedback from HoDs to their teachers, moderation was also conducted verbally, with no written feedback. The documents analysed in

Chapter 5 revealed that moderation tools were completed only when I requested them. Moderation was also completely absent in one of the schools as the HoD was not a qualified mathematics teacher.

The HoDs in this study were never trained to conduct moderation, but were given moderation protocols to read, interpret and implement on their own. As a result, the multiple interpretations and implementations of moderation led to a variation in the quality, reliability, validity and credibility of the SBA tasks. Moderation varied as the five HoDs focused on different aspects of the task because no standards were set and no uniformity was agreed upon. Furthermore, most of the HoDs were inexperienced and had just begun to act in their posts.

6.3.2.2 Types of SBA tasks

CAPS does not stipulate how assessment should be carried out, therefore the types of SBA tasks analysed varied in terms of quality and forms. As no consensus was reached on what type of assessments should be conducted within specified timeframes, variation became clearly evident. According to the data gathered from the interviews and documents analysed, it would seem that the participants were not trained how to develop other forms of assessments such as investigations, assignments, projects, and examinations. As a result, SBA tasks mainly took the form of tests, which were the only SBA tasks that were presented for documents analysis. When analysing these documents, it was evident that the content, cognitive levels and the weightings of the mathematics topics varied from one to school to another. Despite the fact that other types of SBA tasks were stipulated in the CAPS document, I observed some form of anxiety being displayed by the teachers when they expressed their frustration in developing their own examinations. The mid-year examinations were traditionally provincial common question papers, however, for the year in which this study took place, each school was required to set their own examinations.

6.3.2.3 Marking standards

From the data analysis, it became clear that there were no clear marking guidelines given to the teachers. Most of the educators blamed the education system in terms of

large classes and a lack of capacity. Moreover, some of the teachers' marking was done using incorrect memoranda.

A lack of marking standards and training becomes a source of variation as marking may be too strict and thus disadvantage the learner, or be too lenient and lead to high SBA marks. One HoD conducted marking workshops for the mathematics teachers in her school based on her experience in Grade 12 marking sessions, this therefore ensured consistency among the mathematics teachers in her school. However, there was no evidence of re-marking the learners' scripts as part of moderation. There was only one school in the sample that submitted evidence of post-moderation. However, this was not rigorous, as any post-moderation observed was purely in the form of shadow marking with no feedback from the HoD. CAPS does not provide clear guidelines in terms of mark allocation for the SBA tasks. In this regard, it emerged that the teachers from the five participating schools had varied mark allocations for the tests, which varied between 25 and 50 marks.

It is worth noting that the participants involved in this study also indicated their concern regarding time constraints as the participants claimed there was less time and more topics to be covered in Grade 9. In scrutinising the CAPS document, it was discovered that there is only 4.5 hours per week allotted to the bloated curriculum. In addition to the already reduced time given in the CAPS document, another area in need of attention is the time taken every Monday of the week to attend the workshop that the participants claimed was imposed on them by the DBE, known as one plus four (1+4). 1+4 literally means that one day of the week is taken away from class teaching so that teachers can attend the workshop, where after the teachers only have four days of actual class teaching left. There were conflicting points of view regarding the quality and purpose of 1+4. Some participants believed that it was a waste of time as the topics addressed were not in line with the Annual Teaching Plan (ATP), which should be aligned to the CAPS curriculum coverage. Also, the facilitators reportedly lacked knowledge and skills. Alternatively, some of the participants believed that they received relevant information as lesson plans were already developed for them to use, which made it easier for them to teach. Additionally, a major finding in this study was that differing interpretations of

policy and assessment guidelines were the main source of the varied quality of SBA tasks.

6.3.2.4 The role of SBA

Chapter 5 presented evidence that the purpose of SBA is not uniformly understood by all stakeholders across the education spectrum.

In the data analysis that was carried out, it was evident that teachers still have limited skills in using information on SBA to improve learning. Usiskin (2012) suggests that mathematics teachers rather focus on the right answer than on the algorithm used (i.e. the steps used to reach the answer). Due to the reduced time allocation for mathematics in the Senior Phase, as indicated in CAPS, the teachers lamented that they did not have sufficient time to consolidate and give feedback to their learners to improve learning. Black and Wiliam (2003) assert that once a task has been assessed, proper feedback needs to be given so that both teaching and learning can be enhanced. The results show that the teachers rushed over mathematical concepts and topics in order to complete the syllabus.

The literature further confirms that teachers still have insufficient knowledge about implementing SBA, and are inconsistent in their application of AfL practices. Black and Wiliam (1998) maintain that the application of formative assessment (FA) is still minimal as teachers are less qualified, especially in integrating FA techniques in the process of teaching and learning. Feedback is a critical feature of the assessment cycle and should be emphasised to improve teaching, learning and assessment. Additionally, feedback reduces the discrepancy between the quality of teaching and learning, and the quality of SBA.

This study revealed that the CAPS document for mathematics does not give clear guidelines in terms of assessment. From the evidence presented, each participating teacher and HoD had his/her own way of interpreting the guidelines, for example, mark allocation. The tests also varied in terms of mark allocation and the duration of the test from one school to another. In addition, other input variables in terms of the quality of SBA include language, classroom sizes and school orderliness. Whilst the South

African education system is in the process of addressing the imbalances of Apartheid, the performance between rural and urban, advantaged and disadvantaged schools has widened (OECD, 2012). There is further evidence, as provided in this study, that predominantly rural classrooms are overcrowded, with up to 60 learners per Grade 9 class. This is a serious problem as overcrowded class sizes have proven to be less conducive to quality mathematics teaching and learning.

6.3.3 Sub-question 2: How teachers, Heads of Department and school principals perceive their role in ensuring the quality of SBA

This section deals with the role of teachers, HoDs, and school principals in ensuring the quality of SBA.

6.3.3.1 The role of teachers in ensuring the quality of SBA

Before initiating SBA tasks, educators should be provided with clear guidance. This study highlighted the fact that the teachers were not provided with clear SBA guidance. In addition, it was also found that the teachers were more focused on results than on the quality of teaching and learning. As a result, these teachers taught to the test. Teaching to the test is not ideal as predictably can skew the understanding of learner performance. According to the National Protocol on Assessment, teachers should set their own SBA and examinations internally, however, this study found that it was the norm of the NCED to provide provincial Grade 9 mathematics common examination question papers to schools. For the 2015 mid-year examinations, however, schools were requested by the NCED to set their own question papers. The teachers seemed to be frustrated as they struggles to set their own examination question papers. This move might lead to further variation in the quality of assessment in different schools.

6.3.3.2 The role of HoDs in ensuring the quality of SBA

HoDs' key role is to guarantee effective curriculum delivery in ensuring the quality of teaching, learning and assessment in their schools. Part of their role is to also work collaboratively with teachers to design SBA tasks and improve learner performance. They should further demonstrate appropriate SMK to assist teachers in designing assessment activities.

There were indications that the participating HoDs were aware of the role that they needed to play in the moderation process of SBA, however, the participants were uncertain due to inadequate training. SBA tasks should be designed by a competent subject teacher and should be moderated by the mathematics HoD or a senior teacher in the subject. This study found that in three of the five participating schools, there were only two permanently appointed mathematics HoDs. This scenario paints a bleak picture as in one of the schools, the appointed mathematics HoD was neither a mathematics teacher nor were there any senior mathematics teachers.

The finding of this study is that during in-service training, there was no training on the moderation process. These HoDs were only issued with the moderation protocol and left to read and interpret it on their own, which has led to varied interpretations, misinterpretation and an inability to implement the moderation process. In addition, the study found that not all of the HoDs received the moderation tool from the district office, but obtained it coincidentally from other colleagues, who in turn could not confirm the origin of the moderation tool.

The participating HoDs' lack of professional knowledge and skills was observed to have led to poor or no support for their teachers. The mathematics teachers therefore had no support or guidance on how to develop SBA of high quality, which might have led to poor learner achievement.

Another role of HoDs is to carry out teacher appraisals in the form of IQMS, which is only done once a year for salary increment purposes only. As a result, teacher appraisals are not performed for the intended purposes of improving teaching and learning. Research conducted by the OECD (2012) has found that feedback regarding lesson plans, teaching and learning improves learner performance. In this study, there was no evidence of any written feedback regarding lessons and assessments to assist teachers in reflecting on their teaching and assessment practices in order to improve teaching and assessment quality. Assisting teachers in interpreting learner feedback significantly increases HoDs' workloads, which has proven to be problematic in executing their core duties of monitoring and moderation, and has hampered their

performance. It was also discovered that there was insufficient time to perform rigorous monitoring and moderation, which was compounded by the fact that the HoDs found it challenging to balance their administrative duties and teaching and learning. In the interviews, it emerged that one of the HoDs was frustrated by the fact that one of her responsibilities was to ensure that the staffroom was kept clean, which therefore limited her time to attend to the teachers. Above and beyond the factors mentioned above, it was disconcerting to discover that most of the HoDs lacked experience and training, which could be detrimental to their ability to monitor and moderate, which in turn could filter down to the learners' performance.

6.3.3.3 The role of school principals

It is school principals' duty to recruit the best mathematics teachers, make subject allocations, and draw up assessment programmes. This study has revealed that the participating principals had not received training in terms of the management of SBA.

According to the National Protocol of Assessment, principals need to draw up the assessment plans that teachers and HoDs require. This study found no evidence of such assessment plans. Some of the principals admitted to having "failed in that regard". A lack of assessment plans may lead to an unplanned and haphazard way of conducting assessment. At the time that the data were collected, the teachers should have had a test and an assignment completed with their Grade 9 learners. However, according to the evidence, only a test had been written in Term 1.

Furthermore, there were contradictions in terms of how assessments unfolded in the different schools. It was revealed that while most of the principals said that monitoring was taking place, the HoDs and teachers contradicted this statement. It would seem that the principals did not know what was happening at their schools.

Additionally, principals are responsible for the progression and promotion of learners. Circulars from the NCED stipulate that learners who do not meet the minimum promotion requirements need to be progressed to the next grade due to the number of years spent in the phase, and due to their age in the phase. It emerged from the data that this practice had been interpreted in various ways. In this regard, it was confirmed

that almost none of the learners from Grade 7 and 8 attained the minimum promotion requirement, which is Level 3 (40%-49%). The participants themselves admitted that mathematics teachers inflated mathematics scores to 40% to effect a pass. A principal at one of the schools put the blame for poor learner performance on the NCED due to the information promoted in this circular. The principals expressed that they were confused about promotion and progression requirements due to a lack of proper and clear guidelines.

6.4 REFLECTION ON THE CONCEPTUAL FRAMEWORK

The conceptual framework of this study aimed to guide the analysis process and interpretation of the outcomes. For the purposes of this study, a decision was made to make adaptations to the original integrated model of school effectiveness, as proposed by Scheerens (1990).

6.4.1 Scheeren's original Input-process-output model

Scheerens (1990; 2000; 2004) introduces the input-process-output framework of education as a basis for defining quality, and for categorising measures of quality in education. Scheeren's (2004) context-input-process-output (IPO) model was useful in guiding the selection of variables and the main analysis of this study. In addition, the model placed emphasis on the relationship that exists between inputs-process and outputs. IPO is a descriptive conceptual framework that is used to categorise a range of interpretations of educational quality, and is used in terms of its value for policies aimed at quality. Scheerens comes from the school effectiveness and school improvement school of thought, which has a direct link to educational process and learner achievements (Creemers & Reezigt, 1997). The framework was used in this study to clarify a broad range of quality interpretations. Scheerens, Glas and Thomas (2007) posit that the model should be used as a framework to indicate educational content and generate key object areas within education.

6.4.2 Scheeren's model as envisioned for this study

The quality of education is interpreted in terms of the input-process-output-context framework (Chua, 2004, as cited in Arjomandi, Kestell & Grimshaw, 2009). Scheeren's Input-Process-Output (IPO) framework is quite general and flexible in describing the functioning of education.

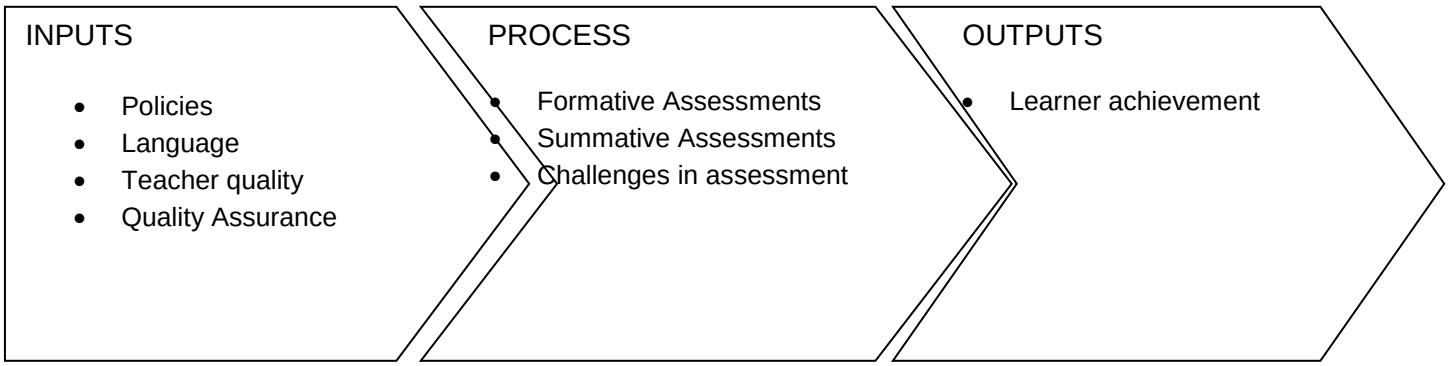

Figure 6.1 The original conceptual framework used in this study

Figure 6.1 presents the original conceptual framework as envisioned and discussed in Chapter 3. Initially, the input factors of this study were assessment and curricula policies; teacher quality that encompasses qualifications, experience and teacher content knowledge; language in mathematics; and quality assurance. Processes included formative assessment and summative assessment, as well as challenges in assessment. Lastly, the output factors included learner achievement.

Figure 6.2 presents the conceptual framework in terms of the themes that emerged as a result of the data were collected.

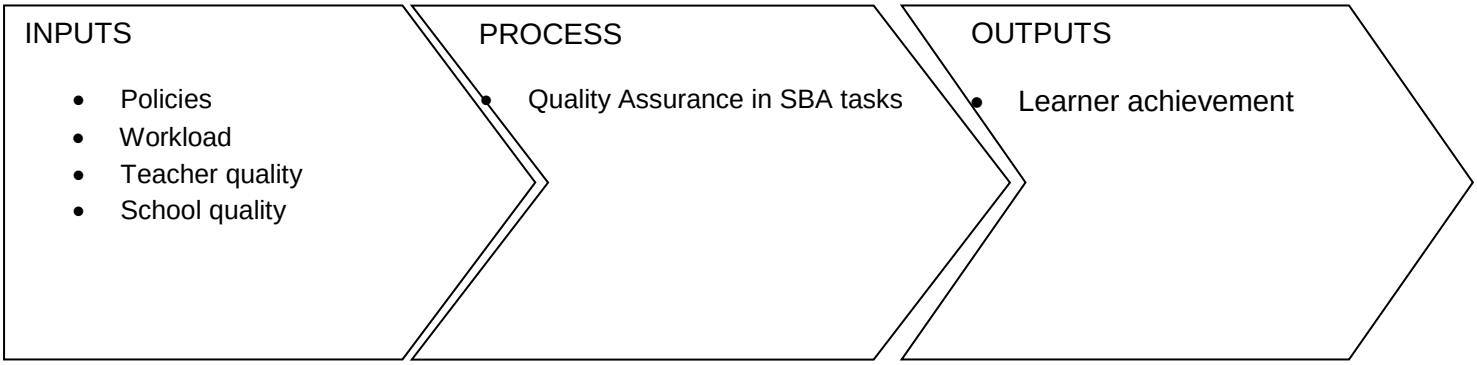

Figure 6.2 The conceptual framework that emerged as a result of the data collected

Initially, language was viewed as an input variable and as a theme on its own. However, after collecting the data, it emerged that the participants viewed language as part of teacher quality. Workload, the theme that I did not anticipate in my original conceptual framework, emerged strongly during data collection. Similarly, school quality did not form part of the input variables in the original conceptual framework. However, in my observations and field notes, school quality became an important input variable that formed part of how the different schools implemented SBA in their schools. Additionally, in the initial conceptual frame, I proposed that quality assurance was an input variable, nonetheless, it emerged from the data collected that quality assurance is a process indicator as monitoring and moderation processes are implemented and conducted in varying degrees at the five schools.

Similarly, in the proposed conceptual framework in Chapter 3, formative and summative assessments were viewed as processes. When the participants were asked to respond regarding these issues during the interviews, the picture of the proposed conceptual framework changed as the participants could not respond to these questions due to a lack of knowledge about formative and summative assessments. Furthermore, all adaptations of the conceptual framework were based on data collected and analysed in this study.

The following sections describe the findings of this research in terms of each input, process and output factor, as presented in Figure 6.2.

6.4.3 Input factors explored in this study

6.4.3.1 School quality

The background of the schools was one issue that emerged from the observational and field notes. Scheeren's school effectiveness, leadership qualities of principals, and disciplinary environment (Scheerens, 2004) proved to influence classroom practice. As described earlier, I observed a lot of time being wasted in the mornings for choir practice at one of the schools. I also observed that, in most of the schools, an atmosphere of orderliness was conspicuously absent. Most of the learners were outside of their classrooms loitering, some classes were unattended, there were broken

windows, and dilapidated buildings that could not have been conducive to quality teaching and learning.

6.4.3.2 Qualifications and experience

Teachers' knowledge and experience in mathematics play a pivotal role in ensuring quality SBA tasks. Wenglinskyl (2002) suggests that teachers' qualification in mathematics is associated with better learner performance. This study has shown that the better qualified mathematics teachers are, the better they are able to plan their lessons and manage their classrooms, and are better able to cover the curriculum. This in turn may produce positive results in learners' achievement. Two of the teachers at two different schools had a postgraduate qualification in mathematics. According to international standards, these teachers were highly qualified and demonstrated competency in the development of high quality SBA tasks. In stark contrast, the other teachers only had a teachers' diploma in primary education and did not major in mathematics. In addition, one HoD had an Honours degree that was not even related to mathematics. Of major concern was that an HoD at another school did not have any mathematics qualification, which could have seriously impacted the learners' performance in that particular school.

Teacher and HoD experience also proved to have an impact on the quality of SBA tasks. Most of the HoDs lacked managerial experience in producing quality SBA tasks. One HoD had more than 10 years of experience in her post and was highly experienced in that she had been a National Senior Certificate marker. As expected, the HoDs without managerial experience and training produced lower quality assessment tasks.

Experienced teachers attend mathematics workshops in order to improve their assessment practices. It would seem that the workshops attended by these teachers did not meet the required objectives of training, a finding also discovered by Spaull (2013). The participants admitted that the duration of training was a few hours only, and was only once per term. Furthermore, CAPS training lasted only three days, which was insufficient, as reported by one of the principals. Most of the HoDs and teachers also alluded to the fact that the facilitators were inadequately equipped. The teachers were

not well prepared to meet the expected standards of quality assessments. This may have been due to insufficient training and experience, and/or a lack of guidance, and/or insufficient workshops.

6.4.3.3 Language used in the teaching of mathematics

Language forms part of mathematics education. Thurston (1995) suggests that effective communication in mathematical ideas is key. Research suggests that learners who are taught mathematics in a language other than their primary language are disadvantaged and perform poorer than learners who receive mathematics in the same language as their primary language (Howie, 2003; Setati & Adler, 1998). In this study, two of the schools had parallel-medium classes, which means that the Afrikaans mathematics classes were separated from the English mathematics classes. Evidence provided from the collected data shows that the learners who were being taught mathematics in either language still performed poorly in mathematics

6.4.3.4 Content knowledge

Leendertz, Blignaut, Nieuwenhoudt, Els and Ellis (2013) define content knowledge as the quality and organisation of knowledge in the thought process of teacher. Firstly, Leendertz et al. (2013) posit that mathematics teachers should have appropriate content knowledge (CK) in order to teach mathematics fluently. Secondly, pedagogic knowledge (PK) refers to expertise in selecting appropriate methods for teaching particular content to learners. Shulman (2004) refers to Pedagogic Content Knowledge (PCK) as the interface between CK and PK, which becomes evident when teachers have the ability to build on learners' prior knowledge and adapt their teaching skills to best facilitate the new content to learners. In this study, it appeared that PCK had a strong association with educators' and HoDs' qualification and experience. The teachers and HoDs with a strong PCK, and who are better qualified and more experienced demonstrated competency in developing high quality assessment tasks. It should also be noted that, despite the fact that one teacher was less experienced, his qualification put him in a better position to develop high quality SBA tasks, thus resulting in improved learner performance. However, according to Wenglinskyl (2002) and the OECD (2012), teacher experience has no link to learner performance. Nevertheless, it

can be argued that, as a young teacher, he was able to grasp curriculum content and assessment practices better and faster than teachers who were more experienced.

6.4.3.5 Policies in assessment

The NPA, NPPPR and CAPS documents were provided to all of the schools. Of particular importance is that all of the teachers were in possession of the CAPS document. In addition to the policy documents, selected schools were also provided with a 'Tracker', which is very similar to the CAPS document. The evidence in this study does not shove distinct differences in the two documents. The participating mathematics teachers in this study expressed their frustration in the sequencing of topics and concepts, as stipulated in the CAPS document. Firstly, according to the participants, the sequencing made it difficult to continue with the work of the previous day as the topics were not related. Secondly, the assessment policy was silent on the weighting of SBA tasks and mark allocation. Thirdly, the cognitive levels in mathematics were not related to the cognitive levels of other subjects. It is important to mention at this point that most of the HoDs in the sample were not only responsible for mathematics in their schools, but other subjects as well.

The NPA and NPPPR give limited guidelines for the GET band, and what little guidance there is in the policy documents is left to individual teachers, HoDs and school principals to interpret for themselves.

6.4.3.6 Workload

Teachers' expected workload is covered in the Educators' Employment Act (EEA) 76 of 1998. The Act stipulates the minimum number of hours to be spent by personnel within different post levels in performing their core duties within the school, and in the classroom, such as teaching. The workload policy is, however, silent on teachers' lesson preparations, as well as the moderation and monitoring of assessment tasks by the SMT. This study revealed that the participants were overwhelmed by the amount of work and the demands from the district office, which took them out of class. In particular, the mathematics teachers that had to be away every Monday of the week for

professional development found this to add to their workload and reduce their teaching time.

In addition to their absence on Mondays, the teachers worked extra hours every afternoon to catch up with the syllabus. The EEA 76 of 1998 requires that teachers work seven hours per day, and 35 hours per week. The data that emerged from the interviews were corroborated by my observations that in all the schools that participated in the study, learners stayed after school for the afternoon classes. In addition to the afternoon classes, one teacher had classes on Saturdays, and one teacher in the school started her day at 06h00 each morning. This was evidenced in that by the fact that I conducted the interview with this teacher at 06h45.

Most of the principals complained that the amount of administrative duties required from them by the Department of Education made no provision for them to be in class, or to make sure that the school runs smoothly. The principals further lamented that they were forever completing forms and were always summoned to the district office. It was so challenging for one of the principals that I had to postpone the interviews due to the demands of the district office.

Breaks do not form part of teaching time, however, due to a large workload, the participants worked through their break time by either supervising the grounds or moderating SBA tasks.

Class sizes added to the workload, as stated by the participants. Several teachers added that they suffered from exhaustion when marking SBA tasks and managing assessment, such as recording and reporting.

6.4.4 Process factors explored in this study

6.4.4.1 Quality Assurance in SBA tasks

Monitoring and moderation form the basis of quality assurance mechanisms in the context of SBA. In the data collected, there was no evidence of rigorous internal monitoring and moderation in these schools. The HoDs were not trained to quality assure the SBA tasks, assessment tools and scores. There was furthermore no

evidence of written feedback, and the teachers seemed to be passive participants in the moderation process. One of the findings was that the teachers seemed to be more focused on the HoD's approval, shown by their signature and the school stamp. No room was made for improvement in terms of the quality of the development of SBA tasks. In addition, there was only evidence of post-moderation in one of the participating schools. Post-moderation was also lacking as only shadow marking was done, while no feedback given.

6.4.5 Output factors explored in this study

6.4.5.1 Learner achievements

The Trends in International Mathematics and Science Study (TIMSS) assesses achievements in mathematics and science in the fourth grade and the eighth grade (Mullis, Martin, Ruddock, O'Sullivan, Arora & Erberer, 2005). In addition, TIMSS provides each participating country with an array of information to interpret learners' achievement results in order to improve mathematics and science performance. South Africa's poor performance in mathematics education was highlighted in the TIMSS reports (Spaull, 2014). South Africa's performance in mathematics in TIMSS painted a very gloomy picture as it was almost the poorest performing of all the participating countries. It is also worrying to see that South Africa's Grade 9 learners perform worse than the Grade 8 learners of other countries writing the same test. It would appear that the participants in this study lacked knowledge of TIMSS, as information from such assessments do not filter through to schools and are not communicated to the schools. As a result of this lack of knowledge, the participants were unable to respond to questions regarding international achievements.

In addition to these international assessments, South African Grade 9 learners participate in the Annual National Assessments (ANAs) in mathematics and languages, which was introduced by the national Department of Basic Education (DBE) (Spaull, 2014). The ANAs are a national testing diagnostic tool used to improve mathematics and language performance, and give learners the opportunity to demonstrate relevant skills and understanding within these subjects.

According to the ANA results, the learners' achievements in languages have improved, however, achievement in mathematics has been declining and is below acceptable levels (HRSC, 2011). The ANA mathematics results indicate that Grade 9 learners perform below the expected minimum levels (40% and 50%). Low achievement in mathematics reveals numerous challenges that learners experience in certain mathematical topics (Spaull & Venkat, 2014). This study reveals that the Grade 9 learners did achieve well in the ANA, as in some schools there was a zero percent achievement. This study also reveals that the participants and their learners did not regard ANA as a diagnostic tool, but rather as a measure used to classify schools. It also emerged that the low achievement of learners was due to an array of factors, such as ANA mathematics being based on CAPS content written in Term 3 instead of at the end of the year. Most importantly, the learners and teachers knew that the ANA scores did not form part of the promotion mark. Learner achievements, as measured through TIMSS and the ANAs, were unacceptably low.

SBA achievement scores, in contrast, were higher than the international and national achievements. There seemed to be a skewed picture that emerged from the responses of the participants. It would thus appear that the Grade 9 mathematics learners' performance did not match what was painted by the external assessments such as the ANAs and TIMSS. As SBA tasks are developed and conducted internally by the educators, the standard of teachers' marking, as revealed in the data collected, the quality assurance mechanisms put in place in the different schools, and learner achievement in mathematics appeared to be improving.

6.5 REFLECTIONS ON THE RESEARCH DESIGN AND METHODOLOGY

The study followed a qualitative research approach that focused on individual, face-to-face interviews using a case study design. The interpretive paradigm was followed as I wanted to obtain first-hand information from the participants through them sharing their experiences and perceptions in their natural setting. I purposefully selected 15 participants from the John Taolo Gaeitsiwe (JTG) district in the Northern Cape: a Grade 9 mathematics teacher, an HoD, and a principal from each of the five purposefully selected schools (Patton, 2002). The focus was on understanding and illuminating

important cases rather than on generalising the results from a sample of the population. The five schools that were purposefully selected varied from rural, semi-rural, and township to semi-urban areas. The data collection methods used in this study were questionnaires, interview schedules, observations, a document analysis of the mathematics SBA tasks and tools, and the moderation reports from the HoDs, which were highlighted and described. The items in the questionnaires further elicited the biographical information of the participants.

The main data collection method used in this study was semi-structured interviews, which were tape recorded. The use and combination of four data sources was used to triangulate the data in order to corroborate or contradict the findings of each (Patton, 2002). Triangulation assumes that the use of different data sources will help both to confirm and to improve the precision or clarity of research findings (Lewis & Ritchie, 2003; Patton, 2002). The triangulation of sources compared data from sources like interviews, questionnaires, documents and observations. In addition, the data collected from the teachers were triangulated with the data collected from the HoDs and the principals. Patton (2002) argues that the triangulation of different data sources within a qualitative study will seldom lead to a single, totally consistent picture. As the researcher becomes an instrument in qualitative research, I have personally analysed and organised the data using the thematic data analysis approach. The experience, training, and my perspective on the topic helped me to analyse the data. However, I had no personal connection to the participants.

6.6 LIMITATIONS OF THE STUDY

The sample of this study was only drawn from the John Taolo Gaetsiwe (JTG) district in the Northern Cape Province, and I do not claim that it can be generalised to other areas. Research done on this topic in other areas of South Africa might have different findings. The sample size for the participants was relatively small, which means that the results could not be generalised to the entire set of South African schools.

The interviews in this study focused on the participants at school level: the teacher, HoD, and the school principal. The study might have yielded valuable findings if a subject advisor was included in the sample.

In some of the schools selected for the study, I was unaware of the fact that there was more than one Grade 9 mathematics teacher. In such schools, the sample should have included all Grade 9 mathematics teachers, which means that the interviews could have indicated alternative ideas in this regard.

A possible limitation of this study could have been that the interviews dealt with a sensitive topic, however, the participants were given constant reassurance of confidentiality.

The interviews were difficult to organise as finding the time and a suitable venue was not always possible. None of the Grade 9 mathematics teachers or their HoDs were available on Mondays at their schools due to the 1+4 programme. The area around the venues was always noisy, and there was disturbance caused by knocks on the door and phone calls.

The questionnaires were completed incorrectly by most of the participants, specifically regarding the language and educational level items. This was despite the very clear instructions given. Having observed this problem, I gave more detailed instruction, and corrections were made.

Almost none of the participants possessed knowledge about international assessments such as TIMSS. It was thus not possible to make comparisons between SBA and international assessments. Although the current study could not provide evidence of how the educators viewed SBA as compared to international assessments, this was a finding in itself regarding the department's inability to effectively communicate such important assessment results down to the teachers at classroom level.

6.7 RECOMMENDATIONS

The following recommendations are made for the current study:

RECOMMENDATION 1: The training of HoDs and principals

An analysis of the interviews, and the document analysis revealed that most of the HoDs and principals lacked in-depth knowledge and understanding of their roles and functions in making SBA reliable, credible and valid. This was not only due to a lack of capacity to perform such functions, but was also due to a lack of effective induction and training by the district and provincial offices.

It is therefore recommended that, in order for HoDs and principals to develop an in-depth understanding of their roles and functions, they should be trained in these roles to ensure that SBA is reliable, credible and valid.

RECOMMENDATION 2: Training on the quality of SBA

Any change in the curriculum and assessment policies would require intensive training to be made available to all of the stakeholders: school principals, HoDs and teachers. Sufficient time for training and exposure to SBA should be provided to all teachers. The feedback gathered from stakeholders such as teachers and HoDs should provide the relevant information to the ministry in terms of their attempt to decipher and make the necessary changes and modifications to the existing assessment policies and guidelines. According to Talib, Naim, Ali and Hassan (2014), the Cascade model is not always the best model to be used as information withers and is lost during training. The cascade model proved to have failed to prepare district officials, school principals, HoDs or teachers for the complexity involved in the implementation of the assessment policy, particularly the SBA component (Dichaba & Mokhele, 2012, as cited in Talib et al., 2014).

RECOMMENDATION 3: Time spent in class

If there are intervention programmes that are in place to assist teachers, they should be designed in such a way that they assist teachers and do not take time away from

teaching a curriculum that is already bloated. Intervention programmes should be in alignment with the Performance Administrative Measures (PAM) in terms of time spent on intervention programmes, as well as CAPS in terms of the pacing and sequencing of topics.

RECOMMENDATION 4: Use of national and international assessment data

The ANAs should be used for the intended purpose: to diagnose the challenges in literacy and numeracy. The ANAs should not be used to name and shame schools and teachers, but rather to expose teachers to the best assessment practices. The timing of the ANAs should be revised as they should not be written during Term 3 when the whole year's work is being assessed. In addition, writing these standardised tests annually does not serve any purpose as there is no time to reflect on the weaknesses within the system and implement remedial actions, as originally intended. Lastly, the ANAs should not be used as a political tool, but rather as an assessment tool that will improve the quality of learning and teaching.

RECOMMENDATION 5: The evaluation of SBA

The effectiveness of SBA depends on a variety of issues pertaining to teachers and learners. With the constant changes being made, it is imperative for SBA to be evaluated form time to time. Countries such as Finland, Hong Kong, Australia and New Zealand have implemented SBA, however, despite their years of experience in implementing SBA, several studies have been carried out from time to time in order to investigate the relevant aspects of SBA.

RECOMMENDATION 6: The communication of guidelines

Clear guidelines should be communicated to all stakeholders regarding the types of assessments and their purpose in order to have uniform interpretation and implementation of such guidelines.

6.8 CONCLUSION

This study sought to analyse any evidence of variation in the quality of School-Based Assessment (SBA) from the perspective of principals, Heads of Department (HoDs) and teachers. This is an important topic as the management, monitoring, moderation, and implementation of SBA filter down from the principal through to the teachers, and eventually, to the learners. SBA has been shown to provide results that do not concur with international assessments, such as TIMSS, which is a matter of concern. This study was able, using a small case study sample, to confirm what has long been suspected in the education system: on a small scale, SBA is not as effective as it could be. While the results of this study are not generalisable, they provide insight into this topic, and provide a starting point for further research on the matter.

This study concludes with a quote from Stiggins (2007, p. 36) regarding assessment in the classroom,

> *Individuals make very important decisions about students based on assessment information. Therefore, all our assessments - standardised as well as classroom; assessment for learning as well as assessment of learning - must be of high quality, yielding accurate results.*

Appendix A

Questionnaire for Teachers

Please indicate by ticking one box per question:

Gender

Male ☐ Female ☐

Age (in years)

18-25 ☐

26-35 ☐

36-45 ☐

46 and above ☐

Qualification in Mathematics

Grade 9 exit level ☐

Grade 12 exit level ☐

Diploma (specialisation in Mathematics) ☐

Degree (specialisation in Mathematics) ☐

Post-graduate Degree (specialisation in Mathematics) ☐

Teaching experience in Mathematics

Less than 1yr ☐

1-5yrs ☐

6-10yrs ☐

10yrs and more ☐

In-service Training on Principles of Assessment

Yes ☐

No ☐

If yes, indicate the source

Curriculum services ☐

Non-governmental organization ☐

Professional bodies ☐

Teacher Union ☐

Language (Indicate by number)

Home language (educator) ☐

Language of learners in class ☐

Language of learning and teaching ☐

Languages:

1. Afrikaaans
2. English
3. IsiNdebele
4. IsiXhosa
5. IsiZulu
6. Setswana

7. Sesotho
8. Sepedi
9. IsiSwati
10. Tshivenda
11. Xitsonga
12. Other

Appendix B

Questionnaire for Heads of Department

Please indicate by ticking one box per question:

Gender

Male ☐ Female ☐

Age (in years)

18-25 ☐

26-35 ☐

36-45 ☐

46 and above ☐

Teaching qualification in Mathematics

Grade 9 exit level ☐

Grade 12 exit level ☐

Diploma (specialisation in Mathematics) ☐

Bachelor's Degree (specialisation in Mathematics) ☐

Post-graduate degree (specialisation in Mathematics) ☐

Teaching experience in Mathematics

Less than 1yr ☐

1-5yrs ☐

6-10yrs ☐

10yrs and more ☐

Experience as Head of Mathematics Department

Less than 1yr ☐

1-5yrs ☐

6-10yrs ☐

10yrs+ ☐

In-service Training on Principles of Assessment

Yes ☐

No ☐

If yes, indicate the source

Curriculum services ☐

Non-governmental organisation ☐

Professional bodies ☐

Teacher Union ☐

Appendix C

Questionnaire for Principals

Please indicate by ticking one box per question:

Gender

Male ☐ Female ☐

Age (in years) ☐

18-25 ☐

26-35 ☐

36-45 ☐

46 and above ☐

Experience as a principal

Less than 1yr ☐

1-5yrs ☐

6-10yrs ☐

10yrs+ ☐

In-service Training on Principles of Assessment

Yes ☐

No ☐

If yes, indicate the source

Curriculum services ☐

Non-governmental organisation ☐

Professional bodies ☐

Teacher Union ☐

Appendix D

The Teacher interview Protocol

Differences in the quality of School-Based Assessment: Evidence for Grade 9 Mathematics.

Description	
Time of the interview	
Duration	
Date	
Place	
Interviewer	
Interviewee	
Pseudonym	
Male/ Female	

School-Based Assessment (SBA) plays a critical role in Continuous Assessment (CASS) and determines progression and promotion. The purpose of this study is to contribute to the research and explore the status quo of SBA done at Grade 9 level and in improving the quality by informing policy formulation. Pseudonyms will be used in the interviews, data analysis and the findings. The data collected in this study will serve in research purposes only and treated as confidential. Access to the data will be granted to the researcher and the supervisor only. Please sign the consent form at the back of this document. Your participation in this study is greatly appreciated.

Questions follow on the next page:

Questions:

1. To what extent do your qualifications and teaching experience in Mathematics have an influence on your performance as a Mathematics teacher?
2. Does Curriculum and Assessment Policy Statement (CAPS) provide sufficient information on Assessment in order to allow you to implement Assessment with confidence?
3. Very briefly, how do you understand Assessment, School-Based Assessment (SBA)? How is Assessment constituted in CAPS?
4. How do you understand the role of the SBA component on learner performance?
5. Describe the elements that must go in the SBA tasks to make up for the standardisation of the tasks. Do you apply such elements? Please elaborate.
6. Do you understand the cognitive levels that should be applied in Mathematics?
7. After you have set the SBA task, is there a process of quality assurance at your school? Please elaborate on your response.
8. What is your learner performance in SBA?
9. How does your SBA achievements compare with external assessment (provincial, ANAs, TIMSS)?
10. How do you use SBA for formative purposes?
11. How do you use SBA for summative purposes?
12. How do you use assessment as learning as extension of formative and summative assessment?
13. What are the things that hamper/enhance your quality of teaching mathematics?

Appendix E

The Head of Mathematics Department interview Protocol

Differences in the quality of School-Based Assessment: Evidence for Grade 9 Mathematics.

Description	
Time of the interview	
Duration	
Date	
Place	
Interviewer	
Interviewee	
Pseudonym	
Male/ Female	

School-Based Assessment plays a critical role in Continuous Assessment and determines progression and promotion. The purpose of this study is to contribute to the research and explore the status quo of SBA done at Grade 9 level and in improving the quality by informing policy formulation. Pseudonyms will be used in the interviews, data analysis and the findings. The data collected in this study will serve in research purposes only and treated as confidential. Access to the data will be granted to the researcher and the supervisor only. Please sign the consent form at the back of this document. Your participation in this study is greatly appreciated.

Questions follow on the next page:

Questions:

1. What should a good candidate have to be appointed to guide and support grade 9 mathematics teachers in your school? Please elaborate.
2. To what extent is it challenging to have other roles?
3. What systems are in place for moderation and monitoring procedures at your school?
4. How do you ensure time-on-task in Mathematics is unfolding amongst your teachers?
5. Did you receive the most recent moderation protocol document from the Northern Cape Education Department that deals with pre-moderation, moderation and post-moderation? If yes, how confident do you implement the guidelines? If no, do you have any form of guidelines that guide your moderation process?
6. When moderating SBA tasks, what is your role in ensuring that the SBA tasks are valid, reliable and credible?
7. How do you make a follow-up on recommendations given to your teachers?
8. Do/did you receive any training/support from the District office in performing your duties as the head of Mathematics at your school?
9. What is the learner performance in SBA at your school as compared with external assessments (such as provincial, ANAs, SACMEQ and TIMMS)?
10. If there is a huge discrepancy between SBA and external assessment, what do you suggest what could be done, in your capacity as the head of the department, to close the gaps? If there none, what measures do you have in place to ensure that there is no discrepancy between SBA and external assessment?
11. As an HOD, do you know:

    (i) the number of formative/summative assessment pieces?

    (ii) Types/forms of assessment used by teachers?

    (iii) Weighting of different assessment forms?

Appendix F

The Principal interview Protocol

Differences in the quality of School-Based Assessment: Evidence for Grade 9 Mathematics.

Item	
Time of the interview	
Duration	
Date	
Place	
Interviewer	
Interviewee	
Pseudonym	
Male/ Female	

School-Based Assessment plays a critical role in Continuous Assessment and determines progression and promotion. The purpose of this study is to contribute to the research and explore the status quo of SBA done at Grade 9 level and in improving the quality by informing policy formulation. Pseudonyms will be used in the interviews, data analysis and the findings. The data collected in this study will serve in research purposes only and treated as confidential. Access to the data will be granted to the researcher and the supervisor only. Please sign the consent form at the back of this document. Your participation in this study is greatly appreciated.

Questions follow on the next page:

Questions:

1. What are the things that hamper/enhance the running of your school?
2. How do you do the subject allocation in your school, specifically with regards to Grade 9 Mathematics?
3. How do you deal with shortage of Mathematics educators in your school? If you do not experience shortage of Mathematics, how do you recruit Mathematics teachers?
4. How do you ensure there is quality teaching in your school?
5. How well do you understand policies such as Curriculum and Assessment Policy Statement (CAPS), National Protocol on Assessment (NPA) and National Policy Pertaining to the Programme and Promotion Requirements of the National Curriculum Statement (NPPPR)?
6. Does the school have an Assessment programme? If yes, is it fully implemented? If no, how do you implement assessment as per policy requirements?
7. What is the learner performance in SBA at your school as compared with external assessments (such as provincial, ANAs and TIMMS)?
8. If there is a huge discrepancy between SBA and external assessment, what do you suggest what could be done, in your capacity as the principal, to close the gaps?

REFERENCES

Bambi, A. (2013). *The role of head of departments as instructional leaders in secondary schools: implications for teaching and learning*. South Africa: University of Johannesburg.

BankSet. (2009). *Assessment and Moderation Policy.* Retrieved from:

https://www.google.co.za/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&cad=rja&uact=8&ved=0ahUKEwjftJCd-NLOAhVkCcAKHQtCCksQFggnMAI&url=http%3A%2F%2Fwww.bankseta.org.za%2Fdownloads%2Fetqa%2Fassessment_and_moderation_policy.doc&usg=AFQjCNFs0bgoMu4O8JCPDDcGu1jBuKZnoQ&sig2=P7_BYvtTK34ScQcQdygIHA&bvm=bv.129759880,d.d24

Bennette, R. (2010). *Cognitively Assessment of, for and as Learning (CBAL): A Preliminary Theory of Action for Summative and Formative Assessment*. Princeton, USA: Educational Testing Service.

Bennette, R. (2011). Formative Assessment: a critical review, assessment in education. *Principles, Policy & Practice*, 18, 5-25.

Bennette, R. & Gitomer, D. (2009). *Transforming K-12 Assessment: Integrating Accountability Testing, Formative Assessment and Professional Support*. Princeton, USA: Educational Testing Service.

Black, P., Harrison, C., Lee, C., Marshall, B & Wiliam, D. (2004). Working Inside the Black Box: Assessment for Learning. *Phi Delta Kappan*, 86 (1). 8-21.

Black, P. & Wiliam, D. (1998). *Inside the Black Box: Raising Standards through Classroom Assessment.* London: King's College London School of Education.

Black. P. & Wiliam, D. (2009). Developing the theory of formative assessment. *Educational Assessment, Evaluation and Accountability*, 1(1), 1-40.

Black, P. & Wiliam, D. (2010). In praise of Educational research: Formative Assessment. *British Educational Research Journal*, 29 (5), 623-637.

Boeije, H. (2009). *Analysis in Qualitative Research*. California: Sage Publications

Brink, H., Van der Walt, C. & Van Rensburg, G. (2012). *Fundamentals of Research Methodology for Healthcare Professionals*, 3rd ed. Cape Town, South Africa: Juta.

Broadfoot, P. & Black, P. (2004). *Redefining assessment? The first ten years of Assessment in Education*. San Francisco, USA: Taylor & Francis Ltd.

Broomes, D. (1997). Practices, problems and potential of School-Based Assessment (SBA). In St. Caribbean Examinations Council. (2012). *School-Based Assessment (SBA) Manual for Principals (Barbados)*. St. Michael, Barbados, Caribbean: Examinations Council.

Buchunan, A. & Hafner, A. (1991). *Current Research on National systems of Education Indicators: Potential Benefits for School-Based Management*. San Francisco, California: Far West Laboratory for Education Research and Development.

Carol (2014). *Learning in 140 Characters: Microblogging for Professional Learning*. Unpublished Doctorate thesis, Queensland University of Technology.

Chappius, S. & Stiggins, J. (2002). Classroom Assessment for Learning. ASCD 60(1), 40-43. Retrieved 23 September 2013 from: www.ascd.org.

Chisholm, L. (2004) (Ed). *Changing Class, Educational and Social Change in Post-Apartheid South Africa.* South Africa: HRSC Press.

Chisholm, L., Motala, S. & Vally, S. (2003). *South African Education Policy Review 1993-2000.* South Africa: Heinemann.

Chisholm, L., Hoadley, U., wa Kivulu, M., Brooks, H., Prinsloo, C., Kgobe, A., Mosia, D., Narsee, H. & Rule, S. (2005). Educator Workload in South Africa. South Africa: HSRC Press. Retrieved 28 February 2016 from: www.hrscpress.ac.za

Clark, I. (2011). Formative Assessment: Policy, Perspectives and Practice. *Florida Journal Educational Administrative & Policy,* 4(2).

Cohen, Hill & Heather (1998). *Instructional Policy and Classroom Performance: The Mathematics Reform in California.* California: Consortium for Policy Research in Education.

Corbetta, P. (2003). *Social Research: Theory, Methods and Techniques*. California: Sage Publications.

Creemers, B. & Scheerens, J. (1994). *Developments in the Educational Effectiveness Research Programme.* The Netherlands: University of Twente.

Creswell, J.W. (1994). *Research Design: Qualitative and Quantitative Approaches*. Thousand Oaks, CA: Sage Publications.

Creswell, J.W. (2005). *Research Design: Qualitative, Quantitative and mixed methods approach* (2nd ed.) University of Nebraska, Lincoln: Sage Publications.

Creswell, J., Ebersőhn, L., Ellof, I., Ferreira, R., Ivankova, N., Jansen, J. & Nieuwenhuis, J. (2008). First Steps in Research. In K. Maree (Ed), *First Steps in Research.* Pretoria: Van Schaik.

Creswell, J.W., Clark, P., Gutmann, V.L., Hanson, M.L. & Hanson, W.E (2003). Advanced mixed methods research design. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioural research* (pp. 209-2400. Thousand Oaks, CA: Sage.

Creswell, J., Hanson, W., Clark, V & Morales, A. (2007). Qualitative Research Design: Selection and Implementation. *The Counselling Psychologist*, 35(2), 236-264. USA: SAGE Publishers.

Creswell, J. & Clark, V. (n.d). *Principles of Qualitative Research: Designing a Qualitative Study.* Lincoln: University of Nebraska.

Davison, C. (2007). *Views from the Chalkface: English Language School-Based Assessment in Hong Kong.* Retrieved 25 March 2013 from: www.tandfonline.com/loi/hlaq20 Retrieved 25/03/2013.

Denzin, K. & Lincoln Y. (Eds.). *Handbook of Qualitative Research* (2nd Ed.). Thousand Oaks and London: Sage Publications.

Department of Basic Education. (2011). *National Curriculum Statements and Assessment Grades R-12.* South Africa: Government Printers.

Department of Basic Education. (2011). *National Policy Pertaining to the Programme and Promotion requirements of the National Curriculum Statement. Grades R-12.* South Africa: Government Printers.

Department of Basic Education. (2011). *National Protocol on assessment Grade R-12.* South Africa: Government Printers.

Department of Basic Education. (2012). *Action Plan to 2014: Towards the realization of schooling, 2025*. South Africa: Government Printers.

Department of Basic Education (2012). *Report on the Annual National Assessments, Grades 1 to 6 & 9.* Pretoria: Government Printers.

Department of Basic Education (2014). *Report on Annual National Assessments, Grades 1 to 6 & 9*. Pretoria: Government Printers.

Department of Education. (2000a). *Criteria for the Recognition and Evaluation of Qualifications for Employment in Education.* South Africa: Government Printers.

Department of Education. (2000b). *Norms and Standards for Educators.* South Africa: Government Printers.

Department of Education. (2002). *Revised National Curriculum Statement Grades R-9 (Schools).* South Africa: Government Printers.

Department of Education. (2006). *The National Policy Framework for Teacher Education and Development in South Africa*. Pretoria: Government Printers.

Dunne, T., Long, C., Craig, T. & Venter, E. (2012). Meeting the requirements of both classroom-based and systemic assessment of mathematics proficiency: The potential of Rasch measurement theory. *Pythagoras*, 33(3), 1-16. Retrieved from: http://dx.doi.org/10.4102/pythagors.v.33i3.19

Edelson, D.C. (2002). Design Research: What we learn when we engage in Design. *The Journal of the Learning Sciences,* 11(1), 105-121.

Employment of Educators Act no 76 of 1998. *Government gazette*. South Africa: Government Printers.

Fraser, W. & Maree, J. (2004). *Outcomes-Based assessment* (Eds). Sandown, South Africa: Heinemann.

Gipps, C. (1994). *Beyond testing, towards a theory of educational assessment*. Washington, D.C: The Falmer Press.

Gipps, C. & Murphy, M. (1994). *Assessing Assessment. A Fair Test? Assessment, achievement and equity*. Buckingham: Open University Press.

Glaser, B.G. & Strauss, A.L. (1967). *The discovery of grounded theory*. London, UK: Macmillan.

Govender, V.G. (2014). *Introducing a National Examination mathematics on South Africa.* Retrieved 30 May 2015 from: www.samf.ac.za.

Government Gazette No. 2143 0f the Republic of South Africa. August 2000. Cape Town, South Africa: Government Printers.

Government Notice 2432. (2008). *Government Gazette*, 400(19377). South Africa: Government Printers.

Griffith, S.A. (n.d). *Quality Assurance In the School Based Assessment Component of A Public Examination.* The West Indies: Institute of Education, University of the West Indies, Mona Campus.

Grima, G. (2003). *School-Based assessment: Implementation Issues and Practices*. *Paper presented at the IEA conference, Cape Town, South Africa.*

Guba, E. & Lincoln, INITIAL. (1994). Competing Paradigms in Qualitative Research. In M. Hammond & J. Wellington. (2013). *Research Methods, the Key Concepts*. London: Routledge.

Hargreaves, E. (2005). *Assessment for Learning? Thinking outside the (black) box*. London: London University.

Harlen, W., Gipps, C., Broadfoot, P. & Nuttal, D. (1992). Assessment and the improvement of education. *The Curriculum Journal, 3(3), 215-230.*

Harlen, W. & James, M. (1997). Assessment and Leaning: differences and relationships between formative and summative assessment. *Assessment in Education: Principles, Policy and Practice,* 4(3), 365-379. Retrieved on 4 August 2015 from: http://dx.doi.org/10.1080/0969594970040304

Harsh, Suri (2011). Purposeful sampling in qualitative research synthesis. *Qualitative Research Journal,* 11(2), 63-75.

Hoadley, U. (2010). *What do we know about teaching and learning in South African primary schools? A review of classroom-based literature research*. Cape Town, South Africa: University of Stellenbosch.

Hoadley, U. (2012). What do we know about teaching and learning in South African primary schools? *Education as Change*, 16(2), 187-202.

Hong Kong Examinations and Assessment Authority (2009). *HKDSE English Language: Recommended Texts for the School-Based Assessment component. Retrieved from: www.hkeaa.edu.hk/DocLibrary/SBA/HKDSE/Eng-SBA_Recommended_Texts-091008.pdf*

Hong Kong Examinations and Assessment Authority (2015). *School-Based Assessment Teachers' Handbook.* Retrieved from: http://www.hkeaa.edu.hk/en/SBA/

Howie, S. (2002). English Language Proficiency and Contextual Factors Influencing Mathematics Achievement of Secondary School Pupils in South Africa. Enschede: Print Partners Ipskamp.

Human Sciences Research Council (2006). Key findings and implications. Retrieved 16 June 2015 from: www.hsrcpress.ac.za.

Human Sciences Research Council (2006). Mathematics and Science achievement on TIMSS. Retrieved 16 June 2015 from: www.hsrcpress.ac.za.

Human Sciences Research Council (2011). *Highlight from TIMSS 2011: The South African perspective.* Retrieved 27 April 2015: www.hsrcpress.ac.za.

Human Sciences Research Council (2013). *Policy brief: Improving teaching and learning through the South African Annual National Assessment: Challenges, possibilities and solutions.* Retrieved 17 August 2015 from: www.hsrcpress.ac.za.

Jensen, B., Sandoval-Hernádez, A., Knoll, S. & Gonzalez, E. (2012). *The experience of New Teachers: Results from TALIS 2008.* Paris, France: OECD Publishing. Retrieved 23 Feb. 2016 from: http://dx.doi.org/10.1787/9789264120952-en.

Johnson, B. & Onwuegbuzie, A. (2004). Mixed Methods Research: A Research Paradigm Whose Time has come. *Educational Researcher, 33(7), 14-16. Washington D.C: American Educational Research Association*. Retrieved 27 July 2013 from: http://www.jstor.org/stable/3700093.

Kanjee, A. (2007). *Improving learner achievement in schools: Applications of national assessment in South Africa*. Pretoria: HRSC Press.

Kothary, C.R. (2006). *Research Methodology: Methods and Techniques*. New Delhi, India: New Age International Publishers.

Kumar, R. (1999). Research Methodology: A step-by-step guide for beginners. London: Sage Publications Ltd.

Kvale, S. (1996). *Interviews: an introduction to qualitative research.* California: Sage Publications.

Kwakman, K. (2002). *Factors affecting teachers' participation in professional learning activities.* Enschede, the Netherlands: Department of curriculum, University of Twente.

Lal, S., Suto, M. & Ungar, M. (2012). Examining the Potential of Combining the Methods of Grounded Theory and Narrative Enquiry: A Comparative Analysis. *The Qualitative Report.* 17 (41), 1-22. Retrieved 25 July 2013 from: www.nova.edu.sss/QR/QR17/lal/pdf.

Lamprianou, I. & Christie, T. (2009). Why school based assessment is not a universal feature of high stakes assessments? Educational Assessment, Evaluation and Accountability, 21(4), 329-345.

Long, C., Dunne, T. & De Kock, H. (2014). Mathematics, curriculum and assessment: The role of taxonomies in the quest for coherence. *Pythagoras,* 35(2), Art. #240, pp. 1-14. Retrieved 03 March 2015 from: http://dx.doi.org/10.4102/pythagoras.v3512.240.

Lyman, H. (1991). *Test scores and what they mean*. (5th Ed). Upper Saddle River, USA: Prentice Hall.

Lyman, H. (1998). *Test scores and what they mean*. (6th Ed). Boston, USA: Allyn & Bacon.

Mackenzie, N. & Knipe, S. (2006). Research dilemmas: Paradigms, methods and methodology. *Issues in educational research*, 16.

McMillan, J. & Schumacher, S. (2006). Research in Education. Evidence-Based Inquiry. 6th ed. Upper Saddle River, New Jersey: Pearson.

Maile, S. (2013). School-Based Quality Assurance of Assessment: An Analysis of Teachers' Practices from Selected Secondary Schools Located in Tshwane

North District. *International Journal of Humanities and Social Science Invention*, 2(10), 15-28. Retrieved 13 May 2015 from: www.ijhss.org.

Makgato, M. & Mji, A. (2006). Factors associated with high school learners' poor performance: A spotlight on mathematics and physical science. *South African Journal of Education*, 16(2), 253-166.

Moloi, MQ. (n.d.). *Mathematics achievement in South Africa: A comparison of the official curriculum with pupil performance in the SACMEQ II Project.* Retrieved from: http://www.jet.org.za/publications/jet-education-services-conferences/School%20quality%20research%20seminar%202/testing-programmes-1/Moloi.pdf

March, C.J. & Willis, G. (2007). *Curriculum Alternative Approaches, ongoing Issues*. (4th Ed). New Jersey, Ohio: Pearson Education Limited.

Marshall, N.M. (1996). *Sampling for qualitative research, family practice*. Great Britain: Oxford University Press.

Meyer, L., Nel, C. & Reyneke, M. (2010). School-based assessment: the leash needed to keep the poetic 'unruly pack of hounds' effectively in the hunt for learning outcomes. *South African Journal of Education,* 30*,* 277-292.

Moloi, M. & Strauss, J. (2005). The SACMEQ II Project in South Africa: A study of the conditions of schooling and the quality of Education. Harare, Zimbabwe: SACMEQ Educational Policy Research Series.

Moustakas, C. (1990). Heuristic research: Design, methodology, and applications. Newbury Park, CA: Sage Publications.

Mouton, J. (2003). *How to succeed in your Master's & Doctoral Studies. A South African Guide and Resource Book*. Pretoria: Van Schaik.

Mullis, I. & Martin, O. (2013). *TIMSS and PIRLS 2011: A Cross-country Analysis of Relative School Effectiveness of Reading, Mathematics, and Science at the Fourth Grade.* Boston, IEA.

Mullis, I., Martin, O., Beaton, A., Gonzalez, E., Kelly, D. & Smith, T. (1998). *Mathematics and Science achievement in the Final Year of Secondary School TIMSS 2003 International Mathematics report.* IEA's Third TIMSS. Boston: International Study Center, Lynch School of Education, Boston College.

Mullis, I., Martin, O., Gonzalez, E. & Chrostowski, S. (2004). *TIMSS 2003 International Mathematics report.* Boston: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College.

Mullis, I., Martin, O., Gonzalez, E., Ruddock, G., O'Sullivan, C. & Preuschoff, C. (2011). *TIMSS 2011 International Mathematics report.* TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College

National Council of Teachers of Mathematics. Executive Summary: Principles and Standards for School Mathematics. Reston, VA: NCTM.

National Council of Teachers of Mathematics. (2007). Assessment Research Clips. Reston, VA: NCTM.

National Qualifications Framework Act. (2009). *Government Gazette No. 31909*. Cape Town, South Africa: Government Printers.

Oakes, J. (1989). What Educational Indicators? The Case for Evaluating the School Context. *Educational Evaluation and Policy Analysis,* 11(2), 181-199.

Onwuegbuzie, A. & Leech, N. (2007). *A Call for Qualitative Power Analyses*. American Psychology Association. Berlin, Germany: Springer.

Onwuegbuzie, A. & Leech, N. (2007). *An Array of Qualitative Data Analysis Tools: A Call for Qualitative Analysis Triangulation.* American Psychology Association. Berlin, Germany: Springer.

Patton, M (1999). Enhancing the Quality and Credibility of Qualitative Analysis. *Health Services Research*, 34(5 pt 2), 1189-208.

Patton, M. (1990). *Qualitative evaluation and research methods.* Beverly Hills, CA: Sage.

Patton, M (2002). *Qualitative Research and Evaluation Methods*. 3rd Edition. USA: SAGE Publications.

Patton, M. & Cochran, M. (2002). A Guide using Qualitative Research Methodology. USA: SAGE Publications.

Pillay, V. (2006). *An investigation into mathematics for teaching; the kind of mathematical problem–solving a teacher does as he/she goes*

about his/her work. Unpublished Master's dissertation, University of Witwatersrand, Johannesburg.

Plomp, T. & Nieven, N. (Eds) (2007). *An Introduction to Educational Design Research. Proceedings of a seminar conducted at East China normal University, Shanghai, November, 2007.*

Poliah, R. (2003). *Enhancing the Quality of Assessment through Common Tasks for Assessment. Paper presented at the AEAA conference, Cape Town, South Africa*.

Poliah, R (2014). *Twenty Years of Democracy in South Africa: A critique of the Examinations and Assessment Journey*. Pretoria, South Africa: Government Printers.

Polkinghorne, D. (2005). Language and Meaning: Data Collection in Qualitative Research. *Journal of Counselling Psychology*, 52(2), 137-145. CA: American Psychologist Association.

Pournara, C (2015). *Divergent views on national assessments*. South Africa: Media Centre, Wits University.

Reddy, V., Van der Berg, S., Janse van Rensburg, D. & Taylor, S. (2012). Educational outcomes: Pathways and performance in South African high schools. *South African Journal of Science*, 108(3/4), Art. #620, pp. 1-8.

Retrieved: 06 October 2015 from:

http://dx.doi.org/10.4102/sajs.v108i3/4.620

Rice, J.K. (2010). *The impact of Teacher Experience: Examining the evidence and policy Implications.* Urban institute, 2010. Retrieved 23 February 2016 from: www.urban.org.

Riek, R.M. (2013). *Arts Education in a Culture of Performativity: A Case of What is Valued in One Queensland School Community*. Unpublished Doctoral theses, Griffith University.

Ritchie, J (2001). *Chapter 9: Not everything can be reduced to numbers in Health Research*. Oxford and Melbourne: University Press.

Ritchie, J. & Lewis, J. (Eds.). (2003). *Qualitative Research Practice* (4th Ed). Thousand Oaks: Sage Publications.

Rivkin, S., Hanushek, E. & Kain, J. (2005). Teachers, Schools and Academic Achievement. *Econometrica*, 73(2), 417-458.

Scheerens, J. (1991). Process indicators of school functioning: A selection based on the research literature on school effectiveness. *Studies in Educational evaluation,* 17, 371-401. Netherlands: Pergamon Press.

Scheerens, J. (2004). *The Conceptual Framework for measuring Quality: Paper 1 for the EFA Global Monitoring Report*. The Netherlands.
Retrieved: 02/05/2015 from: https://www.semanticscholar.org

Scheerens, J. (2013). *Evidence Based Educational Policy and Practice: The Case of Applying the Educational Effectiveness Knowledge Base*. The Netherlands: University of Twente.

Scheerens, J. (Ed). (2011). *Perspective on Educational quality: Illustrative Outcomes on Primary and Secondary Schooling in the Netherlands*. Berlin, Germany: Springer Briefs in Education.

Scheerens, J., Luyten, H. & van Ravens, J. (Eds.) (2011). *Perspectives on Educational Quality: Illustrative Outcomes on Primary and Secondary Schooling in the Netherlands.* The Netherlands: University of Twente.

Scotland, J. (2012). Exploring the Philosophical Underpinnings of Research: Relating Ontology and Epistemology to the Methodology and Methods of the Scientific, Interpretive, and Critical Research Paradigms. *English Language Teaching,* 5(9), 9-16.

Scott, E. (1978). *A Review of School-based Assessment in Queensland Secondary Schools.* Retrieved 22 May 2016 from: web.education.unimelb.edu.au.

Shalem, Y., Sapire, I., & Sorto, M.A. (2014). Teachers' explanations of learners' errors in standardised mathematics assessments. *Pythagoras*, 35(1), Art #254, 1-11. Retrieved 28 April 2015 from: http://dx.doi.org/10.4102/pythagoras.

Silverman, D. (2006). *Interpreting Qualitative Data*. London: Sage Publications.

Singaram, D.T. (2007). Outcomes-Based Assessment as a Non-Reflection of Learner Performance. Unpublished Master's degree, University of Johannesburg.

Singh, T. (2007). *School-Based Assessment: The interface between Continuous Assessment and the external summative examination at Grade 12 level with specific focus on Mathematics and Science.* Pretoria, South Africa: University of Pretoria.

Siyepu, S (2013). The zone of proximal development in the learning of mathematics. *South African journal of Education*. 33(2).

Spaull, N. (2014). *ELI SMT Capacity Building: Teachers can't teach what they don't know. Can school management address this? Research on Socio-Economic Policy*. Johannesburg, South Africa: University of Johannesburg.

Spaull, N. (2013). *South Africa's Education Crisis: The Quality of Education in South Africa, 1994-2011. CDE Report.* Cape Town, South Africa: University of Stellenbosch.

Spaull, N. & Taylor, N. (2012). "*Effective enrolment"- Creating a composite measure of educational access and educational quality to accurately describe education system performance in Sub-Saharan Africa*. Stellenbosch, South Africa: University of Stellenbosch.

South African Qualifications Authority (2010). *Level Descriptors for the South African National Qualifications Framework.* Pretoria, South Africa: Government Printers.

Stake, R.E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage Publications.

Stiggins, R.J. (2004). *Student-Centered Classroom Assessment: A set of Guiding Principles. Student Learning: Doing It Right- Using It Well*. New Jersey: Pearson Education, Inc.

Stiggins, R. & Chappuis (2005). Using Student-Involved Classroom Assessment to close Achievement Gaps. *Theory into Practice,* 44(1), pp.11-18.

Strauss, A. & Corbin, J. (1998). *Basics of Qualitative Research: Techniques and procedures for developing grounded theory* (3rd Ed.). Thousand Oaks, CA: Sage Publications.

Talib, R., Abu Naim, H., Ali, N. & Hassan, M. (2014). School-Based Assessment: A Study on teacher's knowledge and practices. Retrieved 22 May 2016 from: www.researchgate.net/publicatiom/277562401.

Taole, M. (2013). Teachers' Conceptions of the Curriculum Review Process. *International Journal of Education*, 5(1), 39-46.

Taras, M. (2005). Assessment-Summative and Formative-Some Theoretical Reflections. *British Journal of Educational Studies*, 53(4), pp. 466-478.

Terre Blanch, M. & Durrheim, K. (1999).*Research in Practice. Applied Methods for the Social Sciences*. Cape Town, South Africa: University of Cape Town Press.

The Centre for Development and Enterprise: Executive Summary. (2015). *Teacher Supply and demand 2013-2015.* Johannesburg, South Africa: The Centre for Development and Enterprise.

UNESCO (2012). Challenges in basic mathematics education. Paris, France: UNESCO.

UNESCO (2015). Guidelines for Quality Provision in Cross-border Higher Education. Paris, France: UNESCO.

UNICEF (2000). Defining Quality in Education. New York: UNICEF.

Umalusi (2011/2012). Annual Report 2011/2012. Pretoria, South Africa. Retrieved from: http://www.umalusi.org.za/docs/annual/2012/annualreport1112.pdf

Umalusi (2013). Policy and criteria for the quality assurance, accreditation and monitoring of independent schools and private assessment bodies. Retrieved from: http://www.umalusi.org.za/docs/policy/2013/independent_schools.pdf

Usiskin, Z. (2013). *The Transition years: Grades 6-9, in School Mathematics.* Pretoria, South Africa: University of Pretoria.

Van den Akker, J. (1999). *Principles and Methods of Development Research.* The Netherlands: University of Twente.

Van den Akker, J., Gravenmeijer, K. McKenny, S. & Nieveen, N. (Eds) (2006). *An Introduction to Educational Design.* Abingdon: Routledge.

Van der Berg, Servaas (2008). *How effective are poor schools? Poverty and educational outcomes in South Africa*. CeGE Discussion paper No.69.

Vandeyar, S. & Killen, R. (2007). Educators' conceptions and practice of classroom assessment in the post-apartheid South Africa. *South African Journal of Education, 27(1), 101-115.*

Venkat, H. & Spaull, N. (2007). *What do we know about primary teachers' content mathematical knowledge in South Africa? An analysis of SACMEQ 2007.* Cape Town, South Africa: University of Stellenbosch.

Welch, T (2009). *Teacher Education Qualifications: Contribution from Tessa Welch to the working paper for teacher development summit - 27 May 2009*. Retrieved 22 February 2016 from: www.saide.org.za.

Wenglinskyl, H. (2002). How schools matter: The link between teacher classroom practices and student academic performance. *Education Policy Analysis Archives,* 10(12*).* Retrieved 1 July 2016 from: http://epaa.asu.edu/epaa/v10n12.

Wiliam, D., Lee, C., Harrison, C. & Black, P. (2004). Teachers developing assessment for Learning: Impact on student assessment. *Assessment in Education*, 11(1), 49-65.

World Bank. (2008). *Curricula, Examinations, and Assessment in Secondary Education in Sub-Saharan Africa*. World Bank Working Paper 128. Washington D.C., United States of America.

Yin, R.K. (2008). *Case study research: design and methods* (4th Ed.). Thousand Oaks, CA: Sage Publications

Yin, R.K (2011). *Qualitative research from start to finish*. New York, NY: Guilford.

Yip, D.Y. & Cheung, D. (2005). Teachers' concerns on school-based assessment of practical work. *Journal of Biological Education*, 39(4), 156-162.