

**Grade 9 teachers' and learners' perceptions of the causes of poor mathematics performance and possible interventions in Durban's Ethusini Circuit.**

**by**

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## DECLARATION

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I declare that "**Grade 9 teachers' and learners' perceptions of the causes of poor mathematics performance and possible interventions in Durban's Ethusini Circuit.**" is my own work and that all sources I have used or quoted have been indicated or acknowledged by means of complete references.

I further declare that I submitted the thesis/dissertation to originality checking software and that it falls within the accepted parameters for originality.



27<sup>th</sup> February 2019

**SIGNATURE**

**DATE**

(Mrs C Kabutu-Njekwa)

## **DEDICATION**

I dedicate my dissertation work to my husband Njekwa Njekwa, my daughter Nasutu Njekwa and my son Saasa Njekwa for their prayers, support, understanding, encouragement and for being there for me throughout the entire Master's programme. Special gratitude to my late mother Ester Mainza Chiila, who worked tirelessly to ensure that her children attain education.

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## **ABSTRACT**

This study investigated teachers' and learners' perceptions of the causes of poor performance in Mathematics among Grade 9 learners in Durban's Ethusini Circuit of KwaZulu-Natal Province. By using a phenomenographic research design, a sample of 15 Grade 9 learners who take Mathematics, one Grade 9 Mathematics teacher and one Mathematics head of department was selected purposively from three high schools in the Ethusini Circuit. The three schools are one former model C school, one ordinary government school and one private school. Focus group and semi-structured interviews were used to collect data from the participants. The data were analysed by transcribing the focus group and semi-structured interviews; thereafter, the transcriptions were coded into themes and categories. The results of this study indicate that teachers and learners perceive that poor performance in Mathematics in Grade 9 is due to CAPS curriculum challenges, such as overloaded and advanced content, and insufficient time to complete the curriculum. Parental support, English (first additional language) as a language of learning and teaching, methods of teaching (such as the talk and chalk method), and learners' negative attitude towards Mathematics were also cited. From these findings, recommendations for revisiting the CAPS curriculum and other areas of need, as well as topics for future research were suggested.

## SETSOPOLWA

Dinyakišišo tše di nyakišišitše ka ga maikutlo a barutiši le a baithuti ka ga dilo tše di bakago go se šome gabotse ka thutong ya Dipalo gareng ga baithuti ba Kreiti ya 9 ka Sedikothutong sa Ethusini ka Durban ka Phrobentsheng ya KwaZulu-Natal. Ka go šomiša mokgwa wa dinyakišišo wa fenomenokrafiki, sampole ya baithuti ba 15 ba Kreiti ya 9 bao ba ithutelago Dipalo, morutiši o tee wa Dipalo ka go Kreiti ya 9 le morutiši o tee yo e lego hlogo ya lefapha la Dipalo o kgethilwe ka maikemišetšo go tšwa dikolong tše di phagamego tše tharo ka Sedikothutong sa Ethusini. Dikolo tše tharo tše ke sekolo se tee seo se bego se le sa motlolo wa C, se tee sa tlwaelo sa mmušo le se tee ke sekolo sa phraebete. Sehlopha seo se nepišitšwego le dipoledišano tša dipotšišo tše di beakantšwego peleng di šomišitšwe go kgoboketša tshedimošo go tšwa go bakgathatema. Tshedimošo e sekasekilwe ka go ngwalolla dipoledišano tša dipotšišo tša sehlopha seo se nepišitšwego le tše di beakantšwego peleng; ka morago ga fao, dingwalollo tše di filwe dikhoutu go ya ka merero le magoro a tšona. Dipelo tša dinyakišišo tše di laetša barutiši le baithuti ba bona gore go se šome gabotse ga baithuti ka thutong ya Dipalo ka go Kreiti ya 9 ke ka lebaka la ditlhohlo tša lenaneothuto la Setatamente sa Melawana ya Tekolo ya Lenaneothuto (CAPS), go swana le diteng tša thuto tše di tletšego kudu le tše di gatetšego pele kudu, le nako ye e sego ya lekana ya go fetša lenaneothuto. Thekgo ya batswadi, Seisemane (polelo ya gae ya tlaleletšo) bjalo ka polelo ya go ithuta le ya go ruta, mekgwa ya go ruta (ya go swana le mokgwa wa go bolela le go ngwala ka tšhooko letlapeng), le maikutlo ao a sego a loka a baithuti go Dipalo le tšona di filwe bjalo ka dilo tše di bakago se. Go dikutollo tše, ditšhišinyo tša go etela leswa lenaneothuto la CAPS le makala a mangwe ao o hlokago šedi, gammogo le dihlogotaba tša dinyakišišo tša ka moso le tšona di ile tša šišinywa.

## OKUCATSHANGIWE

Lolu cwaningo luphenye imibono yothisha kanye neyabafundi yezimbangela zokungasebenzi kahle esifundweni seziBalo kubafundi beBanga le-9 kuSekhethi yase-Ethusini eThekweni esifundazweni saKwaZulu-Natali. Ngokusebenzisa isakhiwo sokucwaninga esisezingeni eliphezulu, isampula yabafundi abayi -15 beBanga le-9 abathatha iziBalo, uthisha oyedwa weBanga le-9 kanye nomphathi oyodwa womnyango weziBalo bakhethwa ngenhloso ezikoleni ezintathu eziphezulu kuSekhethi yase-Ethusini. Lezi zikole ezintathu esisodwa semodeli C, esisodwa sikahulumeni ojwayelekile kanye nesisodwa isikole esizimele. Iqembu lokugxila kanye nezingxoxo ezihlelwe kahle zisetshenziwe ukuqoqa imininingwane evela kubahlanganyeli. Imininingwane yahlaziywa ngokubhalwa kweqembu okugxilwe kulo kanye nezingxoxo ezihlelwe kahle; emva kwalokho, imibhalo ivezwe ngendlela engaqondile ezindikimbeni nasezigabeni. Imiphumela yalolu cwaningo ikhombisa ukuthi othisha kanye nabafundi babona ukuthi ukungasebenzi kahle esifundweni seziBalo kuBanga lesi-9 kungenxa yezinselela yezifundo ezibandakanya isifundo esifundwayo seCAPS, njengokuqukethwe okugcwele kakhulu nokuthuthukile, kanye nesikhathi esinganele sokuphuthula izifundo ezibandakanya isifundo esifundwayo. Ukusekelwa kwabazali, isiNgisi (ulimi lokuqala olwengeziwe) njengolimi lokufunda nokufundisa, izindlela zokufundisa (njengeyokufundisa lapho uthisha ebhala ebhodini), kanye nesimo sengqondo esingesihle sabafundi maqondana neziBalo nakho kuveziwe. Ukusuka kulokhu okutholakele, kuphakanyiswe ukuphinda kuphinde kufundwe izifundo ezibandakanya isifundo esifundwayo seCAPS kanye nezinye izindawo ezidingeka, kanye nezihloko zocwaningo lwakusasa ziphakanyisiwe.

## **KEY WORDS**

Challenges in teaching and learning mathematics, Curriculum and Assessment Policy Statement (CAPS), language of learning and teaching (LoLT), learners' attitude, mathematics, parental support, poor performance, teaching methods

## ACRONYMS / ABBREVIATIONS

ANA	–	Annual National Assessments
CAPS	–	Curriculum and Assessment Policy Statements
CDE	–	Centre for Development and Enterprise
CEDU	–	College of Education
DBE	–	Department of Basic Education
DoE	–	Department of Education
FAL	–	First Additional Language
HoD	–	Head of Department
IQMS	–	Integrated Quality Management System
LTSM	–	Learning and Teaching Support Materials
LoLT	–	Language of Learning and Teaching
NSC	–	National Senior Certificate
TIMSS	–	Trends in International mathematics and Science Study
UNISA	–	University of South Africa
SACMEQ	–	Southern Africa Consortium for Monitoring Educational Quality
SCK	–	Subject Content Knowledge
NGO	–	Non-Governmental Organisation
WEF	–	World Economic Forum

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## CHAPTER 1

### BACKGROUND OF THE STUDY

#### 1.1 INTRODUCTION

In South Africa, several factors have contributed to the poor performance in mathematics as a subject (Adler 1998; Crouch & Mabogoane 2001; Howie 2003; Makgato & Mji 2006; Setati & Adler 2000). Some of these factors include learner poor self-concept about their ability in mathematics, inadequate subject content knowledge (SCK) of teachers, inadequate communication ability of pupils and teachers in the language of instruction (the language of the home and English proficiency), and low socio-economic status. The importance of mathematics according to mother, friends and the learner, teacher's attitude, beliefs and commitment also play a role in poor performance. Other factors include limited resources and facilities, underqualified teachers, learners' lack of motivation and interest in the subject and a negative attitude towards the subject. Furthermore, lack of parental involvement in the learners' schoolwork, pressure to complete examination-driven syllabi and non-completion of the syllabus in a year are also contributors. These factors have deprived effective performance of many employees and the nation at large to achieve the desired business and economic objectives.

The challenge of poor learner performance in mathematics is an international phenomenon. Recent studies in Brazil by Vinha, Karino and Laros (2016:93) show that certain factors are positively related to performance in mathematics. These factors include socio-economic status and mother's formal education, resources and pedagogic practices and teachers with better characteristics in the school. Vinha et al. (2016:95) further state that depredation, security, shortage of teachers, number of students, school infrastructure and homework are factors that influence Grade 9 learners' performance in mathematics.

South Africa and India share a history of English and its rise as a second language (Mesthrie 2015:1). Mesthrie (2015:1) further states that as far as external history is

concerned, both countries present investment in a language whose use has long outlived the colonial era, despite the favour and support of indigenous language by the leaders and scholars in these countries.

A related study by Sodhi (2016:10-11) regards the cause of failure in mathematics at secondary school stage with special reference to Punjab state in India. The findings reveal that poor achievement in mathematics is influenced by personal problems, student's ability and attitude, psychological (emotional) problems, instructional problems (teacher's strategies in teaching and attitudes), family problems (financial and relationship), peer problems (adjustment to classmates and board mates) and co-curricular activities. This study seeks to understand poor performance in mathematics in South Africa from the teachers' and learners' perspectives.

The knowledge of mathematics can be personally fulfilling. Mathematics offers one a strong foundation from which certain qualities such as critical thinking, abstract or spatial thinking and problem-solving skills can be developed. Mathematics enhances one's understanding of how and why things relate to each other. It enables one to understand, process and interpret the extensive amounts of quantitative data and qualitative data that exist all around. For example, the unit of probability, which is one of the content topic areas in the Curriculum and Assessment Policy Statement (CAPS) curriculum, requires learners to collect data, examine problems, raise questions, think critically and investigate statistical data. The purpose of the topic is to see whether conclusions can be drawn legitimately about a particular phenomenon and to make predictions about future events. Being mathematically literate is essential for the performance of tasks in our daily life, from measuring ingredients required in a recipe when cooking to making decisions regarding which medical aid to join.

Mathematics plays an important role in the technological, economic and scientific development of a nation. A nation requires highly skilled people to develop in all economic sectors. "South Africa has a huge shortage of skilled workers in various fields such as engineering, applied sciences, accountancy, architecture, medicine and law. Mathematics is a requirement for entry into these careers to enable learners to grasp the

content of various subjects in these disciplines” (Siyepu 2013:1). Zvobwo (2013:1) supports this, stating that all areas of study and research rely heavily on mathematics and that areas of study and research, such as the advancement of agriculture, astronomy and zoology, have all been made possible by some knowledge of mathematics. According to Zvobwo (2013:1), to be better positioned for any career, sufficient and relevant knowledge of mathematics is required in one’s chosen career path. Zvobwo (2013:1) further amplifies that to efficiently meet the demands of the job; fundamental numerical and spatial skills are a requirement for any workplace.

Mathematics expresses itself in almost every facet of life. It is all around us. There are many wonders and uses of mathematics in our daily lives. Zvobwo (2013:3) gives examples of applications of mathematics in daily life, such as the ability to read maps, follow timetables, estimate and calculate areas and volumes, and understand house plans and patterns. Furthermore, Zvobwo (2013:1) maintains, “mathematics makes the world go round because we cannot run away from numbers but have to manipulate them one way or the other”. Despite the importance and usefulness of mathematics highlighted, learners continue to fail the subject. The failure rate is a cause for concern.

In 2016, 717 971 candidates wrote the National Senior Certificate (NSC) examinations. Candidates were comprised of 610 178 full-time and 107 793 part-time candidates respectively. The number of learners passing mathematics at 30% and above, marginally increased from 129 481 in 2015 to 136 011 in 2016, while the number of learners passing mathematics at 40% and above slightly increased from 84 297 in 2015 to 89 119 in 2016 (South African Government News Agency, 04/01/2017). These results suggest that only 12.4% of the candidates achieved 40% and above in mathematics.

McCarthy and Oliphant (2013:4) indicate that the teaching of mathematics in South African schools is among the worst in the world. Furthermore, McCarthy and Oliphant (2013:4) maintain that, in 2011, the Trends in International Mathematics and Science Study (TIMSS) showed that South African learners have the lowest performance among all 21 middle-income countries that participated.

Against the background of the importance and value of mathematics as well as the poor performance of South African students in mathematics, this study will focus on Grade 9 teachers' and learners' perceptions of the causes of poor mathematics performance and possible interventions in Durban's Ethusini Circuit. Next, this chapter will set out further rationale for the study, the research problem and resulting questions and objectives. A brief exposition of the methodology and methods used in the study will also be provided.

## 1.2 RATIONALE FOR THE STUDY

The performance of Grade 9 learners in mathematics as reflected by the Annual National Assessments (ANA) results has remained poor over the years. No consecutive improvement has been seen over three years in the Senior Phase, as indicated in Table 1.1.

**Table 1.1: Summary for Grade 9 mathematics results of 2012, 2013 and 2014 – ANA**

	<b>GRADE 9</b>		
<b>YEAR</b>	2012	2013	2014
<b>MATHEMATICS AVERAGE PERCENTAGE MARK</b>	13	14	11

**Source: Department of Basic Education Report on the ANA of 2014 (2014a:9)**

The 2014 ANA results are the most recent. In 2015, there was deadlock with teacher unions on the writing and influence of ANA. Currently, the ANA programme is under evaluation to determine appropriate models that will suit the aim of the programme.

It is against this background of poor performance of learners in mathematics; particularly the Grade 9 learners that the researcher seeks to conduct this study. The researcher aims to investigate the disappointing levels of competence in mathematics of Grade 9 learners, the lack of improvement and teachers' and learners' perceptions of the causes

of poor mathematics performance among Grade 9 learners in Durban's Ethusini Circuit of KwaZulu-Natal Province. The study aims to establish Grade 9 teachers' and learners' perceptions of the causes of poor mathematics performance and possible interventions in Durban's Ethusini Circuit.

The researcher, who is a teacher by profession and currently the Associate Education Director, has previously taught mathematics from Grade 1 to 7. She has always been interested in how learners perform in mathematics, especially regarding the poor performance results exhibited in mathematics published nationally. The interest to conduct this study originated when the researcher first learnt about the disappointing ANA poor mathematics results of the Grade 9 learners in 2014. As the researcher is a parent of a learner who was in Grade 9 at the commencement of this study, she felt the necessity to conduct research on the causes of poor mathematics performance among Grade 9 learners.

The need to conduct this research became stronger when the researcher was appointed as Associate Education Director at the Southern Africa Union Conference of the Seventh Day Adventist Church. One of the roles of the researcher's current position is to ensure quality assurance in the Adventist schools. It had been discovered that mathematics achievement was a challenge in most of the Adventist schools that had been visited for assessment of performance ratings. In addition to the listed objectives below, the results of this study will assist the researcher in supporting the Adventist schools under her care in the implementation of the interventions that will be suggested for the improvement of mathematics pass rates.

### **1.3 STATEMENT OF THE PROBLEM**

In recent years, South Africa has experienced continued poor performance in mathematics results. South Africa's poor performance in mathematics is evidenced both nationally and internationally, as set out above.

Lack of improvement consecutively over the last three years confirms that the Senior Phase requires urgent action (Department of Basic Education 2014a:6). This urgent need has led to the following research questions.

### **1.3.1 Main research question**

What are the teachers' and learners' perceptions of the causes of poor performance in mathematics among Grade 9 learners in the Durban's Ethusini Circuit of KwaZulu-Natal Province?

The main research question can be sub-divided into the following questions:

- i. What are the teachers' perceptions of the challenges in the teaching and learning of mathematics in Grade 9 in Durban's Ethusini Circuit of KwaZulu-Natal Province?
- ii. What are the Grade 9 learners' perceptions of the challenges in mathematics performance in Durban's Ethusini Circuit of KwaZulu-Natal Province?
- iii. What are the interventions that could be implemented to address the identified areas of weakness that could be contributing towards Grade 9 learners' poor performance in mathematics in Durban's Ethusini Circuit of KwaZulu-Natal Province?

### **1.4 PURPOSE / AIMS AND OBJECTIVES OF THE STUDY**

The main aim of the study was to investigate the teachers' and learners' perceptions of the causes of poor mathematics performance among Grade 9 learners in Durban's Ethusini Circuit of KwaZulu-Natal Province. Ethusini Circuit was selected for the sake of convenience, as it is the area where the researcher works. This study sought to explore the challenges experienced by Grade 9 teachers in the teaching and learning process of mathematics as well as the challenges experienced by Grade 9 learners in mathematics. The study proposes interventions that could be implemented to address the identified areas of weakness that could be contributing towards the poor performance of Grade 9 learners in mathematics in Durban's Ethusini Circuit of KwaZulu-Natal Province.

This study highlights the perceptions regarding the challenges experienced in the teaching and learning of mathematics. The study will thereby assist teachers, learners and the Department of Basic Education in developing strategies to address the areas of weaknesses, which may consequently improve the quality of results. The findings of the study also suggest possible solutions to effective teaching and learning of mathematics generally.

It is anticipated that the findings of the study will be a means through which curriculum developers will gain an understanding of different insights into evolving issues on performance in mathematics. It is expected that the findings will be valuable to teachers and learners in identifying and addressing areas of concern, thereby improving the quality of teaching and learning of mathematics. Both learners and teachers are expected to gain from the findings because improved mathematics performance will encourage them and offer opportunities to pursue mathematics-related courses in higher institutions of learning. It is likely to consequently reduce the shortage of skilled workers that South Africa is currently experiencing in the fields of engineering, applied sciences, accountancy, architecture, medicine and law.

The main purpose of the study can be sub-divided into the following objectives.

#### **1.4.1 Objectives of the study**

- i. To describe the perceived challenges in the teaching and learning of mathematics among Grade 9 teachers in Durban's Ethusini Circuit of KwaZulu-Natal Province.
- ii. To document perceived challenges in comprehending mathematics among Grade 9 learners in Durban's Ethusini Circuit of KwaZulu-Natal Province.
- iii. To propose interventions that could be implemented to address the areas of weakness that could be contributing towards the poor performance of Grade 9 learners in mathematics in Durban's Ethusini Circuit of KwaZulu-Natal Province.

## **1.5 RESEARCH METHODOLOGY**

### **1.5.1 Choice of research design**

This study used a phenomenographic research design, which is a method of inquiry that qualitatively examines various ways in which people experience something or think about a matter (Marton 1986:28).

### **1.5.2 Data sources**

In keeping with the phenomenographic study, the learners' and teachers' perceptions of the causes of poor Grade 9 learner performance in mathematics will be shared through focus group and semi-structured interviews. The benefit of interviews is that, when needed, the interviewer can adjust the questions during the interview process (McMillan & Schumacher 2006:203–206). The advantage of focus group interviews is that they generate an environment where the group members are motivated by one another's insights, which strengthens the value and depth of data collected (McMillan & Schumacher 2010:363). During interviews, the researcher will take note of simple behaviours such as facial expressions and gestures. Semi-structured interviews with open-ended questions allow for discussion with the participants and may reveal the possible ways in which the participants understand and perceive the causes of Grade 9 learners' poor performance in mathematics. Both the researcher and the participants are able to seek for clarification to avoid ambiguous responses to questions (McMillan & Schumacher 2006:203–206).

### **1.5.3 Issues of trustworthiness**

To ensure trustworthiness of the instruments, the researcher presented the focus group and semi-structured interview questions to the school's English teacher, the researcher's supervisor and the UNISA Ethical Clearance Committee for possible adjustments to avoid ambiguity. The research instruments were also piloted with a mathematics teacher and three Grade 9 learners from a nearby school to check for openness and relevance of the questions to the study. External validity was also taken into consideration by purposively

selecting a sample of Grade 9 mathematics teachers, mathematics Heads of Department (HoDs) and Grade 9 learners who take mathematics, comprised of both male and female participants.

#### **1.5.4 Population**

The target population for this study was comprised of the underperforming schools in mathematics in Durban's Ethusini Circuit of KwaZulu-Natal Province. Due to the size of the Ethusini Circuit and logistical limitations, only three schools were selected, namely one former model C school, one ordinary government school and one private school.

#### **1.5.5 Sampling techniques**

Three underperforming schools were purposively selected. Each of the selected schools had one Grade 9 mathematics teacher, one mathematics HoD and fifteen Grade 9 learners who take mathematics making 51 participants in total.

### **1.6 DEFINITION OF CONCEPTS**

#### **1.6.1 Perception**

In this study, perception refers to teachers' and learners' views, thoughts and reflections of their experiences regarding the possible causes of poor learner performance in mathematics among Grade 9 learners in Durban's Ethusini Circuit of KwaZulu-Natal Province.

#### **1.6.2 Poor performance**

Poor performance refers to a performance average that is below the minimum standard requirement of 40% in mathematics for the 2014 ANA results. The 2014 Grade 9 ANA results are the most recent.

### **1.6.3 Challenges**

Challenges refer to problems experienced by teachers and learners in the teaching and learning of mathematics.

### **1.6.4 Curriculum and Assessment Policy Statement (CAPS)**

CAPS is a component of the National Curriculum Statement (NCS) of South Africa. It is a highly structured curriculum, stipulating the aim, scope, content and assessment for each subject from Grades R–12.

### **1.6.5 Parental support**

Parental support refers to the extent of participation a parent has in their child's education. This is the working together of parents and the school to ensure the improvement of the learners' academic achievement, as well as general development and health.

### **1.6.6 Understanding of mathematics**

Understanding mathematics refers to being able to make sense of mathematics and to explain mathematics concepts and processes used, or to give reasons why a procedure works. It denotes flexibility in working with mathematics and being able to solve

### **1.6.7 Language of Learning and Teaching (LoLT)**

LoLT is the medium or language used for teaching and learning of mathematics. For most schools in South Africa and all the three schools that participated in this study, the LoLT of mathematics in Grade 9 is English.

### **1.6.8 Learner attitude**

Learner attitude refers to the outlook or tendency of learners to respond positively or negatively towards mathematics.

## 1.7 LIMITATIONS OF THE STUDY

This study was limited to Grade 9 mathematics teachers and learners in one circuit of KwaZulu-Natal Province in South Africa. Since the study comprised a single researcher, only three schools participated in the study. Therefore, it is possible that individuals who may have made valuable input did not participate in the study.

## 1.8 CHAPTER DIVISION

**Chapter 1 – Background of the study:** This chapter presents the background of the study, the rationale for the study, the statement of the problem, the purpose and objectives of the study, a summary of the research methodology, definition of concepts, limitations of the study and an outline of the chapters.

**Chapter 2 – Literature review:** Chapter 2 provides the challenges experienced by teachers and learners in the teaching and learning of mathematics, and the theoretical framework of the study.

**Chapter 3 – Research methodology and design:** This chapter stipulates the research approach, population and sampling procedures, data collection techniques and data analysis and interpretation, reliability, validity and trustworthiness of the study, research ethics and ethical considerations, as well as the limitations and delimitations of the study.

**Chapter 4 – Data presentation, analysis and interpretation:** Chapter 4 provides the demographic profile of the participants, the findings of the study, as well as an analysis and interpretation of the findings.

**Chapter 5 – Summary, conclusions and recommendations:** This chapter revisits the research questions, provides conclusions, and presents the summary and recommendations of the study.

## **CHAPTER 2**

### **LITERATURE REVIEW: AN OVERVIEW OF CHALLENGES IN MATHEMATICS TEACHING AND LEARNING**

#### **2.1 INTRODUCTION**

To formulate the research topic in a manner that enables an unambiguous expression of the problem, some background information is necessary. This is acquired primarily by reading appropriate publications to the research topic. This process is called the literature review. McMillan and Schumacher (2010:73) declare that literature review determines the essential relations between prevailing knowledge and the research problem being investigated and presents very helpful information about methodology that can be incorporated into a new study. This literature review focuses on factors that contribute to high school learners' poor performance in mathematics. These factors have been grouped into challenges experienced by high school teachers in the teaching and learning process of mathematics, and challenges experienced by high school learners in comprehending mathematics.

The consulted literature revealed that challenges experienced by teachers in the teaching and learning of mathematics include unsatisfactory knowledge of the subject content, partial completion of the curriculum, challenges in learners' commitment and attitude towards mathematics, absence of parental participation, English as a medium of instruction, and other factors influencing learning of mathematics, such as, learning deficits in mathematics acquired at primary school. Challenges experienced by Grade 9 high school learners in comprehending mathematics involve less qualified mathematics teachers as a challenge to mathematical understanding, inadequate learning and teaching support materials and human resources, teaching strategies used by teachers and teacher pedagogical content knowledge, medium of instruction, and teacher attitudes towards mathematics teaching.

Furthermore, the literature review highlights the Distributed Cognition Theory and the Activity Theory as they relate to mathematics education. This theoretical base assists the researcher in framing the study and its questions as well as analysing the data.

## **2.2 CHALLENGES EXPERIENCED BY TEACHERS IN THE TEACHING AND LEARNING OF MATHEMATICS**

### **2.2.1 Unsatisfactory knowledge of the subject content**

The CDE (2014:9) argues that for the past 20 years, research has shown that South African teachers, especially mathematics teachers, have insufficient SCK. Furthermore, the CDE (2014:9) stresses that “two pieces of research 14 years apart suggest that the problem has persisted”. In this light, this study aims to determine if the reasons for poor mathematics performance are the same as what was revealed by the literature.

Makgato and Mji’s (2006:260) study of the factors associated with high school learners’ poor performance in mathematics and physical science in the seven schools with poor pass rates in District 3 of Tshwane North. They indicated that teachers admitted to shortcomings they had with respect to certain sections of the content. These arguments are consistent with Taylor and Vinjevold (CDE 2014:9). They posit that the most definite point of convergence around the “President’s Education Initiative studies” is the conclusion that teachers’ inadequate conceptual knowledge of the subjects they are teaching is a central constraint on the excellence of teaching and learning activities. This inadequacy consequently affects the quality of learning outcomes.

A study that seems to challenge the findings in South Africa is that which explores the contributory factors to secondary school students’ poor performance in mathematics in Kenya. Mbugua, Kibet, Muthaa and Nkonke (2012:87–90) indicate learners’ opinions on the effectiveness of their mathematics teachers in teaching the subject. The findings showed that 63.3 per cent were highly effective, 27.5 per cent were average and 1.9 per cent were not effective. On the other hand, a study conducted by Chirume and Chikasha (2014:201) in Zimbabwe concurs with the findings in South Africa, indicating that lack of SCK contributes to high school learners’ poor performance in mathematics.

The researcher concurs with the findings in South Africa, which suggest that most South African teachers lack SCK (CDE 2014; Spaul 2013; Makgato & Mji 2006). From the researcher's experience of the fortnightly mathematics cluster meetings held in Ethusini Circuit in Durban, only a few mathematics teachers were confident to illustrate how they would explain the solution of a specified problem to their learners. The finding regarding mathematics teachers' unsatisfactory SCK is worrying and implies a serious challenge for improving high school learners' performance in mathematics.

This study will determine to what extent teacher SCK is still a prevailing problem in mathematics classrooms.

### **2.2.2 Partial completion of the curriculum**

A study conducted by Makgato and Mji (2006:261) found that learners and teachers had differing views. Teachers attributed the lack of completion of the syllabus to sport and breaks during teaching time as these activities consume teaching time and impede the successful completion of the syllabus. On the other hand, learners generally thought that teachers spent a lot of time on teaching what they perceived their educators knew best (Makgato & Mji 2006:261).

The reasons attributed to the non-completion of the syllabus by the teachers in Makgato and Mji's study seem to be contrary to the researcher's opinion of the current CAPS. This is perhaps due to the fact that Makgato and Mji's study was conducted before the introduction of the CAPS curriculum. According to the researcher's experience as a mathematics teacher, the breadth of the CAPS curriculum of South Africa poses a challenge in terms of managing the curriculum and curriculum coverage. Informal interviews with the teachers at a school where the researcher taught revealed that most teachers complain about the CAPS having too much content and that it is challenging to manage and complete the prescribed topics. According to the interviewed teachers and from the researcher's own experience as a teacher, this results in a rush-through of curriculum coverage where some topics are omitted and the depth at which the sub-topics are taught is compromised. According to Grussendorff, Booyse and Burroughs (2014:46)

a curriculum that tries to cover too much does so at the risk of losing depth of understanding.

This challenge has also been detected by the media. In the Daily Mail, Sihle Mlambo (2014) wrote an article entitled “Concerns over New Curriculum”. He writes that three weeks before 170 000 KwaZulu-Natal matric pupils sat for their final matric exams under the new CAPS curriculum, some education stakeholders raised concerns about the system. One of the concerns raised is that CAPS is too time-focused and does not allow teachers enough time to do remedial work with pupils. The curriculum is strict on how and when sections should be taught. “If children struggle with concepts, teachers must move ahead, there is no time to slow down and enable pupils to grasp the work,” said the KZN Parents Association’s South Durban Chairman, Vee Gani. “The solution is that teachers have to work with the children outside of class, but that becomes difficult because there are transport issues and the teacher may have commitments.” Gani claims the consensus from teachers was that pupils were suffering (Daily News 2014).

These findings are substantiated by Makhubele and Kakoma (2014:62), who explored the factors associated with learners’ poor performance in Grade 9 mathematics ANAs. This study established that learners’ poor performance may be due to the quantity and quality of mathematical content taught to learners, which was related to curriculum coverage. The results of term one and term four indicated that only 60% of the content was covered while 50% and about 43% of content was covered in term two and three respectively (Makhubele & Kakoma 2014:62).

The researcher’s analysis of the reasons for partial completion of the curriculum is affirmed by Makhubele and Kakoma (2014:64), whose findings indicate that learners complained about the quick pace at which teachers taught the topics to cover the curriculum. This pace resulted in learners’ not understanding the topics, which consequently resulted in learners’ negative attitude towards the subject.

The CDE (2014:15) stresses that poor curriculum management creates a delay in learners’ mathematical knowledge, which starts at primary school and has substantial

results for mathematics learning in High schools. The CDE (2014:15) concurs with the sentiments discussed above as it further states that, since teachers do not have the time to re-teach concepts, they move on to the next concept. As a result, the gap between what learners should know and what they do know widens.

The findings in South Africa seem to agree with Mwenda, Gitaari, Nyanga, Muthaa and Reche (2013:98), who also identified an overcrowded syllabus as one of the contributory factors to poor performance in mathematics in public secondary schools in Kenya.

To the contrary, a study conducted by Chirume and Chikasha concluded that neither the curriculum nor the Zimbabwe School Examinations Council (Zimsec) was to be blamed for the learners' poor performance in mathematics in Gweru District in Zimbabwe. However, employers, as one of the classes of participants in their study, pointed out that school leavers went to work in their companies having book knowledge but no real-life skills.

This study endeavours to determine to if coverage is still a constraining problem in the teaching and learning of mathematics. It aims to reveal what other related factors are important in dealing with curriculum coverage.

### **2.2.3 Challenges in learners' commitment and attitude towards mathematics**

In a study conducted by Makgato and Mji (2006:260), teachers pointed out that lack of concentration, late-coming and lack of homework commitment by learners resulted in poor motivation, which contributed to poor performance in mathematics.

Similarly, Tachie and Chireshe (2013:70) investigated learners' attributions of the high failure rate in mathematics examinations in rural senior secondary schools in the Mthatha District of Education in the Eastern Cape Province of South Africa. Their findings showed that learners' laziness, negative attitude towards mathematics and their perception of mathematics as a difficult subject, learners' absenteeism and their lack of effort contributed to the high failure rate in mathematics (Tachie & Chireshe 2013:70). Learner

perceptions seem to offer a complex variety of reasons for poor performance. This study aims to add to this research by focusing on a different province.

Ascribing poor learner performance in mathematics to absence of learner commitment and negative attitude towards the subject substantiates a number of findings in South Africa (Spaull 2013; CDE 2001; Ramohapi, Maimane & Rankhumise 2015; Makhubele & Kakoma 2014). These findings seem to be consistent with the conclusions in other African countries like Kenya, Nigeria and Zimbabwe. Mbugua et al. (2012:88–89) identified learners' personal factors like gender and economic factors, active resistance by learners to learn the subject and retrogressive practices as some of the contributory factors to Kenya's secondary school learners' poor performance in mathematics.

Sa'ad, Adamu and Sadiq (2014:32) made similar conclusions in their study of the causes of poor performance in mathematics among public senior secondary school students in Nigeria. Sa'ad et al. (2014:32) identified anxiety and fear as well as fear of mathematics as contributory factors to poor performance in mathematics.

The research results of the consulted literature which revealed learners' lack of concentration, late-coming and lack of homework commitment suggest a negative attitude of learners towards mathematics. Attitudes and beliefs about oneself with regard to mathematics play an important role in the performance of learners in the subject. The common relationship between attitude and performance is built on the concept that the better the attitude a learner has towards mathematics, the higher the performance level in the subject.

According to Stuart (2000:333), learners like or dislike mathematics based on their own experiences and are likely to have more positive experiences if their parents are supportive and helpful in their mathematical endeavours. Consequently, it is imperative for teachers, parents and all other education stakeholders to promote a positive attitude in learners towards mathematics through positive reinforcement.

#### **2.2.4 Absence of parental participation**

Research findings of Makgato and Mji (2006:261) signify that both learners and teachers identify parents as very important participants that influence or contribute to the improvement of learners' performance at school. However, the study further revealed that lack of parental involvement in the learners' schoolwork contributes to poor performance in mathematics. According to Makgato and Mji (2006:261), the lack of parental involvement is due to parents' low levels of education.

These conclusions are supported by a study undertaken by Ramohapi et al. (2015:445) who investigated factors contributing to learner performance in mathematics in the Motheo District in South Africa. Their study found that parental support was linked to learners' performance in mathematics. According to Ramohapi et al. (2015:445), learners were demotivated by their parents' and peers' saying that mathematics is a difficult subject which needs clever people. The study also pointed out that 71.4% of the teachers indicated that they had no support from the learners' parents (Ramohapi et al. 2015:450).

The absence of parental participation as one of the contributory factors to poor learner performance in mathematics is also identified and supported by Spaul (2013), CDE (2001), Makhubele and Kakoma (2014), Tachie and Chireshe (2013), Department of Basic Education (2014), Crouch and Mabogoane (in CDE 2001) and CDE (2014).

The researcher concurs with conclusions by Ramohapi et al. (2015:450). From the researcher's experience as a teacher and through the interaction with a few parents during parent-teacher consultation meetings, the researcher suggests that some parents may themselves not be interested in subjects that are perceived to be difficult, such as mathematics. This may be due to their own school background and lack of knowledge of the respective subjects. As with South African literature, lack of parental participation in the education of their children is concurred by findings of Sa'ad et al. (2014:37) in Nigeria. Correspondingly, Kiwanuka, Damme, Noortgate, Anumendem and Namusisi (2015:9) in their study of factors affecting mathematics achievement of first year secondary school

students in Central Uganda showed that parental support is associated positively with students' performance in mathematics.

Topor, Keane, Shelton and Calkins (2011:183) posited that children whose parents are more involved in their education have higher levels of academic achievement than children whose parents are involved to a lesser degree. Furthermore, Topor et al. (2011:183) agree with the hypotheses of previous studies that parents who have a positive attitude towards their child's education, school and teacher are able to positively influence their child's academic performance.

The researcher subscribes to the arguments made by Topor et al. (2011:183). As a teacher, the researcher experienced that learners whose parents helped them with homework (evidenced through the parent's signature in the homework book), attended parent-teachers' consultation meetings and were active in school activities including extra-curricular activities like sports performed very well in their academic achievements. The positive attitude of the parents and their involvement in their children's education are highly likely to have contributed to such learners' success.

Lack of parental involvement is noted by nearly all studies that were consulted (Makgato & Mji 2006; Tachie & Chireshe 2013; Mwenda et al. 2013; Mbugua et al. 2012; Department of Basic Education 2014; Crouch & Mabogoane in CDE 2001; Spaul 2013; CDE 2014). The results of these studies also suggested that parents with low levels of education may not be able to intervene in their children's education.

Parents' and guardians' attitude towards mathematics influences learner attitudes to mathematics. The CDE (2014:15) emphasises that learner motivation and positive experience of learning mathematics are valuable factors in generating the requirements for improved results. Similarly, Visser and Juan (2015:1) contend that a conducive environment for learning extends beyond the classroom and school to include the home. Visser and Juan (2015:1) further argue that these environments provide learners with both tangible and intangible resources that impact on their educational experience.

### **2.2.5 English as a medium of instruction**

The findings made by Makgato and Mji (2006:262) denote that many teachers felt that it was sometimes challenging to clarify mathematical concepts in the vernacular to assist learners whose home language was not English. It brought confusion, misinterpretation of ideas and different outcomes.

Consistent to the conclusions reached by Makgato and Mji (2006:262), the Zenex Foundations (2007:10–11) identified poor language skills in the LoLT among teachers and learners as one of the main factors that impacts negatively on mathematics attainment in South Africa.

According to Howie (2003:14), “the difficulty of not being able to communicate fluently in a common language leads to increased frustration for the teacher, disorientation on the part of the child, a slow rate of learning, disciplinary problems and teacher-centred instruction”. The use of English as being linked to learners’ performance in mathematics is also cited by Ramohapi et al. (2015: 445).

### **2.2.6 Other factors influencing learning of mathematics**

Learning deficits in mathematics acquired at primary school affect learners’ performance at high school. According to Spaul (2013:6), the learning deficits that learners acquire in their early school years at primary school increases over time. Spaul (2013:6) argues that the “gap between what the learners should know and what they do know widens as time goes on; hence, learners fall further and further behind the curriculum, leading to a situation where remediation is almost impossible in high school since these learning gaps have been left unaddressed for too long”. Furthermore, Spaul (2013:6) gives an analysis of pupils in the Eastern Cape Province of South Africa who showed that while pupils are already 1,8 years behind the benchmark by Grade 3; this grows to 2,8 years behind the benchmark by Grade 9, making successful remediation at this higher grade impractical.

Makhubele and Kakoma (2014:65) found that teachers indicated that the South African Admission Policy for Ordinary Public Schools (1998), (which limits grade repetition to a

maximum of one year per school phase (DBE 2008)), contributed to poor learner performance in mathematics as learners who had not mastered the pre-requisite concepts to the following grade were progressed to the next grade.

The researcher shares the same sentiments as Spaul (2013) and Makhubele and Kakoma (2014). From the researcher's experience, learners who are progressed to the next grade generally perform poorly, as it is a challenge for them to grasp the new concepts that are taught in the new grade. The new concepts are a build-up of what they should have mastered in the previous grade. The researcher suggests that such learners be given encouragement and support according to their individual needs, to ensure that they achieve to their maximum potential.

Another area that plays a role is Foundation Phase concepts. It is at the Foundation Phase level where support for learners, particularly in mathematics, is most needed, since this phase is an important entry point into the education system and into the future of learners. The aspects discussed above should start from the Foundation Phase to reduce the chances of learners accumulating deficits through inadequate mathematics teaching.

## **2.3 CHALLENGES EXPERIENCED BY LEARNERS IN UNDERSTANDING MATHEMATICS**

### **2.3.1 Less qualified mathematics teachers as a challenge to mathematical understanding**

Tachie and Chireshe (2013:69–70) in their study that sought to investigate learners' attributions on high failure rate in Mathematics examinations in rural senior secondary schools in the Mthatha District of Education, concluded that 60% of the learners attributed their high failure rate in mathematics to incompetent mathematics teachers in their schools. The learners accounted that unqualified teachers are less likely to provide the necessary support that is required for problem-solving. The learners also revealed that some teachers were not competent with particular topics, which resulted in their focusing on only topics that they were familiar with and ignoring topics where they were not competent. This also made it difficult for the teachers to assist the learners during revision

of past examination papers, often absconding from school so as not to embarrass themselves. (Tachie & Chireshe 2013:69–70). On the contrary, the CDE findings of 2012 found that the inability of most HoDs to solve a higher-order mathematical problems or to illustrate how they would explain the solution of a specified problem to their learners, appeared to be unrelated to schools' mathematics performance (CDE 2014:6).

From the researcher's experience as a teacher, Deputy Principal and Acting Principal underqualified teachers or teachers who teach subjects that they are not specialised in, usually get discouraged, overlook topics that are perceived as difficult and choose to emphasise and deliver on only topics with which they are knowledgeable. Findings by Crouch and Mabogoane (in CDE 2014:8) suggest that teacher qualifications as a determinant of teacher effectiveness were highly linked to increase in learner performance.

Spaull (2013:24) argues that teachers are and have always been the primary focus of schooling systems around the world. He further states that being the single key component of the education system, the quality of a country's teachers is closely related to the quality of its education system. Furthermore, Spaull (2013:24) emphasises that teacher SCK is necessary but not sufficient for effective learning to take place because the fact that teachers can calculate the sum of two fractions does not imply that they will be able to impart this understanding to the learners. Consequently, this implies that for effective learning to take place, pedagogical knowledge is also required.

Similar to South African studies, Mbugua et al. (2012:88–89) identify a lack of effectiveness of mathematics teaching as one of the contributory factors to secondary school learners' poor performance in Kenya. Chirume and Chikasha (2014:201) conducting research in Zimbabwe also mention less knowledgeable teachers as factors in mathematics poor performance.

The explored studies suggest that the mastery of content knowledge and good classroom practice would enhance the confidence of teachers in the teaching of mathematics. This therefore requires the improvement of teachers' skills. The CDE (2014:5) affirms that the

upskilling of teachers continues to be an enormous challenge, despite considerable amounts of money spent by the government on advancing serving teachers' qualifications through universities, as well as frequent in-service short-term and off-site training workshops run by District personnel or Non-Governmental Organisations (NGOs).

### **2.3.2 Inadequate learning and teaching support materials and human resources**

Makgato and Mji (2006:260) have concluded that resources have an influence on the performance of the learners in mathematics. In their study, learners suggested that lack of textbooks contributed to their lack of motivation to learn mathematics (Makgato & Mji 2006:260)

Consistent to the research results realised by Makgato and Mji (2006:260), Tachie and Chireshe (2013:69) indicate that learners attributed their performance in mathematics to shortage of mathematics teachers. This resulted in the non-completion of topics that needed to be taught before examinations. The learners also pointed out that their high failure rate was attributed to inadequate textbooks and overcrowded classes (Tachie & Chireshe 2013:69).

Ramohapi et al. (2015: 450) identify late delivery of resources and insufficient supply of resources as being related to the performance of learners in mathematics.

Regarding the overcrowded classes, these research results are inconsistent with the conclusions made by Howie (2003:14), whose findings show that the effect of the actual number of pupils in class did not have a significant effect on the achievement of learners in mathematics. According to Howie (2003:14), in the case of South Africa, those classes with large numbers of pupils (on average 50 pupils) are also those at schools with poor conditions, limited resources and facilities and large percentages of underqualified teachers. Furthermore, pupils come from poor socio-economic backgrounds and instruction occurs in a secondary language. Howie (2003:14) states that the inadequacy of resources in schools was linked to learners' performance as compared to class sizes.

The general agreement among South African studies is that the accessibility or insufficiency of crucial learning and support materials influences the learners' academic performance, with the availability of key resources being associated with better results (Spaull 2013; CDE 2001; Van der Berg 2008; Visser, Juan & Feza 2015; Makhubele & Kakoma 2014).

The findings consistent with those identified by researchers in Kenya, Nigeria and Zimbabwe. Mbugua et al. (2012:1) highlighted overcrowding, under-staffing and insufficient teaching materials as factors that have an impact on learners' academic performance in mathematics. This is concurred by Mwenda et al. (2013:93–98) and Sa'ad et al (2014: 32).

Avong (2013:320) indicated that shortage of qualified teachers and inadequate resources have the strongest link to poor performance in mathematics in Nigeria. Chirume and Chikasha (2014:201) reached the same conclusions in their study in Zimbabwe.

The results of the above studies showed that inadequate teaching and learning support materials (LTSM) and human resources contribute to learners' struggle in comprehending mathematics. This suggests that the improvement of learner performance in mathematics is to an extent dependent on competent mathematics teachers and the availability of physical facilities and LTSM. On the other side of the coin, it may be thought-provoking to note that learners experience challenges in mathematics even when they are taught by qualified teachers. Teachers and resources appear to be one of a number of complex and interrelated factors.

### **2.3.3 Teaching strategies used by teachers and teacher pedagogical content knowledge**

Makgato and Mji (2006:260) have reported that some of the methods teachers use do not assist learners to develop conceptual understanding of mathematics. In their study learners identified poor teaching strategies and the teachers' lack of patience as one of the contributory factors to poor performance in mathematics.

Similarly, Tachie and Chireshe (2013:69) identified the unstimulating mathematics classroom environments and lack of effective teaching methods as factors that contribute to poor learner performance. Makhubele and Kakoma (2014) as a contributory factor in poor performance in mathematics also mention poor teaching methods. These findings concur with studies from other African countries such as Kenya, Zimbabwe and Nigeria (see. Mbugua et al. (2012:88–89), Nyaumwe, Bappoo, Buzuzi & Kasiyandima (2004:33), Sa'ad et al. (2014:32), Avong (2013:321) and Chirume & Chikasha (2014:201).

Bajak (2014:1), set out that learners who are taught using the lecture method are 1.5 times more likely to fail than learners who are exposed to more motivating or active learning approaches. Bajak (2014:1) further advises that lecture methods change every ten minutes to more active methods to ensure learner success. Discussions, project and discovery methods generate an enabling environment for the learners and ensure that individual differences are taken into consideration. The researcher concurs with the sentiments by Bajak (2014). Since learners have different learning styles, it is essential for teachers to use different methods in their teaching of mathematics to cater for individual learners' needs.

The findings suggest that a lack of subject and pedagogical knowledge of mathematics points to a critical challenge in the teaching and learning of mathematics. This denotes that critical features of the teaching and learning process such as knowledge of the content and knowledge of the pedagogy should not be ignored. Burns (2015:1) declares that teaching begins with a teacher's comprehension of what is to be learnt and how it is to be taught. A teacher should therefore have the knowledge of what teaching approaches fit the content and how components of the content can be organised for effective teaching and learning to occur. This is supported by Venkatakrisnan (2013: 6–7), who confirms that it is essential for all mathematics teachers to have a deep understanding of the mathematics concepts and how to teach them. This refers to the ability to reason in a mathematical way and comprehend mathematics content in ways that make it practical for teaching.

Mathematics as a subject requires an active learning strategy instead of a passive learning approach. Active learning involves learners and teachers, which becomes a two-way process with both the teacher and the child learning from each other. According to the CDE (2014:10), at the centre of pedagogical content knowledge is the way in which the subject matter is transformed for teaching. This happens while the teacher translates the subject matter to find diverse ways to present it and make it comprehensible to the learners.

#### **2.3.4 Medium of instruction**

In South Africa, English is the most frequently used language in schools but not the most frequently spoken home language. According to Howie, Venter, Van Staden, Zimmerman, Long, Du Toit, Scherman and Arche (2008:553), English as a first language is spoken by less than 10% of the population. Grade 9 learners are taught in a language (English) that is not their home language. Learning through a second language becomes a challenge to many learners. This language system is known as immersion (Howie et al. 2008:552). Admiraal et al. (in Naidoo, Reddy & Dorasamy 2014:158) state that instruction in a language foreign to learners contributes to poor reading abilities of the learners. When learners struggle with reading comprehension they are at a severe disadvantage, as they do not get meaning from what they have read. Consequently, this may negatively affect the performance of learners in other subjects, including mathematics.

At a school where the researcher taught, there is almost full immersion with all subjects being taught in English while isiZulu is taught only as a subject. However, the language policy stipulates that children should be learning in their home language until Grade 3. The researcher's former school is one of the private schools that uses English (second language) as a medium of instruction from Grade R to Grade 12. Although 98% of the learners are Africans, of which 87% are isiZulu home language speakers, they are taught in English. This could be one of the contributory factors to poor comprehension skills as these learners do not have the opportunity to first master the reading comprehension skills in their mother tongue and may therefore lack the necessary skills to transfer to reading in English (Zimmerman & Smit 2014:2). This may therefore result in poor

performance in mathematics. From the researcher's experience as a mathematics teacher at a private school in Ethusini circuit in Kwa Zulu Natal province of South Africa, most of the learners in the Senior Phase perform poorly in word problems, which suggests poor comprehension skills. The researcher shares the same sentiments with Zimmerman and Smit (2014) and supports Howie's (2003:13) view that "the most significant factor in learning science and mathematics isn't whether the learners are rich or poor. It's whether they are fluent in English."

Visser, Juan and Feza (2015:5), concluded that the language that the learners spoke at home was one of the most influential factors to learners' mathematics achievement. According to Visser et al. (2015:5), "learners from higher socio-economic backgrounds, who spoke the language of the test at home, and had one parent with at least a Grade 12 education qualification performed better in mathematics."

Of most importance to note is that the challenge of the medium of instruction is also acknowledged by the Department of Basic Education in South Africa. The South African Department of Education's analysis of learner responses in the ANA of 2013 and 2014 identified language as one of the challenges in Grade 9 (Department of Basic Education 2014b:11).

Adding to the complexity of language and learning, Van der Berg, Taylor, Gustafsson, Spaul and Armstrong (2011:18) argue that although there is a view that language proficiency in English affects the learning of other subjects, it is essential to recognise the strong and complex relationships between language, socio-economic status and school functionality in South Africa. According to Van der Berg et al. (2011:18), those who learn in their second language also have a lower socio-economic status than first language English and Afrikaans speakers. Van der Berg et al. (2011:18) further contend that English second language learners are more likely to attend schools characterised by weak management, poor accountability, low levels of cognitive demand and a myriad of other factors associated with less well-functioning schools in South Africa. Van der Berg et al. (2011:18) emphasise that the binding constraint that disadvantages African language learners may be the quality of First Additional Language (FAL) teaching rather

than an intrinsically language-related issue. Van der Berg et al. (2011:18) conclude that there are other factors (that affect the performance of learners in mathematics) rather than language on its own.

Van den Berg et al. (2011:18) consider language in a more complex way. Language also has socio-economic consequences. The conclusions by Van der Berg et al. (2011:18) are inconsistent with the research results attained by Makgato and Mji (2006:261), who stress that the language of instruction (English) is generally a problem on its own.

Mathematics uses a unique language that is sometimes different to the normal language of learners and overlaps in usage; this tends to affect learners' understanding of the subject and results in alternative conceptions. This is affirmed by the Department of Education (2001:16–17), that “although language problems reflect insufficient conceptual understanding, difficulties associated with the learning and teaching of mathematics and science are also associated with lack of proficiency in the medium of instruction”. It is therefore essential to strengthen the teaching of English as a second language.

As with South African literature, research in other African countries has shown that the language of instruction has an effect on learners' academic performance. Owu-Ewie (2012:83) reported that there is strong positive correlation between language (Ghanaian language – Fante and English) performance and that of mathematics. Similar findings were found in Kenya (Wafula 2015:76).

The findings of the literature consulted indicate that the home language of a learner and the LoLT have an influence on learner performance in mathematics. The research results suggest that learners who speak the LoLT (English) as a second language are more likely to produce poor results than their first language English counterparts are. When learners are not capable of decoding a question in the examination, there is little possibility of learners' offering the appropriate explanation. The findings suggest that the medium of instruction in schools makes it difficult for learners to make meaning out of what they learn. This view is supported by the CDE (2014:16), which contends that there is a significant relationship between children's acquisition of language in their early years and

their ability to learn. Language attainment needs to occur at an early age. The CDE (2014:16) further emphasises that language is the medium through which learning takes place and if either teachers or their learners are not competent in the respective LoLT, then teaching and learning are extremely difficult.

### **2.3.5 Teacher attitudes towards mathematics teaching**

The results of Tachie and Chireshe (2013:69) pointed out that South African learners attributed their poor performance in mathematics to teachers' behaviour. In this study, the learners explained that teachers are frequently absent from school and classes, they insult learners in class for giving wrong answers, they do not motivate learners in class and teachers also beat learners in class (Tachie & Chireshe 2013:69). Tachie and Chireshe's research results suggest that the negative attitude of the teachers towards learners contributed to the poor performance of learners in mathematics.

Mbugua et al. (2012:88–89) report that teachers' attitude towards mathematics was one of the major factors that contributed to poor performance in mathematics in secondary schools in Kenya. Attitudes of teachers towards teaching and learning mathematics, lack of motivation by teacher and undedicated teachers have also been found to negatively affect learners' performance in mathematics among senior secondary school students in Nigeria and Zimbabwe (Avong 2013:322; Chirume & Chikasha 2014:201).

Onoshakpokaiye (2011:19) attributes learner failure in mathematics to teachers' attitudes, and posits that teachers' negative attitude towards the subject is the source of many challenges in the teaching and learning of mathematics. Onoshakpokaiye (2011:19–20) further states that "the success of the mathematics programme depends greatly on the mathematics teacher since he is the prime mover that will put all that is contained in the curriculum into action".

The results of the consulted literature indicate that teachers' behaviour towards learners during the teaching and learning process of the subject may influence learners' performance. This is supported by a study conducted by Stuart (200:333), who revealed that learners' worst experiences in the teaching and learning process of mathematics

involved failure, criticism and difficulties yet to be overcome. Furthermore, Stuart (2000:331) argues that teacher; peer and family attitudes towards mathematics either may positively or negatively influence learners' confidence in mathematics. Additionally, Stuart (200:333) stresses that learners who have a positive attitude towards their teachers have high performance levels.

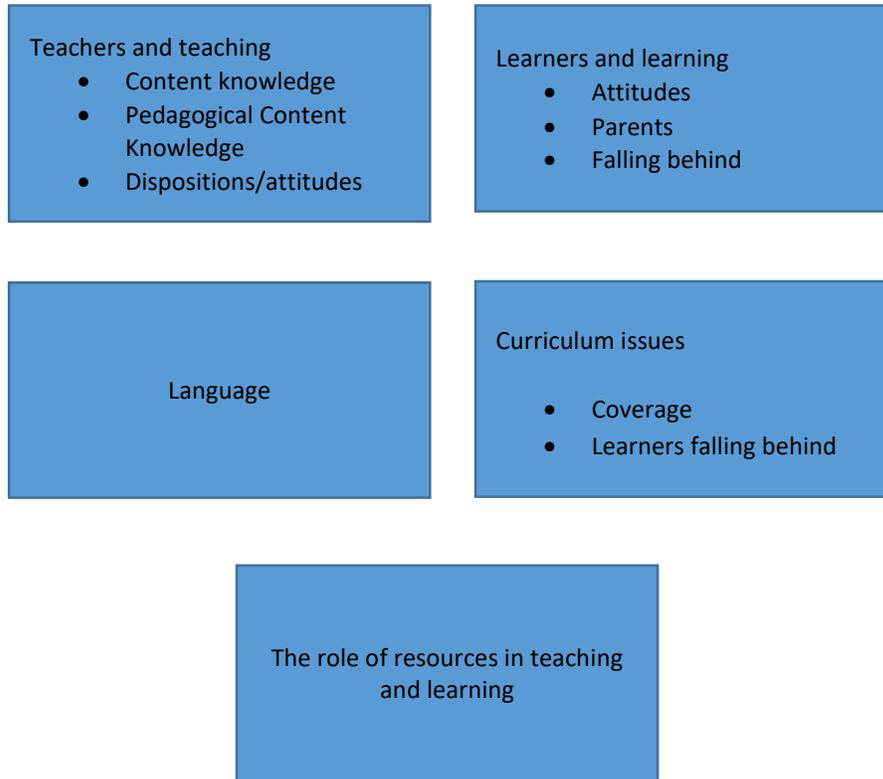
It appears that teachers affect mathematics learning in more ways than simply their content knowledge or pedagogical content knowledge. This study aims to determine some of the tacit domains of teacher and learner actions in mathematics classrooms as well as possible interventions that could be implemented to address the identified areas of weakness in Durban's Ethusini Circuit.

The challenges experienced by teachers and learners in the teaching and learning of mathematics as set out in the above literature study can be summarised diagrammatically as indicated in Table 2.1.

**Table 2.1: Challenges raised by teachers and learners**

<b>Issues raised by teachers</b>	<b>Issues raised by learners</b>
Content knowledge	Content knowledge
Time to complete curriculum	LTSM
Learner dispositions	Teacher behaviour
Parents	Pedagogical content knowledge
Language	Language
Falling behind	

From the literature review and the table generated, these challenges can be further collapsed into five broad areas as follows:



**Figure 2.1: Challenges raised by teachers and learners**

## **2.4 THEORETICAL FRAMEWORK**

Cobb (in Lester 2007:3) states that in mathematics education, the subject of significant debate is that of dealing with multiple and regularly contradictory theoretical perspectives. According to Cobb (in Lester 2007:3), the theoretical perspectives that are presently suggested include radical constructivism, Social Cultural Theory, symbolic interactionism, Distributed Cognition Theory, information processing psychology, situated cognition, critical theory, Critical Race Theory and Discourse Theory.

This study adopts the Distributed Cognition Theory and the Activity Theory's perspective as they relate to mathematics education. In seeking to understand poor mathematics performance from teacher and learner perspectives, a theory that supports the notion that both are role-players and stakeholders in mathematics education was sought.

Both the Distributed Cognition Theory and the Activity Theory fit into a qualitative, interpretivist paradigm. Similar to both the Distributed Cognition Theory and the Activity Theory, interpretivists are anti-foundationalists who are certain that there is no single correct path or specific method that results in cognitive development, as indicated by Willis (1995:9). In the same vein, Golfahsani (in Klenke 2016:23) asserts that “interpretivists embrace the view that all knowledge, and therefore meaningful reality as such, is contingent upon human practices, being constructed in and out of interactions between human being and the world and developed and transmitted within a social context”. Distributed Cognition Theory allows us to understand that the teacher and learner are co-constructing mathematics knowledge while Activity Theory allows us to view the mathematics classroom as an interrelated complex system. Both of these theories support the understanding of teachers and learner perceptions of poor performance in mathematics in their contexts.

There is a close relationship between interpretivist paradigm and qualitative methodology. Since the interpretivist paradigm seeks to understand a phenomenon from the participant’s subjective experiences, it favours the use of a qualitative research approach in data collection. This is substantiated by Cao Thanh and Le Thanh (2015:24), who confirm that “interpretivism is a research paradigm, and it prefers using qualitative methods in data collection”.

#### **2.4.1 Distributed Cognition Theory**

The Distributed Cognition Theory is linked to Pea (1993), who asserts that cognition is distributed across people and resources and that we build knowledge by interacting with people, tools and resources. According to Pea (1993:47), the perspective of the Distributed Cognition Theory is that “cognition is distributed – across minds, persons, and the symbolic and physical environments, both natural and artificial”. Gregory Bateson in Pea (1993:47) declares that “the memory is half in the head and half in the world”. Bateson’s sentiment suggests that cognition does not singularly take place in a person’s mind but that the individual constitutes part of the cognitive system, as indicated by Cobb (2007:27).

The researcher does not believe that the problem in mathematics education in South Africa can be attributed to only one aspect. A research approach that assists in integrating the factors holistically is required. Distributed cognition helps to deal with some of the factors holistically.

Distributed cognition theorists attach significance to Hutchins's investigations. Hutchins (1995:359) in his effort to establish the concept of distributed cognition explained how computational features of navigation were spread among a group of quartermasters, machinery and equipment as they navigated an aeroplane off the southern coast of California. Hutchins's (1995:359) conclusion that intelligence, labour and understanding could be comprehended through social interactions and cultural artefacts substantiate Pea's argument.

Distributed cognition stands out in mathematics as the teaching and learning thereof are distributed across tools such as books, calculators, pencils, rulers and chalk. As indicated by Johansen (2009:181), even the very simple task of counting is normally strengthened by external supports such as tally marks, pebbles, fingers and other accessible objects. This declaration is supported by Liu, Nersessian and Stasko (2007:1) who maintain that various tools such as multiplication on pencil and paper to diagrams appear to reinforce cognition as we can achieve more with than without them. According to Johansen (2009:181), tools such as written tables, counting boards, abaci, computers and calculation machines allow mental calculations to be replaced by various forms of epistemic activities. To illustrate this, Johansen (2009:181) suggests that "using written tables, calculations are substituted by perceptual and search processes, using abaci and counting boards, calculations are substituted by manipulation of physical counters in accordance with given algorithms, and using computers, calculations are substituted by keyboard operations".

On the other hand, Hutchins (1995:170–171) argues that none of our cognitive capabilities are amplified by the use of tools and proposes that it is essential to distinguish between the intellectual effects of the use of tools and the cognitive properties of the minds. Hutchins (1995:170–171) suggests that "tools permit us to transform difficult tasks

into ones that can be done by pattern matching, by the manipulation of simple physical systems, or by mental simulations of manipulations of simple physical systems. Tools are useful precisely because the cognitive processes required to manipulate them are not the computational processes accomplished by their manipulation". However, the researcher is of the view that the manipulation of tools supports and improves our cognitive performance because tools bring abstract concepts into reality, which consequently enhances understanding of the concepts. Ohlson de Fine (2017:1) substantiates this view as she declares that "resources give children a more concrete learning experience that reinforces what is happening in the classroom".

Distributed cognition can be viewed as a valuable framework in the teaching and learning of mathematics. This is because it emphasises interactive cognitive processes that involve not only the mind, but also the influence of the support to learning that is attained from other people and external environmental materials and resources. Johansen (2009:182) confirms this assertion as he emphasises that "the use of physical artefacts and the embodied strategy of substituting mental calculations with epistemic actions is an integral part of mathematical cognition and has been more or less so from the dawn of calculation".

Cobb (2007:26) states that Distributed Cognition Theory can be viewed as a good support for the creation of designs at classroom level because it considers classroom processes as emergent phenomena. This view is also supported by Pea (1993:48) who affirms that in the Distributed Cognition Theory, intelligence is accomplished rather than possessed.

On the other hand, Cobb (2007:27) points out that the emphasis that the Distributed Cognition Theory places on the classroom as the direct setting of the students' learning prevents regard of the conflicts that some students may encounter concerning the accentuated social setting of the classroom and the practices they are engaged in outside the school. Cobb (2007:27) further advises that Social Cultural Theory combines the placement of the classroom activity as both the immediate learning environment and the consideration of the account of the students' engagement in the groups and communities out of school. This approach could be integrated to counter this limitation.

Cobb (2007:27) suggests that the characterisation of an individual as an element of a reasoning system delegitimises cognitive analyses of individual learners' reasoning. According to Cobb (2007:27), the failure to recognise the contributions that cognitive analyses of individual students can make to the process of adjusting and modifying an instructional design places a limitation on the distributed cognition perspective. Cobb (2007:27) advises that the presence of individual learners' reasoning is essential to the design and teaching of mathematics. Furthermore, Cobb (2007:27) recommends that the diversity in learners' reasoning, which is key to the promotion of continued classroom discussions that concentrate on fundamental mathematical concerns, is a resource that the teacher can use to counter this limitation. In the light of the multidimensional nature of the potential source of challenges that may emanate from the study, distributed cognition is an appropriate theoretical framework.

Learning is communal and constructivist from African philosophies. The distributed cognition approach ties in well with the African concept of Ubuntu. The word Ubuntu is summed up in the Nguni expression "umuntu ngumuntu ngabantu", which can be interpreted as "a person is a person through others" as indicated by Desmond Tutu.

Similar to distributed cognition that strengthens collaboration and reasoning among individuals, together with their tools and resources in a given setting, the Ubuntu notion of "a person is a person through others" stresses collectiveness through its emphasis of the interconnectedness of human beings and therefore echoes the distributed cognition approach.

According to Nussbaum (2003:1–10), Ubuntu enhances learning as it acknowledges that individual success is strengthened by the interdependence of self and community. The Ubuntu interpretation of humanity recognises that a common goal can be achieved only by amalgamating other people's abilities and desires. This view is supported by Nussbaum (2003:2), who states that "Ubuntu is consciousness of our natural desire to affirm our fellow human beings and to work and act towards each other with the communal good in the forefront of our minds."

With regard to mathematics teaching and learning, the influence of Ubuntu would enable the researcher to view mathematics learning as teachers and learners working together through communication and engagement with each other in the classroom or in a school setting.

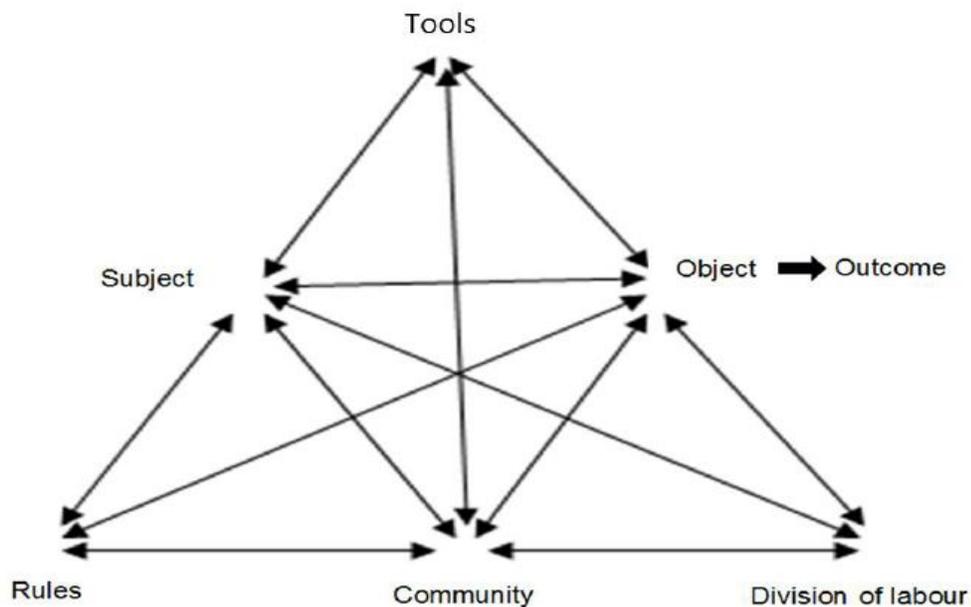
### **2.4.2 Activity Theory**

Activity Theory has its roots in the work of Vygotsky's mediation concept that was developed in the 1920s and early 1930s (Engeström 2001:134). Barab, Evans and Beak (2004:199–200) describe Activity Theory as a “psychological and multidisciplinary theory with a naturalistic emphasis that offers a framework for describing activity and provides a set of perspectives on practice that interlink individual and social levels.” Alternatively, Hasan and Kazlauskas (2014:9) provide a simplified definition of Activity Theory as a theory that is all about “who is doing what, why and how.”

The discussion on Activity Theory will draw on Engeström's third-generation Activity Theory because it is an improved model of the two previous generation cultural-historical activity theories.

#### **2.4.2.1 Engeström's third-generation Activity Theory**

Engeström expanded the first-generation original Vygotskian triangle as indicated in Figure 2.2. The central unit of analysis in the Activity Theory is the Activity system that is defined as “object-oriented, collective and culturally mediated human activity” (Engeström & Miettinen 1999:19).



**Figure 2.2: Simplified version of Engeström's (1987:186) Model of Activity Theory**

Engeström's activity system presents a systemic whole, as shown in Figure 2.2, that is composed of interrelated elements that include the subject, object, tools, community, division of labour and rules. "The relationship between subject and object is mediated by 'tools', the relationship between subject and community is mediated by 'rules' and the relationship between object and community is mediated by the 'division of labour'" (Kuutti 1995:8). Engeström's description of the integration of the various elements in the system suggests that the activity system is a coordinated system that reinforces a structure into which diverse components are assimilated. For this study, Activity Theory provides the lens through which to view mathematics teaching as an integrated system within a specific context or environment. Mathematics teaching and learning are seen as complex endeavours that cannot be explained as simplified actions.

Activity Theory starts with the concept of activity. Kuutti (1995:8) describes an activity as a system of "doing" that involves a subject to work on an object to achieve the required outcome, where a subject is a person or group that is involved in an activity. Correspondingly, Sriraman and English (2010:521) confirm that "activities are not merely actions but lines of conduct aimed at outcomes, or consequences." In the case of

mathematics education, Basharina (2007:84) describes an activity of learning using the elements of the activity system, as “the joint activity of a learner, physical/symbolic tool(s), and another person(s) performing together as a working social system to achieve some outcome under cultural constraints such as rules.”

The central idea in Activity Theory is the concept of mediation. Basharina (2007:84) describes mediation as a “mechanism through which external socio-cultural activities are transformed into internal mental functioning”. The source of mediation can be any material or psychological resources used by the subject to facilitate the achievement of the purpose of an activity. These are referred to as tools that can enable or limit an activity (Kuutti 1995:8; Hardman 2005:3; Basharina 2007:84).

In the context of mathematics teaching and learning, Núñez (2009:12) identifies psychological resources as tools of mathematics, concepts, approaches, techniques, language and learners’ mathematical knowledge. Material resources, on the other hand, include computers, calculators, mathematics software, interactive whiteboards and dictionaries.

In the Activity system, an object defines an activity and is described as any tangible or intangible material thing that motivates activity. An object can be manipulated by participants of the activity to achieve the desired outcome (Kuutti 1995:8). In the perspective of mathematics teaching and learning, the object will change according to the subject – who may be the teacher or teacher researcher or learner. If the subject of the activity is the teacher, the object may imply long-term objectives. For example, the enhancement of mathematics teaching and learning methods. If the subject is the learner, an object leans towards short-term objectives like solving of mathematical problems (Jaworski 2003:31; Hardman 2005:3–4; Vekant & Adler 2008). This argument is substantiated by Kuutti (1995:8) who asserts that objects are not absolute and that they can change during the process of an activity. According to Kaptelinin (2005:5), “the object of activity has a dual status; it is both a projection of human mind onto the objective world and a projection of the world onto human mind.”

From a research perspective, Kaptelinin (2005:5) declares that the notion of the object of activity shows the potential of being an analytical tool that enhances the comprehension of what people are doing and why they are doing it. Kaptelinin (2005:5) further states that “the object of activity can be considered the ‘ultimate reason’ behind various behaviours of individuals, groups, or organizations and can be defined as ‘the sense-maker,’ which gives meaning to and determines values of various entities and phenomena”. Correspondingly, Hardman (2005:4) stresses that, since the object signifies the motive for the presence of the activity and acts as a motivational factor that directs the subject’s actions, “interviews can be useful tools for unpacking motives.”

The community represents all individuals or groups of people involved in the activity system with activity goals that are alike. In the context of mathematics, Jaworski (2009:4) and Hardman (2005:4) identify the community as everyone who has the potential to be involved in the teaching and learning of mathematics whose goal is to improve the awareness and understanding of mathematics. These are mainly teachers and learners whose collective efforts are to solve classroom mathematical problems.

Division of labour involves the shared roles and responsibilities of the people in the community. For example, the teacher’s role in the classroom is to teach while the learner’s role is to learn (Jaworski 2009:5; Hardman 2003:4; Jaworski 2003:31). Duties and authority may be collaborated within the classroom and throughout the school. According to Hardman (2003:4), the roles of the teacher and the learner may be shifted by the use of a computer, where other learners may act as teachers to other learners.

The researcher suggests that the consideration of other stakeholders and sharing of responsibilities is an important factor that can enhance the teaching and learning of mathematics, which can consequently improve the learners’ success in mathematics. This argument is supported by the KwaZulu-Natal Department of Education ([sa]:23) that affirms that the engagement of other stakeholders in the learning process and shared responsibilities “translates into a child who is developed holistically – has good character, good marks, good morals, healthy ambitions etc.”

Hardman (2005:4) refers to rules as both clearly stated and implied norms, principles and social interactions within the classroom, which motivate the subject's actions. Within the school and classroom context, Jaworski (2003:31) and Hardman (2005:4) identify rules as the raising of one's hand when answering a question, school schedules, curricular and testing requirements and appropriate behaviour.

According to Jaworski (2009:5), the relationship of the different elements illustrated in the activity system stresses that the "learner (the subject of the learning process) with an object of learning mathematics, the activity of engaging in mathematics in a mathematical community is mediated by all of these factors as well as the artefacts commonly used to support learning."

Essentially, the use of the Activity Theory in the teaching and learning of mathematics would involve a consideration of the partnership and collaboration of the teachers, learners and parents. This includes sharing ideas on the mediation of tools and how they enhance the understanding of mathematics. The use of language as a tool and how it affects the understanding of rules and instructions in the teaching and learning process, the influence of these aspects on the roles of the learning community (teachers, learners and parents) and sharing of responsibilities as well as the division of labour among all stakeholders. An understanding on how all these aspects in the activity system influence effective teaching and learning of mathematics (outcome) is necessary. Conceptualising mathematics classrooms as activity systems allows one to broaden the scope in terms of identifying challenges in the teaching and learning of mathematics. The outcome in mathematics classrooms (learning) is not a linear process but rather a networked one, as shown in Figure 2.1.

Nardi (1996:8) argues that Activity Theory presents a challenge of understanding "the interpenetration of the individual, other people and artefacts in everyday activity". According to Engeström (2001:136), this challenge emanates from the Activity Theory's multi-voicedness which he refers to as "multiple perspectives, interests, and traditions of the members of an activity system". In the same vein, Khiok-Seng (2003:465), Jaworski (2009:5), Kuutti (1991) and Russel (in Hardman 2005:3) assert that Engeström's model

places emphasis on the subjects' historical differences and positions in division of labour, which in turn leads to different multiple or conflicting interpretations of the object and other elements.

Hardman (2005:3) declares that recognising contradictions in a classroom, known as an activity system, could provide information regarding the possible change in pedagogical practice. Consequently, activities in the teaching and learning of mathematics may overlap in that learners of different social and historical backgrounds engaged in a series of synchronised actions may have multiple or different objects to those of the teacher.

Engeström (1987:16) suggests that contradictions can be resolved through a process of "living movement leading away from the old" when transforming a goal into a new outcome. On the other hand, Jaworski (2009:5) perceives inquiry as a tool that facilitates mathematics learning, teaching and development and then as a way of being in practice. According to Jaworski (2009:5), the continuous use of inquiry as a tool accentuates its mediational quality in the activity system. Hence, the tool becomes part of our identity and the community at large. Haneda (2014:3), who maintains that learners who are given opportunities to engage with their peers and their teachers in the learning process develop a better grasp of the topics they study, supports this argument. Furthermore, Haneda (2014:3) stresses that an inquiry approach to teaching and learning tries to overcome the traditional teacher-centred approach that disregards learners' interests, life experiences, cultural and linguistic backgrounds.

Subsequently, Jaworski (2012:152) suggests that to deal with the conflict that Activity Theory may present between the teacher and the learner, as discussed above, both from the teacher's and the learners' perspective and their relationship with the general norms and traditional practices, must be taken into account. This endorses the purpose and objectives of this study.

Both Distributed Cognition Theory and Activity Theory can be valuable frameworks that can be used side by side in researching the teaching and learning of mathematics. These

two theories are related in several ways as they reveal a shared intellectual tradition of emphasis on the cognitive, as indicated by Halverson ([sa]:7).

These theories encourage the active engagement of the learners among themselves and with the tools. The researcher suggests that the interaction of learners and manipulation of tools can enhance learners' learning, promote critical thinking, increase their mathematical conceptual understanding, develop increased problem-solving skills and strengthen the learners' success in learning mathematics. This is because "visual information is part of the way we interpret experience and build understanding" (McLoughlin 1997:1). This argument is substantiated by Basharina (2007:84), who maintains "mediators, in the form of objects, symbols, and persons transform natural, spontaneous impulses into higher mental processes, including strategic orientations to problem-solving". Similarly, Haneda (2014:3) maintains that learners who are given opportunities to engage with their peers and their teachers in the learning process develop a better grasp of the topics they study. According to Naidoo ([sa]:2), "learning environments that incorporate visual tools and technology add value to lessons."

## **2.5 CONCLUDING REMARKS**

The relationship between the Distributed Cognition Theory and the Activity Theory incorporates the emphasis on cognition and the social and cultural background of cognition. It takes into account exploring phenomena from the participant's perspective (Halverson, [sa]:5–6). Resultantly, both theories can be helpful in understanding learner's learning of mathematics from their different points of view.

A number of underlying factors have been identified as contributors to the poor performance of high school learners in mathematics in South Africa. The findings in South Africa are consistent with other African countries like Kenya, Zimbabwe, Uganda, and Nigeria. The above discussion clearly indicates that schools have a responsibility of identifying and applying alternative strategies on how to improve school/parent/community partnership. From the research findings as per literature reviewed, it is evident that better teaching method, competent teachers and LTSMs are

required in the teaching and learning of mathematics. The role of the curriculum is also a factor in understanding poor performance while it is also noted that the medium of instruction has an influence on the performance of learners.

Although the literature review has revealed a number of aspects that affect teaching and learning of mathematics, this study will determine how many of these factors are related to Grade 9 teachers' and learners' perceptions of the causes of poor mathematics performance and determine possible interventions in Durban's Ethusini Circuit of KwaZulu-Natal Province. The study will also set out to establish if any other factors affect the teaching and learning of mathematics in this context.

The next chapter provides an overview and description of the research methods and techniques that were used in conducting this research. It begins by explaining the research approach that was used to conduct the study.

## **CHAPTER 3**

### **RESEARCH METHODOLOGY AND DESIGN**

#### **3.1 INTRODUCTION**

This chapter presents an outline and description of the research approach that was applied in this study to answer the question: “What are the teachers’ and learners’ perceptions of the causes of poor mathematics performance among Grade 9 learners in Durban’s Ethusini Circuit of KwaZulu- Natal Province?”

The chapter will also highlight the target population and sampling procedures that were employed in the study. Data collection instruments and the process of generating the data, data analysis and interpretation, issues of trustworthiness, research ethics, and limitations and delimitation of the study are other aspects that are presented in this chapter.

#### **3.2 RESEARCH APPROACH**

The researcher explored the research topic through qualitative methods. Marshall and Rossman (2011:2) assert that qualitative research is inquiry that is normally performed in naturalistic settings. Qualitative research centres on the situation, is emergent and evolving and is interpretive. Bearing in mind that the research involved human participants, the researcher considered qualitative research to be appropriate for this study because it draws on multiple methods that respect the humanity of the participants in the study (Marshall & Rossman 2011:2).

Qualitative research allows the researcher to self-reflect and reflect on the research. Contrary to quantitative research, Flick (2014:17) argues that qualitative research considers the researcher’s interaction with the field and its participants as an obvious part of the research process. Furthermore, Flick (2014:17) maintains “researchers’ reflections on their actions and observations in the field, their impressions, irritations, feelings and

so on become data in their own right, forming part of the interpretation, and are documented in research diaries or context protocols”.

Among the different approaches to qualitative research is phenomenography and phenomenology. Marton (1986:28) refers to phenomenography as a method of inquiry that qualitatively examines various ways in which people experience something or think about something. According to Flick (2014:541), “phenomenology is a careful description and analyses of the subject’s life world and the meaning making and understanding in that life world.” Phenomenography seeks to understand the perceptions about the phenomenon, while phenomenology strives for understanding the phenomenon itself.

Phenomenography was considered suitable for this study. The researcher anticipated that a phenomenographical approach would enable a thorough investigation of the research questions since it ascertains relationships and distinctions in the way one understands experiences. Through face-to-face semi-structured interviews, the phenomenographic approach would lead to greater understanding of the challenges experienced by learners in learning mathematics and the challenges experienced by teachers in the teaching of mathematics (Marton and Booth in Fortkamp 2018:180–181). These scholars declare that phenomenographic research strives to add to the knowledge of learning through the manifestation of the different ways learners perceive their learning. The highlighted challenges experienced by teachers and learners in mathematics education provided a basis for developing interventions. Implementing these interventions could assist to address the identified areas of weaknesses that could be the causing poor performance in mathematics classrooms.

### **3.3 POPULATION AND SAMPLING**

#### **3.3.1 Introduction**

McMillan and Schumacher (2010:48) define a population as a group of people or events from which a sample is obtained and from which results can be produced. The target population for the study were the underperforming schools in mathematics in Durban’s Ethusini Circuit of KwaZulu-Natal Province. The learner population was composed of

Grade 9 learners who take mathematics, while the teacher population were the Grade 9 mathematics teachers and mathematics HoDs in the three schools that participated in the study in Durban's Ethusini Circuit. This population may be very similar in many areas of South Africa.

### **3.3.2 Participant selection**

The study employed a purposeful sampling method. Purposive sampling is a type of sampling that allows selecting small groups or individuals who are likely to be knowledgeable and informative about the phenomenon of interest, selecting cases without requiring or desiring to generalise to all such cases (McMillan & Schumacher 2010:138).

The study applied criterion purposive sampling. Since the research sought to investigate the teachers' and learners' perceptions of the causes of poor mathematics performance among Grade 9 learners, the selection of the schools was based on the criterion of poor mathematics results. Three low-performing schools in Durban's Ethusini Circuit of KwaZulu-Natal Province, one former model C school, one independent school and one ordinary government school was selected. Low-performing schools are those that received a performance average that is below 40% in mathematics for their 2014 ANA results. This is a moderate achievement on the recording and reporting scale that is used in South African schools. The schools were selected from a published list of schools with their ANA results. The three schools were selected because of their proximity to where the researcher lives. This was a convenient, manageable sample for a single researcher. In terms of adequacy, it provided data saturation and allowed the researcher to answer the research questions. According to the promotion and progression requirements of Grade 9 mathematics, 40% is a minimum standard requirement for one to be promoted to the next grade.

From each of the three low-performing schools that were selected, all Grade 9 learners who take mathematics were the population. The researcher used purposive sampling to select the participants. The researcher used this population to select ten learners for focus

group interviews with a composition of five males and five females, and five other learners for semi-structured interviews, which was composed of three males and two females. The composition of the total sample of fifteen learners at each school. The selected learners were those who were willing and volunteered to participate in the study and would be available for interviews.

In the schools where there were more than two Grade 9 mathematics teachers, the criterion that was used is that the teacher should have had taught mathematics in Grade 9 for at least three years, since they would not be considered novice teachers. It was assumed that teachers with this experience are likely to give more insight into the research phenomenon and for the research finding to be valid. Since there is only one mathematics HoD per school, all mathematics HoDs in the three schools that were selected were selected as a sample.

### **3.3.3 Grade 9 learners**

Ten Grade 9 learners from each of the three participating schools, comprised of five females and five males, were sampled from the population for focus group interviews. An additional five learners participated in individual semi-structured interviews.

### **3.3.4 Grade 9 mathematics teachers**

One-on-one semi-structured interviews with one mathematics teacher from each of the three participating schools were conducted. One-on-one interviews would allow the researcher to work individually with participants and participants would be more likely to share their perceptions around their mathematics teaching.

### **3.3.5 Mathematics Heads of Department**

The researcher conducted a one-on-one semi-structured interview with each mathematics HoD from the three participating schools. The open-ended questions elicited information regarding the strategies that can be put in place to ensure the improvement of mathematics teaching and learning. Since mathematics HoDs are experts in the

subject, the open-ended questions allowed for discussion and elicited rich information related to challenges experienced by both Grade 9 learners and teachers in the teaching and learning process of mathematics as well as strategies that can be put in place to improve mathematics performance.

Each group of participants was given a schedule that clearly indicated the time and day when the focus group interviews and semi-structured interviews would be conducted. To avoid disruption of the classes, all data collection was done during free periods (which was a decision of the school. Otherwise, research would have taken place afterschool hours).

### **3.4 INSTRUMENTATION**

The data collection instruments included semi-structured interview schedules and focus group interview schedules. Three different instruments were used for face-to-face interviews. One for the Grade 9 learners who take mathematics, one for Grade 9 mathematics teachers and another for mathematics HoDs. One instrument was used for learners' focus group interviews (see Appendix K, L, M, and N).

A broad literature review as shown in Chapter 2 informed the formulation of the instruments. The researcher also tried to avoid leading questions, such as “Why is English as a medium of instruction a contributory factor to poor learner performance in mathematics?” to prevent bias and prejudice. An example of open-ended questions that the researcher asked in the learners' semi-structured interview instrument is, for instance, “How would the teaching of mathematics in your home language influence your understanding of mathematics?” as indicated in Appendix L.

### **3.5 DATA COLLECTION TECHNIQUES**

#### **3.5.1 Data collection process**

Before collection of data, the researcher ensured that she clearly understood the goal of collecting data. The main purpose of this study was to investigate the teachers' and

learners' perceptions of the causes of poor mathematics performance among Grade 9 learners in Durban's Ethusini Circuit of KwaZulu-Natal Province. The study sought to explore perceived challenges in the teaching and learning of mathematics among Grade 9 teachers and learners. It further proposes interventions that could be implemented to address the identified areas of weaknesses. The findings of the study suggest possible solutions to effective teaching and learning of mathematics generally.

The researcher made preliminary visits to the respective schools. During this visit, the researcher ensured that the participants understood what was expected of them. The researcher in consultation with the participants drew up a schedule for the collection of data. Using the understanding from the previous steps, the researcher then began the data collection.

The methods of collecting data included:

- a) One Focus group interview at each school
- b) One Individual semi-structured interviews with five learners from each school
- c) One individual semi-structured interview with one teacher from each school
- d) One individual semi-structured interview with one HoD from each school

These all took place on the same day at each respective school so that participants would not discuss the questions and possibly influence responses of other participants

Both the focus group and individual semi-structured interviews were recorded and transcribed by the researcher before analysis took place. The process of mechanically transcribing the recordings added validity to the study since the researcher went through the data twice before analysis began. This contributed to "researcher fluency" (McMillan & Schumacher 2006:314) with the data.

### **3.5.2 Focus group interviews**

One session of focus group interviews with ten Grade 9 learners who take mathematics from each of the three participating schools was used as a means of collecting data in this study. Since three schools were involved in the study, three focus groups were

conducted in total. The discussions with each focus group lasted for approximately 30 minutes.

The focus group interviews were held at the respective schools to create an environment that is conducive and familiar to the learners. The learners were requested to express themselves freely. The environment was both safe and familiar to them.

The researcher herself conducted the interviews to enable first-hand data collection. An interview schedule (see Appendix O) was prepared beforehand. Although the discussions were audio-taped, the privacy and identity of the participants was assured. The participants were advised not to identify themselves during discussions. Since the learners knew each other, the confidentiality of the focus group was discussed with them. The researcher appealed to learners to share their views and for all learners to support views that may be contrary to their own. The researcher wanted learners to give as many views as possible and for the results to be trustworthy. The learners also signed a confidentiality agreement.

McMillan and Schumacher (2010:363) affirm that focus group interviews generate an environment where the group members are motivated by one another's insights, which strengthens the value and depth of data collected. During interviews, simple behaviour, such as facial expressions, reactions and gestures, was noted. In a focus group interview, both the researcher and the learners had an opportunity to seek for clarification by asking for rephrasing or repeating. As compared to individual interviews, focus group interviews can save time and money as it involves dealing with a group of participants at once and at the same location.

On the other hand, in focus group interviews, the participants may be hesitant to speak, especially if their views are different from those of others in the group. Therefore, there is a possibility that the participants may not express their personal opinions about the research problem at hand. To counteract this, the researcher created a supportive environment by explaining the research purpose and explaining that all opinions were valued. Learners were asked focused questions to encourage discussion and the

expression of differing opinions (Marshall & Rossman 2011:149). The teachers were not part of the learners' interviews, and all participants were encouraged to discuss and take their turn in the focus group discussion. Ground rules were elicited from the learners themselves in an effort to elicit the ground rule to "Respect each other's views". This encouraged all participants to share their views even if they had views that were different from others.

Since one of the focus areas of the study is the learners' perceptions of the challenges in comprehending mathematics, a focus group interview was still the most suitable method of collecting data as it allows for a shared understanding from several individuals from whom data are collected (Creswell 2012:218). The unit of analysis in the focus group is the collective view of the learners' perception of the challenges in comprehending mathematics, while the individual semi-structured interviews allowed for an individual view.

### **3.5.3 Semi-structured interviews**

Sessions of face-to-face semi-structured interviews with open-ended questions that allow for discussion with the interviewees were used to collect data from five Grade 9 learners who take mathematics, one Grade 9 mathematics teacher and one mathematics HoD from each of the three participating schools. The learners' interviews lasted approximately 20 minutes while the teachers' and HoDs' interviews lasted between 30 and 45 minutes. One session of interviews for each group of participants was conducted. The semi-structured interviews were held at the respective schools to create an environment that is conducive and familiar to the learners. The researcher herself conducted the interviews. Although the discussions were audio-taped, the privacy and identity of the participants was assured as they were advised not to identify themselves during discussions. All data collection was done during free periods to avoid the disruption of classes.

McMillan and Schumacher (2010:205) explain that "the interview technique is flexible and adaptable". It can be used with many different problems and types of persons, such as those who are illiterate or too young to read and write, and responses can be probed,

followed up, clarified and elaborated to achieve specific accurate responses. Nonverbal as well as verbal behaviour can be noted in face-to-face interviews, and the interviewer has an opportunity to motivate the respondent. One other advantage of using the interview is that the questions can be structured, semi-structured or unstructured.

Since semi-structured interviews allow the interviewer to be flexible during the interview process, it provided an opportunity for the researcher to explore particular responses further. This enhanced the collection of rich and reliable information.

### 3.6 DATA ANALYSIS AND INTERPRETATION

#### 3.6.1: Activity report of data collection

Table 3.6.1 offers a summary of the data collection process that was followed.

**Table 3.6.1: Activity report of data collection**

Type of interview	What happened?	How the participants responded	What went wrong?	Researcher's reflections on how data were collected
Learner focus group interviews and semi-structured interviews, mathematics teachers' and mathematics HoDs' semi-structured interviews	The researcher received a positive response from all participants in all the three schools. The researcher worked with the participating schools to ensure that all logistics were well arranged according to the interview schedules for all the three schools. The interview room and the	The majority of the learners were very expressive. Most of the learners indicated that they were interested in the study because they wanted to see improved mathematics performance.  Due to the interviewees' interest	At School B, the room that was set for the interviews was next to the playground. The learners' individual semi-structured interviews ran through break-time. Since the interviews were audio-recorded, the noise from the	The interviews seemed to have gone well. However, having reflected on the interviews, the researcher noted that although she had followed the semi-

	<p>interviewees were ready as per scheduled time and date.</p> <p>The researcher arrived at the schools on time for the interviews. Although the researcher had already met the participants during the preliminary visits to the schools, she was courteous to the participants by greeting the participants and introducing herself again.</p> <p>Before commencement of the interviews, the researcher created a conducive environment for the participants through establishing rapport with the them.</p> <p>Although the recording of the interviews was indicated in the participants' consent and assent forms, the researcher asked the participants if the interview sessions could be recorded, to which they agreed.</p>	<p>in the study, they wanted to continue and not stop. The focus group interviews in all the three schools ended up taking between 40–45 minutes instead of the scheduled 30 minutes. The other contributory factor to this effect could have been that the researcher was too flexible. Fortunately, the free period lasted for 1 hour and the researcher was allowed to do her interviews within that 1 hour.</p> <p>Although the HoDs and the teachers have other extra-curricular activities and administrative duties that they do during free periods, they were very positive and interested to participate in the study. This was evidenced in the participants' warm welcome to the researcher and the</p>	<p>playground was also recorded. This made it more difficult for the researcher to listen to the audio-recorded data for that specific interview.</p> <p>The researcher used her cell phone to record the interviews and although a call briefly disrupted the first interview, the researcher ensured that all phone calls were blocked before commencement of the next interview.</p> <p>The HoD at School H was not available for interviews as scheduled even after arranging for an alternative date due to his busy schedule. The results of this study do not include his responses.</p>	<p>structured interview guide during the interviews, she may have been a bit too flexible, which could have contributed to the focus group interviews lasting longer than scheduled.</p>
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	<p>For the focus group interviews, the ground rules for the session were elicited from the learners, which ensured the respect of one another's views.</p> <p>During the interview, the researcher allowed for clarifications and offered cues to the participants to indicate that she was interested and engaged in what the participants were saying.</p> <p>After the interview, the researcher thanked the participants, and the school principals; she informed the participants that she would go back to the schools to share a summary of the findings.</p> <p>The researcher sent an email of gratitude to all the three schools for allowing her to conduct research in their schools.</p>	<p>participants' expressive nature.</p> <p>Detailed information in relation to the research questions was gathered. Data that was collected during Focus Group and Semi-structured interviews were similar. The teachers' and learners' responses were also similar.</p>		
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Since the study used the phenomenography method, it generated qualitative data. The researcher transcribed the focus group interviews and semi-structured interviews. This added validity to the study. The theoretical framework of Activity Theory (Engeström 1987:186) and Distributed Cognition Theory (Pea 1997:47) were used to provide

overarching data collection themes such as tools, rules and division of labour within the mathematics classroom. The transcriptions were then coded to identify certain themes and categories that were already described in the literature, such as language, teacher pedagogical knowledge and learner attitudes. The researcher also coded new ideas and concepts that emanated from the data. Categories that were considered to be similar in nature were then collapsed into themes after secondary analysis had taken place. Qualitative data analysis was done during data collection period as well as after all the data had been gathered. An inductive analysis process of organising data into categories and identifying patterns and relationships among categories was used. McMillan and Schumacher (2010:307) assert that “inductive analysis is the process through which qualitative researchers synthesise and make meaning from the data, starting with specific data and ending with categories and patterns”. The data were analysed in terms of what learners, teachers and HoDs identified as challenges. The data were coded using themes that emanated from the literature review (Figure 2.1). New themes were also coded if they did not fit those five themes. From the findings of the study, the triangulation of data also occurred as learners’, teachers’ and HoDs’ identified perceptions of the challenges experienced in the teaching and learning of mathematics were similar.

### **3.7 CREDIBILITY AND TRUSTWORTHINESS**

Credibility and trustworthiness were sought by ensuring that the interview questions were structured in an unambiguous manner and in the language that the participants understand, as indicated by McMillan and Schumacher (2010:331). To ensure validity and reliability of the instruments, the semi-structured interview questions to be used in the study were presented to the English language teacher to avoid ambiguity of the questions. Relevant corrections, adjustments, additions and subtractions were taken into consideration.

Furthermore, the questions were also presented to the researcher’s supervisor for her input for possible refinement of the instruments. Through the CEDU ethics application form, the research questions were presented to the Ethical Clearance Committee of UNISA. This process provided clear questions that offered reliable responses.

Before conducting the interviews, a convenient sample of three learners and a mathematics teacher from a nearby school was used to pilot the set of questions. This was done to check for openness and the relevance of the instruments to answer the research question. The sampled schools from which data were collected is trustworthy in that it goes across different school types, namely a former model C school, a government school and a private school. The selection of learners is trustworthy because issues to do with diversity and sensitivity to the differences of the learners in terms of race, social economic status, ethnic and cultural background, language and performance in mathematics were considered.

The interviews can be considered trustworthy because the researcher prepared the questions beforehand and each school was asked the same questions. The questions were read by someone else in the field to check for reliability. The researcher's use of verbatim accounts in the next chapter also adds to the trustworthiness of the study.

External validity was also taken into account. McMillan and Schumacher (2006:141) define external validity as the generalisability of the results. Population external validity was considered. The subjects from which data were collected had a specific characteristic; that is, they were Grade 9 learners who take mathematics, Grade 9 mathematics teachers and mathematics HoDs, comprising both male and female.

The purposeful sampling of Grade 9 mathematics teachers provided reliable information on the challenges experienced by teachers in the teaching and learning process of mathematics. Likewise, the purposively selected Grade 9 learners provided dependable data on their perceptions of the challenges experienced by Grade 9 learners in comprehending mathematics.

### **3.8 RESEARCH ETHICS / ETHICAL CONSIDERATIONS**

#### **3.8.1 Permission – KwaZulu-Natal Department of Education: Ethusini Circuit**

Issues of ethical confidentiality and privacy of personal rights of the participants were protected. The researcher firstly sent an email to the Ethusini Circuit manager to request

permission to conduct research in the Circuit. All necessary documentation was included. The aim of the email was to request the Circuit Manager to assist the researcher in identifying low-performing schools in mathematics in the Circuit and to familiarise the Circuit Manager on the topic, aim and nature of the study. The researcher requested an appointment with the Circuit Manager for further discussion of the research problem, for further clarifications, if necessary, and to collect permission letters to conduct research in the identified schools.

### **3.8.2 Consent to principals, parents, learners, mathematics teachers, HoDs and Ethusini Circuit manager**

The permission letter from UNISA and the Department of Education Circuit Office, consent forms by principals and parents and proof of registration of a Master's degree programme were used to seek for permission from the principals in the participating schools to conduct this research.

The researcher sent an email to the sample schools to make an appointment to see the school principal. She attached all the necessary documents regarding the request to conduct research. Once the researcher had been given a date, she visited the sample schools. The principals of the participating schools met the researcher on the respective dates and time that had been chosen by them. The researcher was given a positive response by all the three participating schools. The researcher explained the purpose of the study and what the study entails. The participants were allowed to ask questions, give suggestions and advise the researcher on how best the research could be conducted without the disruption of classes. From the researcher's observation, it seems that all the principals in the participating schools were very interested in the study. They started sharing their perceptions of the causes of poor learner performance in mathematics in general, although this was not an interview. The principals' perceptions of the causes of poor learner performance in mathematics are similar to those perceptions of the Grade 9 mathematics teachers and the mathematics HoDs in this study. During this visit, a date for a preliminary visit to the schools to meet the potential participants was set.

Preliminary visits to sample schools were made by the researcher, after she had obtained permission to carry out the research. The researcher was given a positive response from all the participating schools. The mathematics HoD, Grade 9 mathematics teacher and Grade 9 learners who take mathematics met the researcher. During this time, the researcher explained the purpose of the study. The participants were allowed to ask questions. The researcher worked in consultation with the participants to draw an agreed upon time schedule for focus group interviews and semi-structured interviews. This timetable, indicating specific dates and times of when the interviews would be conducted, was provided to all the participants to help them to plan for those particular dates.

A letter was written to parents of learners in Grade 9 to inform them about the intent to conduct this research project on “Grade 9 teachers’ and learners’ perceptions of the causes of poor mathematics performance and possible interventions in Durban's Ethusini circuit of KwaZulu Natal Province.” Among other issues, the letter highlighted the purpose of the study, the benefits, the medium risk involved and alternatives such as transport arrangements that needed to be made for the learners who participated in the study. The letter to the parents and the learners assured the recipients that the results for individual learners would be kept confidential and that the findings of the research project would be shared with the parents and learners. The parents were asked to sign the consent form to allow their children to participate in this research project. Likewise, the learners were also asked to sign the learner assent forms.

Two weeks before commencement of the study, the researcher visited the participating schools again. During this visit, the participating schools indicated that, the researcher could use free periods to make all the necessary arrangements. It is during these free periods that the researcher personally issued the parental consent letters to the learners who had volunteered to participate in the study. The learners took the letters home. The following day, the researcher visited the schools again to personally collect all the letters from the learners.

During this same visit, the consent form that also guarantees confidentiality was presented to all participants. Learners, mathematics teachers and HoDs were made

aware that their participation would be out of their own free will and that each participant would have the option to withdraw from the research at any time without reproach.

Although the researcher had planned to have all data collected after the contact session to avoid disruption of classes, the participating schools were kind enough to grant the researcher their free periods to conduct the research. Hence, the research was conducted during contact time. There were no incentives for participation in the research. The objectives of the study were verbally explained to the learners. The school premises were used to ensure that all participants were in a familiar and conducive atmosphere.

### **3.9 LIMITATIONS AND DELIMITATIONS OF THE STUDY**

#### **3.9.1 Limitations of the study**

It was anticipated that attracting participants in the study without any incentive may be a challenge. Furthermore, demands of the Department of Basic Education on the teachers in terms of assessments and other administrative tasks are ever-increasing. However, this did not seem to be the case as all participants were very willing to participate in the study without any reward. It is possible that the key informants did not avail themselves due to other responsibilities that are done during free periods.

#### **3.9.2 Delimitation of the study**

The research was conducted in high schools in Durban's Ethusini Circuit of KwaZulu-Natal Province. The Circuit is composed of former model C schools, ordinary government schools and private/independent schools. Some of the schools in Ethusini Circuit are located in urban Central Durban while some are located in the townships. Due to logistical constraints, the researcher was not able to include every member of the population; that is, all Grade 9 learners who take mathematics and all Grade 9 mathematics teachers and HoDs in the Circuit. However, the sample of study was purposively selected from three low-performing schools in the Circuit, one former model C school, one independent and one ordinary government school. This means that this study does not include the

perceptions of poor performance in mathematics by learners at adequately performing or well-performing schools.

### **3.10 CONCLUSION**

This chapter provided a summary of the qualitative research approach as a research methodology that was employed in this study. The Grade 9 learners who take mathematics, Grade 9 mathematics teachers and mathematics HoDs were identified as the composition of the sample that was selected.

The chapter also draws attention to the data collection process, instruments and techniques, which included semi-structured interviews and focus group interviews. The interviews were then transcribed by the researcher, coded and categorised to look for certain themes meant for data analysis. Included in this chapter are the limitations and delimitations of the study.

In answering the research questions, this chapter links the literature review to the data and findings from the data. In exploring the causes of poor performance among Grade 9 learners, a phenomenographic approach supported by perceptions from learners and teachers may present perceptions that support existing findings, or may elicit new dimensions to understanding poor performance in mathematics learning.

The next chapter presents the findings and interpretations of the study as set out in this chapter.

## CHAPTER 4

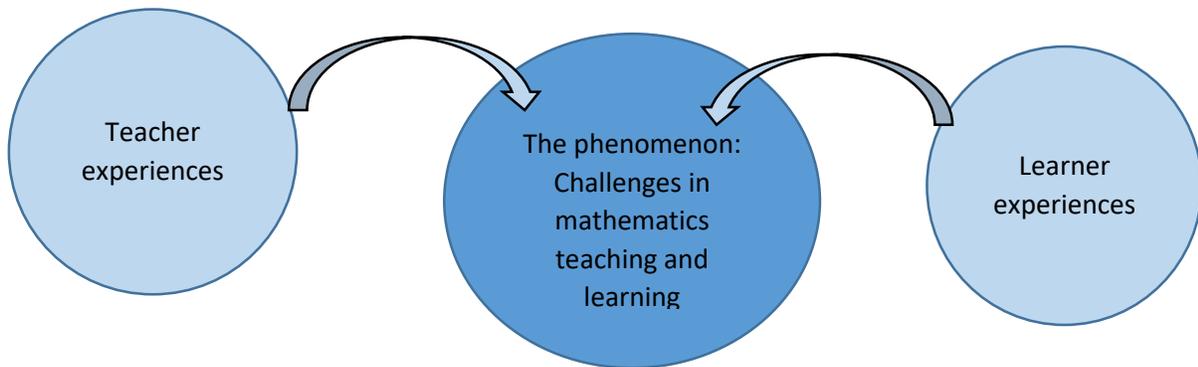
### DATA PRESENTATION, ANALYSIS AND INTERPRETATION

#### 4.1 INTRODUCTION

This chapter provides a presentation, and analysis of the collected data. It starts by stating the main research question and the sub-questions. This is followed by the demographic profile of the participants. The chapter contains the responses from the Grade 9 teachers and learners in Ethusini Circuit on what they perceived as the causes of poor mathematics performance. The findings are presented using figures, tables and narrations. The research findings originate from data collection instruments which incorporated focus group and semi-structured interviews. These instruments are provided in Appendices K, L, M and N. The data is presented in two sections, the teachers' perceptions of the challenges in teaching and learning of mathematics in Grade 9, and the Grade 9 learners' views of the challenges in comprehending mathematics in Durban's Ethusini Circuit of KwaZulu Natal Province.

The chapter also presents a discussion on the theoretical frameworks of Distributed Cognition and Activity Theory and how these were used as analytical lenses to make sense of the data. A discussion on the comparison of the findings of this study and findings in the reviewed literature is also included.

A phenomenographic approach was used in this study since it attempts to understand the participants' broad explanations and interpretations of their experiences. This is summarised in Figure 4.1.



**Figure 4.1 Researcher's phenomenographic descriptions and analysis**

The research results of this study are indicated by revisiting the research questions presented in section 1.3.1. The research questions are indicated below:

**4.1.1 Main research question:**

What are the teachers' and learners' perceptions of the causes of poor mathematics performance among Grade 9 learners in Durban's Ethusini Circuit of KwaZulu-Natal Province?

The main research question was sub-divided into the following questions: [covering the elements of the main question]

- i. What are the teachers' perceptions of the challenges in teaching and learning of mathematics in Grade 9 in Durban's Ethusini Circuit of KwaZulu-Natal Province?
- ii. What are the Grade 9 learners' perceptions of the challenges in mathematics performance in Durban's Ethusini Circuit of KwaZulu-Natal Province?
- iii. What are the interventions that could be implemented to address the identified areas of weakness that could be contributing towards Grade 9 learners' poor performance in mathematics in Durban's Ethusini Circuit of KwaZulu-Natal Province?

Five wide-ranging categories emerged as causes to poor learner performance in mathematics in Grade 9. These are: CAPS curriculum challenges, parental support,

English as a LoLT, methods of teaching, and learners' attitude towards mathematics. Although the categories are interrelated to some extent, they capture both the learners' and teachers' perceptions of the challenges experienced in the teaching and learning of mathematics. The categories were identified from the responses to the interview questions.

The researcher intended to convey the participants' perceptions, reflections, meanings and experiences correctly by using direct quotations in the findings as evidence. This is also in keeping with a phenomenographic approach where the different ways learners and teachers experience mathematical teaching and learning are captured.

The following codes were used to identify the participants and the schools that were involved in the study:

O – Private school B – Former Model C school

H – Ordinary government school

TO – Teacher at School O

TB – Teacher at School B

TH – Teacher at School H

HO – Mathematics HoD at School O

HB – Mathematics HoD at School B

L2O – Learner 2 at School O

L4B – Learner 4 at School B

L10H – Learner 10 at School H

## **4.2 DEMOGRAPHIC PROFILE OF PARTICIPANTS**

Fifty participants took part in the study. These were 45 learners from the three participating schools (15 from each school), three mathematics teachers and two

mathematics HoDs. The study did not include the mathematics Curriculum Adviser and one mathematics HoD, as indicated in the research design, due to their non-availability. The demographic profile of the participants consisted of the age range, gender, educational achievement and experience in the teaching of mathematics.

#### **4.2.1 Age range**

Most of the participants were in the age range of 14–16 years, 30–42 years and 42–65 years for learners, teachers and HoDs respectively.

#### **4.2.2 Gender**

From the group of learners, there were 23 girls and 22 boys; eight girls and seven boys from each school. The teacher participants comprised two males and one female, while the HoDs category was comprised of one female and one male.

#### **4.2.3 Educational achievement**

Three of the teachers and one HoD were qualified with a Bachelor of Education degree, while one of the HoDs was qualified with a Master's degree in education.

#### **4.2.4 Experience in the teaching of mathematics**

Based on the collected data during the semi-structured interviews, all teacher and HoD participants have between 4 and 27 years' experience in teaching mathematics.

The demographic profile reflects typical demographics at the schools.

### **4.3 Teachers' perceptions of the challenges in teaching and learning of mathematics in Grade 9 in Durban's Ethusini Circuit of KwaZulu-Natal Province**

Most of the teachers centred their conceptions of the challenges in teaching and learning of mathematics in Grade 9 in Durban's Ethusini Circuit of KwaZulu-Natal Province on two major categories, namely challenges in implementing the curriculum and parental support.

Although there were other categories that were mentioned only twice, the following categories were mentioned by most interviewed teachers and HoDs. The following results are from the interviews with teachers and HoDs at the three schools.

#### **4.3.1 Problems and issues in implementing the CAPS**

The findings of this study revealed that the current CAPS provides its own challenges. The breadth of the CAPS poses a challenge in terms of administering the curriculum and curriculum coverage. The challenges pertaining to the CAPS curriculum related to five interconnected parts of the curriculum, such as CAPS coverage and administration, advanced curriculum content, insufficient time to complete the CAPS curriculum, questioning style and language for standardised assessments, and gaps in learners' mathematical comprehension.

##### **4.3.1.1 CAPS coverage and administration**

During the individual semi-structured interviews, the teachers complained that the CAPS mathematics curriculum is fully loaded with advanced content that is above the age and grade level of the Grade 9 learners. All teachers further stated that the CAPS does not provide an opportunity for teachers to explain the content in detail to do revision or remedial work. Collected data from the three teachers at the three participating schools revealed that this situation resulted in teachers' rushing through the content and focusing on topics that will be taught in the next grade and on topics that are likely to be assessed. According to the teacher participants, the "completion" of the syllabus is not possible.

##### **4.3.1.2 Advanced curriculum content**

When asked if the reasoning level of the Grade 9 learners was at an appropriate level, TH compared his experience of mathematics of when he was in Grade 9 to his current experience of mathematics as a teacher as well as his perception of his learners' experience of the subject content. He remarked:

*"Eeehh, you see, uuum, I was a learner in Grade 9, that was in 1992, but standard 9 (Grade 11) mathematics by then is now taught in Grade 9, so by the reasoning level, I find mathematics to*

*be very challenging. Because, you see like, eeee, in Grade 9 those years when it comes to factorisation, common factors, the difference of two squares, was done in Grade 10, but now you see this new CAPS, they always add flesh and challenging flesh. So, for our kids, eehh, 14 years, 15 years, it's challenging."*

Similarly, in response to a question that required the mathematics HoDs to state their perception of the learners' attitude towards mathematics, HO attributed the challenging CAPS content to learners' unhappiness and negative attitude towards the subject. He further suggested that the content should be revised to the level of the Grade 9 learners. This is reflected in his remarks,

*"I feel that the challenging nature of CAPS creates an atmosphere of unhappiness, I feel that not everybody can do maths, the Department should consider the syllabus being more watered down, being acceptable to the average learner. And then, I mean, I am not saying that we mustn't have levels. We do have to have levels but most of the topics should be within the reach of an average child. And then you will find that maybe they will take the subject and will improve their results. Now because it's a challenge, they dislike it and they are unhappy and they don't perform."*

This was confirmed by TH who said:

*"Learners who find mathematics a challenge are unhappy and end up not liking the subject. Such learners do not try to put more effort into their work."*

These arguments are supported by Du Plessis's (2015:8) findings which showed that the CAPS level of content was too high for learners. Although this study confirms existing findings, it is important to determine if CAPS is still a challenge five years after its implementation.

Based on the participants' responses above, it may seem that the increasing demands of the CAPS and the desire for the teachers to keep up with the curriculum demands to the extent where teachers are overwhelmed by both the content and volume to cover has resulted in uninteresting, monotonous lessons that are limited to the subject content. The implication of this situation where both the teacher and the learner have lost the

appreciation of the teaching and learning process seems to have resulted in a state where teaching and learning have become an imposition.

Unsatisfactory and unhappy learning and teaching experiences of mathematics can be a contributory factor to poor learner performance in the subject. According to Quinn and Duckworth (2007:1), learners who have a high sense of well-being are more likely to perform better academically.

#### **4.3.1.3 Insufficient time to complete the CAPS curriculum**

In response to a question that required the participants to explain the adequacy of the time allocated to complete the Grade 9 mathematics CAPS prescribed syllabus, HB summed up the challenges of the CAPS curriculum in her remarks:

*“Whoooo! Never enough! They (Department of Basic Education) even know because they send a document at the end of each term that is called a tracker to track whether you have completed the syllabus; if not, what are your intervention methods? It is just impossible, because what the Department does, it prescribes like its prescribing pills (laughs). To tell you to do ratio and proportion in two days, it’s not possible. I am in a practical environment here, learners will come late, there will be bus strike one day, they will not be here and on that day, I will then not be able to complete just to give an exercise on the previous lesson. So, there are many factors, and eeh no one can prescribe because I am dealing with learners in a main stream in an inclusive classroom who understand at different levels. Even if I want to move on, one learner will say, uh but ma’am I still don’t understand, so what do I do in that case? And besides that factor, if you look at it (CAPS curriculum), it is just packed. It does not give a breather, it does not have that day when you come back from holiday when you say, today it is remedial work, because that’s what we do, when we come back from holiday, you give back their (learners) scripts and do remedial work, we fight, we shout at each other, when is that time in the curriculum? It’s not accommodated for, two days before the end of the term, they tell you common tests, it’s just teaching from day one, there is no gap for revision of that section it’s just teaching, teaching.”*

These views were echoed by TH in his response:

*“You find yourself galloping, because there are external examinations coming whose content*

*covers all topics. You don't do justice to important topics. This thing of giving the teachers external examinations when the teacher did not teach, it is wrong, that is why sometimes we find ourselves under pressure and galloping because we can't pitch up. In terms of content it's the CAPS curriculum is too much, it is indeed too much. Topics that are meant to be taught in one-week overlap to another week for another 3 to 4 days; hence, the teacher falls behind the schedule most of the times."*

In the same vein, TO's sentiments suggested that time allocated in the CAPS curriculum to complete the syllabus is impossible to fulfil and creates a gap in the learners' development. This is reflected in his views:

*"The CAPS document is a challenge in that in the fourth term especially, as it offers 9 week topics to teach when there are only 3 weeks of school as the other 6 to 7 weeks are used for exams. Learners miss out on what is supposed to be taught in the rest of the four weeks that are used for exams. This results into a gap as learners miss out on the 4-week content from Grade 1 to Grade 9 which catches up with them eventually."*

This opinion was shared with HO, who added that even with the extension of one hour thirty minutes contact sessions; the school timetable would not accommodate the number of hours prescribed for the CAPS mathematics curriculum.

Similarly, TO affirmed this argument in his remarks:

*"Due to the intensity of the curriculum, we are tempted to just push the syllabus because learners are expected to write common papers at the end of the term. Due to the fast pace at which the syllabus is covered, the learners are overwhelmed."*

The findings of the study are consistent with Makgato and Mji's (2006:1) as well as Green and Condy's (2016:7) research results, which revealed that a lack of time to complete the syllabus is one of the challenges experienced by teachers in the teaching and learning process of mathematics. This argument is also supported by revealed literature that showed that learners' poor performance in the ANAs may be due to the quantity and quality of mathematical content taught to learners, which is related to curriculum coverage (Makhubele & Kakoma 2014:62).

Due to the prescriptive nature and unfriendly timeframes of the CAPS, curriculum knowledge is transmitted and received by pupils for the purpose of reproduction during assessments. Education may therefore be perceived as a technical exercise where the curriculum content is always stated and decided by the government. The objectives are set, a plan is drawn up and applied and, finally, the outcomes are measured during assessments and examinations.

One significant result of the situation of the CAPS being too intense and fully packed with too much content to learn within a short period of time is that teachers use fewer methods that engage learners actively into the lesson. Teachers tend to quickly narrate the subject matter to the learners, with learners as passive recipients of information. This is evident in HB's comment:

*“Because of the amount of work to be covered, we rush through the topics and find ourselves sticking to the talk-and-chalk method just to complete the syllabus.”*

A study conducted by Cui and Zhou (2018:1) revealed that there is a positive correlation between learner engagement and learners' academic achievement. When asked which their preferred method of teaching was, teachers from all three schools said they often used the talk-and-chalk (lecture) and discussion methods for quick coverage of the syllabus. The teachers pointed out that due to insufficient time to cover the curriculum, it was difficult for them to use the methods that actively engage learners, as such methods were perceived to be time-consuming.

#### **4.3.2 Questioning style and language for standardised assessments**

During the individual semi-structured interviews, the teachers revealed that the Grade 9 learners battle to comprehend the standardised common test examination questions.

All teachers and HoDs at the three schools observed that the questioning style and the language used is very challenging to the age and grade level of the learners as well as the teachers themselves. This is indicated in TO's remarks:

*“There is level 1, 2, 3 and 4 questioning, but for level 3 and 4 you can really fail, even you as a teacher, you don’t just simply throw your eyes on a question and then say I am going to do it in class, no! You have to read it and do it at your own spare time because you might be surprised that in class doing the very same calculation whereby you did not practice it, you can’t do it, even you as a teacher it does somehow challenge you. They (learners) need a lot of listening, especially in the word problems, the level of questions that are asked are very challenging.”*

TO’s remarks may be perceived to be a reflection of poor content knowledge on the part of the teacher.

The Grade 9 mathematics teachers and HoDs’ responses corresponded with the learners’ responses as they were concerned with questioning style for external common tests as one of the challenges experienced by learners. However, the teacher participants had different reasons for learners’ high failure rate in external examinations.

TH observed that learners’ performance in internally set exams was better than their performance in external assessments. Based on TH’s response, learners’ perception that external examinations are difficult contributes to their low performance in externally set tests. This is reflected in his argument:

*“For instance, everything can be same; you take the very same external paper and say, it was written Sipho, now I am going to write Lindiwe, external paper it was R500.00 now I am going to write R550.00. You see, same style, same content but the performance is better for internal paper as compared to the external paper, then I fail to understand this. My suggestion is that we must not tell them (learners) that it’s an external paper, because even with the Grade 11 and Grade 12, same story.”*

According to Wills (2001:1), although lack of capability contributes to poor academic achievement, the quality of the test itself is another contributory factor to learners’ poor performance. Wills (2001:1) further states that most learners achieve poor results due to poorly constructed instructions and test questions.

The implication is that standardised common tests on their own cannot be a precise measure of the learners’ comprehension of mathematics. Wills (2001:1) declares that the

first aspect to consider when learners are performing poorly is the quality of the test itself. There should be clear, unambiguous instructions and questions that are free of confusing language and unfamiliar vocabulary.

The research findings suggest that external common test items are too difficult for the learners. Furthermore, learners have a “mental block” to external common tests. The teacher participants’ responses imply that externally set test questions are not always clearly formulated.

#### **4.3.3 Gaps in learners’ mathematical comprehension**

As shown above, mathematics teachers depicted the curriculum as one of the learners’ poor mathematics comprehension.

Their opinion was that learning gaps are partly caused by the inflexible nature of the CAPS that does not allow teachers to repeat the concepts even when learners have not grasped them. This view was widely shared by the participants in all the three schools.

When exploring the teachers’ perceptions of the learners’ reasoning level, all three teachers observed that learners reasoning varied depending on what was taught in previous grades. The lack of a solid background in mathematics is reflected in the following quotes:

*“The problem is that 80% of the learners cannot remember what was taught because there is no reinforcement in CAPS. I taught area and place value in Grade 8. When they (learners) got to Grade 9, it was almost like they have never seen this in their life. They sort of slept over that in Grade 8.” (HO)*

The teachers’ sentiments were corroborated by the learners’ arguments as indicated by Learner 1 School B (L1B) who was very precise in sharing her experience of the CAPS curriculum. She said:

*“New topics everyday can be very difficult to understand. Different examples everyday causes confusion. Monday you start a new topic; by Friday you will have forgotten what you learnt on*

*Monday because there is no time for you to first grasp the last topic before you can continue to the new topic. If you don't understand the past work and move to the next topic the following day which you also don't understand, you will have a backlog of work that you do not understand and that can result into discouragement."*

These findings are consistent with Du Plessis's (2015:8) conclusion that the CAPS curriculum "did not provide time to cover skipped topics and, as a result, uncontrolled circumstances, like teachers' and learners' absenteeism, led to gaps and some content not being mastered".

The research results indicate that a deficiency in one topic of mathematics generally creates challenges in the comprehension of other topics too, since all parts are linked. This implies that elementary mathematics operations such as addition, subtraction, multiplication and division, and pre-algebra skills that are taught at early childhood level and primary school level are essential to every section of the curriculum. They set building blocks for secondary and tertiary mathematics. Therefore, it is important for learners at primary level to develop all the skills they will need in Grade 9 and in further grades for them to perform better in mathematics.

The CDE (2014:15), which stresses that poor curriculum management creates a delay in learners' mathematical knowledge, is evident in this study. Mathematical knowledge starts at primary school and has substantial results for mathematics learning in high school. Teacher perceptions in this study are aligned with the CDE's (2014:15) conclusion that teachers' lack of time to re-teach concepts resulted in a widened gap between what learners should know and what they do know.

The mathematics CAPS portrays a spiral curriculum. A spiral curriculum is one where learners will visit the same topics each year of their school career. The topics increase in difficulty and intensity as they progress to higher grades. The Grade 9 mathematics CAPS content is based on five content areas throughout the school career, namely number, properties and operations, shape and space (geometry), measurement, data

handling and algebra. Trying to fit all five content areas into each grade, each year may result in a too full curriculum.

According to Grussendorff, Booyse and Burroughs (2014:46), a curriculum that tries to cover too much does so at the risk of losing depth of understanding.

#### **4.3.4 Learner attitudes**

Both teachers' and learners' responses suggested that the value that learners attach to mathematics is linked to the economic and financial gain that the learners perceive to be associated with the subject. This may be compared to a marketised curriculum. Posner (in Du Preez & Reddy 2014:58) defines curriculum in a marketised ideology as a production system consisting of a structured set of experiences aimed at pre-designed learning outcomes. Collected data demonstrated a marketised attitude towards the learning of mathematics.

During the individual semi-structured interviews, when asked if learners enjoyed mathematics, L5H remarked:

*"I learn mathematics 'coz I think it's the only key that will help me to go wherever I want to go to in my life and be what I wanna be when I grow up. I want to be a doctor."*

L2B echoed these sentiments in his comment:

*"I do not enjoy maths because I do not understand. I am doing it because of the profession I want to be."*

Similarly, when asked what their perception of their learners' attitude towards mathematics was, the teachers linked their learners' attitude towards mathematics to subject choice in Grade 10 and career preference. TB shared the following information:

*"The attitude of learners who decide to take mathematics in Grade 10 is perfect. Learners who opt for mathematics literacy in Grade 10 literally give up in Grade 9. They don't want to participate, they act like they are participating but when they write the test, they get 20%."*

These sentiments were substantiated by TH as indicated in his remarks:

*“We are battling! The negative attitude of our learners towards mathematics is at high levels. When it comes to subject grouping in Grade 10, 80% of learners who take commercial subjects have a negative attitude towards mathematics, whereas in a science class, the learners have a positive attitude towards mathematics. With the same teachers, learners in a science class perform better than learners in commercial classes; for example, 60% pass for science class and 15% pass for commercial class.”*

In the same vein, when asked if the Grade 9 learners attached value to mathematics, HB indicated that learners who want to take up professions that require mathematics attach value to the subject. This is reflected in her observation:

*“Learners who want to be engineers or doctors do very well because they know that they need mathematics and they need to love it. And those who attach value are the ones who put in more effort in their work and make time to seek for help where they do not understand.”*

The sentiments by both learner and teacher participants suggest that the learning of mathematics has become a process of production of results that are considered of value for existence and development. The findings of the study are supported by Du Preez and Reddy (2014:69), who declared that “teaching and learning in South Africa driven by market-related values has shifted educational relations to means and ends”.

The findings of this study substantiate Waghid’s (in Du Preez & Reddy 2014:69) declaration that “South African children have become consumed with the market-oriented ‘logic’ of learning”. This is demonstrated in the NCS Grades R–12 whose purposes include “providing learners with access to higher education, facilitating the transition of learners from education institutions to the workplace, and providing employers with a sufficient profile of a learner’s competences (Department of Basic Education 2011a:4)”.

#### **4.3.5 Parental support**

Parental engagement in their child’s education is essential for the learners’ performance. According to the Centre for Child Well-being (2012:1), parental involvement in the

learner's learning creates numerous opportunities for achievement as it develops a child's drive, attitude and educational attainment in all subjects and fosters improved behaviour and social adjustment.

Data collected from the teachers in all the three schools showed that parents rarely interact with the teachers to find out about their children's progress. The following three quotes led to this finding:

HB shared her experience in her remarks:

*“Eyi this is the most frustrating part in teaching and learning of mathematics. For me personally, I have perceived .... that a parent just thinks that the school is a gambling zone. Ummm, maybe I am too harsh on them or maybe they are too busy and they think that everything is under control, but I feel like learners are dumped. No one follows up, you can write in the maths book incomplete work, you can write a letter for the parents, please see me .... Whatever you write the message is never carried across. We do have days for reports picking up, and on those days, if I have a weak learner, I would say to the class teacher that please make sure that so and so's parents see me. You find that those parents will never come and see you. They will fetch their report and go home. And in terms of parental support, you get support from those parents of learners that you don't really need. [...] The ones that are doing well, the parents will always come. The ones that are not doing well, we struggle, sometimes even to get through the phone, you must make a follow-up, they don't buy textbooks. It's like a parent will come at the end of the year when they are overwhelmed themselves, they don't know what has happened, why the child has failed, but you have never seen them at school. Or maybe, they don't really understand that school is open for them to come any day to ask questions, to call, it's difficult in terms of support.”*

Similarly, TH commented:

*“Eeehh, unfortunately, yes, there are parents who would like to support, uhh but 95% of parents are not supportive. Eeehh, I used to do extra classes on weekend, I write the letters to parents, informing the parents, learners must be pushed to school, check homework, do this, do this, negative! Negative! Three years ago I started teaching extra lessons on weekends but this year I decided to stop, I am wasting my time, you come here at 9:00, you find only three to four learners*

*instead of 80. So it's a waste of time, it's a waste of petrol and everything, you see. You phone parents, you make them aware, you have parents, consultation meeting, no support!"*

Furthermore, TH compared his experience of parental support at an ordinary government school with parental support at an independent or former model C school. He remarked:

*"Eehhh, you see these so-called better schools, you find that if ... there is parents meeting, you find that about 90% of the parents will come to school, their parents are concerned about their children, their parents are able to take their children for private mathematics extra tuitions. They pay to ensure better marks for mathematics. My school here is in the same location but you will never find them, eehh, I do not know why, I do not know why. In my experience a learner who receives support from parents does very well."*

TH's observation was confirmed by collected data which revealed that eight of the ten learners at School O (a private school) said that their parents were involved in their school work, compared to three out of 10 and 5 out of ten at School H (an ordinary government school) and School B (a former model C) school respectively.

This argument was also confirmed by HO at School O in his sentiments:

*"There is a good support structure. The support fluctuates but parents are reminded of their responsibility; 80% cooperate."*

These results are consistent with Manilal's (2014: ii) research results that showed that parents from the privileged schools were more involved than parents from the underprivileged schools.

TO set out further reasons for the benefits of parental support:

*"The monitoring of the child's work at home ensures that the learners take responsibility of their own learning and do what is expected of them, thereby improving the mathematics results."*

These arguments were supported by HB when asked to give views of the influence that parental support would have on the learner's performance. She observed:

*“Yoooh a lot, we would get an overwhelming positive response from the learners, if parents can just know, even if they don’t understand the content itself, if they can just know that learners get homework every day. If parents can just know that learners must be at school every day for maths because every lesson is a build-up from the previous lesson. If parents can just know when is the child given an assignment and when is it due, when is the child given a test, a formal test and when is it due. If parents can just know what extra support in terms of material, if they can afford buying their child, instead of giving them all the material gadgets they give them it will help a lot.”*

Perhaps parents have poor educational background themselves due to past inequalities and marginalisation; this may make them hesitant to engage in their children’s education. Based on TH’s response, it may be essential to enlighten the parents on the importance of parental engagement and offer them opportunities for parental engagement in ordinary government schools, specifically schools where the socio-economic status of parents is low. This requires a school management that can bring about effective school/parent/community partnership.

The research results suggest that parental engagement is a significant element in learners’ improved performance in mathematics. This conclusion is supported by Topor et al. (2011:183). Makgato and Mji’s (2006:261) research also indicated that children whose parents are more involved in their education have higher levels of academic achievement than children whose parents are less involved.

#### **4.3.6 English as a language of learning and teaching**

Differing from the learners’ views of English as a LoLT, the teachers indicated that there was little difference between mathematics performance of learners whose home language is the LoLT; and learners whose home language is different from the LoLT. The teachers affirmed that what was important was the learners’ understanding of the basic concepts in mathematics. The following excerpts from the teachers at the three schools put this finding into perspective. TB observed:

*“I feel maths is a universal language because in my class there are some learners whose English is not like impeccable, but their maths is outstanding .... and they do better than learners who*

*... speak English at home. As long as they understand what you are writing on the board, ... the times, divide and plus, then there is no problem unless their language ability is very very bad, like they don't understand a word of English, then they won't understand entirely but they will still pick up a few things from here, ask a friend next door ... but yeah, no problem."*

These arguments were substantiated by HB who observed that mathematics has its own terminology and definitions reflected in his comment:

*"For instance, mathematics has its own language, the term appreciation value in mathematical terms means the value is increasing; when it comes to English, to appreciate is to cheer someone or to be grateful, so I don't think language is a problem in mathematics, no, whether isiZulu or what no problem."*

TO suggested that the language barrier only compounded the problem of comprehending mathematics when the learner's mathematical ability was weak. She shared her experience of a learner whose home language was different from the LoLT:

*"It won't be like a rule, because in my class, I have got a learner from India, right! And her home language is Urdu, I think, and she only joined the school this year. But I find... because of her ability in maths, she is able to cope with the language barrier. For learners who already have a problem in maths, the language barrier compounds the problem."*

Although the findings of this study may seem to contradict the reviewed literature (Mji 2006:262; Zenex Foundations 2007:10–11; Ramohapi et al. 2015:445; Howie 2003:14) that revealed that English as a LoLT was a contributory factor to poor learner performance, the findings of this study show that teachers perceive poor language skills in the LoLT lead to frustration and disorientation for both the teacher and the learner. The previous studies' reasons suggest that given a situation where learners have developed language skills in the LoLT, the LoLT may not be a major challenge even with learners whose home language is different from the LoLT. Teachers themselves may not fully understand the effect the LoLT may have on learning mathematics.

#### **4.4 Grade 9 learners' views of the challenges in comprehending mathematics in Durban's Ethusini Circuit of KwaZulu-Natal Province**

Most of the Grade 9 learners taking part in this study based their views of the challenges in comprehending mathematics on: CAPS curriculum management and implementation, parental support, English as a LoLT, methods of teaching, and learners' attitude towards mathematics. The following list was constructed by coding learner responses and categorising the responses according to themes. The following themes emanated.

##### **4.4.1 Difficulties with the CAPS curriculum**

Corresponding with the data collected from the teachers and HoDs, the evidence of difficulties with the management and implementation of the CAPS curriculum was observed in the following learners' responses.

Corresponding with teachers' responses, all learners at the three schools complained that the CAPS curriculum does not provide an opportunity for learners to obtain a comprehensive understanding of mathematics. L3H commented:

*"Eeee ma'am, we are not able to ask questions even when we do not understand because, uhhh, we can see that the teacher is rushing because he wants to cover the syllabus."*

L5O confirmed the teachers' opinion that learning gaps are partly caused by learners' not being able to remember previous work. This is reflected in his remarks:

*"Ummm, it goes very fast, in the sense that every day is a new topic, so there is no enough chance to really... ahh if you are not a person who can absorb immediately you are at an immediate disadvantage. Coz it's not jalled in your head and some people need that. Some people need to be told over and over and over for them to understand. Some things just need to be repeated. Because if you do a new topic every day, then at the end of the week you have four new topics and then at the end if you ask me something I am not going to remember. So the idea of a recap session at the end of the week is a good idea because that can refresh your memory."*

L2H also attributed his poor performance in mathematics to the fast pace of teaching. He pointed out:

*“I am struggling with maths because there is no time to catch up in the lesson to spare for slow learners, you will have to find your own spare time to catch up with other learners and only once in a while will the teacher find time to revise the lesson with you, so I feel that has dropped my mark a lot. Maths topics are linked; if you miss out on one topic you may not be able to understand on the other topic in the next grade.”*

L8O echoed these opinions in her suggestion of the CAPS curriculum as a challenge. She posited:

*“So I feel like if she (teacher) does one section over like for two or three days, then everyone who did not understand on the first day can maybe understand on the second day and she can may be extend like all the examples that she gives, more examples to practise on. The teacher explains really well but she also moves too fast.”*

These results correspond with those obtained by Makgato and Mji (2006:1) and Green and Condy (2016:7).

The above arguments suggest that the CAPS offers plentiful content with limited opportunities for conceptual understanding.

It is possible that the implication of this situation set out in this study, where both the teachers and learners find the curriculum too full and the subject content challenging, has defeated the meaning of successful teaching and learning experiences. Based on the participants’ responses, it seems that the expansive curriculum and resulting pace of teaching and learning in Grade 9 has become an imposition to both teachers and learners. Furthermore, the researcher suggests that this contributes to the perception that teaching and learning mathematics is a process of preparing for examinations and providing a gateway for the learners’ choice of careers without real understanding being required.

#### **4.4.2 Questioning style and language for external common tests**

Corresponding with the teachers’ responses, the majority of the learners from all the three schools linked the learners’ poor performance in mathematics to the advanced level of questioning in the external standardised common tests. Most of the participants said that

the Department of Basic Education's common tests present very difficult questions that learners are not familiar with, which results in their poor performance. This is reflected in the learners' perceptions of the external common tests. L2B remarked:

*"When it comes to external exams, you will read the question three times and you will be like heee ... like you don't understand what is being said. You read it and you are just confused. The level of English is just too high. Once you are doing corrections with the teacher you are like, waw that's what they were saying! They couldn't just say it like this!"*

L5H observed:

*"Ma'am, you get taught a certain thing but when it comes to exams it's a different thing, like the way they question, using different words."*

These views were shared with L1H, who did not understand why there was a high failure rate for external examinations. He commented:

*"I don't understand, ma'am, we are failing the government paper but our teacher is following the portfolio, we don't understand because it's all new to us and we all blank coz we don't understand that's why we fail."*

The findings of this study seem to agree with Zimmerman's (2014:1) conclusion that the results of external assessments are an indication of the learners' immense challenges in literacy development faced by South African learners.

The research results of this study suggest that the examiner's understanding of the questions may be different from the learners' comprehension of the questions. Questions that seem clear to the examiner can be ambiguous or confusing to learners. The findings also suggest that the language used in examinations may not be compatible with learners' understanding of the concepts.

When learners are unable to make sense of a question in the examination, they are unlikely to answer the question correctly. Assessing how learners decoded ambiguous questions can assist an examiner in establishing if the question was ambiguous or

confusing or if the learners' knowledge of the topic is insufficient. This will help the examiner to understand how to review and adjust the questions.

#### **4.4.3 Learning styles and pace of learning**

Although the CAPS provides instruction on differentiated learning through its "*Guidelines for responding to learner diversity in the classroom through the Curriculum and Assessment Policy statements*", one of the concerns raised during the focus group and semi-structured interviews is that the CAPS is too time-focused. It is precise on how and when the topics should be taught.

Collected data revealed that due to the CAPS' time prescription and overload of work to be covered within a specified period of time, the teachers do not have an opportunity to cater for every learner as an individual. If learners encounter challenges with comprehending concepts, teachers just proceed with the next topic as there is no time to slow down and allow learners to comprehend the work. The way out of this situation and to ensure the coverage of the curriculum is that teachers have to offer extra lessons outside contact hours, or request learners to attend private extra lessons.

While school-based intervention measures that were put in place (such as offering of extra lessons) could make a difference in learners' understanding of mathematics and consequently improve learners' performance in mathematics, collected data revealed that these intervention measures were a challenge to implement. The teachers from the three schools had differing views pertaining to the reasons for this. These include learners' lack of commitment, lack of parental support, difference in the methods used by parents and extra lessons tutors, which causes confusion in the learners' understanding.

When exploring the learners' experiences of a typical mathematics lesson, L2B said:

*"A typical mathematics lesson is when teacher gives us knowledge and then for us children to comprehend the knowledge."*

These sentiments reflect direct instruction only. L3B was of the opinion that a typical mathematics lesson should be one where the teacher takes into consideration the different needs of each learner to ensure assured learning for every learner.

L5O shared his experience:

*“Like she (teacher) asks all the questions to the smart learners, so how will she know that some learners do not understand?”*

These sentiments suggest that in a typical mathematics lesson, the teacher ignores the weaker learners. This may perhaps be due to the inadequacy of time as indicated in the findings of the overload of the CAPS.

L1B recommended:

*“One-on-one lessons could assist to improve the results because there are no distractions, for learners to perform better in the subject as mathematics, it requires focus.”*

These findings are consistent with Du Plessis and Marais’s (2015:8) research results that revealed that there is no leeway for the individual learning styles of the learners in the CAPS curriculum. Correspondingly, the research results of this study substantiate the reviewed literature by Makhubele and Kakoma (2014:64), whose findings indicate that learners complained about the quick pace at which teachers taught the topics to cover the curriculum. This resulted in learners not understanding the topics, which led to learners having a negative attitude towards the subject.

Although easy to use and seemingly simple to implement, there are some drawbacks to using a standardised curriculum like the CAPS. It is likely that the CAPS’ prescriptive nature, curriculum overload and limited time to complete the syllabus limits the teachers’ classroom freedom. It therefore becomes more difficult for teachers to effectively plan for and respond to individual learners’ needs.

#### 4.4.4 Parental support

##### 4.4.4.1 Absence of parental engagement in their children's education

Similar to the teachers' responses, a number of learners revealed that their parents were not engaged in their schoolwork. They stated that their parents' involvement was primarily limited to attending parent/teacher consultation meetings during the collection of the end-of-term results and encouraging learners to work hard. Parental support also varied from school to school.

During the focus group interviews, three out of ten learners at School H (government), 5 out of ten learners at School B (previous model C) and nine out of ten learners at School O (private) indicated that their parents were involved in their school work. L8O remarked:

*“Ummm, support, I think there is two ways you need to get it. Parents can motivate you and say, 'I believe in you; you can do well' and they give you a sense of 'I can do this', you know. But also, that's not all they should be doing because if you are failing the subject and if you are not good as they would like you to be, the first step is motivation. The second step is they must also take the time and the effort; they put in that effort and make sure that you complete your homework and you do extra examples and you are working. They can tell you, 'I believe in you and I know you are not gonna fail the next test but if they don't make sure that you do extra work on your own and assist you where you are lacking, you will fail the test because just believing is not enough, you have to work.”*

The findings from both teachers and learners indicated that the engagement in the form of assistance with school work from parents was lacking, as indicated in Table 4.1.

**Table 4.1: Parental assistance with homework**

<b>School</b>	<b>Out of ten learners</b>
B (previous model C school)	2
O (private)	3
H (government)	0

Many learners pointed out that they did not receive assistance from their parents for the following reasons: working parents with busy schedules, which results in some learners' living with grandparents and siblings, insufficient knowledge of mathematics and low levels of education. These findings are substantiated in the reviewed literature (Manilal 2014: ii; Legotlo, Maaga, Sebogo, Westhuizen, Mosoge, Nieuwoudt and Steyn 2002:114; Makgato & Mji 2006:261; Spaull 2013; CDE 2001; Makhubele & Kakoma 2014; Tachie & Chireshe 2013; Department of Basic Education 2014; Crouch and Mabogoane in CDE 2001; CDE 2014).

Most of the learners suggested that parental engagement depended on parents' educational background in mathematics and the economic status of the parents. The inequalities of the past education system still have a bearing today.

#### **4.4.4.2 Parents education background in mathematics**

Collected data indicated that parents with low levels of education may not be able to intervene in their children's education. This is evidenced in the following four quotes:

L3H remarked:

*"Truly speaking is that ... ahh ... I am like the only person that helps myself at home, who has to work hard, because ahh my mum, she doesn't know maths. So, I teach myself mathematics."*

L6B also stated:

*“I do not receive support at home, no one knows maths, so that’s why I wanted to be the first one to do maths and go to physics in Grade 10.”*

When exploring the influence that the home environment has on mathematics achievement, L2B remarked:

*“If you are surrounded by people who do not know maths, you will not be able to receive help. You end up giving up hope because you will be like at school you don’t understand, at home there is no help, so you will be like maybe there is no use of maths anyway. So you just give up right there and then, you are like, I am done with maths. Once you have put your mindset to like I don’t know maths, it stays there, until somebody changes it for you because you see it in a different way, because maths is like a mind game.”*

Contrary to most of the learners’ experiences of parental support, L4O was one of the few learners who indicated that he received full support from his parents. He remarked:

*“If you have parents who understand maths, they will help you and make sure that you understand. We had a very bad maths teacher last year, so I got most of my maths mark from my mother. On the other hand, if you have challenges, they may not understand you and may put a lot of pressure on you, which may result into poor results.”*

These findings are substantiated by Legotlo et al. (2002:114) and Makgato and Mji (2006:261), who indicated that low levels of parents’ education were a contributory factor to parents’ lack of involvement in their children’s education.

The research results also indicated that some parents may themselves not be interested in subjects that are perceived to be difficult, like mathematics, due to their own school background. Such parents may transfer their negative attitude towards the subject to their children. Based on the participants’ feedback, such parents settle for less and are satisfied with their children’s poor mathematics achievement, as evidenced in L10H’s comment:

*“If you have a parent who says, when I was at school, I hated maths, obviously you also gonna hate maths.”*

#### **4.4.4.3 Socio-economic background of the learners**

The findings of this study suggested that the socio-economic background of the learners may have both a positive and a negative influence on the learners’ academic performance generally. This is reflected in the following four quotes:

L1B shared her experience:

*“I come from a poor family, and you ask for help, my mother will be like, how is maths going to help you out of this situation? The only thing we need is money, and then you end up giving up hope and you will be like, maybe she is right, maybe I need to quit school and go and look for a job and forget about maths.”*

On the contrary, L4B was of a different opinion in his remarks:

*“If parents are poor, they will support you with your school work because they don’t want you to end up like them.”*

L3O observed:

*“If you come from a rich family, you say I don’t need to pay attention in the class, my parents have money, I have everything I need.”*

L9O shared:

*“The home environment may not have an impact on you, it depends on you; if one wants to do something, you can still do it.”*

The findings of the study suggest that the behaviour of the parents towards their children’s schoolwork tends to be modelled by their children. Learners are likely to realise the value of education by emulating their parents’ conduct towards their schoolwork, as indicated by L1B. When learners see an integrated approach to their schoolwork between their

parents, themselves and their school and teachers, they are more likely to comprehend the significance of their education.

The collected data imply that although parents with high socio-economic status are normally successful in getting their children ready for school due to the availability of numerous resources that can promote learning, the success of the child also depends on the learner themselves and the kind of support offered by parents. The implication is that the stereotypical belief that the low socio-economic background of the parents may be a factor on its own to poor learner performance is brought into question. Other factors such as intrinsic motivation may boost the academic performance of the learner as indicated by L9O.

#### **4.4.4.4 Pressure from parents**

The findings of the study revealed that many of the learners could not handle the pressure from their parents. The perception of parental pressure on their children was significantly more among the former model C school and the private school learners.

Collected data indicated that the majority of the learners experienced pressure that resulted in unhappiness due to the anxiety of not being able to meet their parents' requirements. Based on the learners' responses, pressure from parents can be detrimental to learners' performance. The following statements from the learners support the researcher's argument.

L8B suggested that the perception of parents that the only professions that exist are those that require mathematics, such as doctor, engineer or pilot, contributes to their over emphasis on the subject. She remarked:

*"I have a friend that her father only focuses on her maths, like she would get 90 or 80s for everything else and then she will get 70 for maths. They will ground her for a month just because of that."*

It would seem that there is a great deal of pressure to succeed in mathematics at Grade 9 level. Parents and learners come to a realisation that the choice of one's field of study

at higher education is linked to the subject choices in Grade 10. Some fields like pure sciences and engineering require one to have passed mathematics.

The following excerpts from the learners' responses suggest that parents may not discern when they are being supportive, stressful or demanding.

L10B observed:

*"I feel like our parents do not understand, they just say like, we are paying school fees and we are sending you to school, there is no distractions, you are gonna learn and come back you know everything, that is how they think. I feel that parents should understand us, there are so many things going on around us, there are so many things we go through. We can't just go through life as a breeze especially at this time and age. One of the reasons we don't do well is that first of all, you have school, the pressure will be at school, at home you've got pressure, you've got your own pressure, your friend, your family, the whole environment is just clogging up on you and its bringing you into one space, that pushes people's marks really low. You try your best and your parents say you have disappointed me, it hurts when your parents do that."*

L4H added:

*"Sometimes you feel like parents are not part of the support system because you feel like they are actually fighting you."*

L1H pointed out that parental pressure resulted into one comparing oneself with high-performing learners. She remarked:

*"Sometimes you think that what will my parents say if I was doing like her and you push yourself too hard and then you end up failing. You wish to be another learner."*

L4B added:

*"When you start focusing on others, it makes it worse, you don't work at your full potential because you just want to please others."*

Based on the learners' responses, pressure originated from parents' lack of understanding of their children's capability in mathematics and the lack of belief that mathematics is a difficult subject. This is depicted in L4H's remarks:

*"When your parents are pushing you too hard and cannot let you choose for yourself. When your parents are controlling you and they tell you, no go to pure maths, but at the same time you know that you cannot cope with pure maths. They make your life difficult. It's their right to look after you, guide you, but at the same time, choosing subjects, they don't understand. You see my mom wants me to take physics next year when my maths results are poor. By the way, my father is right in maths, he is right in this, he is asking me, when are you passing maths? What's going on with your maths? Parents, they make you more furious with yourself; they are not patient, I could say that."*

L8O perceived pressure as being both good and bad. He pointed out that pressure also arose from siblings' good performance in mathematics. She put it this way:

*"Even if parents don't say it loud, you know you have to get an A in maths in matric because your brother got very good matric results in maths. Pressure can be good in the sense that I am going to achieve this and I am going to put in time and I am gonna put in more effort and I am going to achieve. But it can be also bad in that if you can't grasp something; your self-esteem is affected quite badly and that affects not just maths but also other subjects because you just now don't care because it's not just happening for you. Parents need to understand when you don't understand."*

The findings of this study are consistent with Sangma, Shantibala, Akoijam, Maisnam, Visi and Vanlaldusaki (2018:74) and Makgato and Mji (2006:261) whose research results concluded that learners who received too much pressure from parents were demotivated and experienced depression due to pressure.

The findings of the study suggest that too much pressure from parents on their learners to succeed may result in unhappy learners who feel threatened. Consequently, this may lead to dampened motivation to give of their best and may also lead to mathematics anxiety. Ramohapi et al. (2015:445) support these findings.

Based on the learners' responses, mathematics anxiety can be a factor to negative perceptions and may cause learners to engage in bad behaviour such as cheating in the examinations or the copying of homework just to ensure better results. This may subsequently lead to absence of learning.

#### **4.4.5 English as a language of learning and teaching**

The research results indicated that the effects of home language of a learner and the LoLT at school were inclusive. All subjects at the three schools were taught in English while isiZulu was taught as a separate subject. Although 100% of the learners at schools B and H are Africans, of which 80% are isiZulu home language speakers, they are taught in English. The majority of the learners at schools B and H whose home language is different from the LoLT (largely Zulu speakers) preferred to be taught mathematics in English. Learners had different opinions on the effect that English as a LoLT has on mathematics performance.

Learners at schools B and H whose home language was mostly isiZulu indicated that it was easier to understand mathematics when taught in English. When asked how the teaching of mathematics in their home language would contribute to the learners' understanding of mathematics, the participants indicated that the use of their home language, for example isiZulu, would negatively affect their understanding of mathematics.

L2H observed:

*"It would be hard to learn maths in isiZulu because some words are difficult in Zulu. It's much more understandable and explainable in English."*

The learners' responses at schools B and H also indicated that the influence that the teaching and learning of mathematics in their home language would have on their performance in the subject would depend on the language proficiency of the learner in the LoLT.

This finding is reflected in the remarks of L1B who said:

*“For some of the learners who are not good in English, it would be helpful if it (mathematics) is taught in Zulu. Like in our class, there are a few learners who do not understand English and when we explain it in Zulu they understand; so for those certain kids, they do understand in Zulu.”*

This argument was substantiated by L3H who shared his past experience of English as a LoLT. He put it this way:

*“When I came to this school in Grade 8, I was not good in English. Due to my lacking in English, I was not able to understand or comprehend what the question is asking and when that happens, one panics and then makes mistakes.”*

English second language learners at schools B and H did not seem to have a problem with English as a LoLT. This is perhaps because these learners are competent in English despite it being a second language for them. Dorasamy’s (2012:1) findings suggested that English as a LoLT on its own did not have an effect on English second language learners’ academic performance. Instead, it influenced the effectiveness of the use of the language and other issues outside English as a medium of instruction. On the contrary, Makagato and Mji’s (2006:261) research results concluded that the language of instruction on its own was generally a problem. This contradiction may be due to the relationship between English language efficiency and the learning and teaching of mathematics of which the situation could have been different for both studies.

Likewise, the findings of the study seem to contradict those obtained by Albakri (2017:2), which revealed that the use of the indigenous language as a LoLT would lead to more comprehension of the subject matter and possibly lead to better results. On the other hand, Albakri’s conclusion supports the results of this study that the participants in his study acknowledged difficulties in their schoolwork due to their insufficient language competence in English. Further research is needed in this area.

The above arguments imply that English as a LoLT should be augmented to support successful and valuable teaching and learning in mathematics. This argument is supported by L7B, who suggested that mathematics and English cannot be separated as indicated in her comment:

*“English and maths go hand in hand; if we are strong in English, then obviously we will be strong in other subjects because English we use it to teach, we use it to learn, so if you are able to read and understand what it means and you are able to explain something in English, it surely shows that you can be good at maths, so if we want to improve maths, we should try focusing first on English and maths together as a package.”*

#### **4.4.6 Methods of teaching mathematics**

Collected data suggested that the learners perceived that part of their difficulty in understanding mathematics is based on some of the teaching methods used. During individual and semi-structured interviews, all learners at the three schools pointed out that their teachers used the talk-and-chalk method most of the time.

Based on the responses received from the learners, using the same method all the time led to boring lessons, which resulted in unproductive teaching and learning. When asked which method would contribute to the comprehension of mathematics, a number of the learners pointed out that a method that allows learners to actively participate in the learning process and provides an opportunity for recap of previous lessons would be effective in the teaching and learning of mathematics. The following three quotes led to this finding. L4O suggested:

*“I feel like we do not want to do mathematics because of the same method every time, no repeat. I feel the lessons should be different. Instead of just standing in front of the board and explaining the sections, worksheets, they should do something different like for geometry, the stuff is all around us like parallel lines like the walls, may be they can take us outdoors and show us the stuff, like triangles. They can do so many different things or make us bring things to class, or be creative. I feel like a lot of girls in the class are more creative but they kind of sit in the class and look at the board. Maybe she (teacher) should have like groups and give them different activities and go to the individual groups and not stand in front of the board.”*

L2B echoed these sentiments in his remarks:

*“I think interaction is very important, I think that you can't just stand there and deliver a speech. You have to ask questions, you have to make sure that they understand, you have to engage the*

*class. Yeah you have to make it fun, you can't always be work, work, work. You have to make it positive for the learners so that they look forward to that optimistic that they can do well in future."*

L5H linked the method of teaching to qualities of a good mathematics teacher:

*"I feel like the teacher has to be happy, not just that I am just doing my job, a teacher must be patient and ensure that every learner understands because if she doesn't, it's her job to extend the teaching, take learners who do not understand on the side and repeat the lesson. Get somebody else to explain if they still don't understand because it may be your method that they (learners) don't understand."*

The findings of this study correspond with previous studies (Makgato & Mji 2006:260; Tachie & Chireshe 2013:69; Makhubele & Kakoma 2014, Mbugua et al. 2012:88–89; Nyaumwe, Bappoo, Buzuzi & Kasiyandima 2004:33; Sa'ad et al. 2014:32; Avong 2013:321; Chirume & Chikasha 2014:201), that showed that poor teaching methods and teachers' lack of patience in teaching mathematics contributed to poor learner performance in the subject. The following learners' responses put this into context. When asked how the relationship with their teachers influenced their mathematics performance, L5O commented:

*"Some teachers are not patient, they get angry when you ask something several times, so you feel discouraged to ask questions and when you do not understand you end up not liking mathematics".*

L2B substantiated this argument in her remarks:

*"When you ask a question they say, you weren't listening, but you were listening. The teacher won't even bother to explain it more and the kid will be scared, and you can't wait to leave the classroom."*

L10H added:

*"I feel that if a learner feels that the teacher does not care about him, he will also not care and will not even ask questions even when he doesn't understand."*

The learners' responses imply that the methods that mathematics teachers implement in the teaching of mathematics have a bearing on the learners' comprehension of the subject and consequently their performance in mathematics. Collected data suggested that methods actively engage learners in the teaching and learning process will be beneficial. Munyaradzi (2013:1) supported this argument, concluding that a teacher-student interactive method was the most effective teaching method.

On the other hand, the use of the same method, talk-and-chalk, almost all the time may be attributed to the inflexible CAPS curriculum and inadequate time to complete the syllabus, which results in a rush-through of the lessons as indicated by TH, TO and TB. This argument corresponds with Green and Condi's (2016:7) research results that showed that time constraints in the implementation of the CAPS curriculum did not allow for active and critical learning.

According to Hudson-Ross and McWhorter (1996:46–54), the lack of new approaches to teaching and learning that relate to educational needs of the learners may lead to many learners' performing poorly and may be a contributing factor to learners' quitting of studies.

#### **4.4.7 Learners' attitude towards mathematics**

Collected data suggested that learners' attitude with regard to mathematics is essential in the teaching and learning of the subject. The results of the study revealed that learners' relationships with the teachers, and learners' lack of commitment and dedication contributed to the formation of their attitude towards mathematics.

##### **4.4.7.1 Relationship with teachers**

When asked how the relationship between the learners and their teachers influence the learners' mathematics performance, the majority of the learners in all the three schools had similar views, which indicated that there is a noteworthy link between the learners' relationship with the teacher and the learners' mathematics performance. Most of the

learners' answers referred to their past or present experiences of their relationship with their mathematics teachers.

L10B declared that the learners' relationship with the teacher has a positive influence on the learners' mathematics performance as indicated in his comment:

*"Sometimes children have this mentality, if they think this teacher doesn't like me, because he doesn't like me, I won't do his work, or sometimes you feel like he focuses on somebody else and he doesn't focus on me I am not gonna do his work. We always think like that. Like I do say that sometimes. I know that teachers have little time but they should try and say that today, I am gonna speak to this learner, today it's this learner, and this learner, I feel that children should feel that my teacher is my friend with respect though, my teacher is my parent, I am able to speak to this person and this person will help me. If the child does not have a relationship with the teacher, obviously the child will be like why should I do that, this teacher never likes me, he is always shouting at me, he will be like I am not gonna do this, there is no need for me to do it."*

These sentiments were echoed by L7H in her observation:

*"If the teacher has a negative attitude towards you, you also develop a negative attitude towards mathematics and vice versa."*

L5B linked poor learner relationship between learners and teachers to learners' lack of motivation to give of their best. He shared his experience:

*"Our teacher always encourages us to do better. And you know... if you get your marks and they are not looking good, he tells us that, you know what, you can do better and you can still change that (marks). And that makes you feel good that your teacher actually believes in you and it helps you want to do better so that you can make him proud."*

Other learners at the same school, who associated good learner-to-teacher relationships with positive reinforcement and further stated that positive reinforcement from the teacher contributes to better results generally, supported this view.

Correspondingly, L6O remarked:

*“My teacher’s attitude is good. She will always encourage you. I feel like if the teacher is constantly screaming at you and shouting at you, then... you actually don’t wanna do what she says, you don’t wanna listen to her, you will be like, you know what I don’t care. She doesn’t treat me like... why should I bother in her class? You obviously, you gonna find it hard to confront her about things, like you know what, ma’am, I don’t understand because you feel like she is gonna scream at you more. So to avoid all that screaming and shouting, you just gonna leave it and carry on when you don’t even understand your work.”*

L9B commented:

*“Some of us are sensitive and we will take it in a bad way. Just because your teacher told you that you gonna fail, that stays in your mind, oh my teacher said I will fail so let me not do it anyway.”*

These findings are in line with reviewed literature (Mensah, Okyere & Kuranchie 2013:132; Mbugua et al. 2012:88–89; Avong 2013:322; Chirume & Chikasha 2014: 201) where it was concluded that teachers’ positive attitude produced self-assurance in learners. This resulted in confidence and a positive attitude towards the learning of mathematics. The learners’ responses are in line with the supposition by Okyere et al. (2013:132) that “positive reinforcement creates room for the formation of positive attitude for mathematics”.

Contrary to this view, L4H and a few other learners were of the opinion that the relationship between the teacher and the learner has no impact on the learner’s performance, as indicated in L4H’s quote:

*“It will go by what you want. If you really want to pass, you will just ignore the teacher, carry on with your work and just be yourself, yeah.”*

This argument contradicts the conclusion by Mensah et al. (2013:132). Perhaps this is because the learners considered other variables that affect the learning of mathematics as more significant than the teacher-learner relationship. Although the relationship between the teacher and learners plays a major role in the academic achievement of the learners, the effect thereof may depend on the affected learner.

Nevertheless, the research results imply that it is essential for a teacher to create a learning environment that promotes healthy relationships with learners to ensure quality teaching and learning.

The conclusions of this study are consistent with several other research results (Spaull 2013; CDE 2001; Ramohapi, Maimane & Rankhumise 2015; Makhubele & Kakoma 2014; Tachie & Chireshe 2013:70; Mbugua et al. 2012:88–89; Sa’ad et al 2014:32; Chirume & Chikasha 2014:194; Avong 2013:321; Mwenda et al. 2013).

#### **4.4.7.2 Learners’ commitment and dedication**

Interestingly, the learners linked their own lack of commitment and dedication to their poor performance in mathematics. This finding is reflected in the following quotes.

L3H observed:

*“Some learners do not pay attention when the teacher is teaching. They talk, do their own stuff, come late to school, do not do their homework and do not care about what is going on in the classroom then they point fingers to the teacher and say that the teacher does not know how to teach and yet the problem is with them.”*

This was echoed by L5B who commented:

*“The problem with children of our age, ma’am, is that they go home, ma’am, they just sit, watch TV, just chilling and forget about school work, when maths is an everyday thing and maths is the most difficult subject where you have to practise every time and do nothing. That’s why maths is not going anywhere. The mindset you put in maths determines the marks you get.”*

L8B confirmed that learners’ difficulties in comprehending mathematics arose from the learners’ lack of commitment and dedication. This is reflected in her remarks:

*“We know that we play around at primary school and when we are at high school that’s when we start paying attention, so what I am saying is that it doesn’t start here but it starts from the lower level grades going up.”*

These comments are in contrast to Makgato and Mji's (2006:260), results that learners did not seem to acknowledge any weaknesses from their side but assigned their poor performance to other factors like the lack of learning resources and teachers' lack of motivation to learners. On the other hand, teachers in the same study highlighted the challenge of learners' commitment to their schoolwork.

Ascribing lack of learners' commitment and dedication to challenges experienced by both teachers and learners in the teaching and learning of mathematics is not unique to this study. The results are supported by several research findings in South Africa and internationally, as indicated in the reviewed literature (Spaull 2013; CDE 2001; Ramohapi, Maimane & Rankhumise 2015; Makhubele & Kakoma 2014; Tachie & Chireshe 2013:70; Mbugua et al. 2012:88–89; Sa'ad et al. 2014:32; Chirume & Chikasha 2014:194; Avong 2013:321; Mwenda et al. 2013).

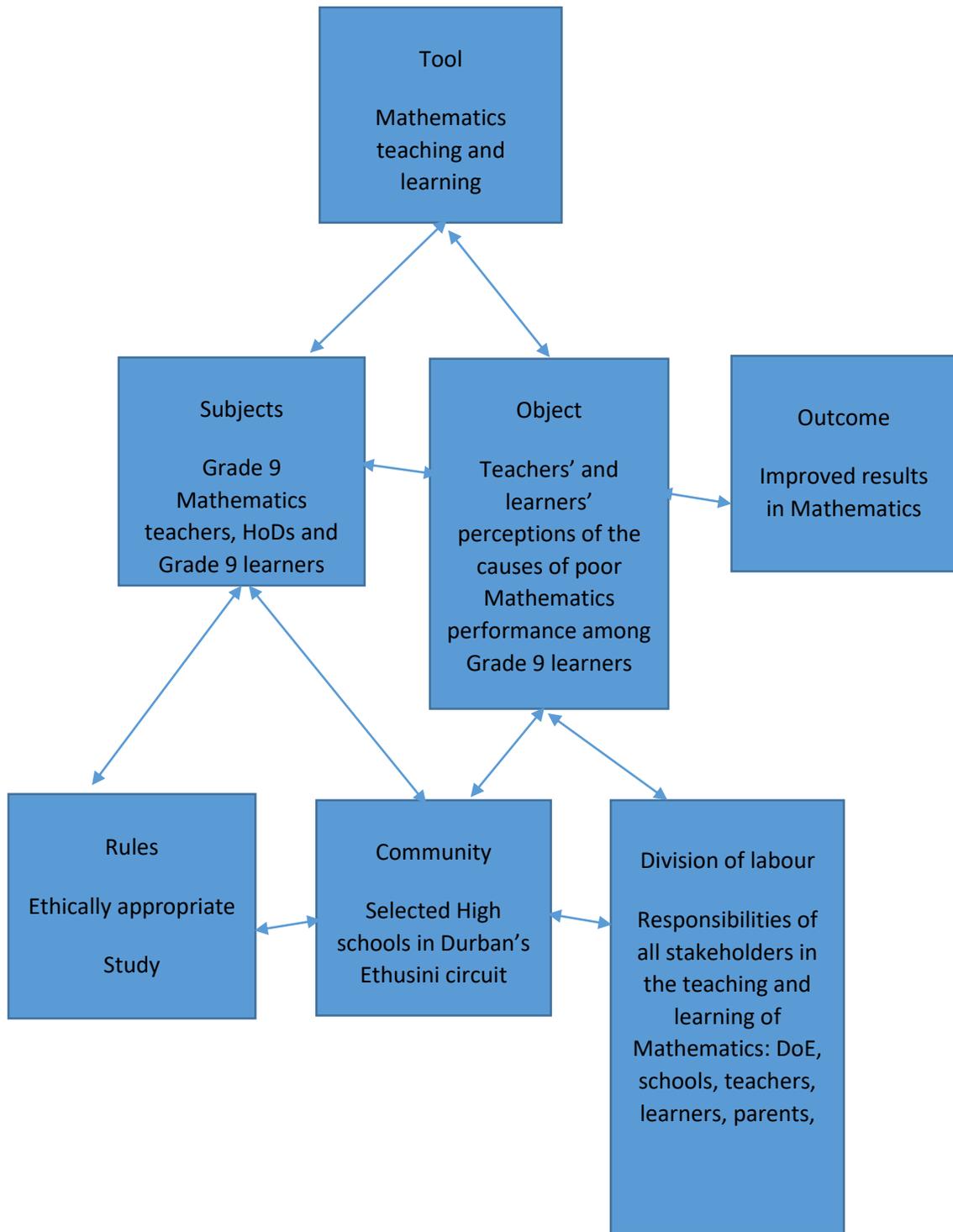
The findings of this study suggest that learners' lack of commitment and dedication in the learning of mathematics results in poor results, which consequently leads to a negative attitude towards the subject. Improving on the aspects that inhibit learners' commitment to effective mathematics participation could better the learners' performance in mathematics.

When asked what they should do to improve the performance of mathematics, the majority of the learner respondents suggested that they should take responsibility for their own learning and strive to their maximum potential. Furthermore, they said they need to develop a positive attitude towards mathematics, practise mathematics every day, participate in extra lessons, discover other methods that could help them understand the subject, stop skipping classes, avoid activities that may have a negative influence on one's performance, such as drug use, and choose good friends.

## **4.5 Revisiting Activity Theory and Distributed Cognition Theory**

### **4.5.1 Activity Theory**

Using the Activity Theory, the phenomenon of mathematics teaching and learning was the tool in the community of selected high schools in Durban's Ethusini Circuit of KwaZulu-Natal. The subjects were the Grade 9 mathematics teachers, mathematics HoDs and Grade 9 learners from the three participating schools. The object was the purpose of the study, namely to explore the teachers' and learners' perceptions of the causes of poor mathematics performance among the Grade 9 learners. The division of labour included the responsibilities of the different stakeholders in the teaching and learning of mathematics. These were comprised of the DoE, schools, teachers, learners, parents and the community. The appropriateness of the study and consideration to ethics was the rule, while the outcome is improved results in mathematics in Grade 9 as indicated in the Figure 4.2.



**Figure 4.2: Application of the Activity Theory in the study**

The Activity system was drawn by capturing the viewpoints of the Grade 9 mathematics teachers, HoDs and Grade 9 learners. These ideas permitted the researcher to explore the challenges experienced by both teachers and learners in the teaching and learning of mathematics.

In exploring all the essential elements that may involve the improvement of the teaching and learning of mathematics as experienced by both Grade 9 teachers and learners, for the purpose of improving mathematics performance, the Activity Theory seems to draw together all of the elements under the same roof. The theory therefore offered a holistic understanding of the phenomenon. Jonassen and Rohrer-Murphy (1999:68) explained that Activity Theory “provides a different lens for analysing learning processes and outcomes for the purpose of designing instruction”. According to Johassen and Rohrer-Murphy (1999:68), instead of concentrating on knowledge states, Activity Theory “focuses on the activities in which people are engaged, the nature of the tools they use in those activities, the social and contextual relationships among the collaborators in those activities, the goals and intentions of those activities, and the objects or outcomes of those activities”.

#### **4.5.2 Distributed Cognition Theory**

A key principle of Distributed Cognition Theory is that cognition is distributed among the individual, group of people, tools and the relations among these elements. According to Pea (1993:47), the perspective of the Distributed Cognition Theory is that “cognition is distributed – across minds, persons, and the symbolic and physical environments, both natural and artificial”.

Similar to Activity Theory, distributed cognition was suitable for this study as it does not focus on only the mind but also on other interactive elements involved in the teaching and

learning of mathematics, such as the influence of the support that is obtained from all stakeholders and external environmental tools and resources.

Following the Distributed Cognition Theory, effective distributed collective exploration of the teachers' and learners' perceptions of the causes of poor performance in mathematics could take place. When all elements supporting the investigation offered an opportunity for the participants to communicate as individuals, share their opinions and cooperate with each other through their interactions and their connections with the tools and resources in their environment. Creating an environment where participants respect each other's views and experiences during data collection allowed individual participants' cognition to be equally represented as all participants were free to share their experiences of the phenomenon. This allowed for distribution of the participants' perceptions across the comprehensive cognitive system for reflection and evaluation of the collected data.

#### **4.6 CONCLUSION**

The findings of the research reveal Grade 9 teachers' and learners' perceptions of the challenges experienced by both in the teaching and learning of mathematics in Durban's Ethusini Circuit of KwaZulu-Natal Province. The above results substantiate the findings in South Africa and internationally by Makagato and Mji (2006:261), Legotlo et al. (2002: 114), Makhubele and Kakoma (2014:64), Dorasamy (2012:1) and Mwenda et al. (2013:98) that revealed that challenges in the implementation of the curriculum, parental support, English as a LoLT, methods of teaching mathematics and learners' attitude towards mathematics are some of the causes of poor learner performance in mathematics. The results also confirm that these identified causes are still a constraining problem in the teaching and learning of mathematics.

The suggestions of the conclusions of this study are that if the academic performance of the Grade 9 learners in mathematics were to improve, the concerns raised in previous research and in the current study need to be addressed.

## CHAPTER 5

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 SUMMARY

The main purpose of this phenomenographic study is to understand the participants' broad explanations and interpretations of their experiences. A phenomenographic study was preferred for this study due to its capability to uncover the different ways in which the Grade 9 teachers and learners of Durban's Ethusini Circuit of KwaZulu-Natal Province perceive the challenges experienced in both the teaching and learning of mathematics. According to Barnard, McCosker and Gerbera (1999:212), a phenomenographic study is perceived to have a unique characteristic that acknowledges the similarities and differences in the way people experience and comprehend phenomena in the world around them. The phenomenon in this study is the poor performance in Grade 9 mathematics in South Africa generally and in this District of KZN specifically.

This chapter presents the summary of the findings of the study, conclusions and recommendations founded on the research results. This study also revisits the research questions to provide coherence. The conclusions of the study comprise five categories that emerged as causes to poor learner performance in mathematics as perceived by Grade 9 mathematics teachers and learners. These include CAPS curriculum challenges, parental support, English as a language of learning and teaching (LoLT), methods of teaching, and learners' attitude towards mathematics. The findings of the study revealed that teachers' and learners' perceptions of the challenges experienced by both in the teaching and learning of mathematics are similar.

## 5.2 REVISITING RESEARCH QUESTIONS

The research results of this study are summarised by revisiting the research questions presented in section 1.3.1. The research questions, a selection of the research findings to highlight how the research questions have been answered, are presented below:

### 5.2.1 Main research question:

What are the teachers' and learners' perceptions of the causes of poor mathematics performance among Grade 9 learners in Durban's Ethusini Circuit of KwaZulu-Natal Province?

The main research question was sub-divided into the following questions: [covering the elements of the main question]

- iv. What are the teachers' perceptions of the challenges in teaching and learning of mathematics in Grade 9 in Durban's Ethusini Circuit of KwaZulu-Natal Province?
- v. What are the Grade 9 learners' perceptions of the challenges in mathematics performance in Durban's Ethusini Circuit of KwaZulu-Natal Province?
- vi. What are the interventions that could be implemented to address the identified areas of weaknesses that could be contributing towards Grade 9 learners' poor performance in mathematics in Durban's Ethusini Circuit of KwaZulu-Natal Province?

Through the findings of the study, the researcher was able to explore perceived challenges in the teaching and learning of mathematics among Grade 9 teachers in Durban's Ethusini Circuit of KwaZulu-Natal Province. The study revealed that the teachers were met with difficulties, which hindered the effective implementation of the CAPS curriculum. Quality teaching to meet the expectations of learners was hampered by the advanced curriculum content and overload, as well as insufficient time to complete the syllabus. Based on the findings of the study, it can be deduced that the challenge of the CAPS coverage and administration caused the teachers to change their general

method of teaching to a focus directed on the completion of the syllabus and preparation of external common tests (see sections 4.3.1.2 and 4.3.1.3).

The study revealed that the standardised external common tests were too difficult for the learners. However, based on the responses from the teacher participants, it can also be assumed that the overemphasis by the DoE on external common tests and the style and language used in the common tests created a mental block on the learners. This hindered the learners' performance in mathematics, as discussed under section 4.3.2.

Learners' prior mathematics content knowledge is another aspect that narrowed quality teaching and learning. The findings of the study revealed that gaps in learners' background mathematical comprehension created a challenge when it came to connections between topics learnt in previous grades and current topics as learners were not able to understand or relate previously learnt mathematical concepts to the current same advanced mathematical concepts. Hailikari and Lindblom-Ylänne (2008:1) state that insufficient or disjointed prior knowledge is a key aspect to consider because if there is a discrepancy between the teacher's expectations of the learners' knowledge and the learners' actual knowledge base, learning may be hindered from the beginning of the learning process. The research findings indicated that an early, quality mathematical foundation provides a basis for effective teaching and learning of mathematics (see section 4.3.3).

The findings of the study revealed that part of what limited successful teaching and learning of mathematics were the learners' negative attitude towards the subject, which discouraged and prevented learning. The research results showed that learners' negative attitude towards the learning of mathematics was partly a result of continuous failure in the subject. Smith (2004:4) states that negative attitude towards mathematics seriously affects the learner's capability to perform well, as well as their willingness to endure the learning of the subject. According to Smith (2004:4), "this makes the mathematics teacher's job of teaching his students to succeed in and appreciate mathematics extremely difficult, if not impossible."

The study also showed that lack of parental support in their children's learning limited the teachers' effectiveness in the teaching and learning of mathematics. While the teachers stated that they gave of their best and tried to make up for insufficient time to complete the syllabus through offering extra lessons, these efforts to improve mathematics results were frustrated by the lack of parental support (see section 4.3.5).

The second sub-question looked at the Grade 9 learners' views of the challenges in comprehending mathematics. The study showed that the teachers' challenges in the teaching and learning of mathematics were also part of the learners' challenges in comprehending mathematics.

Part of what made effective comprehension of mathematics a challenge were the diverse needs of the learners that were not met by the teachers. While teachers have to be prepared to cater for every learner's needs, this was partly hindered by the CAPS curriculum due to its intensity, overload and insufficient time to complete the syllabus. The research findings also concluded that teachers' absence of connection between new content and the previously taught content created gaps in learners' mathematical comprehension (see sections 4.4.1.2; 4.4.2; 4.4.3).

One of the factors that affected the learners' learning of mathematics was lack of parental support and parental pressure. The research results showed that the overemphasis of the importance of mathematics as a requirement for what is perceived to be good careers, and the myth that mathematics is a difficult subject, created mathematics anxiety on learners, resulting in frustrated and unhappy learners. This diminished the learners' desire to give of their best (see sections 4.4.4; 4.4.4.1; 4.4.4.3).

Although the findings of the study showed that the learners did not have a challenge with the LoLT, the study concluded that good language skills in the LoLT are needed to enhance the learners' comprehension of mathematics. Based on learners' responses, inefficiency in the LoLT can create challenges in learning mathematics (see section 4.4.5).

Innovative teaching methods which could stimulate learners' interest in mathematics and enable them to comprehend the subject were not provided by the teachers. The use of the talk-and-chalk method created boring lessons, which consequently led to the lack of interest in the subject (see 4.4.6).

The findings of the study revealed that the teacher-learner relationship could damage or help motivate learners' learning of mathematics. In this study, learners who believed that they had a good relationship with their teachers and that their teachers had high expectations of them tended to have a more positive attitude towards the learning of the subject and vice versa. Based on the learners' responses of their experiences of their mathematics teachers, teachers who were harsh in their demonstration of authority caused a lasting feeling of negativity towards the learning of the subject, as discussed under section 4.4.7.

The research results also showed that learners' poor performance in mathematics was a result of lack of commitment and dedication to their learning of the subject. This contributed to the learners' negative attitude towards mathematics (see section 4.3.4). According to Nicolaidou and Phillippou (2005:1–22), learners who have negative feelings towards mathematics are likely to stall their understanding and curiosity. Nicolaidou and Phillippou (2005:1–22) further state that such learners have low confidence and are less satisfied with the learning process.

### **5.3 CONCLUSIONS**

- i. Most of the reasons for the poor learner performance in mathematics were related to the CAPS curriculum itself rather than the learners' lack of ability to comprehend mathematics. Although the Department of Education has conducted several training sessions on the CAPS curriculum in response to and in seeking to reduce the difficulties to do with the implementation of the curriculum, the non-completion of the CAPS syllabus is an issue that still exists. The findings of this study substantiate Olivier's (2013) results, which revealed that about 50% of teachers were unable to complete the curriculum in 2013. Furthermore, 45% of pupils said

they could not cope academically with the CAPS mathematics curriculum. These findings are also consistent with Du Plessis and Marais's (2015) results that showed that the implementation of the CAPS remains a challenge.

- ii. The role of primary instruction is to set building blocks for high school and tertiary mathematics education. If a firm foundation is set at Foundation Phase level, it is probable that challenges in comprehending mathematics may not arise at later levels.
- iii. Since all sections of mathematics are integrated, mathematics teaching and learning requires adequate time for learners and teachers to participate in a meaningful learning activity that enhances the learning process that promotes full understanding by individual learners, where learners can relate the specific content to other topics.
- iv. Healthy parental support in their child's learning is a need by both teachers and learners for the enhancement of the teaching and learning of mathematics. However, the amount of parental participation in this study was hindered by the parents' education background in mathematics, their social economic background, lack of parent's understanding of their child's capability in mathematics, and lack of differentiation by parents between parental support and parental pressure. Parents have a crucial role to play in the learning and teaching process of their children. Parental engagement yields considerable rewards in the learners' academic performance generally. According to Topor et al. (2011:183) and Legotlo et al. (2002:115), the significance of parental engagement as a vital ingredient in the learners' academic performance cannot be over emphasised. Makgato and Mji (2006:263) declare "parents have the distinct advantage over anyone else in that they can provide a more stable and continuously positive influence that could enhance and complement what the school fosters on their children".
- v. English as a LoLT on its own may not affect mathematics performance of learners whose mother tongue is different from the LoLT. Lack of proficiency in the LoLT may compound the problem of comprehension of mathematics. Considering that mathematics has its own universal language with its own terminology that may

differ in meaning from the meaning in English, learners' proficiency in mathematical vocabulary is crucial for successful learning of the subject to take place.

- vi. According to Bean (2004:1), the success of a learner somewhat hinges on how much the learner is engaged in the learning process. Teaching and learning methods that actively engage learners, such as buzz groups, brainstorming, role-play, discussion, demonstration, problem-solving and projects, were greatly desired by the learners. Although the teachers may have been equipped and have had knowledge of the techniques that engage learners in the teaching and learning process, the use of different teaching and learning methods was stalled by teachers for quick coverage of the curriculum. This resulted in a situation where learners became passive recipients of knowledge transferred to them by their teachers, to be reproduced during examinations. This study concluded that the frequent use of the lecture method could possibly be attributed to the broad and advanced level of the CAPS curriculum.
- vii. Developing positive teacher-learner relationships has a positive impact on learners' attitude towards mathematics. Positive teacher-learner relationships lead to a healthy emotional environment, which can consequently result in effective teaching and learning of mathematics. The research results also showed that for learners to improve their performance in mathematics, they need to be inspired by teachers, be enthusiastic to take responsibility for their own learning and practise mathematics conscientiously.

## **5.4 RECOMMENDATIONS**

Improvements in mathematics performance have to come from all stakeholders' participation, the Department of Education, the school, the teacher, the parents and the learners themselves.

### **5.4.1 Department of Basic Education**

The researcher recommends that the Department of Basic Education:

- i. Revisit the mathematics CAPS curriculum with consideration to content and breadth of the syllabus in terms of the age and grade level of the learners, adequacy of time, and spacing of topics and provision of time for revision. This is likely to bring about effective teaching and learning as different learning needs of the learners may be catered for.
- ii. Conduct ongoing general training and workshops on the management and implementation of the CAPS curriculum for all mathematics teachers at all levels, namely Foundation Phase, Intermediate and Senior Phase, and Further Education and Training Phase.
- iii. Assess how learners decode the identified questions that are perceived to be ambiguous in external common tests to assist the examiner to establish if the question was ambiguous or confusing and, if so, offer an understanding on how to review and adjust the questions.
- iv. Consider the allocation of more time for teaching and learning of mathematics in the CAPS curriculum.
- v. Improve the monitoring and evaluation of mathematics teachers to ensure quality assurance.

#### **5.4.2 Parents**

The researcher recommends that:

- i. Parents actively engage and invest in their children's education and support the learners in their academic activities.
- ii. Parents monitor their children's education and ensure that the learners do what is required of them.
- iii. Although the research results may suggest that only parents who have mathematics knowledge may contribute to their children's learning of the subject, the researcher proposes that this is not the case. There are many ways in which parents who lack mathematics knowledge may support their children. The researcher recommends that parents explore other ways of learner support, such as the provision of financial, emotional, moral support and monitoring of their

children's educational activities. Such support may contribute to the learners' improved results.

### **5.4.3 Schools and teachers**

The researcher recommends that:

- i. Schools suggest and implement ways in which they can build school-parent and community partnerships to ensure the engagement of the parents in the teaching and learning process of mathematics.
- ii. Teachers establish an encouraging learning environment where learners feel cared for, have a sense of rapport with the teachers as well as a sense of self-worth. This may bring about pleasurable learning experiences and develop learners' positive attitude towards the learning of mathematics.
- iii. Mathematics teachers consider the learners' different learning styles in their choice of their teaching methods to make mathematics interesting and to cater for the different learning needs of the learners.
- iv. Teachers use the "language used in the common exams" in their own test or exams so that learners become used to this type of language. It will benefit the learners in terms of general vocabulary improvement and knowing how to tackle high stakes tests like common exams.
- v. For the curriculum to be accessible and thus inclusive for all learners, it needs to be differentiated. Curriculum differentiation refers to changes that relate specifically to instruction or curriculum content. It deals with adaptation, modification and any adjustment to learning, teaching and assessment of environment (DoE 2006:105). The researcher recommends that schools implement the Guidelines on Differentiation Policy to cater for individual learners' needs.
- vi. School administrators, the principals, deputy principals and HoDs implement the Integrated Quality Management System (IQMS). When asked if the School Management Team's observation of the mathematics lessons in classrooms could influence their mathematics performance, the learners suggested that

administrators should be visible and take interest in the learners, especially learners who are lagging behind and spend time with them to assist the learners to improve their mathematics performance.

- vii. Mathematics teachers engage in the upgrading of their qualifications in mathematics, attend cluster workshops and conduct in-service staff development workshops to help teachers to understand the mathematics content and to share ideas on how effectively the CAPS mathematics curriculum can be managed and implemented, and the different methods that can be used in teaching mathematics. This would improve one's understanding of the content because it allows teachers to share ideas on how to teach different topics.

#### **5.4.4 Learners**

The researcher recommends that:

- i. Learners take more responsibility for their own learning and develop the desire to actively engage with mathematics concepts through frequent mathematics practice. This is likely to improve their comprehension of mathematics. Learners should develop commitment and dedication and practise good habits that can contribute to their improvement in their mathematics performance. This includes doing their homework, attending classes at all times, developing a positive attitude towards mathematics, establishing a good relationship with the teachers, attending extra lessons that are offered for free at school, putting more effort into their school work and concentrating during the teaching and learning process.

#### **5.5 FURTHER RESEARCH**

- i. Based on the reviewed literature (see section 2.2) and the findings of this study, whether or not **parental engagement** can contribute to the improvement of learners' academic performance is no longer a matter of discussion. Learners whose parents are engaged in their education are likely to perform better than those whose parents are not. The researcher recommends further research be conducted that focuses on why **parents** do or do not, get engaged in their

children's schooling, and what the responsibility of schools and teachers is in developing an effective school/parental/community partnership.

- ii. Further studies can be conducted that focus specifically on the management and implementation of the mathematics CAPS curriculum with consideration to the Grade 9 content and breadth of the syllabus, adequacy of time, spacing of topics and provision of time for revision.

## **5.6. CONCLUSION**

This chapter concluded the phenomenographic study on challenges in the teaching and learning of Grade 9 mathematics. The conclusions indicate that a single factor cannot be identified but that the experiences of both the learners and teachers reflect a range of challenges. The challenges in Grade 9 mathematics therefore need to be dealt with holistically and eclectically. It is important that all stakeholders are considered in finding solutions to problems in the teaching and learning of mathematics.

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# APPENDICES

## Appendix A: Proof of registration



0726 MIRST

KABUTU-NJEKWA C MRS  
P O BOX 30133  
MAYVILLE  
4058

STUDENT NUMBER : 4600-543-9

ENQUIRIES NAME : M&D ADMIN SUPPORT  
ENQUIRIES TEL : (012) 441-5702

DATE : 2018-01-29

Dear Student

I wish to inform you that your registration has been accepted for the academic year indicated below. Kindly activate your Unisa eLife (<http://my.unisa.ac.za/portal>) account for future communication purposes and access to research resources. Please check the information below and kindly inform the Master's and doctoral section on [mandd@unisa.ac.za](mailto:mandd@unisa.ac.za) on any omissions or errors.

DEGREE : MED CURR STUD (90059)  
TITLE : Contributory factors to Grade 9 learners' poor performance in Mathematics: A case of selected High Schools in Durban's Ethusini Circuit  
SUPERVISOR : Dr P BICCARD  
ACADEMIC YEAR : 2018  
TYPE: DISSERTATION  
SUBJECTS REGISTERED: DLCUR95 MED - Curriculum Studies (Dissertation of Limited Scope)

A statement of account will be sent to you shortly.

If you intend submitting your dissertation/thesis for examination, complete form DSAR20 (Notice of Intention to Submit) before 30 September. If this deadline is not met, you need to re-register and submit your intention for submission by 15 April and submit your dissertation by 15 June.

Your supervisor's written consent for submission must accompany your notice of intention to submit.

Yours faithfully,

Prof QM Temane  
Registrar (Acting)



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## Appendix B: Ethical clearance



### UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE

Date: 2018/07/18

Ref: **2018/07/18/46005439/29/MC**

Dear Mrs Kabutu-Njekwa

Name: Mrs C Kabutu-Njekwa

Student: 46005439

**Decision:** Ethics Approval from  
2018/07/18 to 2021/07/18

**Researcher(s):** Name: Mrs C Kabutu-Njekwa  
E-mail address: cathy.njekwa@gmail.com  
Telephone: +27 79 857 9052

**Supervisor(s):** Name: Dr P Biccard  
E-mail address: biccap@unisa.ac.za  
Telephone: +27 12 429 6634

**Title of research:**

**An investigation of the teachers and learners' perceptions of the causes of poor Mathematics performance among Grade 9 learners: A case of selected High schools in Durban's Ethusini Circuit of KwaZulu Natal province**

**Qualification:** M. Ed in Curriculum and Instructional Studies

Thank you for the application for research ethics clearance by the UNISA College of Education Ethics Review Committee for the above mentioned research. Ethics approval is granted for the period 2018/07/18 to 2021/07/18.

*The **medium risk** application was reviewed by the Ethics Review Committee on 2018/07/18 in compliance with the UNISA Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the UNISA College of Education Ethics Review Committee.



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3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
7. No field work activities may continue after the expiry date **2021/07/18**. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

The reference number **2018/07/18/46005439/29/MC** should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.

Kind regards,



**Dr M Claassens**  
**CHAIRPERSON: CEDU RERC**  
mcdtc@netactive.co.za



**Prof V McKay**  
**EXECUTIVE DEAN**  
Mckayvi@unisa.ac.za

## Appendix C: Letter requesting permission to conduct research – KwaZulu-Natal Department of Education: eThusini Circuit manager



13<sup>th</sup> June, 2018

The Circuit Manager  
Ethusini Circuit  
Durban

Dear Mr. Mthembu,

I, Catherine Kabutu-Njekwa, am doing research towards a MEd at the University of South Africa under the supervision of Dr. Piere Biccard, a lecturer College of Education – School of Teacher Education, in the Department of Curriculum and Instructional Studies. We are inviting you to participate in a study entitled "An investigation of the teachers and learners' perceptions of the causes of poor Mathematics performance among Grade 9 learners: A case of selected High schools in Durban's Ethusini Circuit of Kwa-Zulu Natal Province"

The aim of the study is to determine the contributory factors to Grade 9 learners' poor performance in Mathematics. The study will seek to establish the challenges experienced by Grade 9 teachers in the teaching and learning process of Mathematics, challenges experienced by Grade 9 learners in comprehending Mathematics, and propose interventions that could be implemented to address the identified areas of weaknesses that could be contributing towards the poor performance of Grade 9 learners in Mathematics in Durban's eThusini Circuit of KwaZulu-Natal Province.

I am a teacher by profession and currently working as Associate Education Director at the Southern Africa Union of the Seventh-day Adventist Church. I have previously taught Mathematics from Grades 1 to 7 and have always had an interest on how learners perform in Mathematics going by the poor performance results exhibited in Mathematics often published nationally.

Your circuit has been selected on the basis of convenience and purposeful sampling. Convenient sampling applies as the circuit is located in an area that I am familiar with as I have taught at a school in eThusini circuit for seven years. The circuit is also accessible to me as I reside in the same area.

The study will entail a sample that will be selected from 3 low performing schools in Mathematics in Durban's eThusini circuit of KwaZulu Natal Province, 1 former model C school, 1 Independent, and 1 ordinary Government school.

Fifteen Grade 9 learners who take Mathematics from each of the participating schools will be sampled from the population. Ten Grade 9 learners comprising of 5 female and 5 male will participate in focus group interviews. Five Grade 9 learners will participate in face-to-face semi-structured interview. Data collection will also entail conducting semi structured interviews with 1 Grade 9 Mathematics teacher and 1 HoD from each of the participating schools, and 1 Mathematics Curriculum Advisor. Data collection will be done after school hours.



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The right of the participants to confidentiality will be respected. The names of the participants will not be recorded anywhere and no one will be able to connect them to the answers that they will give. The answers given by the participants will be given a code number or a pseudonym and they will be referred to in this way. The participants' anonymous data may be used for other purposes, such as a research report, journal articles and/or conference proceedings.

Participating in this study is voluntary and the participants are under no obligation to consent to participation. Participants have the freedom to withdraw at any time and without reprisal.

Before commencing on the study, the researcher will conduct a preliminary visit to the school. During this visit, the researcher will take time to disclose the topic of the study, the purpose, objectives, the nature of the study, and the medium risk involved, alternatives, and the benefits of the study. Each group will be given a schedule which clearly indicates the time and day when the focused group interviews will be conducted.

The benefits of this study include the possibility of improved Mathematics performance through the identified strategies that can be implemented to improve performance in the subject. It is anticipated that the findings of the study will be a means through which curriculum developers will have an understanding of different insights into evolving issues on performance in Mathematics. It is also expected that the findings will be of value to the teachers and the learners as these will assist in identifying and addressing the areas of concern, thereby, improving the quality of teaching and learning of Mathematics. Both learners and teachers are expected to gain from the findings because improved Mathematics performance will give them encouragement and opportunities to pursue Mathematics related courses in higher institutions of learning, which is likely to consequently reduce the huge shortage of skilled workers that South Africa is currently experiencing in fields such as engineering, applied sciences, accountancy, architecture, medicine and law.

The research has a potential medium risk in that it will involve human participants and children under the age of 18 as well as foreseeable risk of inconvenience as all data collection will be done after school hours.

Since the learners will be required to stay a little later after school and also because most of the learners have pre-arranged transport that picks them up immediately after school and transport costs are paid in advance, learners will require alternative transport. For this reason, there will be reimbursement of transport costs and provision of lunch. There will be no incentives for participation in the research.

Feedback procedure will entail the submission of a written summary of the research findings that will be disseminated to the schools through the eThusini Circuit Manager. It is anticipated that if the feedback is channeled through the Circuit Manager, it will enable Management to effect new and corrective decisions.

If you have questions about this study please ask me or my study supervisor, Dr. Piera Biccard, a lecturer College of Education – School of Teacher Education, in the Department of Curriculum and Instructional Studies at the University of South Africa. My contact number is 079 857 9052 and my e-mail is [cathy.njekwa@gmail.com](mailto:cathy.njekwa@gmail.com). The e-mail of my supervisor is [biccap@unisa.ac.za](mailto:biccap@unisa.ac.za).

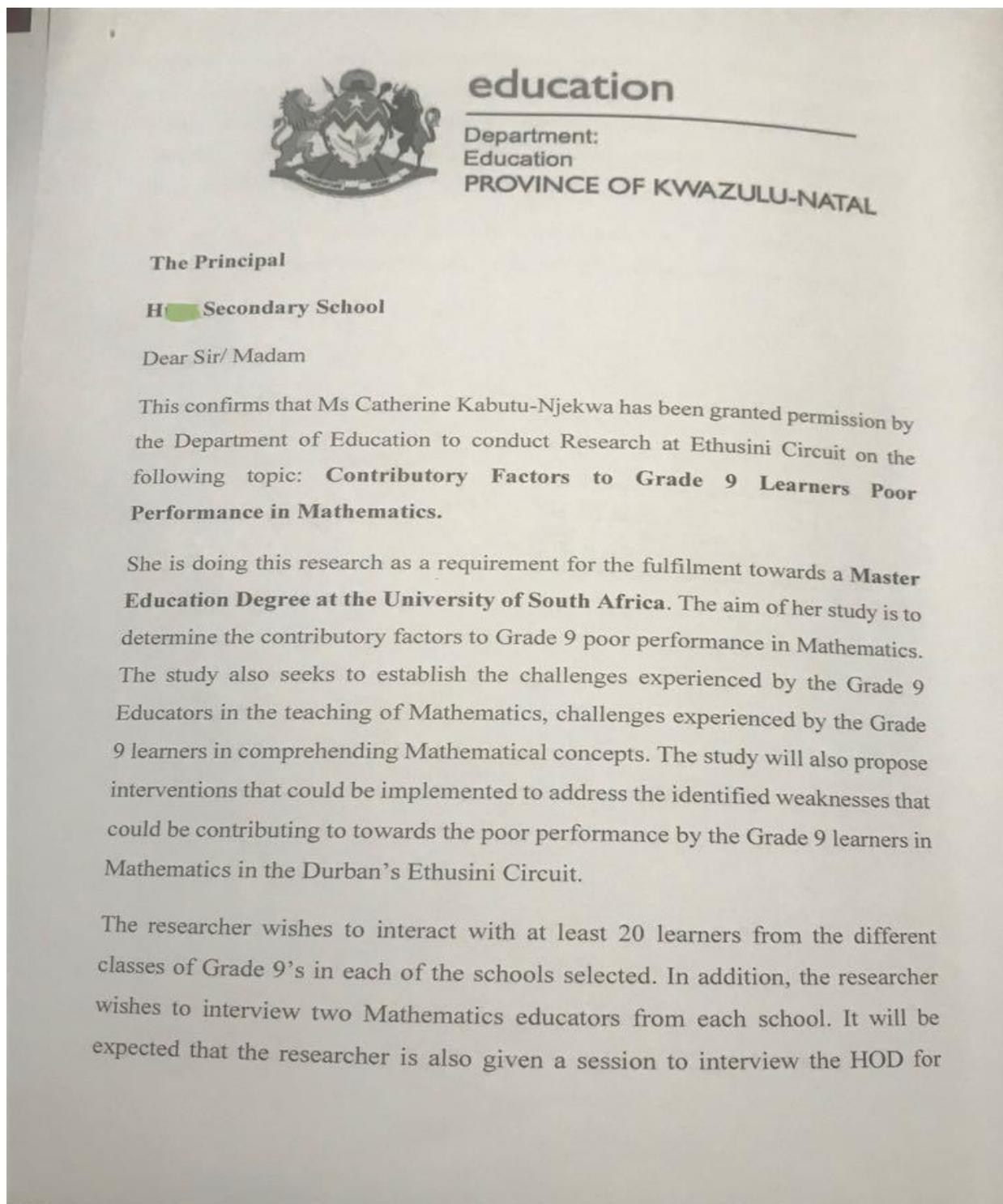
Yours sincerely



Catherine Kabutu-Njekwa (Mrs.)



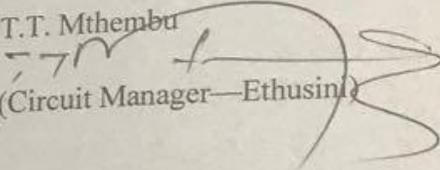
## Appendix D: DoE letter granting permission to conduct research



Maths in each school. The researcher is mindful of the fact that the school programme of teaching and learning should not be disrupted because of her presence in the school. She will appreciate if the sessions she will conduct with learners, educators and the HOD's be scheduled for the time after the formal lessons have been finished for the day.

We as the Department of the education plead with your school to kindly accommodate the researcher and give her all the assistance she may require.

Yours in faith

T.T. Mthembu  
  
(Circuit Manager—Ethusini)

Mr T.T Mthembu  
KZN Education Dept  
S.E.M Umlazi District  
Durban Central

## Appendix E: Letter requesting permission to conduct research – School Principal

27<sup>th</sup> July, 2018

The Principal

Durban

Dear Sir/Madam,

I, Catherine Kabutu-Njekwa, am doing research towards a MEd at the University of South Africa under the supervision of Dr. Piere Biccard, a lecturer College of Education – School of Teacher Education, in the Department of Curriculum and Instructional Studies. We are inviting you to participate in a study entitled “An investigation of Grade 9 teachers’ and learners’ perceptions of the causes of poor mathematics performance in Durban’s eThusini Circuit.”

The aim of the study is to investigate the causes of Grade 9 learners’ poor performance in Mathematics. The study will seek to explore the challenges experienced by Grade 9 teachers in the teaching and learning process of Mathematics, challenges experienced by Grade 9 learners in comprehending Mathematics, and propose interventions that could be implemented to address the identified areas of weaknesses that could be contributing towards the poor performance of Grade 9 learners in Mathematics in Durban’s eThusini Circuit of KwaZulu-Natal Province.

I am a teacher by profession and currently working as Associate Education Director at the Southern Africa Union of the Seventh-day Adventist Church. I have previously taught Mathematics from Grades 1 to 7 and have always had an interest on how learners perform in Mathematics going by the poor performance results exhibited in Mathematics often published nationally.

Your school has been selected on the basis of convenience and purposeful sampling. Convenient sampling applies as the school is located in an area that I am familiar with as I have taught at a school in eThusini circuit for seven years. The school is also accessible to me as I reside in the same area.

The study will entail a sample that will be selected from 3 schools in Durban’s eThusini circuit of KwaZulu Natal Province, 1 former model C school, 1 Independent, and 1 ordinary Government school.

Fifteen Grade 9 learners who take Mathematics from each of the participating schools will be sampled from the population. Ten Grade 9 learners comprising of 5 female and 5 male will participate in focus group interviews. Five Grade 9 learners will participate in face-to-face semi-structured interview. Data collection will also entail conducting semi structured interviews with 1 Grade 9 Mathematics teacher and 1 HoD from each of the participating schools, and 1 Mathematics Curriculum Advisor. Data collection will be done after school hours.

The right of the participants to confidentiality will be respected. The names of the participants will not be recorded anywhere and no one will be able to connect them to the answers that they will give. The answers given by the participants will be given a code number or a pseudonym and they will be referred to in this way. The participants’ anonymous data may be used for other purposes, such as a research report, journal articles and/or conference proceedings.

Participating in this study is voluntary and the participants are under no obligation to consent to participation. Participants have the freedom to withdraw at any time and without reprisal.

Before commencing on the study, the researcher will conduct a preliminary visit to the school. During this visit, the researcher will take time to disclose the topic of the study, the purpose, objectives, the nature of the study, and the medium risk involved, alternatives, and the benefits of the study. Each group will be given a schedule which clearly indicates the time and day when the focused group interviews will be conducted.

The benefits of this study include the possibility of improved Mathematics performance through the identified strategies that can be implemented to improve performance in the subject. It is anticipated that the findings of the study will be a means through which curriculum developers will have an understanding of different insights into evolving issues on performance in Mathematics. It is also expected that the findings will be of value to the teachers and the learners as these will assist in identifying and addressing the areas of concern, thereby, improving the quality of teaching and learning of Mathematics. Both learners and teachers are expected to gain from the findings because improved Mathematics performance will give them encouragement and opportunities to pursue Mathematics related courses in higher institutions of learning, which is likely to consequently reduce the huge shortage of skilled workers that South Africa is currently experiencing in fields such as engineering, applied sciences, accountancy, architecture, medicine and law.

The research has a potential medium risk in that it will involve human participants and children under the age of 18 as well as foreseeable risk of inconvenience as all data collection will be collected during school hours.

Feedback procedure will entail the submission of a written summary of the research findings that will be disseminated to the schools through the eThusini Circuit Manager. It is anticipated that if the feedback is channeled through the Circuit Manager, it will enable Management to effect new and corrective decisions.

If you have questions about this study please ask me or my study supervisor, Dr. Piera Biccard, a lecturer College of Education – School of Teacher Education, in the Department of Curriculum and Instructional Studies at the University of South Africa. My contact number is 079 857 9052 and my e-mail is [cathy.njekwa@gmail.com](mailto:cathy.njekwa@gmail.com). The e-mail of my supervisor is [biccap@unisa.ac.za](mailto:biccap@unisa.ac.za).

Yours sincerely



Catherine Kabutu-Njekwa (Mrs.)



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## Appendix F: Letter requesting parental consent for minors to participate in a research project

### Dear Parent

Your child is invited to participate in a study entitled “An investigation of Grade 9 teachers’ and learners’ perceptions of the causes of poor mathematics performance in Durban’s Ethusini Circuit.”

I am undertaking this study as part of my master’s research at the University of South Africa. The purpose of the study is to determine the contributory factors to Grade 9 learners’ poor performance in Mathematics. The study will seek to establish the challenges experienced by Grade 9 teachers in the teaching and learning process of Mathematics, challenges experienced by Grade 9 learners in comprehending Mathematics, and propose interventions that could be implemented to address the identified areas of weaknesses that could be contributing towards the poor performance of Grade 9 learners in Mathematics in Durban’s eThusini Circuit of KwaZulu-Natal Province.

I am asking for permission to include your child in this study because he/she is one of the Grade 9 learners who take Mathematics at O school and his/her experience in the teaching and learning of Mathematics will add value to the study. I expect to have 14 other learners participating from O school, 15 learners from 2 other participating schools, 1 Mathematics teacher, and 1 Mathematics HoD from each of the 3 participating schools.

If you allow your child to participate, I shall request him/her to:

- Take part in a face to face semi-structured interview that will take place at O school on 3<sup>rd</sup> August 2018. The time to complete the semi-structured interviews will be 15 minutes.
- Take part in a focus group interview to be conducted at O school on 3<sup>rd</sup> August 2018. The 10 sampled learners will participate in the focus group interview that will take approximately 30 minutes.

I kindly ask for permission to audio record the semi-structured interviews and focus group interviews.

Any information that is obtained in connection with this study and can be identified with your child will remain confidential and will only be disclosed with your permission. His/her responses will not be linked to his/her name or your name or the school’s name in any written or verbal report based on this study. Such a report will be used for research purposes only.

Furthermore, confidentiality issues associated with focus groups will be considered. All learners who will participate in a focus group will be required to sign individual confidentiality forms in addition to the consent forms. The researcher will provide the learners with a detailed explanation on the reasons for not disclosing what is discussed in the focus group. The learners will be advised not to divulge any information that is shared in the group discussions to any person outside the group in order to maintain confidentiality.

Your child will receive no direct benefit from participating in the study; however, the possible benefits to education include the possibility of improved Mathematics performance through the identified strategies that can be implemented to improve performance in the subject. It is anticipated that the findings of the study will be a means through which curriculum developers will have an understanding of different insights into evolving issues on performance in Mathematics. It is also expected that the findings will be of value to the teachers and the learners as these will assist in identifying and addressing the areas of concern, thereby, improving the quality of teaching and learning of Mathematics. Both learners and teachers are expected to gain from the findings because improved Mathematics performance will give them encouragement and opportunities to pursue Mathematics

related courses in higher institutions of learning, which is likely to consequently reduce the huge shortage of skilled workers that South Africa is currently experiencing in fields such as engineering, applied sciences, accountancy, architecture, medicine and law.

Your child's participation in this study is voluntary. Your child may decline to participate or to withdraw from participation at any time. Withdrawal or refusal to participate will not affect him/her in any way. Similarly you can agree to allow your child to be in the study now and change your mind later without any penalty.

In addition to your permission, your child must agree to participate in the study and you and your child will also be asked to sign the assent form which accompanies this letter. If your child does not wish to participate in the study, he or she will not be included and there will be no penalty. The information gathered from the study and your child's participation in the study will be stored securely on a password locked computer in my locked office for five years after the study. Thereafter, records will be erased.

If you have questions about this study please ask me or my study supervisor, Dr. Piera Biccapp, a lecturer College of Education – School of Teacher Education, in the Department of Curriculum and Instructional Studies at the University of South Africa. My contact number is 079 857 9052 and my e-mail is [cathy.njekwa@gmail.com](mailto:cathy.njekwa@gmail.com). The e-mail of my supervisor is [biccapp@unisa.ac.za](mailto:biccapp@unisa.ac.za).

Permission for the study has already been given by the Department of Education, eThusini circuit Manager Mr. Mthembu, O School Principal Mr. Dlamini and the Ethics Committee of the College of Education, UNISA.

You are making a decision about allowing your child to participate in this study. Your signature below indicates that you have read the information provided above and have decided to allow him or her to participate in the study. You may keep a copy of this letter.

Name of child \_\_\_\_\_

\_\_\_\_\_  
Parent/guardian's name (print)

\_\_\_\_\_  
Parent/guardian's signature

\_\_\_\_\_  
Date

Catherine Kabutu-Njekwa (Mrs)  
Researcher's name (Print)

  
Researcher's signature

27/07/2018  
Date



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## Appendix G: Learner assent form – Secondary school

27<sup>th</sup> July 2018

**Title of my research - An investigation of Grade 9 teachers' and learners' perceptions of the causes of poor mathematics performance in Durban's Ethusini Circuit.**

Dear prospective participant,

I am doing a study on causes of Grade 9 learners' poor performance in Mathematics in selected High Schools of Durban's ETthusini Circuit as part of my studies at the University of South Africa. Your principal has given me permission to do this study in your school. I would like to invite you to be a very special part of my study. I am doing this study so that strategies on how to improve Mathematics performance in Grade 9 can be identified and implemented. This may help you and many other learners of your age in different schools.

This letter is to explain to you what I would like you to do. There may be some words you do not know in this letter. You may ask me or any other adult to explain any of these words that you do not know or understand. You may take a copy of this letter home to think about my invitation and talk to your parents about this before you decide if you want to be in this study.

I would like to ask you to participate in a focus group interview of 10 learners or a semi-structured interview where 5 learners will be interviewed. Answering the semi-structured interviews will take 15 minutes and focus group interview questions will take approximately 30 minutes. The interviews will be conducted at your school. Your right to confidentiality will be respected. Your name will not be recorded anywhere and no one will be able to connect you to the answers that you will give. Your answers will be given a code number or a pseudonym and you will be referred to in this way. Your anonymous data may be used for other purposes, such as a research report, journal articles and/or conference proceedings.

Participating in this study is voluntary and you are under no obligation to consent to participation. You have the freedom to withdraw at any time without reprisal.

Furthermore, confidentiality issues associated with focus groups will be considered. All learners who will participate in a focus group will be required to sign individual confidentiality forms in addition to the consent forms. I will provide you with a detailed explanation on the reasons for not disclosing what is discussed in the focus group. All learners will be advised not to divulge any information that is shared in the group discussions to any person outside the group in order to maintain confidentiality.

I will write a report on the study but I will not use your name in the report or say anything that will let other people know who you are. Participation is voluntary and you do not have to be part of this study if you don't want to take part. If you choose to be in the study, you may stop taking part at any time without penalty. You may tell me if you do not wish to answer any of my questions. No one will blame or criticise you. When I am finished with my study, I shall return to your school to give a short talk about some of the helpful and interesting things I found out in my study. I shall invite you to come and listen to my talk.

The possible benefits of this study include the possibility of improved Mathematics performance through the identified strategies that can be implemented to improve performance in the subject. It is anticipated that the findings of the study will be a means through which curriculum developers will have an understanding of different insights into evolving issues on performance in Mathematics. It is also expected that the findings will be of value to the teachers and the learners as these will assist in identifying and addressing the areas of concern, thereby, improving the quality of teaching and learning of Mathematics. Both learners and teachers are expected to gain from the findings because improved Mathematics performance will give them



## Appendix H: Mathematics Teacher Consent Form

27<sup>th</sup> July, 2018

Dear prospective participant,

My name is Catherine Kabutu-Njekwa. I am doing research towards a MEd at the University of South Africa under the supervision of Dr. Piere Biccard, a lecturer College of Education – School of Teacher Education, in the Department of Curriculum and Instructional Studies. We are inviting you to participate in a study entitled “ An investigation of Grade 9 teachers' and learners' perceptions of the causes of poor mathematics performance in Durban's Ethusini Circuit.”

The purpose of the study is to investigate the causes of Grade 9 learners' poor performance in Mathematics. The study will seek to explore the challenges experienced by Grade 9 teachers in the teaching and learning process of Mathematics, challenges experienced by Grade 9 learners in comprehending Mathematics, and propose interventions that could be implemented to address the identified areas of weaknesses that could be contributing towards the poor performance of Grade 9 learners in Mathematics in Durban's eThusini Circuit of KwaZulu-Natal Province.

I am a teacher by profession and currently working as Associate Education Director at the Southern Africa Union of the Seventh-day Adventist Church. I have previously taught Mathematics from Grades 1 to 7 and have always had an interest on how learners perform in Mathematics going by the poor performance results exhibited in Mathematics often published nationally.

You are invited to participate in this study because of your role as a Grade 9 Mathematics teacher at Orient Islamic school. It is anticipated that your experience in teaching Mathematics will add value to the study.

I obtained your contact details from the school principal of Orient Islamic school. The participants include 15 Grade 9 learners, 1 Grade 9 Mathematics teacher, and 1 Head of Mathematics Department from each of the 3 selected schools in EThusini circuit.

The study involves a semi-structured interview. A set of questions that will be asked have been attached. The expected maximum duration of your participation in the interview is 45 minutes.

Participating in this study is voluntary and you are under no obligation to consent to participation. If you do decide to take part, you will be given the information sheet to keep and be asked to sign a written consent. You are free to withdraw at any time and without giving a reason.

The benefits of this study include the possibility of improved Mathematics performance through the identified strategies that can be implemented to improve performance in the subject. It is anticipated that the findings of the study will be a means through which curriculum developers will have an understanding of different insights into evolving issues on performance in Mathematics. It is also expected that the findings will be of value to the teachers and the learners as these will assist in identifying and addressing the areas of concern, thereby, improving the quality of teaching and learning of Mathematics. Both learners and teachers are expected to gain from the findings because improved Mathematics performance will give them encouragement and opportunities to pursue Mathematics related courses in higher institutions of learning, which is likely to consequently reduce the huge shortage of skilled workers that South Africa is currently experiencing in fields such as engineering, applied sciences, accountancy, architecture, medicine and law.

There is a foreseeable risk of inconvenience as you will forego approximately 45minutes of the time that you are supposed to be doing your own work.

Your right to confidentiality will be respected. Your name will not be recorded anywhere and no one will be able to connect you to the answers you give. Your answers will be given a code number or a pseudonym and you will be referred to in this way. Your anonymous data may be used for other purposes, such as a research report, journal articles and/or conference proceedings.

Hard copies of your answers will be stored by the researcher for a period of five years in a locked filing cabinet in the researcher's office for future research or academic purposes, electronic information will be stored on a password protected laptop. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable.

This study has received written approval from the Research Ethics Review Committee of the CEDU REC, Unisa. A copy of the approval letter can be obtained from the researcher if you so wish.

If you would like to be informed of the final research findings, please contact Catherine Kabutu-Njekwa on 079 857 9052 or email [cathy.njekwa@gmail.com](mailto:cathy.njekwa@gmail.com).

Should you have concerns about the way in which the research has been conducted, you may contact Dr. Piera Biccard on 012 429 6634 or email [biccap@unisa.ac.za](mailto:biccap@unisa.ac.za).

Thank you for taking time to read this information sheet and for participating in this study. Thank you.



Catherine Kabutu-Njekwa (Mrs.)  
Researcher



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## Appendix I: Head of Department consent form

27<sup>th</sup> July, 2018

Dear prospective participant,

My name is Catherine Kabutu-Njekwa. I am doing research towards a MEd at the University of South Africa under the supervision of Dr. Piere Biccard, a lecturer College of Education – School of Teacher Education, in the Department of Curriculum and Instructional Studies. We are inviting you to participate in a study entitled “An investigation of Grade 9 teachers’ and learners’ perceptions of the causes of poor mathematics performance in Durban’s Ethusini Circuit.”

The purpose of the study is to investigate the causes of Grade 9 learners’ poor performance in Mathematics. The study will seek to explore the challenges experienced by Grade 9 teachers in the teaching and learning process of Mathematics, challenges experienced by Grade 9 learners in comprehending Mathematics, and propose interventions that could be implemented to address the identified areas of weaknesses that could be contributing towards the poor performance of Grade 9 learners in Mathematics in Durban’s eThusini Circuit of KwaZulu-Natal Province.

I am a teacher by profession and currently working as Associate Education Director at the Southern Africa Union of the Seventh-day Adventist Church. I have previously taught Mathematics from Grades 1 to 7 and have always had an interest on how learners perform in Mathematics going by the poor performance results exhibited in Mathematics often published nationally.

You are invited to participate in this study because of your role as a Mathematics Head of Department at O school. It is anticipated that your experience in teaching Mathematics will add value to the study.

I obtained your contact details from the school principal of O school. The participants include 15 Grade 9 learners, 1 Grade 9 Mathematics teacher, and 1 Head of Mathematics Department from each of the 3 selected schools in EThusini circuit.

The study involves a semi-structured interview. A set of questions that will be asked have been attached. The expected maximum duration of your participation in the interview is 45 minutes.

Participating in this study is voluntary and you are under no obligation to consent to participation. If you do decide to take part, you will be given the information sheet to keep and be asked to sign a written consent. You are free to withdraw at any time and without giving a reason.

The benefits of this study include the possibility of improved Mathematics performance through the identified strategies that can be implemented to improve performance in the subject. It is anticipated that the findings of the study will be a means through which curriculum developers will have an understanding of different insights into evolving issues on performance in Mathematics. It is also expected that the findings will be of value to the teachers and the learners as these will assist in identifying and addressing the areas of concern, thereby, improving the quality of teaching and learning of Mathematics. Both learners and teachers are expected to gain from the findings because improved Mathematics performance will give them encouragement and opportunities to pursue Mathematics related courses in higher institutions of learning, which is likely to consequently reduce the huge shortage of skilled workers that South Africa is currently experiencing in fields such as engineering, applied sciences, accountancy, architecture, medicine and law.

There is a foreseeable risk of inconvenience as you will forego approximately 45minutes of the time that you are supposed to be doing your own work.

Your right to confidentiality will be respected. Your name will not be recorded anywhere and no one will be able to connect you to the answers you give. Your answers will be given a code number or a pseudonym and you will be referred to in this way. Your anonymous data may be used for other purposes, such as a research report, journal articles and/or conference proceedings.

Hard copies of your answers will be stored by the researcher for a period of five years in a locked filing cabinet in the researcher's office for future research or academic purposes, electronic information will be stored on a password protected laptop. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable.

This study has received written approval from the Research Ethics Review Committee of the CEDU REC, Unisa. A copy of the approval letter can be obtained from the researcher if you so wish.

If you would like to be informed of the final research findings, please contact Catherine Kabutu-Njekwa on 079 857 9052 or email [cathy.njekwa@gmail.com](mailto:cathy.njekwa@gmail.com).

Should you have concerns about the way in which the research has been conducted, you may contact Dr. Piera Biccadd on 012 429 6634 or email [biccap@unisa.ac.za](mailto:biccap@unisa.ac.za).

Thank you for taking time to read this information sheet and for participating in this study. Thank you.



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## Appendix J: Focus group confidentiality



I \_\_\_\_\_ grant consent/assent that the information I share during the focus group may be used by Mrs. Catherine Kabutu-Njekwa for research purposes. I am aware that the group discussions will be digitally recorded and grant consent/assent for these recordings, provided that my privacy will be protected. I undertake not to divulge any information that is shared in the group discussions to any person outside the group in order to maintain confidentiality.

Participant's Name (Please print): \_\_\_\_\_

Participant Signature: \_\_\_\_\_

Researcher's Name: (Please print): \_\_\_\_\_

Researcher's Signature:

A handwritten signature in black ink, appearing to be "C. Kabutu-Njekwa", written over a horizontal line.

Date: 27<sup>th</sup> July 2018



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## Appendix K: Learners' focus group questions

1. Describe a typical mathematics lesson to me?
2. What are the major challenges that you as Grade 9 learners experience with the learning of mathematics?
3. What is your perception of the qualities of a good mathematics teacher?
4. What should learners do to improve their mathematics performance?
5. How often does the School Principal, mathematics HoD, or mathematics subject specialist visit your classroom to observe the delivery of a mathematics lesson while the teacher is teaching?
6. How does the relationship with your mathematics teacher influence your performance in mathematics?
7. How does the number of learners in your class affect your learning of mathematics?
8. What impact does the home environment have on your performance in mathematics?



## Appendix L: Semi-structured interview questions for learners

1. What are the major challenges that you as Grade 9 learners experience with the learning of mathematics?
2. What Learning and Teaching Support Materials (LTSM) for mathematics does your school provide for you?
3. What effect does the use of Learning and Teaching Support Materials (LTSM) have on the understanding of mathematics?
4. How does the support of your parents or siblings in your learning of mathematics influence your performance in the subject?
5. How would the teaching of mathematics in your home language contribute to your understanding of mathematics?
6. In your opinion, what teaching methods can contribute to the understanding of mathematics?
7. What influence does your teacher's attitude towards you have on your performance in mathematics?
8. In your opinion, what should be done to improve Grade 9 mathematics results?



## Appendix M: Grade 9 mathematics teachers' semi-structured interview questions

1. What are the major challenges that you experience in teaching Grade 9 mathematics?
2. What is the relationship between the availability of Learning and Teaching Support Materials (LTSM) and the choice of your teaching methods?
3. What are the challenges that you experience when it comes to using different methods of teaching?
4. Is the reasoning level of your Grade 9 learners at an appropriate level? If not, what are some of the contributory factors to learners not being at the acceptable level of cognitive development?
5. How does the performance of a learner whose home language is the same as the medium of instruction differ from a learner whose home language is different from the medium of instruction?
6. Explain the adequacy of the time allocated to complete the Grade 9 mathematics CAPS prescribed syllabus.
7. What is your perception of your learners' attitude towards mathematics?
8. How much support from parents/guardians do you receive in the teaching and learning of mathematics?
9. How would the support of parents to your learners in the learning of mathematics influence the learners' performance?
10. What in your view should be done to ensure the improvement of the performance of Grade 9 learners in mathematics?



## **Appendix N: Mathematics Head of Department (HoD) semi-structured interview questions**

1. Do you enjoy teaching mathematics? Why?
2. What are the major challenges experienced by your school in the teaching and learning of mathematics in Grade 9?
3. Does the availability of Learning and Teaching Support Materials (LTSM) affect the teaching and learning of mathematics? Explain.
4. How much support from parents/guardians do you receive in the learning of mathematics?
5. How would the support of parents to your learners in the learning of mathematics influence their performance?
6. Does the performance of a learner whose home language is the same as the medium of instruction differ from a learner whose home language is different from the medium of instruction? Explain.
7. What are the challenges that you experience when it comes to using different methods of teaching?
8. What are some of the teaching approaches that can enhance the teaching and learning of mathematics?
9. Is the reasoning level of your Grade 9 learners at an appropriate level? If not, what are some of the contributory factors to learners not being at the acceptable level of cognitive development?
10. How would you rate the performance of your Grade 9 mathematics teachers?
11. With the Grade 9 CAPS prescribed curriculum for mathematics, is the time allocated to complete the syllabus adequate? Explain.
12. Do your learners attach value to being good in mathematics? Explain.
13. What are some of the strategies that can be implemented to ensure the improvement of Grade 9 learners' performance in mathematics?

**Appendix O: Data collection schedules for the participating schools**

**School B Schedule for collection of data**

Type of interview	Date	Time
Grade 9 Learners' Focus Group interviews	02/08/2018	09:00 – 09:45
Grade 9 Learners' Semi-structured interviews	02/08/2018	09:50 – 11:30
Grade 9 mathematics Teachers' Semi-structured interviews	02/08/2018	12:00 – 12:30
Mathematics HoDs' Semi-structured interviews	02/08/2018	13:30 – 14:00

**School O Schedule for collection of data**

Type of interview	Date	Time
Grade 9 Learners' Focus Group interviews	28/08/2018	10:00 – 10:30

Grade 9 Learners' Semi-structured interviews	28/08/2018	12:30 – 14:00
Grade 9 mathematics Teachers' Semi-structured interviews	28/08/2018	09:00 – 09:30
Mathematics HoDs' Semi-structured interviews	28/08/2018	10:30 – 11:00

#### School H Schedule for collection of data

Type of interview	Date	Time
Grade 9 Learners' Focus Group interviews	03/08/2018	08:00 – 08:30
Grade 9 Learners' Semi-structured interviews	03/08/2018	11:00 – 12:30
Grade 9 mathematics Teachers' Semi-structured interviews	03/08/2018	09:45 – 10:15
Mathematics HoDs' Semi-structured interviews	03/08/2018	10:30 – 11:00



## Appendix P: Turn-it-in certificate



### Digital Receipt

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An investigation of the teachers' and learners' perceptions of the causes of poor mathematics performance among Grade 9 learners: A case of selected high schools in Durban's Ethusini Circuit of KwaZulu-Natal Province

by

CATHERINE KABUTU-NJEKWA

Submitted in accordance with the requirements for the degree of

MASTER OF EDUCATION IN CURRICULUM AND INSTRUCTIONAL STUDIES

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: DR PIERA BICCARD

JANUARY 2019