THE IMPLEMENTATION OF THE MATHEMATICS CURRICULUM AND ASSESSMENT POLICY STATEMENT IN SOUTH AFRICA

by

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DECLARATION

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07 August 2021

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DEDICATION

Firstly, I dedicate this study to my mother Maggy Rakgoale and my late father Edward Rakgoale, who laid the foundation in my upbringing. I thank GOD's favour to have such wonderful parents.

Secondly, I dedicate this study to following:

- My loving husband, Matome David Manamela, for his love, support, encouragement and confidence he has shown through the journey of my studies. He was always there for me and always responded to my frustrations with love.

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ACRONYMS

ACE	Advance Certificate in Education
ANA:	Annual Assessment Task
AS	Assessment Standard
Bed	Bachelor of Education
CAPS	Curriculum and Assessment Policy Statement
C2005	Curriculum 2005
CUMSA	Curriculum Model of South Africa
CV	Curriculum Vitae
DA	Democratic Alliance
DBE	Department of Basic Education
DoE	Department of Education
DHs	Departmental Heads
DPME	Department of Planning, Monitoring and Evaluation
DST	Department of Science and Technology
ELRC	Education Labour Relation Council
FP	Fundamental Pedagogy
FET	Further Education Training
HSRC	Human Science Research Council
IMD	International Institute for Management Development
IMU	International Mathematics Union
IPAA	Institute of Public Administration in Australia
IQMS	Integrated Quality Management System
LoLT	Language of Learning and Teaching
LTSM	Learner Teacher Support Material
MST	Mathematics, Science and Technology
NSC	National Senior Certificate
NCS	National Curriculum Statement
NDP	National Development Plan
NPPPR	National Policy pertaining to the Programme and Promotion Requirements

NPA	National Protocol for Assessment
NQF	National Qualification Framework
OECD	Organization for Economic Co-operation and Development
OBE	Outcome Based Education
PGCE	Post Graduate Certificate In Education
RNCS	Revised National Curriculum Statement
SAASTE	Summer Academy of Applied Science and Technology
SBA	School Based Assessment
SACE	South African Council of Educators
SADTU	South African Democratic Teacher`s Union
SASA	South African School Act
SGB	School Governing Body
SIFTE	Sugar Industry Trust Fund for Education
SMT	School Managing Team
TIMSS	The Trend in International Mathematics and Science Study
UNESCO	United Nations, Education, Scientific and Cultural Organization
WEF	World Economic Forum

ABSTRACT

The Curriculum and Assessment Policy Statement (CAPS) for mathematics Grades 10-12 is part of the National Curriculum Statement Grades R–12, which is a policy in teaching and learning in South African schools. However, there is a notable concern that educators in most of the rural areas of South Africa experience challenges with the implementation of the Mathematics CAPS Grades 10-12 and that results in the low pass rate in mathematics. Therefore, this study explored the experiences of educators regarding the implementation of the Mathematics CAPS Grades 10-12 with the aim of improving the teaching of this subject.

The study achieved this through a qualitative phenomenographic case study approach which was supported by some quantitative data. In addition to the 43 completed questionnaires using Google forms,

Semi-structured interviews were carried out with twelve mathematics educators and two mathematics departmental heads in Mopani West District, Limpopo Province, South Africa. The findings revealed themed challenges with the execution of the CAPS, henceforth recommendations for best practices were given. The results of this study advise the Department of Basic Education to stimulate the national and international dialogue among mathematics policymakers and mathematics educators regarding the implementation of the Mathematics CAPS.

KEYWORDS

Curriculum and Assessment Policy Statement
Curriculum implementation
Curriculum changes
Deliverology
Educator`s experiences
Grade 10-12 learners
Mathematics curriculum
Mathematics educators
Rural schools
Phenomenographic research
Education policy

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CHAPTER ONE: OVERVIEW OF THE STUDY

1.1 INTRODUCTION

There is a notable concern about poor academic performance of Grades 10 -12 learners in South Africa in the subject of mathematics in the national and international assessments. South Africa ranks amongst the lowest performing countries regarding the pass rate in mathematics. The lowest performing countries were found to be Botswana, Jordan, Morocco, South Africa and Saudi Arabia (The Trend in International Mathematics and Science Study -TIMSS 2015). TIMSS is a cross-national assessment of mathematics and science levels of learners from different participating countries, and it is carried out every four years. In South Africa, it assesses Grade 9 learners. According to the Organization for Economic Co-operation and Development (2016), South Africa`s mathematics education ranked second last out of 76 countries. Another body, the World Economic Forum (WEF) (2017) ranked South Africa last in the quality of mathematics education in the global competitive index. The 2017 international Institute for Management Development (IMD) report ranked South Africa 47th out of 63 countries in a mathematics education survey. In the National Senior Certificate (NSC) examination report (DBE 2020) stated that, out of all the gateway subjects offered in Curriculum and Assessment Policy Statement (CAPS), mathematics performance remains to be the lowest. The International Mathematics Union (IMU) (2014) concurs that in the South African schools, mathematics achievement is inadequate, with a low number of students going to universities with insufficient mathematics background. South Africa has undergone various curriculum changes to improve the performance of learners especially in mathematics. One of these is CAPS, which was introduced to uplift the education quality in the country and mathematics is one of the subjects in the CAPS curriculum.

The CAPS represented an amendment of the National Curriculum Statement (NCS) Grades R-12(Department of Basic Education (DBE) 2011). Moodley (2013) stated that CAPS was designed in such a way that every subject in each grade would have a one comprehensive and consistent curriculum and

assessment policy. It would also provide details of the content teacher ought to teach and assess in a grade and or a subject. The DBE (2011a) stated that one of the purposes of the South African curriculum was to equip the 21st century learners with skills, regardless of their race, socio-economic, physical ability or intellectual ability. The 21st century society needs to be equipped with 21st century skills so that learners succeed in life and in their working environment. The skills required by the 21st century learners are critical thinking, problem solving, creativity and innovation, teamwork, social justice and human rights. They are the same skills that are expected to be acquired in the CAPS curriculum. Learners who acquired these skills would be able to read critically for understanding, listen critically for understanding, write for a variety of purposes and communicate clearly through speaking. This includes applying critical thinking for reasoning and problem solving. According to the National Development Plan 2030 learners would also use critical thinking to present information (DBE 2011b). Therefore, educators as agents for the implementation of the curriculum needed to be equipped with the necessary skills and knowledge so that they could deliver the curriculum objectively and effectively to the learners.

1.2 BACKGROUND OF THE STUDY

When the new government in South Africa came into power in 1994, one of the decisions made was to change the education system from that of apartheid to one that is relevant to the needs of the society in a democratic country. People in South Africa were thirsty for change, and they had positive expectations. The first education system introduced in South Africa after democracy was Curriculum 2005(C2005) generally known as Outcomes-Based Education (OBE). Mbatha (2016) stated that the education changes in the country put forward a paradigm shift from a teacher and content driven curriculum to an outcome-based and learner-centered curriculum. The objective of OBE was to address the legacy of apartheid. Its main emphasis was for learners to obtain skills, knowledge, attitudes and values that suited a democratic change, and the approach was learner centred. According to Adu & Ngibe (2014), the main aim was to integrate education and training into a lifelong system of learning. However, the curriculum failed because it did not address the problems that it was expected to address

and, therefore, the implementation was not successful. This was because the curriculum designers lacked the experience for designing and implementing it. Moodley (2013) added that the unreliability of change, complicated terminology, complex design features and workload resulted in educators grappling with the execution of C2005. However, Adu & Ngibe (2014) further stated that introducing OBE was not only an attempt to change the education system but also to transform the society by allowing the parents and the guardians of the learners to take charge and responsibility for their children`s education.

In the year 2000, because of concerns expressed by educators, the Minister of Education of that time, Kader Asmal, appointed a new committee to investigate the structure and design of C2005. The committee suggested that the curriculum should be streamlined and altered to make it more user friendly to the educators. In 2002, the second curriculum named Revised National Curriculum statement (RNCS) for Grade R-9 was introduced. Later in 2004 the National Curriculum Statement (NCS) for Grade 10-12 was introduced and the implementation started in Grade 10 in 2006. The RNCS and NCS strengthened and streamlined the design features of C2005 but, according to the DBE (2002), they were not new education systems because they had the assumptions, thrust and purpose of C2005. According to Moodley (2013), the RNCS and NCS also faced some implementation problems similar to those of C2005. These included understanding of the outcome-based terminology, assessment strategies and teaching methods. Therefore, as stated above the RNCS and NCS attempted to addresses the problems of curriculum implementation of South Africa but with very little success.

1.2.1 The historical Background of CAPS

In response to problems faced by the educators in implementing the RNCS and NCS curricula, the new Minister of Basic Education, Angie Motshekga, appointed a team for further investigations (DBE 2009). Following the recommendation made by the task team, the minister took the first step to develop a five-year action plan which was named *Towards the realization of schooling 2025*. Three policies namely, *the National Curriculum and Assessment Policy Statement*

Grades R-12 per subject, The National *Policy pertaining to the Programme and Promotion Requirements (NPPPR) of the National Curriculum Statement Grades R-12* and *The National Protocol for Assessment (NPA) Grades R-12* were developed and introduced. According to the DBE (2012a), these policies guided and directed teaching and learning in every school in South Africa. Educators had to read these policies and implement the content.

1.2.2 The implementation of CAPS

The South African education system has the following phases: Foundation Phase- Grade R-3, Intermediate Phase – Grades 4-6, Senior Phase – Grades 7-9 and Further Education Training (FET) Phase – Grades 10-12. CAPS was introduced into the Foundation Phase and Grade 10 in 2012, into the Intermediate Phase and Grade 11 in 2013 and into the Senior Phase and Grade 12 in 2014. It was streamlined and strengthened by developing a single, coherent document per subject per phase from Grades R-12. Other recommendations that were implemented were the clarification of the policy regarding the allocation of subject advisors, their roles and functions. The Annual Assessment Task (ANA) was introduced in 2011 to improve the quality of assessment in all primary and senior phases up to Grade 9 but was phased out in 2015.Subjects were reduced from eight to six, and English as a first additional language was introduced in the Foundation Phase. The centralization of Learner Support Teaching Materials (LTSM) was accomplished, and workbooks were distributed annually to learners in Grades 1-9 mathematics; the Funza Lushaka bursary scheme was introduced in order to expand teacher education. Government allocated R1,1 bn for continuous professional development of educators in 2014 and R435m was spent (DBE 2017b).

Currently, the Mathematics CAPS is being implemented. According to the DBE (2018), CAPS is comparable in quality, breadth, and depth to the mathematics curricula of other countries worldwide. It has now been six years since the amendment of the CAPS, but the educators in South Africa, especially those who are teaching mathematics in rural areas, for example the Limpopo Province, are experiencing problems regarding the implementation of the Grades 10-12

Mathematics CAPS. The International Mathematics Union (2014) stated that mathematics education in rural areas is also even poorer as compared to that in urban schools. CAPS emphasizes a learner-centred approach, but educators are not adequately equipped to carry out the tasks as they were not properly trained to deal with the learner-centeredness. In 2016, the Department of Planning, Monitoring and Evaluation (DPME) commissioned Jet Evaluation Services to evaluate the implementation of CAPS in 12 primary schools and 12 high schools, quintile 1-3 schools in 4 provinces of Eastern Cape, Gauteng, Kwazulu Natal and Mpumalanga. CAPS looks comprehensively at providing knowledge and content to satisfy specific aims of the curriculum (Themane and Mamabolo 2011). This study seeks to explore the experiences of educators regarding the implementation of the Mathematics CAPS in Grades 10-12.

1.2.3 Expectation of the Mathematics CAPS Curriuclum

The aim of the Mathematics CAPS was to produce learners that would be able to identify and solve problems and make decisions using critical and creative thinking. These learners had to be able to work effectively as individuals and with others as members of a team; learners would also be able to organize and manage themselves and their activities responsibly and effectively. The CAPS had to produce learners that could collect, analyze, organize, and critically evaluate information. Learners had to be able to communicate effectively using visual, symbolic and or language skills in various modes. They had to use science and technology productively, by managing the health of others and the environment. Lastly, learners had to demonstrate an understanding of the world as a set of related system by recognizing that problem-solving contexts do not exist in isolation (DBE 2011a). However, according to the research conducted in this regard, the actualization of these values has not been evident in the Grades 10-12 mathematics learners. In addition, the examination results related to the mathematics subject in most provinces of South Africa have been disappointing. Therefore, there was a need to investigate the experiences of educators in implementing the Grades 10-12 Mathematics CAPS, six years after its introduction.

Part of the reason for conducting this study was that some research into the problems of the Mathematics CAPS has been carried out and recommendations provided, but there are still problems with the implementation of the curriculum. For example, educators give learners poor quality of informal assessment tasks. Based on CAPS analysis report (DBE (2017b), some questions related to the implementation of Mathematics CAPS were as follows: Has the Mathematics CAPS addressed the negative aspects of NCS Mathematics? What were the negative aspects? In addition, how were they addressed? Are there clear guidelines provided relating to the pacing and sequencing of curriculum change in mathematics? How did CAPS amend NCS by avoiding repetition of content in different grades of mathematics? How has the risk of overload in mathematics been addressed?

It appears that there is a huge gap between the aims of the Mathematics CAPS and its execution in the South African curriculum. This study is important because it seeks to understand and gain more knowledge on how the implementation of CAPS can be improved in mathematics Grades 10-12 in high schools of Limpopo Province. According to the literature conducted, it seems that educators are struggling with the implementation of the Mathematics CAPS Grades 10-12. Therefore, it was important to carry out this study to identify challenges that impede the implementation process of the new CAPS in order to improve the teaching and learning of mathematics in South Africa.

1.2.4 The context of Rural High Schools in South Africa

A rural high school in South Africa, for example in the Limpopo Province, is characterized by being located in the previously disadvantaged rural area, which is typically remote and underdeveloped. Communities found in rural areas are often poor and this makes the schools to be disadvantaged. The schools lack resources such as water, roads and infrastructure. They also lack facilities such as libraries, laboratories, classrooms, teaching and learning resources like apparatus, textbooks and proper school buildings. The rural profile of a school is characterized by distance to town, topography (conditions of roads, bridges to schools), access to information technology, transport infrastructure (roads,

buses, taxis), access to services and facilities such as electricity, water, sanitation (United Nations Education Scientific and Cultural Organization –UNESCO-2005).

In South Africa schools are divided into public fee free schools, public private schools and private schools. Public fee free schools rely on government funding. These schools are usually found in rural, farms and township communities dominated by black learners; they usually fall under no fee schools. Public private schools also known as former Model C schools are subsidized by the government and they charge school fees. These schools are often found in towns and are dominated by white learners. Former Model C schools have opportunities and access to all the services and facilities that black learners do not possess. Private schools are independent schools that are privately governed, and they charge school fees. The constitution of South Africa (1996) has tried to bridge the gap by introducing equal education opportunities for all. For example, it informs the South African Schools Act (SASA) (act 84) on how to categorizes the schools according to the quintile system. This system was based on the level of economy in the community that surrounds the school. The quintile (group) 1 schools are allocated more funds than the quintile (group) five schools. The reason was to bridge the gap in economic and educational historical inequalities. However, the gap could not be bridged overnight because it has existed for a very long time.

1.2.5 Problems that emerged after the implementation of the Mathematics CAPS

According to DPME (2017) evaluation report for the implementation of the CAPS, there were issues that were observed in the failure to implement the expectations of the Mathematics CAPS. Among the problems identified were the following: Educators were unable to follow timetables. Educators were disrupting classes frequently and were giving learners poor quality formal assessment tasks. There was no alignment of cognitive levels of learners by teachers. There was little coherence concerning the use of assessment to improve teaching and learning. The weighting of assessment was not aligned to the expected time and marks. The educators were found to be teaching for assessment and not for the understanding of the content area. The mathematics reading levels of learners

did not match their grade levels. The learners did not seem to have acquired the 21st century skills of dealing with mathematics. Finally, learners showed the inability to analyze critically when solving mathematics problems. Recommendations to address the above challenges were made. Assuming that the schools and the department attempted to address these challenges between 2012 and 2014, and there are still noticeable problems with the implementation of the Mathematics CAPS. This study intends to find out what could be the problem now, given that six years have passed.

The manner in which mathematics was presented in South Africa prior 1994 caused the majority of educators to have little knowledge of the subject. Currently mathematics CAPS informs the educators to upgrade their knowledge and teaching skills to be able to teach the subject. Seemingly educators need guidance and support to make adaptations that are necessary for teaching mathematics. Therefore, empowering educators is a good investment because they would pass on the knowledge and the skills to the learners.

The National Policy Framework for Teacher Education and Development in South Africa was drafted to begin a teaching profession, which can fulfill the needs of a democratic South Africa in the 21st century (DoE 2006). The policy`s goal was to initiate a community of excellent teachers dedicated to providing high quality education with high level of performance, as well as professional and ethical standard. Therefore, the CAPS has to guide and empower educators on how the implementation of the mathematics curriculum must take place in the classroom. The aim of this study therefore was to contribute to the improvement of quality teaching and learning of mathematics content knowledge relevant to Grades 10-12 educators. It is hoped that the study would also start a national and international dialogue among policymakers and mathematics educators about Mathematics Education Policy and programmes to uplift mathematics results in Grades 10 -12.

1.3 RATIONALE OF THE STUDY

The CAPS was introduced by the Department of Basic Education (DBE) for the delivery of public education in South Africa. As mentioned above that the aim of the CAPS was to develop and support the South African education system for the 21st century skills and therefore learners had to acquire the skills, knowledge and values that are in the NCS Grade R-12 policy documents. It was also mentioned above that from grade R- 12 the Department of Basic Education designed three documents which are policies to guide the curriculum implementation in South Africa. The reason was to make the curriculum easier and simpler for the educators to understand the aims of the CAPS. All the three policy documents have a common aim and purpose. The policy documents of the CAPS Grade R-12 for an example, emphasize the idea of grounding knowledge in local context, while being sensitive to global imperatives (DBE 2011a).

The CAPS plays an important role in the education of the learners in South Africa. When learners acquire knowledge, skills, attitudes based on the objectives of CAPS, the competencies learned go beyond the school and can be applied in learners` working environment and in the communities in which they live. The curriculum addresses the education inequalities of the past and provides equal opportunities for the whole population of South Africa. It encourages an active and critical approach to learning so that learners can achieve minimum standard of skills and knowledge in each grade in all the subjects. The content learned and their context shows progression from simple to complex in each grade. The curriculum closes the gap between learners in rural schools and urban schools by addressing the principle of inclusivity to help learners who have barriers to learning. It promotes the principles and practices of human rights, environment, social justice as outlined in the constitution of the Republic of South Africa and provides education that is comparable in quality, breadth and depth to those of other countries (DBE 2011a).

It was observed in the discussion above that the CAPS implementation seemed to be failing in the mathematics section, hence the TIMSS report 2015.It was indicated above that the aim of the CAPS in South Africa was to improve the

quality of mathematics education. It was important to encourage and empower educators in implementing the Mathematics CAPS because the country would benefit through producing learners in the career fields of mathematics such as engineering, medicine, accounting therefore the economy of South Africa would grow (TIMSS 2015). Educators would benefit from this study by acquiring skills and knowledge of CAPS that will improve learners' performance in mathematics. The educators would also gain more understanding in the Mathematics CAPS. The government would benefit by producing learners who acquire the 21-century skills needed in the South African curriculum. Since CAPS is a new curriculum that is implemented in South Africa, it is of utmost importance to investigate whether it addresses the problems of South Africa. Therefore, the study aims to understand the experience of the teachers regarding the execution of the Mathematics CAPS in South Africa. This would in turn support the development of strategies that will promote effective teaching and learning of mathematics Grades 10-12 in schools.

1.3.1 The role of the Curriculum in South Africa

Curriculum plays an important role in the education system of South Africa. According to Praveen (2016), curriculum is a systematic and intended packaging of competencies such as knowledge, skills, attitudes underpinned by values. Learners should acquire these values through organized learning experienced both in formal and informal setting. According to the definition by Rayou and Van Zanten (2015), curriculum is a programme developed by public authorities, informed by values and ideas, directed to education actions, and implemented by administrators and education professionals.

Curriculum is developed by curriculum developers and delivered in schools for implementation. According to Dube (2016), the four stages for developing the curriculum are to design, disseminate, implement and assess. This study is situated in the third stage, which is curriculum implementation. In the education field, there are theories for guiding the curriculum for an example curriculum theory, curriculum development theory, theory of curriculum change, curriculum implementation theory. According to Wiersma and Jurs (2009), a theory is a

generalization or series of generalizations by which we attempt to explain some phenomenon. The framework for this study will be discussed later under theoretical framework.

1.4 PROBLEM STATEMENT

Problems with the implementation of the CAPS have existed since the first democratic government came into power. For example, a panel of experts in curriculum was appointed by the Minister of Basic Education in 2012 to assess the implementation of the CAPS, with the aim of making it easy to use, but it did not realize its aim as expected, especially in Mathematics CAPS Grades 10-12 in rural schools. Curriculum implementation of a particular subject should be done in a way that learners can understand. Therefore, the aim of this research was to investigate educators` experiences with the implementation of the Mathematics CAPS with the purpose of reducing the challenges encountered in the execution of the phenomenon.

1.5 RESEARCH QUESTION, AIM AND OBJECTIVES OF THE STUDY

1.5.1 The Research Question

What are the experiences of educators regarding the implementation of the Mathematics CAPS in Grades 10-12 in South Africa?

Based on the main question, the following sub-questions were formulated:

- What are the expectations of the Mathematics CAPS in Grades 10- 12?
- What are the challenges experienced by the mathematics educators regarding the implementation of Mathematics CAPS in Grades 10-12?
- What are the best practices that can help educators in the implementation of the Mathematics CAPS in Grades 10-12?

1.5.2 Research Aim

This study aims to explore the experiences of educators regarding the implementation of the Mathematics CAPS in Grades 10-12 in South Africa.

1.5.3 Research Objectives

Following the research questions above, the objectives of the study are:

- To determine the expectations of the Mathematics CAPS in Grades 10-12.

- To investigate the challenges experienced by the mathematics educators regarding the implementation of the Mathematics CAPS in Grades 10 -12.

- To recommend best practices that can help educators in the implementation of the Mathematics CAPS in Grades 10-12.

1.6 PRELIMINARY LITERATURE REVIEW

This study conducted a thorough literature review by using sources such as Google scholar, EBSCO e-books, books, government gazettes, conference presentations, newspaper articles, reports and journal articles were consulted.

1.6.1 Curriculum and Assessment Policy Statement

CAPS is a curriculum, that is now used in South Africa. CAPS is a content-driven curriculum since it is very particular about what content must be covered each day and for how long (duration) (Moodley 2013). The CAPS for each approved school subject should be read and implemented with the CAPS NPPPR of the NCS Grades R to 12 and NPA Grades R to 12 (Department of Basic Education 2012a). The three CAPS documents needed to be made available to *all* schools, district offices and to parents via print and digital media (DBE 2011a). As stated

above, CAPS was implemented in schools in the foundation phase and Grade 10 in 2012, the intermediate phase and Grade 11 in 2013, the Senior phase and Grade 12 in 2014. This study defines curriculum as an element of education that forms the base of lifelong learning planned competencies such as knowledge, skills and values. These are needed to engage with the world and can be changed depending on the political, social, economic and environmental status of a country. Marope (2017) concurs that curriculum is the vehicle through which a country empowers its citizens with the necessary knowledge, skills, attitudes and values socially and economically in order to empower them for personal and national development. According to Kenyaplex (2017), curriculum has two meanings, namely, curriculum as a field of study and curriculum as a programme of institution. Curriculum as a programme of instruction views curriculum as a plan of instruction, while curriculum as a field of study views curriculum as an aspect of knowledge which has developed into disciplined area of study. This study was situated at the level of curriculum as a programme of instruction.

1.6.2 Curriculum Changes

The curriculum of South Africa has undergone several curriculum reviews. Nkabumbule and Amsterdam (2018) concur that four curriculum reviews have been introduced by the DBE within a space of 15 years, from 1997-2012 and they are C2005, RNCS, NCS and CAPS. The British Columbia Teachers` Federation (BCTF) (2017) report states that the process of curriculum change is about policy and practice. In South Africa, the old apartheid education system had to change, and the new democratic curriculum had to be introduced. When a new curriculum is introduced, curriculum has to be redesigned and all stakeholders must be involved. The Organization for Economic Co-operation and Development (OECD) (2018) report states that curriculum change ensures that education is an ecosystem with many stakeholders, students, educators, school leaders, parents, national and local policy makers, academic experts, unions, social and business partners work together. Therefore, careful planning is needed when changing the curriculum. The OECD (2018) report explains that the common challenges of curriculum changes identified globally are that schools deal with curriculum load, and curriculum reforms suffer from time lags between recognition, poor decision-

making, implementation and impact. It adds that the gap between intended curriculum and learning outcome is too wide, meaning that there is poor planning of the curriculum.

1.6.3 Challenges with the implementation of the Mathematics Curriculum

Curriculum implementation refers to how educators deliver instruction and assessment using specified resources found in a curriculum (Nevenglosky 2018). Cambridge and Oxford dictionaries define it as an act of putting decisions or plans into action. Viennet and Pont (2017) define curriculum implementation as a purposeful and multidirectional change process aiming to put a specific policy in to practice. In this study mathematics educators had experiences with the implementation of the mathematics curriculum. According to literature, Dube (2016) conducted a study of teachers' experiences of the implementation of the Mathematics CAPS at the FET Phase and found that language barrier affects the implementation of the mathematics curriculum. Mohyuddin and Khalid (2016) identified the misconceptions of elementary mathematics learners and found that teachers' insufficient knowledge of curriculum hindered the learners` understanding and progress. Sometimes the problem with implementation results from a problem with the curriculum itself (Caropreso, Haggerty and Ladenheim 2016; Marsteller and Bodzin, 2015). Olivier (2015) stated that according to literature, some adjustments were made in the FET mathematics curriculum, where some topics that were not included previously such as, Euclidean geometry and probability were then included. Teachers' preparedness plays an important role in that there is a need for them to know the curriculum well in order to strengthen instructional practices (Battey, Neal, Leyva and Adams Wiggins 2016 and McNeill, Katsh-Singer, Gonzalez-Howard and Loper 2016).

The literature review of this study has highlighted the interrelatedness of concepts such as CAPS, curriculum changes and curriculum implementation. These were used to provide the understanding of experiences of educators with the implementation of the Mathematics CAPS.

1.7 THEORETICAL FRAMEWORK

The theoretical framework that underpinned this study is Deliverology. Deliverology is an approach to managing reform initiatives, pioneered in the United Kingdom it has had significant impact in a number of countries around the world (Barber, Moffit and Kihn 2011b). Deliverology was originally developed by the then British Prime Minister, Tony Blair. Barber was the head of the Deliverology Unit that was launched in 2001.

In 2015, Barber adopted the Deliverology approach and refined it to accommodate the current trends of curriculum in the Department of Education. This study has adopted the Deliverology approach because the intention is to help improve the implementation of the Mathematics CAPS in South Africa. Therefore, this approach is based on the assumption that, in order to achieve the aims of the Mathematics CAPS, there should be effective curriculum implementation. The Deliverology approach has proven to be the best in understanding the context within which curriculum implementation is taking place in South Africa. In this study Deliverology encouraged the implementation of the CAPS by ensuring that the curriculum developers set clear goals in the policies (skills, knowledge, attitudes and values) which are specific and measurable so that implementation can be effective.

According to the Deliverology approach, when educators experience some problems in the implementation of the Mathematics CAPS, the curriculum should remain flexible throughout the process of implementation. Therefore, in order to achieve the best practices in the implementation of the Mathematics CAPS regular monitoring and analysis of the curriculum should take place so that the curriculum can be revised or innovated. Curran (2016) stated that Deliverology focuses on providing solutions to a country`s challenges by refining the ministry's efforts and capabilities. It relies on top-level political support to be able to do its work. Therefore, the Deliverology approach focuses on priorities, typically mid to long-term goals as directed by the country. According to Barber (2015) effective implementation from the delivery standpoint is implementation that ‘’gets things

done'' to achieve the government`s goals. Curriculum implementation involves stakeholders such as principals, educators, parents and learners.

1.8 RESEARCH DESIGN

In this study, the qualitative phenomenography research approach was used. The qualitative phenomenography research design is aimed at identifying and describing qualitatively, different ways of experiencing and identifying educationally critical aspects that could be used as a means towards new and more complex ways of understanding a pedagogic purpose (Kettunen and Paakkari 2017). The qualitative approach was adopted as the main method and was supported by quantitative approach. A qualitative method was used to identify the way mathematics educators experience and understand the implementation of the Mathematics CAPS. In this study, the qualitative approach was appropriate because the stories, experiences and voices of respondent are the medium through which reality is explored and understood (Maree 2012). The data was collected in the form of a case study in rural high schools of Mopani West District. This was because qualitative research designs emphasize collecting the data in the natural setting of the phenomenon (McMillan and Schumacher 2010). The population included all the rural high schools and all the mathematics educators teaching Grades 10-12 in Mopani West District. Purposive sampling was employed to sample both the schools and the participants.

Semi- structured interviews and online survey were used as methods of collecting data. The semi-structured interview participants included twelve Grades 10-12 mathematics educators and two Departmental Heads (DHs) for mathematics. Interview participants were selected from a sample of five rural high schools. An online survey used Google forms to collect data from mathematics educators of Grades 10-12. In purposive sampling the participants are selected according to pre- selected criteria relevant to a particular research question (Maree 2012). In this study, ethical procedures were explained and followed. Qualitative phenomenographic data analysis was conducted during and after the data had been collected. Thereafter, quantitative data description, which was assisted by

a software package, was employed. The credibility and trustworthiness of this study`s results were assured. Macmillan and Schumacher (2010) state that a research design outline the plan for carrying out a study including when, from whom and under what conditions.

1.9 RESEARCH APPROACH

In this study a qualitative research approach was supported by some quantitative research data. Qualitative research is concerned with understanding processes of social and the cultural context (Maree 2012). In qualitative research, the multiple meaning of individual experiences is understood better by interpretations and interaction of the participants in the place where they live or work. Therefore, the purpose of this qualitative research was to understand educator's feelings and experiences in their natural setting, which is the school. The qualitative approach enables the researcher to gain a deeper understanding and insight through the words of the educators. The quantitative research is a systematic and objective process of using numerical data from a selected group to generalize the findings of the phenomenon.

1.10 RESEARCH METHODOLOGY

The research methodology guiding this study has been outlined. More details will be provided in Chapters 3 section 3.5.

1.10.1 Geographical position of the Study

This study was conducted in rural high schools of Mopani West District in the Limpopo Province, South Africa.

1.10.2 Population and Sampling method

For the purpose of this study, there were two populations. The first was drawn from all the rural high schools of Mopani West District in Limpopo province. The 5 high schools were sampled because they were located in the rural areas. Within

the 5 rural high schools, the second population was drawn from all Grades 10-12 mathematics educators. In the high schools selected, the principals were requested by the researcher to select the educators who teach mathematics in Grades 10-12. To avoid bias and preferences, the principals provided a list of all the names of the educators and the names of the Departmental Heads (DHs). The twelve-post level 1 educators who each had three years teaching diploma or more and had experienced some of the curriculum changes brought by C2005, RNCS, NCS and CAPS curricula were selected purposefully. Some had 20 years or more experience of teaching mathematics in Grades 10 -12, and others had also attended CAPS workshops. The two DHs were also selected purposefully based on having BEd Honours qualifications or more and their experiences of being mathematics DHs within the CAPS. The number of participants depended on data saturation.

1.10.3 Data collection techniques

For the purpose of this study, two methods for collecting data were utilized to gain an in depth understanding of the phenomenon under study. These were semi structured interviews and online survey.

The first data collection method was the online survey which used a software package called Google forms for quantitative data collection. The formulation of questions was based on the research question and the objectives of the study. In order to respond to the purpose of the study, 110 Google forms were sent to Grades 10-12 mathematics educators in the district. The second data collection method was the semi structured interviews. A set of detailed questions was developed in advance (Maree 2012) to get rich information from the participants. To ensure consistency in the collection of data, one set of questions was developed for both the mathematics educators and mathematics DHs. Individual face-to-face interviews were conducted to ensure honest and accurate responses. Data collected from interviews was recorded, transcribed and used in data analysis and interpretations of the findings of the study.

1.10.4 Data analysis

In this study, the data analysis was mainly qualitative and supported by some quantitative data. A software package was utilized to describe the quantitative data. The data collected was captured, analyzed, and interpreted by Google forms. The findings were reported in the form of percentages, frequencies, graph and pie charts to explore the implementation of the Mathematics CAPS Grades 10-12. In qualitative data analysis, the researcher summarized what had been heard with regard to common phrases, patterns or themes that assisted in understanding, explaining, and drawing conclusions of the phenomenon under investigation (Maree 2007). The data collected was organized, examined and reduced into significant categories. The themes were created to represent the overall objectives of the study. This was supported by the software package that was utilized to analyze quantitative data.

Finally, the findings from quantitative data and those from qualitative data analysis were consolidated for the interpretation and presentation. Conclusions and recommendations were provided.

1.11 RESEARCH ETHICS

In this study, the procedure for ethical research principles was followed. According to Walshaw (2015), the ethical application focuses primarily on the link between research methods and the participants. Prior the commencement of data collection, a letter requesting the permission for collection of data in rural high schools of Mopani West District was sent to the Department of Basic Education; the letter described the purpose of the study. After the permission was granted, letters were sent to the school principals and the mathematics educators of the schools sampled, describing the purpose of the study. The subject advisor for mathematics provided the emails for sending Google forms to all educators teaching mathematics in Grades 10-12. There after educators and the DHs had been purposively selected, they were invited to participate in the interviews. The main purpose for conducting this study was explained and clarified to the participants. The subject advisor for mathematics provided the emails for sending

Google forms to all educators teaching mathematics in Grades 10-12. Informed consent and voluntary participation forms were explained and signed by participants who were willing to participate. Informing participants was done in a way that encouraged free choice of participation (Macmillan and Schumacher 2010). Communication was in the form of emails, telephone calls, SMSs and WhatsApp to confirm the availability of participants.

Respect, honesty and sympathy among participants was emphasized and adhered to. Participants were ensured that information and responses to be shared during the study would be kept private and confidential, and they would not be exposed to any physical or psychological harm. According to Mbatha (2016) the trustworthiness of the study should be judged by how ethically engaged the researcher was likely to be during the conduct of the study.

1.12 CREDIBILITY AND TRUSTWORTHINESS

In this study credibility, transferability, conformability and dependability were used as aspects or criteria to ensure trustworthiness. McMillan and Schumacher (2010) argue that irrespective of method, approach or criteria used for collecting data, results must be reliable, valid and trustworthy. To ensure credibility of the results, this study utilized different data collection methods to check the consistency of the findings. Hence, semi-structured interviews and the online survey were used as triangulation. Engaging multiple methods of data collection led to trustworthiness (Maree 2012). To strengthen the credibility of the results of this study the rechecking of mistakes from the transcripts was done. To ensure consistency of coding data there were regular meetings to double-check the codes developed by participants. To establish transferability of the results, evidence that the findings of this study could be applicable to other situations and context will be provided. To ensure the dependability of results, audio recording from interviews and description of Google forms were used. The methodology and data analysis procedures were done purposefully, with caution and were free from bias by following the above criteria of ensuring trustworthiness.

1.13 LIMITATIONS

This study was confined to rural high schools of the same district of Mopani West in the Limpopo province South Africa. Therefore, the findings cannot be generalized to other high schools in South Africa. No independent high schools or urban high schools were studied. There was limited literature on the subject because it is from the educators in rural high schools. Sometimes participants were not honest with their responses and hid their feelings and that hampered the investigations.

1.14 CLARIFICATION OF KEY WORDS

1.14.1 Mathematics Curriculum

In this study mathematics curriculum was a set of skills and knowledge designed for directing and guiding mathematics as a subject. Dube (2016) describes it as the curriculum designed for the mathematics subject. Therefore, the explanation of Dube fitted well in this study.

1.14.2 Mathematics educator

In this study, mathematics educator was used interchangeably with a mathematics teacher. In this study a mathematics educator is someone who delivers mathematics curriculum to learners so that they can be responsible adults. Ramabulana (2017) stated that an educator helps learners to acquire values, knowledge and competencies.

1.14.3 Curriculum

Moodley (2013) stated that the definition of curriculum is complex because it may mean various things to different people. It ranges from rather limited interpretations to broad, systematic interpretations, which involve all components of the education system (McMillan and Schumacher 2010).

1.14.4 Learner centred approach

Dube (2016) defines the learner-centered approach as an approach developed to motivate the learner to be independent of the teacher in solving the problems using prior knowledge. Mbatha (2016) stated that some of the methods associated with learner-centered education are learning through discovery, working in small groups which develops social and cooperative learning as well as problem-solving.

1.14.5 Rural School

Du Plessis (2014) stated that a rural school is a school in the outskirts of the town. Du Plessis added that rural school emphasizes history and structures that have created conditions and circumstances of oppression, depravation, disadvantage, and deficit. In this study, rural school is a school located in an underdeveloped and inactive economic area.

1.14.6 Department of Basic Education

The Department of Basic Education (DBE) is one of the South African government's departments with the role of overseeing primary and secondary schools (Kokela 2017). The Department of Basic Education is responsible for designing a basic education system to ensure effective and efficient operations (DBE 2011c).

1.14.7 Education Policy

In this study education policy is a set of rules and regulations that stipulate the curriculum and assessment in the South African schools. This implies that education policy is the action taken by the DBE in relation to educational practices, to direct how the production and delivery of the education system should be implemented. According to the DBE (2012a), the National Curriculum Statement Grades R to 12 CAPS document, represents a policy statement for

teaching and learning in the schools of South Africa. For an example in the DBE, CAPS is the curriculum policy to be implemented.

1.14.8 Deliverology

In this study the Deliverology approach is the theoretical framework that supports the study. According to Barber (2015). Deliverology is the approach to managing and monitoring the implementation of activities that have significant impact on the outcomes. For example, in this study, it can be used by the Department of Basic Education to improve the implementation of the Mathematics CAPS curriculum in the schools.

1.15 CONCLUSION

This study focused on the experiences of educators with the implementation of Mathematics CAPS curriculum in Grades 10-12. The study adopted the qualitative phenomenological research design. The theoretical framework of Deliverology approach was employed (Barber 2015). Deliverology assumes that if the Department of Education could set clear aims and objectives of the curriculum, effective implementation process would take place. Every time implementation challenges arise; the curriculum should be revisited, and some adjustment or innovation should be done so that the process of implementation can be effective. As a result, there would be an improvement of performance in mathematics Grades 10 – 12.

CHAPTER TWO: THE LITERATURE REVIEW

2.1 INTRODUCTION

This chapter provides the literature review of the mathematics Curriculum and Assessment Policy Statement. It also presents the theoretical framework on which the study is grounded. The chapter systematically explores existing literature of the Mathematics CAPS by firstly understanding the general concept ‘’curriculum’’ and all aspects related to curriculum changes in the context of this study. Furthermore, the school curriculum is conceptualized in the South African context. In depth discussion regarding the history of the mathematics curriculum before democracy and after democracy is presented. Democracy is when the people are vested with the supreme power to govern their own country. According to Lincoln (1863) democracy is when the government is “of the people, by the people, and for the people”.

2.2 THE CURRICULUM

Curriculum is an element of education that forms the base of lifelong learning planned competencies such as knowledge, skills and values, which are needed to engage with the world. According to Zulu (2019) curriculum is the sum of all academic and non-academic activities, processes, and experiences, formal, informal and unintentional, designed to educate students, initiated by the school system, within or outside school. Lambert & Biddulph (2015) define a curriculum as what to teach. The word curriculum is placed in a bounced context to mean the totality of learning experiences undertaken by learners within a programme of education (Kwao 2017). According to Khoza (2015) successful educators in teaching start by identifying and understanding their curriculum vision, followed by identifying relevant goals of their subject’s content. Curriculum is divided into personal, societal, professional and reconstruction visions while goals are divided into aims and objectives (Van Manen 1977). Vision is what is to be achieved in the long run, in this case after the implementation of mathematics in Grades 10-12. The objectives are short term goals achieved by the educator to make sure that the learners focus according to the given instruction. Wilson (2014) defines

objectives as activities that need to be done and achieved by the educator within a short period of time, for example, achieving mathematics objectives on a daily or weekly basis.

Understanding the curriculum visions helps the educators to reflect on their teaching in order to improve on their teaching practice (Van Manen 1977). The teachers' lack of understanding of the curriculum and its goals have become a worldwide challenge that needs to be addressed in order to promote quality teaching and critical thinking (Berkvens, Van den Akker & Brugman 2014). For example, when the mathematics educators present the mathematics content to learners, their perceptions of what constitutes effective teaching influence what they do or attempt to do in their classrooms and should therefore be a critical aspect of the intention to teach (Stols, Ono & Regan 2015). Therefore, for the purpose of this study, curriculum is defined as a plan for teaching and learning (Berkvens et al 2014).

2.3 THE GENERAL AIMS OF THE SOUTH AFRICAN CURRICULUM

Curriculum change means giving a new direction or position to the curriculum. Curriculum change is not just putting into place the latest policy, but changing the cultures of classroom, schools, district and or universities (Fullan 2001). Curriculum reform is not primarily concerned with what it claims such as learning objectives, content to be covered, teaching strategies, assessments procedures, and so forth but with addressing political constraints and conflicts around the state (Carlson 1990).

Curriculum reform can produce citizens who are scientifically literate to compete with other countries worldwide. But it is important to note that the development of the new curriculum does not automatically solve the shortcomings that may arise (Gitlin & Margonis 1995). According to Cornelisen (2013), there are three ways in which teachers can change when a new policy is introduced. These are the use of new materials, the use of new teaching approaches and the educators' beliefs. Educational change can only take place when individuals embrace it by changing their beliefs and when there is a change in an individual`s practice.

According to Nieveen & Plomp (2017), all components and actors in the education system must be addressed, including the support from outside. For example, textbook publishers, assessment developers and researchers must also change. When a curriculum has to change, the focus is on policy knowledge. For example, education policy is fed by political agendas that reflect the struggle of opposition groups to have their interests, values, histories, and politics dominate the school curriculum (Chisholm 2005). The other focus is on how knowledge is constructed and what the role of the school is, in teaching and learning (Chisholm 2005). Curriculum reform in South Africa was influenced by political changes that took place (De Waal 2004). This implies that politics played a part in the choice and decision of elements of curriculum change reflected in C2005, Revised National Curriculum Statement/ National Curriculum Statement and Curriculum and Assessment Policy Statement. Therefore, C2005 is viewed as a political strategy that was used to drive educational change in South Africa.

The democratic government of South Africa inherited an unequal and divided education system. Before democracy, the nineteen different educational departments were separated by ideology, geography and race (Maphalala 2006). The education system prepared children in different ways for the positions they were expected to occupy in the social, economic and political life under apartheid. In each department, the curriculum played a powerful role in reinforcing inequality. What, how and whether children were taught differed according to the roles they were expected to play in the wider society (DoE 2004). Curriculum change in South Africa started immediately after the election in 1994 when the National Education and Training Forum began a process of syllabus revision and subject rationalization.

The purpose of curriculum change was mainly to lay the foundations for a single and national syllabus. In addition to the rationalization and consolidation of existing syllabi, the National Education and Training Forum and curriculum developers removed overtly racist and other insensitive language from the existing syllabi. For the first time, decisions concerning the curriculum involved stakeholders from different races, cultures and background (DoE 2004). Jansen (1998); Chisholm (2005) commended that since democracy, past educational

injustices of South Africa have been addressed by several changes in educational policies. However, contrary to expectations, the curriculum changes implemented do not yield positive results. The purpose of educational reforms is to redress the inequalities caused by race, and to contest the current skills shortage in Mathematics, Science, and Technology. These have not been universally welcomed (Lessing & De Witt 2007). Therefore, there was a need to refine the mathematics curriculum policy on a regular basis so that it can cater for the interests of all South Africans.

2.3.1 The School Curriculum in South Africa

In 1994 after the democratically elected government came into power, South Africa needed a school curriculum which is aligned with the principles of education contained in the Freedom Charter. According to Govander (2012), the broadband system contained in the freedom charter ensured the education system to be democratic, non-racial, free, and compulsory for all South Africans. The African National Congress (2011) declared that the doors of learning should be opened to all the people of South Africa. The aim of education was to teach the youth to love their people and their culture, to honor human brotherhood, live in liberty and peace as well as enjoy equal rights and opportunities. The principles of education in the Freedom Charter aim to eliminate the elements of apartheid. Therefore, learners as future generations of South Africa are targeted to close the gap created by apartheid by exposure to the education principles through learning.

According to Engelbrecht & Harding (2008), the newly elected government needed a curriculum that would teach learners to acquire problem -solving skills. It was hoped the new curriculum would evoke critical thinking skills, reasoning skills, reflection, as well as knowledge (Maringa 2016). The curriculum had to be learner-centred and thereforeteachers had to be facilitators who would continuously use group work and teamwork to implement the new approach of teaching and learning (DoE 1997). According to the first Minister of Education in the new government Sibusiso Bengu (1995), the new curriculum had to produce active learners who would be evaluated on a continuous basis. Therefore,

curriculum changes that took place after 1994 (C2005/OBE, RNCS/NCS and CAPS) needed to produce a typical learner as described above.

The National Department of Education in South Africa is divided into two departments: the Department of Basic Education (DBE) for Grades R-12 and the Department of Higher Education and Training (DHET) for tertiary education. Each department of education has its own minister of education who is responsible for its administration and coordination. According to Jansen & Taylor (2003), the new government has achieved several notable successes in the post 1994 period. The nineteen departments of education which were divided ethnically, racially, and regionally were merged into one single department of education. The creation of non-discriminatory school environments into which access was gained based on criteria other than gender, race or religion was successful. The National Qualification Framework (NQF) was drawn up to improve the quality of teaching and learning in South Africa. The shift from apartheid curriculum practices to democratic curriculum practices in the Department of Education has enabled South Africa to compete with other countries in the world in terms of the teaching of mathematics through its participation in the TIMSS international assessment that assesses the Grade 9 mathematics learners after every four years. This study is situated in the DBE. In South Africa, the multiple agencies, which include the private and public sector as well as local authorities (for example the Department of Science and Technology) play a role in the education sector. Universities are responsible for the training of educators.

As indicated above, the school curriculum in South Africa is guided by three policies, namely, the CAPS Grades R-12 as per subject, the NPPPR of the NCS Grades R-12 and the NPA Grades R-12 (DBE 2011a). The three policies are applied in all public schools, special schools, and independent schools in South Africa. The school curriculum is divided into the General Education and Training (GET) band for Grade R-9 and Further Education and Training (FET) band for Grades 10-12.

Mathematics is compulsory from Grade R to Grade 9. Learners with special needs may either attend ordinary schools or special schools depending on the

individual's level of barriers to learning (DBE 2011a). The above description reflects a typical school curriculum in South Africa.

2.4 THE GENERAL AIMS OF THE SOUTH AFRICAN CURRICULUM

The NCS Grades R-12 stipulates the curriculum policy of South African schools. It depicts the knowledge, skills, and values to be learned in South African schools. The curriculum aims to ensure that children apply knowledge and acquire skills to improve the standard of their lives. The curriculum promotes knowledge in local context while being sensitive to global imperatives (DBE 2011a).

The purpose of the NCS Grades R-12 is:

> *to equip learners, irrespective of their social-economic background, race, gender, physical ability or intellectual ability with knowledge, skills, and values necessary for self-fulfillment and meaningful participation in society as citizens of South Africa. Learners must be provided with access to higher education. The transition of learners from education institutions to the workplace has to be facilitated and employers have to be provided* with a sufficient profile of a learner`s competences (DBE 2011a:4).

There are many principles on which the NCS is based. First is social transformation which ensures that the education disparity of the past is rectified, and equal rights are provided for all sections of the population. Second is the emphasis on an active and critical approach to learning. In addition, high knowledge and high skills ensure that the minimum standard of knowledge and skills to be achieved are specified at each grade in all the subjects while progression ensures that content and context of each grade is incremental from simple to complex. Furthermore, human rights, inclusivity, environmental and social justice ensure that the NCS Grades R-12 is responsive to matters of diversity such as gender, age, race, poverty, disability, language, and other factors. It places value on indigenous knowledge systems by acknowledging the rich history and heritage to nurture the values contained in the constitution.

Finally, credibility, quality, and efficiency provide an education that is comparable in quality, breadth and depth to those of other countries. However, according to the research conducted in this regard, the actualization of these values has not been evident in the Grades 10-12 mathematics learners.

2.5 THE MATHEMATICS CURRICULUM IN SOUTH AFRICA

Before 1948, black people were educationally accommodated in mission schools. According to Gallo (2020), the schools were under-resourced. In addition, the curriculum included elementary arithmetic and communication. Shaban (2016) states that in 1948, the apartheid government introduced the Bantu Education System for black people based in the homelands. The 1954 Bantu Education Act formally legalized racially segregated educational facilities for all South Africans. The act was based on separating the black communities from the white communities. Black people were taught a different and inferior curriculum usually with no mathematics or science. According to Christie (1985), the apartheid policies of the National government were designed in such a way that the white minority group provides inferior education to the majority of black people. In the speech delivered on 17 September 1953 by the then minister of Native Affairs, Dr HF Verwoerd, blacks were discouraged from taking mathematics as a subject. As a result, most of the black learners could not take mathematics at secondary school level. According to Khuzwayo (2000), the challenges of the mathematics curriculum during the apartheid era were the shortage of adequately trained secondary school level mathematics educators. Mathematics educators in black schools had to contend with learners who, because of increasing age, experienced increasing deficit in their mathematical knowledge and skills. The number of schools offering mathematics at secondary level had been drastically reduced and their mathematics performance was low.

2.5.1 The Mathematics Curriculum in south Africa before Democracy

Despite challenges encountered by black learners, the apartheid government did not intervene or correct the situation that existed in the implementation of mathematics education (Vithal & Volmink 2005). It was difficult to find research

that was conducted on the teaching of mathematics during the times of missionaries or even studies that were done during the pre-apartheid era because most of the black researchers were not included in the database (Khuzwayo 2000). In 1965, Van Rooy conducted a study on the teaching of mathematics, general mathematics, and arithmetic in white schools. It was found that there was a shortage of mathematics educators. In the 1970s, the Human Science Research Act (HSRC) was instituted to conduct research on mathematics teaching and a number of mathematics research studies were carried out. For example, there was research on the training of mathematics educators in the republic of South Africa and in some western countries (Van den Berg 1976). Most of the studies conducted in the 1970s found that the way mathematics teaching was reformed, taught, and applied had to conform to the philosophy of Fundamental Pedagogy (FP). According to FP, educators were seen as authoritarian, and their function was to lead children to adulthood (Human 1975). This meant that FP education was not encouraging learners to think critically or to tolerate the views of other learners. Soudien (2011) concurs that before democracy, educators were perceived as vessels of knowledge and learners were passive recipients. FP Mathematics was implemented in all the black schools.

From 1976 to the 1980s, there were disturbing political events which resulted in the Soweto uprising in 1976. Black learners protested educational challenges of unequal access to education, unequal educational opportunities, and inadequate teaching staff (Khuzwayo 2000). As a result, for the very first time in 1981, the Commission of Delange was set up to address the educational problems in the skilled labour market. According to Vithal & Volmink (2005) the Delange Commission was a pragmatic response to the technological needs of the apartheid state. However, the commission had no direct relevance to mathematics reform other than stressing that mathematics should be taught more widely in South Africa. Van den Berg (1978) conducted a pedagogical study of black men`s mathematical ability. The study found that because of poor cultural milieu of traditional black children, their intellectual and mathematical development was delayed when compared to that of the white learners. Wikison (1981) conducted the same study and found that black learners` knowledge of

mathematics was extremely low in all the homeland states of South Africa. Learners who had not mastered the basic mathematics concepts could not overcome language obstacles. In addition, question papers did not consider the cultural background of learners to a sufficient degree. From the above studies, the common elements of culture and race were pointed out as factors that determine learner's mathematics ability. This implies that only white learners could study and apply mathematics to their lives.

According to Adler, Alshwaikh, Essack & Gcsamba (2016), the South African mathematics educators tried to ensure that the teaching and learning of this subject was transformed in schools. The problem-centred approach was piloted in a few schools. It was found that learners in those schools developed a very positive attitude towards mathematics. However, educators had to cope with large classes and poor resources. According to Vithal & Volmink (2005) after the release of Nelson Mandela, attempts were made to change the methodology used by the mathematics educators. However, it remained within the preserved white establishments` framework of apartheid education. For example, between 1990 and 1994, the apartheid government produced the Curriculum Model of South Africa (CUMSA). The model argued for the inclusion of economics, education technology, entrepreneurship, and productivity across all curricula. The country was thirsty for a mathematics education that could best service the demands of the market driven new South Africa. The demands were quality and equal mathematics education for all the people of South Africa.

2.5.2 The Mathematics Curriculum in South Africa after Democracy

2.5.2.1 Mathematics Curriculum 2005 (C2005) and/Outcome-Based Education (OBE)

In South Africa, the history of the mathematics curriculum began when the Minister of Education produced a White Paper on Education and Training in 1995, to present a proposal for Outcomes-Based Education (DoE 1995). According to Jansen (1999) the then minister of education, Professor Bengu, announced the introduction of the new education system, named Curriculum 2005 (C2005),

which was based on Outcomes Based Education (OBE). In October 1997, the NCS for Grades R-9 in the GET Band was published and introduced in 1998. The idea was to phase in the OBE from 1998 and complete it in 2005, hence the name C2005 (DoE 2002). When it was introduced, the following time frames for implementation were envisaged: Grade 1 and 7 (1998), Grades 2 and 8 (1999), Grades 3 and 9 (2000), Grades 4 and 10 (2001), Grades 5 and 11 (2002) Grades 6 and 12 (2003) (Van Rooyen & Prinsloo 2003).

The introduction of OBE which was an outcome model and C2005 being the timeframe of the curriculum were received with an array of feelings and opinions by the education sector. The reactions involved trepidation, outrage, anger and caution. One perception was that it was a good move towards redress and quality, but the other perception was that it was a way to drop the existing quality of education (Ramroop 2004). It is however important to note that C2005 and OBE were seen as important strategies to educational change in South Africa. The curriculum developers believed that the newly developed curriculum could achieve a society which would meet the needs of the 21stcentury. It is unfortunate that the implementation of the new curriculum was fraught with negativity.

Equity and human rights were constitutional elements emphasized by C2005. It was considered necessary for the contents to be non-authoritarian and designed in a participatory manner (Fiske & Ladd 2004). Therefore, C2005/OBE mathematics curriculum was designed to serve the diverse needs of all racial groups irrespective of gender, religion and level of disability.

C2005 is defined as a planned process and strategy of the curriculum supported by components of equity, redress, access, and development (Moodley 2013). Therefore, methodologies to be employed for the implementation of this progressive education system were learner-centred, with the educator as facilitator with relevant contextualized knowledge and making use of cooperative learning (DoE 1997). OBE was the approach through which a curriculum could be realized whereas C2005 was the curriculum that had been developed within the outcomes-based framework (Dewaal 2004). C2005/OBE laid the vision for education to do away with rote learning. Education was focused on nation

building, liberation, and learner-centred approach initiations. The C2005 qualifications, competency, assessment, and skilled-based framework supported the development of curriculum models that were aligned to the NQF (DoE 2002; DoE 2004).C2005 was developed to produce citizens with a high level of values and attitudes needed to rebuild the country. For example, mathematics educators who were teaching learners were required to be competent enough to practically teach the subject. Educators were expected to provide activity-based learning which was aimed at integrating theory and practice as well as mental and manual learning (DoE 1997). Hence, the implementation of C2005 curriculum needed educators who were thoroughly trained.

C2005/OBE required a new role from mathematics educators which would result in a learner-centred approach where educators were expected to facilitate the learning process (DoE 1997). C2005/OBE did not encourage the use of textbooks; instead, educators were expected to produce their own materials (DoE 2002). However, it was evident from research that the most effective tool is the textbook, because it ensures better quality delivery of mathematics curriculum. Another interesting development was that C2005 introduced a new vocabulary that changed the terminology of teaching. The new concepts were used as tools for educators to construct the mathematics curricula. For example, teachers became educators, students became learners, subjects became learning areas, a syllabus became a learning programme, and textbooks became learning support materials (Chisholm 2005). The mathematics educators were expected to internalize these new concepts without adequate training. This resulted in educators being confused because they attended once off training sessions. Training and follow ups should be done on a continuous basis to ensure the readiness of the mathematics educators to implement the curriculum.

The mathematics curriculum implementation challenges started almost immediately when the Department of Education was unable to stick to its timetable. Educators were not properly prepared and trained to cope with the new system (Maphalala 2006). In addition, the philosophy behind outcome-based education and training was not fully understood in the education system and by some of the provincial education departments responsible for the coordination of

the mathematics curriculum. Therefore, the implementation of the mathematics Curriculum 2005 brought about some challenges and shortcomings that necessitated its revision. According to Van Rooyen & Prinsloo (2003) the following were identified as major problems with Curriculum 2005. Firstly, mathematics educators and officials endorsed the underlying principles of learner participation, activity-based education, emphasis on relevance, flexibility, anti-bias, inclusion, holistic development, critical thinking and integration but few mathematics educators understood the hugely complicated system. Secondly, there were structure and design flaws in the mathematics curriculum of Curriculum 2005 and as a result, mathematics educators were flooded by complex language and confusing terminology, meaningless jargon as well as vague and ambiguous language. In addition, the curriculum was overcrowded in that it tried to cover too much. The sequence, pace and progression of the mathematics curriculum was not well-designed. Vithal & Volmink (2005) pointed out that mathematics educators became confused and were unable to adapt to the transformation from traditional aims and objectives to critical and specific outcomes.

Jansen (1999) outlined the following major reasons why OBE would fail. To begin with, the language of OBE was too complex, confusing and at times contradictory. Educators needed to come to terms with more than fifty different concepts, which would change in meaning overtime. Furthermore, OBE policy was lodged in problematic claims and assumptions about the relationship between curriculum and society; there was no shred of evidence that suggested that altering the curriculum of schools led to or was associated with changes in the national economies. In addition, OBE was based on helpless beliefs about what happens inside the schools, how classrooms are organized, and what kind of educators exist within the system. Jansen also argued that the implementation of OBE multiplied the administrative workload on educators. Finally, he contended that OBE trivialized curriculum content even as it claimed to be a potential advantage away from content coverage, which beset the current education system. Children did not learn outcomes in a vacuum. Curriculum content was a critical vehicle for giving meaning to a particular set of outcomes. Jansen (1999) concluded that for OBE to succeed, it required thoroughly trained educators, additional time, new

forms of assessment as well as classroom organization that facilitated assessment and monitoring. Van der Horst & McDonald (1999) offered advice to curriculum developers to retain what was effective from the old system and help educators to adapt to the new way of thinking about teaching and learning away from rote learning towards understanding and doing.

Following the concern about poor curriculum implementation, the task committee responsible to review C2005 curriculum was therefore appointed. The C2005 Review Committee 2000 found that C2005 /OBE had many curriculum aspects such as critical outcomes, learning areas, range statements, learning programmes, specific outcomes, assessment criteria, performance indicators, expected level of performance, phase and programme organizers. Seemingly, instead of spending enough time on practising mathematics for teaching learners, mathematics educators were overloaded with all of these features in their daily lesson planning. The recommendation from the C2005 Review Committee was that while the principles of OBE should be retained, DBE should get rid of C2005 and replace it with a strengthened curriculum which is streamlined.

2.5.2.2 The mathematics murriculum of the Revised National Curriculum Statement (RNCS)

In response to the challenges experienced with mathematics C2005, in 2002, the mathematics Revised National Curriculum Statement (RNCS) and the mathematics National Curriculum Statement (NCS) were developed for the General Education Training (GET) band and Further Education Training (FET) band respectively. Both the RNCS and NCS, like their predecessor, C2005, were still in the Outcomes-Based Education framework. Therefore, they were regarded as enhancements of C2005. The execution of the RNCS Grades R-9 (schools) was planned as follows: 2004 (Grades R-3), 2005 (Grades 4-6), 2006 (Grade 7), 2007 (Grade 8), and 2008 (Grade 9). The NCS was phased in incrementally and systematically in the secondary school grades.

The philosophy of OBE, which is an achievement-oriented, activity-based, and learner-centred education process, remained the foundation of the curriculum

(DoE 2000). The RNCS contained four key design features, namely, critical and developmental outcomes, learning outcomes, learning programmes and assessment standards. The curriculum was now aligned with assessment and provided a clear description of the kind of learner the South African curriculum was trying to develop in terms of knowledge, skills, values and attitudes at the end of the GET band. As indicated above, some of the confusing mathematics terminologies were discarded, for example, range statements, performance indicators, phase organizers and programme organizers. Mathematics Learning Area Statements that specify the learning area and its defining features, mathematics Assessment Standards that describe the level of knowledge and skills expected and a range for each of the learning outcomes for each grade level were introduced (Van Rooyen & Prinsloo 2003).

Molapo (2016) posits that the purpose of the introduction of mathematics RNCS was to improve the implementation of the mathematics curriculum in the classrooms. Bantwini (2009) argues that when the DoE introduced the RNCS, there was no curriculum planning. For example, there were overcrowded classrooms which were also under-resourced and a lack of finances and human resources to carry out the task. Rogan (2007) observes that when a new curriculum is introduced, more focus is put on the new content than how it is to be implemented. Bantwini (2009) notes that a gap is likely to exist between the curriculum aim and the outcome when the values, beliefs, and experiences of educators are neglected.

Challenges such as educators' lack of understanding of the curriculum reform, poor classroom support and a lack of in-service professional development in mathematics, resulted in many mathematics educators finding it very difficult to implement the mathematics RNCS (Bantwini 2010). For example, international studies in mathematics assessment revealed a continued poor performance of South African learners in calculations (Howie, van Staden, Tshele, Dowse, & Zimmerman 2012). The realization of the RNCS in South African mathematics classrooms was overwhelmed with problems and negativity that seriously hampered its implementation (Monyane & Selesho 2012). In their study, Monyane & Selesho (2012) found that many educators still lacked capacity to

innovate and were not clear about what the curriculum entailed, while workshops that were conducted in an attempt to assist educators failed to address the realities of classroom situations they faced. Due to poor implementation, the mathematics RNCS undermined educational quality.

2.5.2.3 Mathematics National Curriculum Statement (NCS)

The process of curriculum reform gained more momentum because of the phasing in of the NCS for the Further Education and Training (FET) band, in the year 2006 (Mosala 2011). The NCS was implemented in Grade 10 in 2006, in Grade 11 in 2007, and then in Grade 12 in 2008.

The mathematics NCS had a purpose of encouraging inclusivity, human rights, environmental and social justice, as defined in the Constitution of the Republic of South Africa (DoE 2003b). Introduction of the use of rubrics was a new way of implementing the mathematics NCS assessment in the FET band. A rubric is a set of criteria that are applied in the learning process (Govender, Hounsome & Weaver 2006). The rubrics could be categorized as self-assessment rubrics, peer-assessment rubrics, group assessment rubrics or ones that were designed to help the educators assess different tasks. The concept of rubric was new to many educators as they were familiar with tests and examinations. Mosala (2011) explains that in the improvement of the mathematics NCS, there was provision of context and content that guided educators with learning outcomes achieved by means of the Assessment Standards (ASs).

The DoE (2003b) states that assessment standards are “predetermined criteria that collectively give evidence of the knowledge, skills and values required in a specific grade in order to achieve the learning outcomes”. According to Motshekga (2009) even though there was some positive feedback on the NCS, it was also criticized in aspects such as educator overload, confusion and stress of mathematics educators and widespread learner underperformance in various assessments of mathematics. Various stakeholders such as teacher unions, parents, school management and academics also commented on the challenges with the implementation of mathematics NCS.

There are many different interventions that were designed to address some of the issues involved in implementing the curriculum; however, none of them were effective (DoE 2000). The NCS envisioned educators who were qualified, competent, dedicated and caring and who would be able to fulfil the various roles outlined in the Norms and Standards for Educators of 2000 (Government Gazette No. 20844). These roles view educators as mediators of learning, interpreters and designers of learning programmes and materials, leaders, administrators and managers, scholars, researchers and lifelong learners, community members, citizens and pastors, assessors and learning area/phase specialists (DoE 2002). As a result, it was not easy for educators to adapt to the new mathematics curriculum that was to be implemented.

Due to the challenges discussed above with the implementation of RNCS and NCS mathematics curriculum, in 2009, a panel was appointed by the Minister of Basic Education, Angie Motshekga, to review the curriculum. This panel first identified then investigated the major complaints and challenges that had been encountered since 2002. The key areas identified were as follows: curriculum policy guidelines for mathematics; transition between grades and phases in mathematics; mathematics assessment; mathematics learning and teaching support materials (LTSM) and teacher support and training for mathematics curriculum implementation (DBE 2009). Recommendations were made to improve the implementation of mathematics RNCS and NCS. In 2012, the Curriculum and Assessment Policy Statement was introduced.

2.6 MATHEMATICS CURRICULUM AND ASSESSMENT POLICY STATEMENT (CAPS)

Mathematics is a language that makes use of symbols and notations for describing numerical, geometric, and graphic representations. It is a ‘’human activity that involves observing, representing, and investigating patterns and qualitative relationships in physical and social phenomenon and between mathematics objects themselves ‘’ (DBE 2011a:13). Mathematics helps to develop the mental processes that enhance logical and critical thinking, accuracy, and problem-solving that contributes to decision-making. Mathematics problem-

solving enables us to understand the world (physical, social and economic) around us. Mathematics helps learners to think critically (DBE 2011a). Educators are expected to align their current practices and plans to strategies, structures and systems that bring their schools closer to attaining the outcomes of the new CAPS Curriculum (Maimela 2015). DBE (2017a) states that the curriculum in place in South African schools is the National Curriculum Statement which was introduced in 2004. The CAPS is one component of the curriculum.

The mathematics curriculum which is currently used in South Africa is based on the Curriculum and Assessment Policy Statement (CAPS). The curriculum is compulsory from Grades R-9. In Grade 10; learners may choose to do either mathematics or mathematical literacy.

2.6.1 Expectations of the Mathematics CAPS Grade 10-12 (FET Phase)

In this study, the Mathematics CAPS documents were analyzed to determine expectations of the CAPS in Grades 10-12. The documents that make up to the Mathematics CAPS are Mathematics CAPS Grades10-12 (FET phase), the NPPPR of the National Curriculum Statements Grades R-12, the NPA Grades R-12 and the mathematics School Policy (2020). The first three CAPS documents are interrelated and the fourth one is designed to support the Mathematics CAPS. The documents together represent a policy statement for mathematics learning and teaching in South Africa.

The CAPS provides the frame that is a guiding compass for teaching mathematics. The CAPS documents therefore provide specific prescripts about how mathematics should be dealt with in Grades 10-12 as detailed in section 2.5.1.1.

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2.6.1.1 The aims of the CAPS curriculum

The aim of the Mathematics CAPS curriculum is to foster and incorporate the general aims of the South African Curriculum. The South African curriculum aims to produce learners that can identify and solve problems, work as individuals and with others in teams as well as collect, analyze, organize and critically evaluate information. It also needs to produce learners that can communicate effectively using different types of language such as visual and symbolic and comprehend the world as a set of related systems (DBE 2011a). This implies that when mathematics educators plan their lessons in this subject, they are expected to always consider incorporation of the above aims. They are supposed to always remember that their role as educators is not only to focus on subject specific knowledge but to develop a well-rounded individual who can contribute to society. The aims and skills are covered in the content of the Mathematics CAPS Grades 10-12.

2.6.1.2 The skills of Mathematics learners Grades 10-12

In the Mathematics CAPS Grades 10-12, learners should be able to communicate by using descriptions in words, graphs, symbols, tables, and diagrams. They also need to know how to use mathematical processes and skills to identify, investigate and solve problems. These processes teach the learners to develop problem-solving skills, have a deep conceptual understanding of mathematics and develop the correct use of the language of this subject. This includes learners being fluent in computation skills without relying on programmable calculators.

2.6.1.3 The skills of Mathematics educators Grades 10-12

Mathematics educators are expected to incorporate mathematics modeling in the Mathematics CAPS Grades 10-12 by using real life examples or activities of social, environmental, cultural, scientific, health and economic relations when they teach. They are further expected to teach in a way that learners can recognize that mathematics is a creative part of human activity. This should be done by including the history of mathematics in the lessons. Educators are also expected to prepare the learners to gain specific knowledge and skills required for the further education and training as well as for the world of work. This includes teaching learners in such a way that they can participate as responsible citizens in local, national, and global communities. They are expected to promote accessibility of mathematical content to all the learners. This includes giving challenging questions to the most able learners and providing remedial support for those to whom mathematics seems difficult. The mathematics educators are expected to incorporate all the above aims and skills in the teaching of the Mathematics CAPS curriculum.

2.6.1.4 Content coverage and Weightings of Mathematics CAPS Grades 10-12

Mathematics CAPS Grades 10-12 contains an overview of ten topics to be covered and laid out in the annual teaching plan. The annual teaching plan is divided into four terms of the school calendar and each term lasts ten weeks. In Grade 10, mathematics educators are expected to have covered all the topics by the second week of term 4. Thereafter, three weeks are reserved for revision and four weeks for the end of year examination. The last week is for administration duties. In Grade 11, educators are expected to have covered all the topics by the third week of term 4. The remaining seven weeks consist of three weeks of revision and the other three weeks for writing the end of year examination. The last week is for administration duties. In Grade 12, educators are expected to have covered all the topics by the sixth week of term 3. The remaining four weeks consist of two weeks of revision and two weeks for the trial examinations. In term 4, there is no effective teaching and learning in Grade 12. Three weeks are

reserved for revision and five weeks for the end of year examinations. The last two weeks are for administration duties. It is evident that, for effective teaching and learning of mathematics Grades 10-12 to take place, adequate planning and preparation are critical. Therefore, mathematics educators are expected to plan each term carefully and timeously so that they can cover all the prescribed content and skills as per the Mathematics CAPS document. When completing the lesson planning and preparation, mathematics educators are expected to consult the Mathematics CAPS document as it stipulates the number of hours to be assigned for mathematics Grades 10-12. The mathematics educators Grades 10-12 are expected to spend 4 to 5 hours per week teaching mathematics (DBE 2011a). In the Mathematics CAPS, the weight of each topic depends upon the allocated time and marks as indicated in Table 2.1.

Table 2.1: Weighting per topic by percentage of time and marks Grades10-12

Mathematics topics.		Weighting by % of time.	Weighting by % of Marks.
1.	Functions	16.9	13.9
2.	Number patterns, sequences, series	6.8	8
3.	Finance, growth and decay	6.8	5
4.	Algebra	14.8	12.2
5.	Differential calculus	3.4	4
6.	Probability	6.8	6.1
7.	Euclidean geometry and measurement	12.5	16.1
8.	Analytical geometry	8.0	10.1
9.	Trigonometry	17	16.1
10.	Statistics	8.0	10

From the table 2.1, it is evident that the Mathematics CAPS Grades 10-12 has laid out the instructional time and number of marks allocated for each topic. The weighting of topics is determined by the percentage of time to be spent in class and the percentage of marks allocated for each topic. For example, in the mathematics topic of Functions, in a year, the allocated percentage time for

teaching is 16.9 and the percentage mark is 13.9. Therefore, mathematics educators are expected to master the content thoroughly considering the time to be spent and marks to be allocated to each topic.

2.6.1.5 Sequencing and Progression in Mathematics Grades 10-12

The sequencing of topics within terms gives an idea of how content areas can be spread and revisited throughout the year. This includes spreading the mathematics topics properly to allow a conducive environment for teaching and learning. Mathematics educators are expected to plan the goals and objectives of the lessons so that they can anticipate difficulties and the problem areas in some of the topics. They should reserve time for doing remedial work on the concepts that learners find challenging and make effective use of the resources needed in a particular topic. This can be done by planning what is intended to happen in the mathematics classroom so that there will be a smooth transition from one topic to another. However, the relative weighting and notional hours of the content areas must be taken into consideration.

The Mathematics CAPS has ensured progression by teaching the learners the content appropriate to their age and grade. This includes describing the concepts and skills to be learned when they progress from grade 10 to grade 12. The concepts and skills of the mathematics content are strengthened and built upon from the previous grade. This prepares the learners for more challenging content. However, in certain topics, the concepts and skills are similar in two or three successive grades. In the progression of topics, mathematics educators are expected to spend less time revising the concepts and skills that were taught in the previous grade and concentrate on the new concepts. Table 2.2 is example of sequence and progression in the topic of Finance, Growth and Decay in mathematics Grades 10-12.

Table 2.2: Example of sequence and progression: Finance, Growth and Decay

Grade 10	Grade 11	Grade 12
The implications of fluctuating foreign exchange rates.	The effect of different periods of compounding growth In addition, decay (Including effective and nomin interest rates).	Critical analysis of loan options.

Assessment in Mathematics Grades 10-12

The Mathematics CAPS has provided the guidelines for assessing Grades 10-12. This curriculum regards assessment as an important element in the improvement of teaching and learning of mathematics in these grades. Mathematics educators are supposed to assess and give feedback on learners' work on a continuous basis in informal (class work and homework) and formal assessments (tests, investigations, etc.) contexts. They are also expected to assess learners based on the number and forms of assessment prescribed in the Mathematics CAPS Grades 10-12 as displayed in Table 2.3.

Table 2.3: Mathematics formal program of assessment Grades 10-12

Per Year	Grade 10 and 11	Grade 12
Number of assessments tasks specified.	7 tasks and one end of year examination.	7 tasks and one end of year examination.
Forms of assessment.	4 tests, 2 examinations, 1 project/Investigation and 1 Assignment/Test.	3 tests, 3 examinations, 1 project /investigation and 1 Assignment.

The Mathematics CAPS Grades 10-11 School-Based Assessment (SBA) and end of year examination are expected to be internally set and marked by the mathematics educator and moderated internally by the mathematics

departmental head (DH). The SBA for Grades 10-11 should constitute 25% of the total marks; the remaining 75% is for the end of year examination. In Grade12, the internally set SBA mark for tasks that are marked by the mathematics educator but externally moderated is 25%; the 75% is reserved for end of year examinations that are externally set, marked and moderated by the DBE and Umalusi.

Cognitive levels for mathematics Grades 10-12

Assessment needs to consider cognitive levels which are the cognitive demand that describes the level of mathematics skills to be demonstrated by the learners when solving mathematics problems. The range of cognitive levels and learners' abilities are illustrated in Table 2.4.

Table 2.4: Cognitive levels for the Mathematics CAPS Grades 10-12

GRADES	Knowledge	Routine procedures	Complex procedures	Problem-solving
Grades 10-12	20 %	45 %	25 %	10 %

Mathematics previous question papers serve as examples in the classroom. Mathematics educators should realize that the cognitive levels are not absolute because what might be considered a complex procedure in one grade may become routine in a higher grade or even later on in a year.

2.6.1.6 Recording formal tasks in the Mathematics CAPS Grades 10-12

Table 2.5: Seven levels of competence used to record learner achievement in Mathematics Grades 10-12 (DBE 2012a:78)

Rating Code	Description of Competence	Percentage
7	Outstanding achievement	80 – 100
6	Meritorious achievement	70 – 79
5	Substantial achievement	60 – 69
4	Adequate achievement	50 – 59
3	Moderate achievement	40 – 49
2	Elementary achievement	30 – 39
1	Not achieved	0– 29

The recording descriptions for assessing learners and grading them at the correct level are given in Table 2.5. Marks are recorded in the record sheets and reported as percentages. The percentages obtained will determine the rating code of a learner.

2.7 THE NATIONAL POLICY PERTAINING TO THE PROGRAMME, PROGRESSION AND PROMOTION REQUIREMENTS

The NPPPR is a CAPS document that is utilized from Grades R-12 (DBE 2012a). The purpose of the NPPPR is to guide the educators in determining the minimum outcomes and standards, as well as the processes and procedures for the assessment of learner achievement in Grades R-12. The information regarding the Mathematics CAPS Grades 10-12 is retrieved from the NPPPR and utilized to communicate the regulations relating to the programme, progression and promotion requirements. Teaching and learning are interrelated and therefore, in this CAPS document the expectations of the mathematics educators are interrelated with the expectations of the mathematics learners.

2.7.1 Programme requirements of the Mathematics CAPS grades 10-12

The duration of the Mathematics CAPS Grades 10-12 is three years. Learners are expected to choose seven subjects in Grade 10. For example, as indicated above, they can choose either mathematics or mathematical literacy. They may also choose to take more than seven subjects provided the additional subjects are offered during all the three years of the National Senior Certificate (NSC) programme of Grades 10-12.

2.7.2 Promotion requirements of the Mathematics CAPS Grades 10-12

The CAPS guides the promotion of mathematics learners from one grade to another if they have completed the mathematics SBA and end-of-year examination requirements. The minimum promotion requirement in the Mathematics CAPS Grades 10-12 is 30%. A learner who fails mathematics can still be promoted to the next grade. To qualify, a condoned learner should have submitted the mathematics SBA and obtained a maximum of 2% either to obtain a pass at 30% or 40% in mathematics.

2.7.3 Consequences for the Mathematics CAPS Grade 10-12

Learners who have been diagnosed to have barriers to learning mathematics may be exempted from the offering of mathematics. If another subject is offered to replace mathematics, such a learner complies with the promotion requirements. Learners who fail because of barriers to learning related to mathematics may be promoted to the next grade provided they have the mathematics SBA and end of year examination.

2.7.4 Changes of subjects in the CAPS Grades 10-122

A mathematics learner may change a maximum of two subjects in Grade 10, provided this is done by the end of the second term. This will be subject to the approval of the principal of the school where the learner is registered. Such change must be done before 30 June of the Grade 10 year. Two subjects may

be changed in Grade 11, provided this is done before 31 March, subject to the approval of the principal of the school where the learner is registered. In exceptional cases, a mathematics learner may change one additional subject in Grade 11, provided this is done before 15 December of the Grade 11 year. Approval for changing a subject in Grade 12 must be obtained from the head of the assessment body. This implies that the CAPS allows learners to either change or choose to do mathematics in Grades 10, 11 or 12 but changing or choosing mathematics in Grade 12 requires the approval from the DBE.

2.7.5 Time Allocation for the Mathematics CAPS Gradse 10-12

The number of hours to be allocated for teaching mathematics Grades 10-12 is 4.5 hours per week (DBE 2011a). mathematics educators are expected to utilize the time allocated for this subject effectively to provide enough time for assessment.

2.8 THE NATIONAL PROTOCOL FOR ASSESSMENT (NPA) GRADES R-12

The NPA is a CAPS document utilized in Grades R-12 (DBE 2012b). Its purpose is to guide educators on the assessment procedure to be followed in these grades. It also communicates the recording and reporting practices to be followed in the same grades.

2.8.1 Expectations of Assessment in the Mathematics CAPS Grades 10-12

Informal assessment and formal assessment

Mathematics informal assessment (assessment for learning) is the monitoring and enhancing of learners' progress in mathematics by using class work and homework (see Chapter 2:2.5.1). In this assessment, the mathematics educators are expected to interact with learners by observing how they solve mathematical problems, for example, discussing with the learners their progress. This provides

feedback to both the mathematics educators and the learners. It also improves the teaching and learning of mathematics by closing the gaps in learners' mathematics knowledge and skills. Though informal assessment is not recorded, educators may choose to record performance in some tasks. The informal assessment builds towards formal assessment.

The mathematics formal assessment (assessment of learning) provides mathematics educators with a systematic way of evaluating learners' progress in the subject by using tests, assignments, examinations, projects and investigations (see Chapter 2:2.5.1). Mathematics educators must ensure that assessment criteria are very clear by explaining to the learners the knowledge and skills to be assessed and the required length of responses. Feedback should be provided to the learners after each assessment, and this could take the form of whole class discussion or teacher-learner interaction on an individual basis. Mathematics educators are also expected to ensure that the forms of assessment used are appropriate to the age and the developmental level of the learners. The assessment tasks are expected to be carefully designed to assess a variety of concepts and skills.

2.8.2 The School-based Assessment (SBA) in Mathematics Grades 10-12

Formal assessment in the Mathematics CAPS Grades 10- 12 consists of mathematics SBA and the final end-of-year examination (see Chapter 2:2.5.1). In mathematics, SBA learners are assessed on a variety of formal assessment tasks that are done during the course of the year. Educators are expected to compile the mathematics SBA that meets the quality and standard for moderation. Therefore, it should be evaluated, checked and authenticated by the mathematics educator before being presented as the learners' evidence of performance.

Mathematics educators are expected to award zero if a learner fails to present the mathematics SBA mark without a valid reason. For a learner who has a valid reason, educators are expected to grant the marks based on a decision by the

head of the assessment body. Should the learner fail to fulfil the outstanding mathematics SBA requirement, the marks for these components should be omitted and the final mark for the relevant subject adjusted for promotion purposes based on the completed tasks. Some of the valid reasons include illness, death of an immediate family member and court hearings. However, this must be supported by valid written proof of evidence. In the event of a learner failing to comply with the SBA requirements of mathematics Grades 10-12, and where valid reasons are provided, the evidence of such reasons must be included in the evidence of learner performance. If the mathematics educator fails to give learners the minimum tasks for SBA in mathematics Grades 10-12, marks will be adjusted accordingly as per CAPS regulations after investigations by the DBE. The SBA shall be kept in the mathematics SBA file.

2.8.3 Mathematics learners' registration of additional subjects in the CAPS Grades 10-12

Some learners may be interested in registering additional subjects for the end of year examination. Therefore, mathematics educators are expected to inform these learners in Grades 10 and 11 of the requirements.

2.8.4 The medium of Instruction in the Mathematics CAPS Grades10-12

Mathematics educators are expected to assess mathematics learners in the Language of Learning and Teaching (LoLT). This includes the setting of mathematics examination question papers. The learners in Grades 10-12 are also expected to answer all the assessment tasks in the LoLT.

2.8.5 Learner absentees in the Mathematics CAPS Grades 10-12

Mathematics educators are expected to file the written evidence of learners who are absent from mathematics classes because of illness or any other circumstances beyond their control. The evidence can be in the form of medical certificates, affidavits, or any other acceptable proof. In Grades 10 and 11, learners who are unable to write the mathematics end-of-year final examination

due to illness or any other circumstances beyond their control should be accommodated. Mathematics educators are expected to calculate and award a mark based on the mathematics SBA obtained by the learner prior to the illness. For a learner who is unable to write (or complete) one or more of the mathematics Grades 10-11 examinations for reasons other than illness or injury, the mathematics educator will write a report to be submitted to the DBE.

2.8.6 Recording and reporting in the Mathematics CAPS Grades 10-12

Mathematics educators are expected to record learner performance in all formal assessment tasks. Records of learner performance are expected to provide evidence of the learner's conceptual progression within a grade, and the readiness to progress to the next grade. This implies the use of records to monitor the mathematics performance of learners. The aim is to inform the planning of mathematics curriculum activities as well as design intervention strategies.

Mathematics educators are expected to give feedback regularly to learners as well as parents on the progress of their children. This includes providing constructive and developmental feedback to inform parents/guardians and other role players on the progress made by the learners.

2.8.7 Management of Assessment Records in the Mathematics CAPS Grades 10-12

Mathematics educators are expected to keep two types of assessment records, namely, the mathematics record sheets and mathematics teaching files (see Chapter 2:2.5.1).

(a) The Mathematics CAPS Grades 10-12 record sheets.

The mathematics record sheets are used to record the formal assessment tasks. Mathematics educators are expected to keep accurate and up-to-date mark sheets of the learners' progress. This includes compiling records and/or evidence of learner performance to justify the final rating a learner receives at the end of

the year. The recording of tasks in the mark sheets should be done after every formal task has been written. Therefore, mathematics educators are expected to keep current records of learners' progress either electronically or in files, books, folders or any other form the school has agreed on. The record sheets are expected to be kept in files.

(b) Mathematics Grade 10-12 teaching files

Mathematics educators are expected to keep two files containing evidence of teaching and assessment, namely the mathematics educator file and the mathematics SBA file. mathematics Grades 10-12 teaching files should contain the relevant up to date documents and be available at school for moderation and monitoring purposes. These files should be evaluated, checked and authenticated by the mathematics educator before being presented to the mathematics DH. Failure by the mathematics educator to maintain the mathematics teaching files with assessment tasks constitutes an act of misconduct requiring disciplinary action.

2.8.8 Assessment of learners with special needs in the Mathematics CAPS Grades 10-12

The mathematics Grades 10-12 typical classrooms in South Africa consist of some learners who have barriers to learning. These learners need to exit school with recognition of competence. Therefore, mathematics educators are expected to implement a consistent representation of inclusive assessment practice in mathematics Grades 10-12. This also needs to be applied in assessment, recording, reporting and promotion.

2.9 MATHEMATICS SCHOOL POLICY (2020)

The mathematics school policy sets the minimum standards which support the implementation of the Mathematics CAPS Grades 10-12 in order to achieve quality teaching and learning of the subject.

2.9.1 Apponitments, duties, and responsibilities of Mathematics Educators in Grades 10-12

Relations Council (ELRC) collective agreement No 1 of 2008, which outlines the criteria for shortlisting candidates and the interview procedure for the appointment of the educators in the Limpopo Province public schools. To qualify for the mathematics level 1 post, the educator is expected to meet the minimum requirements of a recognized three-year (REV 13) qualification which includes appropriate training as an educator with basic knowledge of mathematics, an ID document, registration with the South African Council for Educators (SACE) and a Curriculum Vitae (CV). In addition, the mathematics educator should have mathematics teaching and assessment skills, administration skills, ability to interact with stakeholders, and co- curricular skills. The School Governing Body (SGB) assembles a panel responsible for shortlisting and interviewing at the school. The Limpopo Province Department of Basic Education makes a final decision on the appointment of mathematics educators.

The appointed mathematics educator is expected to carry out the assigned tasks of teaching, administration, interaction with stakeholders, and participation in co-curricular activities. Mathematics department committee meetings are held to remind mathematics educators of their core responsibilities. The School Management Team (SMT) meets once every week to assess the schools` core business and suggest ways to improve teaching and learning. The educators meet once a month to assess the feedback that they get from the management team and give input on mathematics programmes.

2.9.2 Management of Administration in the Mathematics CAPS Grades 10-12

Mathematics educators who are unable to report for duty should inform the mathematics DH in advance so that the learners may be given extra work during the mathematics period. The school general timetable is drawn towards the end of an academic year. Mathematics is taught in the first four periods of the school

day hence mathematics educators are expected to be in classrooms teaching mathematics during that time.

2.9.3 Management of teaching and assessment in the Mathematics CAPS Grades 10-12

The mathematics Grades 10-12 lesson plans are expected to be moderated monthly, and the dates for such moderation reflect on the school`s year plan. The mathematics written work (informal assessment) should be moderated weekly. Mathematics formal assessments for recording and reporting are expected to be moderated by the mathematics DH once a month and the dates for these assessments should reflect on the school year plan. The principal moderates the assessment tasks set by the mathematics DH, who in turn moderates the assessment tasks set by the mathematics educator. Mathematics educators are responsible for item analysis for mathematics. Such analysis informs the educators of where to put emphasis during teaching and learning.

The mathematics CAPS Grades 10-12 educator is expected to understand the curriculum for these grades as well as NPPPR, NPA and other policies regulating mathematics. The mathematics DH should ensure that the policies are implemented as drawn and should regularly support the mathematics educators in performing the given duties. For example, the number of written tasks per week should be stipulated. Monitoring is in the form of class visits and reports. The mathematics class visit is held once in a quarter. The class visit by the DH is for the purpose of support. After each visit, the educator is given feedback and support where needed. The mathematics Departmental Committee should, in one of its meetings, assess the impact of class visits based on reports from mathematics educators.

Mathematics staff development programmes are held from time to time depending on input from various reports such as Integrated Quality Management System (IQMS), class visits, mathematics meetings and educator requests. A development plan is drawn to address the challenges identified. Therefore, it is the responsibility of the mathematics educators to ensure that they master the

content of the mathematics development programmes and, where possible, implement the ideas learned in the programmes in their day-to-day teaching. This includes the use of technology such as computer programmes.

2.10 THE IMPORTANCE OF MATHEMATICS IN THE CAPS

Mathematics is a significant subject in a school curriculum. The foundations of mathematics should be taught because learners use them in their daily lives. Mathematics plays a vital role in the classroom, not only because of direct application of the syllabus material but because of the reasoning processes the students can develop (Boruah 2018). Therefore, the learners should understand the numerical data presented to them and be able to solve simple mathematics calculations on a daily basis. In mathematics education, numerous resources endorse innovative ways of teaching, linking concepts and real-life applications and motivating learners to have interest in mathematics (Hemmings, Grootenboer & Kay 2011). DBE (2018) states that the objective of mathematics education is to produce learners with an ability to think critically by using mathematical knowledge in real life situations. Firdaus, Kailani, Bakar & Bakry (2015) explain that mathematics should develop learners' thinking skills and schools should be responsible for developing and evaluating critical thinking through the teaching and learning process. For example, according to Jojo (2019), mathematics is required to analyze most of the skills areas of the economic sectors that are being targeted to ensure growth is achieved in the country. There is a shortage of skilled people who can make things with their hands. Such people include those who are skilled in an art or craft as well as engineers, architects, doctors, and many of those who are involved in various kinds of applications of mathematics in South Africa.

According to the DBE (2011a), the mathematics curriculum gives learners the opportunity to develop mathematical reasoning and creative thinking skills in preparation for more complex mathematics applications in higher institutions of learning. Seemingly, the performance of learners in mathematics cannot only be considered from a content/subject domain point of view but it should also be applied in real life situations. This implies that the mathematics curriculum should

prepare learners for problem-solving and decision-making situations from childhood to adulthood. The DBE (2011a) further states that mathematics helps learners to acquire a functional knowledge of the subject that empowers them to make sense of society. It ensures access to an extended study of mathematics Science and a variety of career paths. Mathematics has become part of an entry requirement to enrol for many technical and vocational programmes at tertiary institutions. Although many learners view mathematics as difficult, those who study mathematics further graduate as engineers, doctors and technicians (Mutodi & Ngirande 2014).

Mastropleri & Scruggs (2000:459) describe the vital role of mathematics as follows:

> *Mathematics is the key to opportunity. No longer just the language of science. Mathematics now contributes in direct and fundamental ways to business, finance, health and defence. For students, it opens doors to careers; and enables informed decisions. For nations, it provides knowledge to compete in a technological economy.*

According to Du Preez (2018), mathematics skills and knowledge are seen as key factors to boost the economic growth of South Africa. This is supported by an assertion by the DBE (2018) that if mathematics can be implemented effectively, it has the potential to equip learners with the skills for the 21st century and prepare them adequately for the demands of the Fourth Industrialization Revolution. Therefore, the skills and knowledge gained in the mathematics curriculum help people to survive in this new world of technology, which emphasizes cyber-physical production systems as espoused by the World Economic Forum. Skills and industry competencies to be acquired are problem-solving, mathematical reasoning, logical reasoning, cognitive flexibility and ICT literacy.

It is widely believed that mathematics is very important to the economy in terms of scientific and political development of any nation. This is because mathematics can be explored, contested, justified, and communicated. It is this common understanding that has made every nation in the world to make mathematics a

compulsory subject in every aspect of the educational system (Boruah 2018). According to the DBE (2002) mathematics is a purposeful activity in the context of social, political, and economic goals and constraints. The belief is that the mathematics curriculum will reduce challenges that exist in the economy, hence, mathematics is taught from Grade R to12. Changes that have been made in mathematics teaching develop conceptual depth, procedural flexibility, and reasoning among learners (Association for Mathematics Education of South Africa (AMESA) 2010). Over the past 20 years, curriculum development has encouraged the same goals for mathematics teaching (DoE 1997, 2002, 2003a & DBE 2012a). Therefore, the DBE should continuously refine mathematics education to close the gap of economic challenges caused by the apartheid legacy.

2.11 CHALLENGES WITH THE MATHEMATICS CAPS CURRICULUM

There are two main drivers influencing the mathematics curriculum in South Africa. According to Vithal & Volmink (2005:15) the first relates to the previously discussed “post-apartheid challenge for greater equity and social justice, and to entrench and deepen democratic life”. The second relates to the imperative for South Africa to be able to function effectively in a globalized economy. When the Mathematics CAPS curriculum was introduced, South Africans had high expectations. People aimed high and had hope that it would ease the confusion and frustrations of the previous curriculums. Despite the good intentions embodied in curriculum changes, South Africa is still grappling to improve learner performance in mathematics (DBE 2018). For example, the Grade 12 mathematics results are not improving and there is a decline in the number of learners doing mathematics on a yearly basis (Motshekga 2018).

The 2018 matric results announced by the minister of Basic Education on the 3rd of January 2019 showed that mathematics results were less positive as compared to the 2017 results. In 2017, the mathematics matric pass rate was 51.9% with 6726 distinctions as compared to the 2018 pass rate which was 51.5% with 5828 distinctions. According to the National Senior Examination report, the number of candidates passing Mathematics declined in the November

2020 NSC examination (DBE 2020). This may be ascribed to the Covid -19 pandemic conditions having a great impact on schooling in rural areas and the schools' constrained ability to re-organize and regain lost learning time due to closures, learner absenteeism, educator well- being, and lack of access to resources. However, according to literature, learners have been performing poorly in the Mathematics CAPS since its inception. People from different interest groups are complaining about the implementation of the CAPS. The first people who raised concern are the mathematics educators who are the implementers of the curriculum. In their staffroom discussions, they complained about challenges that they met in the implementation of the CAPS. These included the fact that time allocated for the mathematics curriculum is too little. Even if extra time is provided by teaching in the afternoons and over the weekends, learners are not performing well. When mathematics educators are outsourced from nearby schools, the performance deteriorates even further. The mathematics departmental heads (DHs) and the subject advisors want the educator to account for poor performance and do not appreciate what he/she is doing. As a result, some of the educators have gone to the extent of refusing to teach mathematics because they think they are the ones who contribute to the poor performance of the learners.

Mlambo (2014) contends that the Mathematics CAPS provides precise timeframes for completing the topics, but educators spend much time doing remedial work. Therefore, there is no consideration that learners do not learn at the same pace. The South African Council of Educators (SACE) (2016) added that there is definitely too much content planned for the yearly curriculum, especially as there is no time allocated for those children who may be slow to understand the subject material. Mlambo (2014) further argues that the time allocation for the assessment in the Mathematics CAPS is limited, particularly considering that some of the content should be amended. Inadequate time allocation negatively affects elements of curriculum such as the content, teaching methods, objectives and assessment. It also deprives the rights of learners to better education.

Educators should have expertise in the subjects that they teach but most of the mathematics educators do not have a broad knowledge base of the subject content. According to Mouton, Louw & Strydom (2012) educators are struggling with the planning of the content which should be in accordance with the CAPS. The correct use of teaching methods can contribute positively to the implementation of the CAPS (Mopeli 2017). However, this needs skilled mathematics educators who are conversant with the dynamics involved in planning and preparation. The correct application of teaching methods should be maintained by regular educator evaluations and workshops. Unfortunately, the South African Democratic Teacher's Union (SADTU) does not allow the SMTs to evaluate educators because they view it as policing them although it is not the case (Mopeli 2017). SADTU allows educators to be evaluated during Integrated Quality Management System (IQMS) sessions which are attended by the mathematics DH and a peer educator who teaches mathematics. The mathematics educator is assessed by scoring him/her in accordance with the DBE criteria. However, IQMS are conducted for progression of salary; they do not focus on educator development in mathematics teaching (Thobela & Mtapuri 2014). Proof of this fact is that from 2022, the IQMS will be renamed Quality Management System (QMS), and sessions will involve the mathematics DH only. This being the case, the IQMS has deprived learners of acquiring mathematics knowledge and skills. The challenges of the management of teaching mathematics are worsened by parents who do not involve themselves in the education of their children.

McCall, Janssen & Riederer (2008) explain that there are challenges in the implementation of mathematics. Firstly, there are educators who do not have enough content knowledge of mathematics. Secondly, some educators may communicate their negative attitudes about mathematics to learners. Furthermore, continuous challenges of late deliveries and inadequate supplies of the LTSM in schools negatively affect curriculum implementation. This is contrary to the speech by the State President, Ramaphosa, in his state-of-nation-address in 2019 in which he emphasized the right of South African children to safety and dignity regarding educational facilities (Ramaphosa 2019).

DBE (2017b) states that despite interventions made in the implementation of the CAPS, some challenges remain persistent, including content overload, insufficient curriculum coverage, poor assessment practices and a lack of attention to learners with special needs. Educators need training in the various aspects of formal assessment tasks such as the use of cognitive levels, forms of assessment and weighting of assessment. In addition, the concept of teaching for mastery and not for assessment is not fully understood. Furthermore, accommodation and concessions for special needs learners require further attention and the reading level of learners remains a cause for concern, as does the development of 21st century skills. Finally, South Africa does not have sufficient qualified mathematics educators. According to the report from the DBE (2017a), the low qualifications and incompetence of mathematics and science educators in general are a serious impediment to effective learning and teaching. The government is offering the Funza Lushaka bursaries for mathematics student educators so that they can help with the implementation of the mathematics curriculum. Despite this initiative, poor learner performance in mathematics continues. As an intervention strategy, partnership has been established with outside agencies to help in the implementation of the CAPS. For example, in KwaZulu Natal, the DBE has the following service providers: SA Mathematics Foundation (Olympiads), PLATO software, DST, Sugar Industry, SAASTA, Eskom Expo, Technology Innovation Agency, Ethekwini Municipality, Standard Bank, SITFE and Future Wise Quiz, all of which focus on learners, educators and the provision of resources primarily to the under-developed areas. In spite of this support, mathematics learners continue to perform poorly (DBE 2014). Jojo (2019) notes that in South Africa, scarcity or unavailability of important school materials are associated with poor educational results in mathematics.

Most of the DHs for Mathematics oversee the subject they do not teach or have never taught before; they studied it at school and it appears in their academic records. It is alleged that some SADTU members paid for the promotion to DH (Masondo 2016). This means that they do not have skills and expertise to teach mathematics. As a result, they fail to support mathematics educators (Olivier 2013). The same problems encountered in the previous curriculum still stand. For example, subject advisors state that educators are unable to teach because of

being overburdened with administration duties. These include managing overcrowding in the classrooms (SACE 2016). Since the introduction of the CAPS, mathematics educators attend workshops once at the beginning of each new school term except the last term. Although subject advisors conduct workshops and school visits in order to develop and support the mathematics educators, there are still problems encountered (Mopeli 2017). Despite the perennial poor performance in both national and international tests, South African mathematics education authorities have not been able to initiate effective strategies to improve the situation and meet global standards (Mahlaba 2020). Olivier (2015); Adler (2017) agree that in South Africa, neither universities nor any other formal education service providers have ever managed to create a mathematics in-service training program that has been rigorously evaluated and proven to effectively raise educator content knowledge. In Bloemfontein, SADTU members handed a memorandum of demands to complain against the CAPS curriculum (Chabalala 2016). Even the leader of this massive trade union, SADTU general secretary Maluleke, was cited by Savides (2017:1) as stating that the poor performance in mathematics is caused by the change in curriculum, with educators not being properly trained to meet the new requirements and criteria. Savides (2017:4) quotes the DA as saying that "without a quality education in the gateway subject of mathematics, South Africa is destined to remain trapped in the cycle of poverty" and that "there is no better teaching tool than trained teachers in classrooms when it comes to properly educating learners." This implies that the DA perceives that there is a problem with the mathematics curriculum.

In response to the fact that the Mathematics CAPS implementation is a problem in the South African schools, in 2018, the DBE developed a new curriculum framework for mathematics to support the implementation of the current Mathematics CAPS curriculum. The new framework is named the Mathematics Teaching and Learning Framework for South Africa. It supports the key activities of the reviewed Mathematics, Science and Technology (MST) Education Strategy 2019-2030 (DBE 2018). The DBE 2018 further stressed that the framework will not replace the existing curriculum but aims to improve the way mathematics is

taught. The question that arises is whether the new framework will help educators to implement the mathematics curriculum.

2.12 THE FRAMEWORK OF DELIVEROLOGY

The study will be guided by the Deliverology approach. Deliverology is the approach that ensures that government departments implement the desired reforms (Barber 2015). Vithal & Jansen (2010) stated that a theory is a perspective on events and always exists in the context of competing or rival theories. According to Curran (2016), Deliverology is simply the science or art of delivering on goals and promises, particularly those made by governments. According to McKay (2017), the Deliverology approach was developed to create routines and problem-solving techniques that would help the administration deliver on its campaign promises to increase the effectiveness of public service. Deliverology works if you follow its processes and have people dedicated to its method of driving improvements (King 2019). Curran (2016) states that conceivably, Deliverology might be well-suited to the reform of indigenous education, with targets set in collaboration with the department of education around teacher effectiveness, hours of instruction and graduation rates. King (2019) argues that Deliverology goes straight to putting the citizen at the heart of service delivery; it works across governments to make a real difference in citizen`s lives. Deliverology is an approach to manage and monitor the implementation of activities that have a significant impact on outcomes (Barber, Moffit & Kihn 2011b:32). In South Africa, Deliverology is well suited to change the post-apartheid mathematics curriculum and replace it with one that responds to the needs of the current democratic education system.

Although delivery units are meant to support an organization`s leaders in developing a theory of action, identifying strategies to reach the stated goals and sequencing the strategies in the form of a delivery plan, they need to be tested, challenged and revised over time (McKay 2017). Deliverology gives district leaders the tools they need to drive and monitor real change for students at school at classroom level (Barber, Kihn & Moffit 2011a). For effective implementation of the Mathematics CAPS, subject advisors must offer support to mathematics

educators. King (2019) concurs that the role of Deliverology is to help and support educators.

2.12.1 Why deloverology is relevant to the study

Deliverology is relevant in this study because it is a target-driven approach designed to ensure successful implementation of the Mathematics CAPS in the DBE. According to the Figure 2.1, the DBE should set clear goals and objectives of the Mathematics CAPS curriculum. Although mathematics educators will have some experiences throughout the implementation process, effective monitoring and analysis should take place so that the curriculum can be revised and innovated on a regular basis. This implies that the goals and objectives of the Mathematics CAPS will be achieved by effective curriculum implementation as indicated in Figure 2.1.

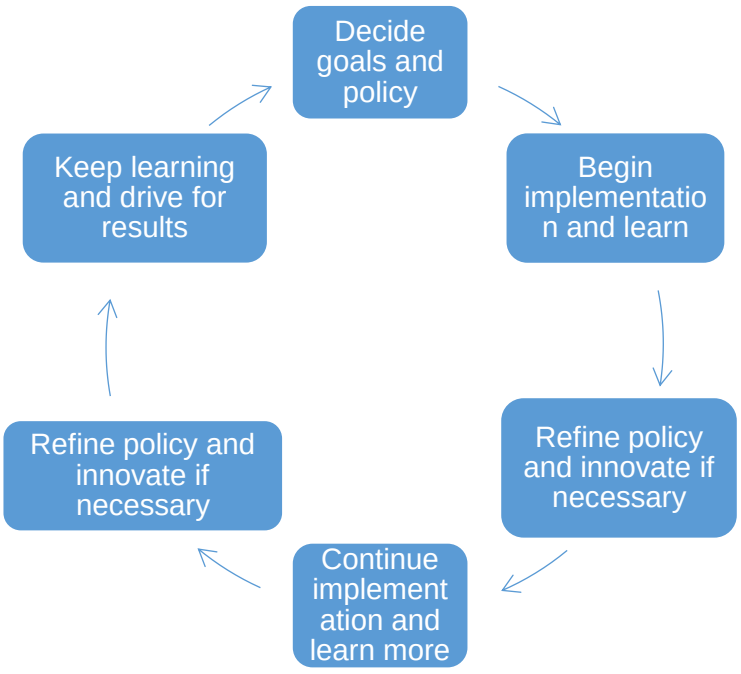

Figure 2.1: Presentation of one possible approach of Deliverology: How to think about implementation (Barber 2015).

Deliverology is best in situations where government departments are performing poorly and where short term measured goals can be identified (Richard 2018). Therefore, as indicated above, it is based on the notion that the Department of Basic Education is not geared towards delivering good results, for example, poor learner performance in mathematics in South Africa. According to literature, Barber (2015) applied the concept of Deliverology with varying degrees of success in the education sector, where the delivery system is complex, and the government has almost exclusive control over outcomes. The true market competition in government is not possible due to the political context (Stewart & Walsh 1992). Devarajan (2013) concurs that dysfunctionality in government has its own roots in politics because there is anecdotal evidence that powerful unions undermine the implementation of government activities. For example, an educator can be absent without notifying the principal. In this instance, Deliverology assumes that the problem is the behavior of the public servant. Deliverology is a quality improvement method to help organizations reach their goals by building upon the approaches they are currently using rather than starting over from scratch. It tries to honor what organizations are already doing, while providing a common and predictable structure, consistency, and rigor for their work (McKay 2017). In mathematics, curriculum has been amended since 1997. Recent educational transformation in the DBE has recommended the mathematics teaching and learning framework for South Africa, to help mathematics educators to teach the subject for conceptual understanding (DBE 2018).

The Deliverology framework is relevant to this study because it assumes that the government should set measurable goals to encourage and direct the implementation of policies. Curran (2016) argues that Deliverology focuses on providing solutions to a country's challenges by refining the ministries` efforts and capabilities. It relies on top-level political support to be able to do its work. In the United Kingdom, it focused on priorities, typically mid- to long-term goals as directed by the then prime minister, Tony Blair. In South Africa, the DBE designs and develops the mathematics curriculum to be implemented by mathematics educators. This implies that the DBE provides a service by using a top-down approach. Seemingly, Deliverology will provide solutions regarding the

implementation of the Mathematics CAPS through the efforts of the DBE. Deliverology is the effective method of improving performance by setting focused aggressive targets and providing frequent follow-ups. The setting of targets and collection of data should be related to the priorities which should be clearly identified (Curran 2016). Richard (2018) concurs that Deliverology employs goal setting, performance measurement and the use of tight feedback loops to ensure that the department delivers on the campaign promises. Curran (2016) further states that in Deliverology, there is an exercise of central oversight through a unit reporting directly and regularly to the leader. In this study, mathematics educators must submit their work, for example lessons preparations, to their departmental heads and principals, as per mathematics School Policy (Mopani west District 2020). According to Barber, Rodriguez & Artis (2016), there should be a design of delivery unit to ensure the sustainable execution of government policies. In the Mathematics CAPS there are some policy documents designed to guide the implementation of the mathematics curriculum.

Deliverology was developed to encourage employees to deliver services in the government departments. In this study, it will encourage mathematics educators to implement the Mathematics CAPS effectively. The idea behind Deliverology is to bring discipline into management and bridge a long-standing gap between policymaking and implementation (May 2019) because, according to Barber (2016) in most cases, the gap between policy ambition and implementation is wide. Curran (2016) explains that a notable aspect of Deliverology is that it can be applied to any sector and any country. For example, in October 2016, the Gauteng Provincial Government introduced Deliverology as a governance methodology of improving the capacity to deliver on outcomes, targeting sets for all departments and entities. The meetings were held with each MEC every two months to conduct stock-taking on delivery, get problems solved promptly and make appropriate interventions to support departments that were struggling (Makhura 2018). In this study, Deliverology is defined as the actions of the government where mathematics educators deliver services to the learners by implementing the mathematics curriculum.

According to Barber, Moffit & Kihn (2011b) the key components of the Deliverology approach are establishing a small team focused on performance and putting into place a delivery unit which is made up of a group of dedicated individuals focused on achieving impact and improving the outcomes. It should constantly challenge performance and ask difficult questions, taking any excuses off the table. In addition, it should acknowledge competing priorities and unexpected situations and should be a permanent structure, an extension of senior leadership. Barber et al (2016) provides the following four steps for a successful policy implementation: learn to set clear, measurable goals and build reform coalition; understand and drive delivery through data analysis, progress monitoring and course corrections; plan for delivery with an explicit, day-to-day implementation plan, updated with proven methods from years of practice and finally identify and address challenges.

Delivery units must put structures and resources in place and ensure that everyone in the organization has the necessary training to implement the delivery plans. Delivery units should meet regularly to review and reflect on outcomes, address emerging issues, and collectively share best practices between individual groups (McKay 2017). Some of the best practices that will contribute to curriculum implementation of the Mathematics CAPS are the availability of capital resources (finance), human resources (mathematics educators) and non-human resources in the form of mathematics textbooks for educators and learners, well-furnished classrooms, media centres with books or libraries and laboratories.

2.13 CONCLUSION

It is almost six years since the Mathematics CAPS was first implemented. It seems there are challenges faced by mathematics educators because learners are still not performing well, hence the amendment of the Mathematics CAPS in 2018. Therefore, in this regard, the approach of Deliverology should help with the best practices concerning the implementation of the mathematics curriculum. The Ministry of Education in Ethiopia (2018) explains that by applying Deliverology, the government hopes to respond to the nation`s needs by creating a better education system that produces a more capable labour market. The Mathematics

CAPS needs to produce learners with skills and knowledge that will help them to function effectively in the world. According to Institute of Public Administration in Australia (IPAA) (2019), Deliverology uses valuable practical tools that affect the day-to-day work of participants. Not only will the individual participants benefit but the organization and its citizens also. When mathematics educators implement the Mathematics CAPS, they are trying to meet the expectations of the DBE.

This chapter discussed the concept of curriculum, curriculum changes and the school curriculum in the context of South Africa. It also discusses Deriverelogy as the theoretical framework that kind the implementation of CAPS.The review of the literature was informed by the history of the mathematics curriculum in South Africa and some issues relating to this curriculum were discussed. The study also explained how the approach of Deliverology helps with the best practices of the Mathematics CAPS. Chapter three focuses on the discussion of the research design and methodology that informed the study.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY.

3.1 INTRODUCTION

The previous chapter discussed the literature pertaining to key elements of the study. This chapter discusses the research design as well as the ethical considerations of the study. This study was designed to explore the implementation of the Mathematics CAPS curriculum to help understand its relation to the experiences of educators. The study goes beyond what was achieved in other studies to gain a better understanding of CAPS through educators' experiences concerning the implementation of the mathematics curriculum.

3.2 RESEARCH DESIGN

The study used qualitative phenomenography research design to provide insight into the way educators experience the implementation of Mathematics CAPS. This is because the phenomenography research method has been widely adopted to research education in multiple disciplines such as mathematics (Kapucu 2014; Gordon & Nicholas 2015). In this study, the qualitative research was adopted as the main approach. This is because in qualitative research, the stories and experiences as well as the voices of respondents are the medium through which reality is explored and understood (Maree 2012). Phenomenography is a qualitative research method used for qualitatively mapping different ways in which people experience, conceptualize, perceive and understand various aspects of phenomenon in the world around them (Marton 1986). A phenomenography qualitative study is aimed at identifying and describing qualitatively, different ways of experiencing and identifying educationally critical aspects, that could be used as means towards new and more complex way of understanding a pedagogic purpose (Kettunen & Paakkari 2017). This study was conducted in the form of a case study in rural high schools of Mopani West District. This is because qualitative research designs emphasize collecting the data in the natural setting of the phenomenon (McMillan &

Schumacher 2010). Therefore, this study adopted a qualitative phenomenographic case study research design.

The population of this study consisted of all rural high schools and all Grades 10-12 mathematics educators in Mopani West District. Phenomenography inquiry adopts purposive sampling which resembles most qualitative methods (Marton 1986 & Booth 1997). In this study, purposive sampling was used to sample both the schools and the educators because they are mostly likely to give information relevant to a particular research question. Therefore, in this study the rural high schools and the mathematics educators were purposefully selected because educators experienced the implementation of the Mathematics CAPS in the schools. In purposive sampling, the participants are selected according to pre-selected criteria relevant to a particular research question (Maree 2012).

In this study, twelve mathematics educators and two mathematics Departmental Heads (DHs) were purposefully selected in 5 rural high schools. According to Marton (2014) there are multiple ways to collect phenomenographic data, such as using semi structured interviews, open ended questionnaires, think aloud methods and observations, each of which offers different strengths and limitations to the research process. In this study, two data collection methods were used, and they were semi-structured interviews and the online survey. Semi structured interviews were able to provide rich and in-depth descriptions (Kapucu 2014; Chiu, Liang & Tsai 2016). With the online survey, a 24-checkbox questionnaire which consisted of mostly closed-ended questions with only questions C4 and C5 allowing for reasons to be provided was developed to test or confirm the conclusions drawn from the qualitative enquiry. The questionaire was sent randomly to a relatively large number of participants to cover a wider range of experience for variations to be revealed. The main source of data collection was qualitative phenomenographic enquiry but was supported by the quantitative data.

Therefore, in this study, phenomenography method was used as the main research method to identify the way mathematics educators experienced and understood the implementation of Mathematics CAPS in their respective schools.

Data from the semi structured interviews was analyzed during and after it had been collected. Quantitative data was described by a software package of Google forms. The findings were in the form of frequencies, percentages, pie charts and graphs. The data analysis of this study designed patterns of understanding in numerical language and described the experiences in the way mathematics educators understand or ascribe meaning in the CAPS world around them. Phenomenography research method was meant to reveal critical aspects not to describe everything that could be captured from data (Kettunen & Paakkari; 2017). Ethical procedures were explained, followed and ensured. The credibility and trustworthiness of this study`s results were assured. This includes piloting of the two data collection methods. According to Makina (2013), research design refers to the specified course of action to be applied by the researcher, in order to make sound judgement about the research. McMillan and Schumacher (2010) further explain that a research design describes the procedures for conducting a study including when, from whom, under what conditions.

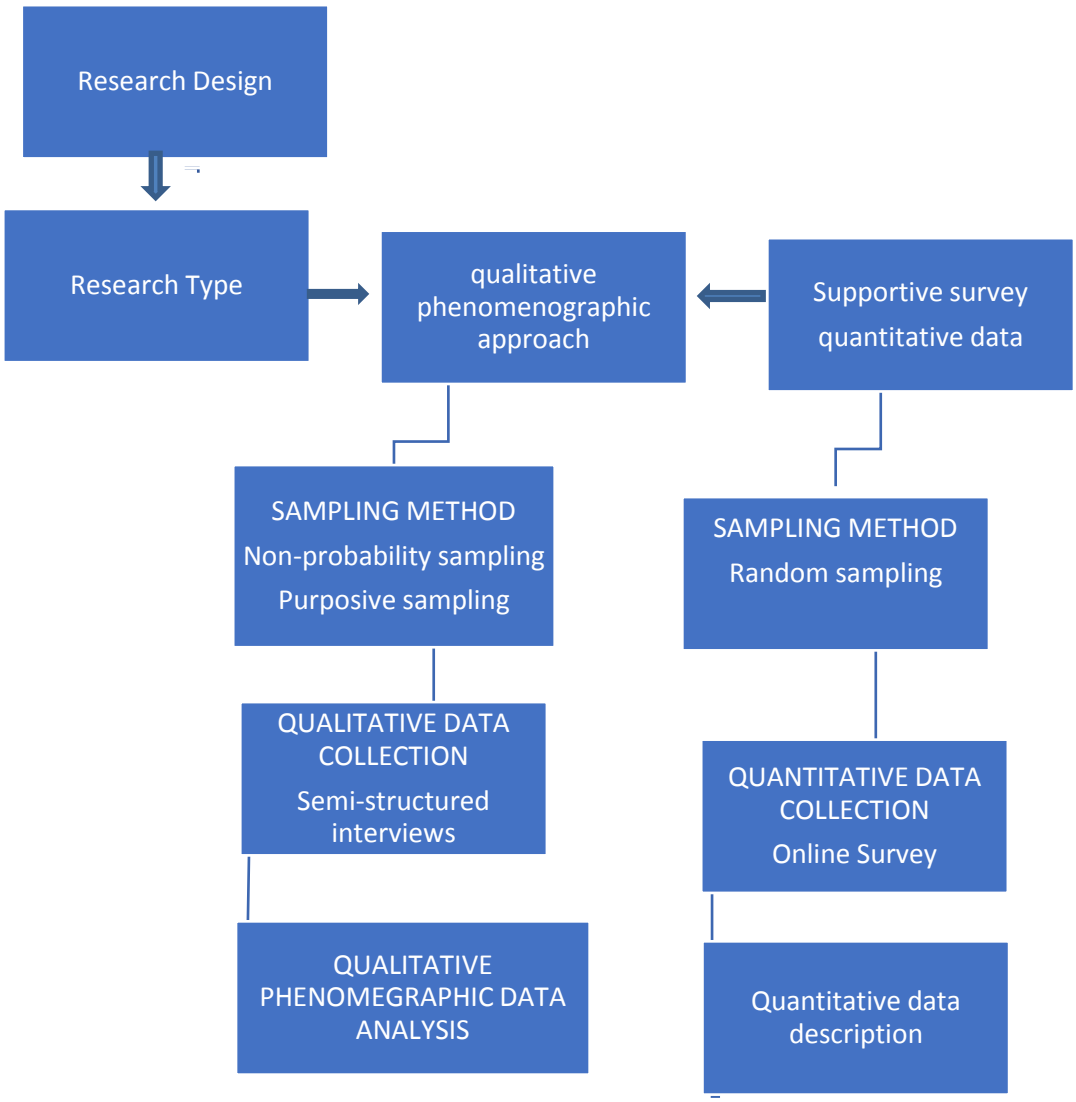

Figure 3.1 :Summary of the research design

3.3 RESEARCH TYPE

In this study, the qualitative research was employed. Qualitative research was appropriate because the aim was to understand and describe educators' experiences in the implementation of the Mathematics CAPS curriculum. According to McMillan & Schumacher (2010) a qualitative research approach is a social phenomenon that includes ideas, thoughts, and actions. Maimela (2015) posits that qualitative research provides information about the "human" side of an issue that is often contradictory of behaviour, beliefs, opinions, emotions and relationships of individuals in the implementation process.

Qualitative research is employed when one wants to study people or systems by interacting with their natural environment (Niewenhuis 2007). According to Mbatha (2016), a qualitative researcher is concerned with practice that focuses on the processes that are occurring. South Africa is in the process of implementing the Mathematics CAPS. Qualitative researchers use a range of data collection methods for an extended time in the field, which usually include interviews, observations and document analysis (De Vos, Strydom, Fouché & Delport 2002). In addition, Lichtman (2014) states that qualitative research is an analytic procedure where data is obtained from participants in a face-to-face interaction by asking a wide range of questions, gathering data comprising mostly of words or text from participants, then defining appropriate tools to evaluate them in a more unprejudiced form over a stipulated period. For the purpose of this study, interviews and online survey served as tools for data collection. Qualitative research is used to uncover trends in thoughts and opinions, and to deliver deeper solution into the problem (Mbatha 2016). Mafokwane (2017) adds that in qualitative research, there is a need to be open-minded, curious and emphatic, flexible and attentive, listening carefully to what participants are saying. In this study, interviews were designed to be open-ended to reveal flexibility understanding of the responded views. Qualitative research asks questions that consist of the why of human behaviour (Mafokwane 2017). Hence, the research question of this study was: "What are the experiences of mathematics educators in the implementation of CAPS curriculum?" In qualitative research, there is a search for themes or a narrative story in which data is outlined as words or

pictures (Maree 2012). In this study, data analysis was in the form of words to describe and interpret the meaning mathematics educators ascribed to the implementation of the Mathematics CAPS. McMillan & Schumacher (2010) agree that qualitative research adopts a common view of generalizability; so that the reader is left to make up, his/her own mind on how far the evidence collected could be used to offer information about the same topic in a similar setting. The findings of this study generalized the experiences of mathematics educators in Mopani West District. Hoepfi (1997) said that researcher use qualitative research to gain new perspective on things that are known. So much was already known about the implementation of Mathematics CAPS in South Africa, but the solution to the problems of its implementation is not yet found. Therefore, for the effective implementation of the Mathematics CAPS in schools, there was a need to understand the processes of implementation and hence the theoretical framework of Deliverology.

3.4 RESEARCH APPROACH

This study followed the qualitative phenomenography research approach. Phenomenography is the empirical study of the different ways in which people think of the world. The aim of phenomenography is to investigate qualitatively, different ways in which people experience something or think about something (Marton 1986 & Booth 1997). In this study, phenomenography described different ways in which mathematics educators perceive the implementation of Mathematics CAPS.

The basic assumption of phenomenography is that different people do not experience a phenomenon in the same way and, instead, people have a wide variety of perceptions and understanding about a phenomenon. Phenomenography is used to understand the thoughts, emotions and behaviours of people in various situations and context (Assarroudi & Heydari 2016). In this study, the phenomenography method attempted to understand how mathematics educators interpret and give meaning to their experiences in the implementation of the Mathematics CAPS. This includes understanding how mathematics educators made their world based on their interpretation of the implementation of

this curriculum. The semi-structured interviews and the online survey were used as tools for data gathering. Because in phenomenography, data is collected in the form of interviews and texts written by participants (Kettunen & Paakkari 2017), in this study, interviews were open and sufficient time for thinking and pausing during the interview was ensured.

3.5 RESEARCH METHODOLOGY

To understand different ways of experiencing a particular social phenomenon, it is important to interact with people who are directly affected in their immediate environment. This involves the data collection, interpretation and drawing the conclusion about a research study.

3.5.1 Geographical position of the study

This study was conducted in government high schools situated in the Mopani West District of the Limpopo Province. The schools are in the rural areas which are stricken by poverty and unemployment. mathematics was one of the subjects offered in Grades R-12. However, this study concentrated on Grades 10-12. According to Maree (2007), a research site is a place in which a research study occurs. To abide by ethical considerations, schools were identified using letters of the alphabet A, B, C, D and E.

3.5.2 Population and sample

In this study, the population was drawn from all the rural high schools of Mopani West District in the Limpopo Province. Five rural high schools were sampled. Makina (2013) explains that a population is the total number of units or individuals from which the sample is taken. Within the rural high schools, a population from all Grades 10-12 mathematics educators was drawn. This is because they were the ones teaching mathematics to Grades 10-12 learners and they had all been implementing the Mathematics CAPS since it was introduced.

3.5.3 Sampling method

Sampling refers to the process used to select a portion of the population for the study (Maree 2012). Based on the qualitative approach, the study employed non-probability sampling because in this process, there is a pre-determined bias of selection of the sample. This implies that it did not give all the mathematics educators an equal chance of being selected. In non-probability sampling, the samples are selected based on the subjective judgment of the researcher (Laerd 2012). Within non-probability sampling, purposive sampling was used to sample both the educators and the schools. In this type of sampling, the participants are selected according to pre-selected criteria relevant to a particular research question (Maree 2012). Within purposive sampling, critical case sampling was employed. Critical case sampling is the process of selecting a small number of important cases which are likely to yield the most information and have the greatest impact in the development of knowledge. Based on quantitative data random sampling was used. In random sampling each sample has an equal probability of being chosen and there is an unbiased representation of the total population.

For the purpose of this study, the five high schools were selected purposefully because they were rural, accessible and convenient thereby minimizing transport costs for the person conducting the study. Within the five rural high schools selected; principals were requested by the researcher to select the educators who teach mathematics in Grades 10-12. To avoid bias and preferences, the principals provided a list of all the names of the educators and the names of the departmental heads (DHs). The educators and the DHs were selected purposefully, based on their knowledge and experience in implementing the Mathematics CAPS. Post level one educators who had a minimum qualification of a three-year teaching diploma, had experienced some of the curriculum changes brought by C2005, RNCS, NCS and the CAPS, were therefore selected purposefully. It was ensured that some had 20 years or more experience of teaching mathematics in Grades 10 -12 and others had also attended CAPS workshops. The DHs were also selected purposefully, based on some having

Bachelor of Education Honours qualifications or higher and their experiences of being mathematics DHs within the CAPS context.

Sampling was based on DHs' and educators' different ages, qualifications, teaching experiences of Grades 10-12 mathematics and curriculum changes experienced. The 12 post- level one educators teaching mathematics in Grades 10-12 were sampled because they were information-rich about the phenomenon. Two mathematics departmental heads were sampled because they were most likely to provide the information needed. The number of participants depended on data saturation. Codes were used for ethical considerations. For example, educators were identified as E1, E2, E3, E4, E5, E6, E7, E8, E9, E10, E11 and E12, while departmental heads were coded as H1 and H2.

Permission was requested from the principals to conduct the study. According to Creswell (2012), researchers intentionally select individuals and sites to learn and understand the central phenomenon. All participants were selected because of their active role in the teaching of mathematics in Grades 10-12. Therefore, there was anticipated richness and relevance of information in response to the study research question that pertained to the implementation of the Mathematics CAPS.

3.5.4 Data collection techniques

The data collection method employed in this study was semi-structured interview. Quantitative data from an on-line survey was used to support qualitative data. According to the literature on phenomenography, data collection involves open-ended interviews which can be semi-structured. Maree (2012) explains that an interview is a two-way conversation in which the interviewer asks an interviewee question in order to collect data. It assists in learning about the ideas, beliefs, views, experiences and behaviour of participants. Zulu (2019) explains that interviews are the outcomes of the conversation between the interviewer and the interviewee in order to provide an understanding of the experiences of paticipants better. Interviews focus on the world of the interviewees and seek to reveal their beliefs, values, reality, feelings, and experiences of a phenomenon (Barnard,

McCosker & Gerber 1999). Online survey refers to a list of questions aimed at extracting specific data from a particular group of people (Johnson & Christensen 2019).

Based on the research question and the objectives of the study, an online survey was carried out to confirm the need of the study (Appendix F). The online survey was mainly used to collect bibliographical data of the participants. An online survey collects information from people who respond to a form or instrument that is distributed through internet channels (Andrade 2020). In this study, the survey collected quantitative data using a free software package called Google forms to select a wide range of questions (Johnson & Christensen (2019). It is a quantitative research method used to collect data from predefined participants and gather information about their preferences, opinions and choices related to their products and services. In this study, quantitative data collection was carried out to corroborate the qualitative data. Permission to conduct this study was requested and granted by the Limpopo Department Education mathematics educators had to provide feedback on their experiences of the implementation of the Mathematics CAPS in Grades 10-12. The questionnaire was sent to participants through emails. In the questionnaire, the purpose of the study was explained, and it was stated that participants should fill in the form voluntarily. The questionnaire was made up of four sections. Section A of the online survey comprised of six questions related to the bibliographic and demographic data of the participants. Section B was made up of five questions on the investigation of the pass rate within the Mathematics CAPS. Section C consisted of five questions focusing on the challenges with the implementation of the Mathematics CAPS while Section D comprised eight questions related to support provided through the community of practice. One hundred and ten (110) Google forms were sent out to the participants and 43 were returned. According to Andrade (2020), the disadvantage of using an online survey method is that it usually has a low response rate. The participants were requested to complete the survey and e-mail it back to the sender who saved the results in the Google account. Responses were indicated by means of frequencies (f) and percentages (percentage) in the form of pie charts and graphs.

Based on the findings from online survey, the main data collection method used was the semi-structured interview (Appendix G). The semi-structured interviews were conducted in the educators` offices or any private place within the chosen schools after school hours. Semi-structured interviews require the participants to answer a set of predetermined questions to elicit rich information (Maree 2012). The aim of the interviews was to have the participants reflect on their experiences and then relate those experiences to their work in the classrooms. In this study, semi structured interviews were conducted to find out the experiences of mathematics educators regarding the implementation of the Mathematics CAPS. To ensure consistency in the data collection, one set of questions was developed for both the mathematics educators and the mathematics DHs. Before the interviews started, the nature of the study and the main aim of the interviews were clarified to each participant. Participants confirmed that they were still interested in participating in the interviews. Permission was requested from the participants to audio record and take written notes during the interviews. The interviewer listened carefully to the responses without any judgment or criticism and probing questions were also asked to generate more understanding and information. Notes taken from the audio recordings helped to identify the gaps so that follow up questions could be asked if necessary. Each interview lasted 30 minutes and it took a total of 10 weeks to complete all interviews. Before the interviews began, a pilot study was undertaken with three educators to ensure that the questions were clearly understandable. Data collected from the interviews was transcribed, coded and analysed.

3.5.5 Data analysis

In this study, the two types of data that were analyzed were semi-structured interviews supported by some online survey responses. Data analysis is when the researcher examines the participant's perceptions, attitudes, experiences, and knowledge, in trying to understand their constructions of a particular issue under consideration (Niewenhuis 2007). The aim of data analysis was to explore the experiences of the Grades 10-12 mathematics educators regarding the implementation of the Mathematics CAPS. Narratives were used as the main

mode of analyzing the data because they have the capacity to represent the holistic nature of experiences and understanding of a phenomenon.

According to Molapo (2016) qualitative data analysis should adhere to the aim of the study. The collected data from the interviews was transcribed. Each transcript was viewed and read several times for the researcher to become familiar with the responses of the participants. Thereafter the transcript was read again and at this stage more focus was put on identifying the similarities and differences of the responses. Similar responses were sorted and classified. The initial set of categories was generated. The most meaningful and relevant extracts were identified. The data was reduced into useful information to address the main research question and the objectives of the study. The initial list of categories was revised to bring forth a comparison among the preliminary listed categories. The categories were compared, refined and modified several times before they were developed into central themes that helped in addressing the research question. The themes helped to explore the different ways of understanding the phenomenon under study. The interview categories/themes were scrutinized very closely and linked to the literature review and the online survey findings. The themes reflected the overall aims and objectives of the study.

Data collected through Google forms was described using the software that automatically analyzed the data. Guided by the research question, the themes of the study started to emerge from Section A up to Section D. These were demographic data, the mathematics pass rate, the challenges with implementation of the Mathematics CAPS and the support provided through the community of practice.

3.5.6 Quality criteria

3.5.6.1 Quality criteria for describing quantitative data

During the quantitative phase of this study, reliability and validity were ensured. Reliability is when the same results can be consistently achieved if the same research is conducted under the same circumstances while validity is the extent

to which the results measure what they are supposed to measure (Middleton 2019). Validity is ensured to assess the quality of quantitative research methods and the findings of the study. To ensure content validity of this study my supervisor ensured that the questionnaire best suited the research question. The questions covered the demographic information of participants, examined the pass rate, identified challenges with the implementation of the curriculum and support provided through the community of practice. Predictive validity was ensured by the questions included in the questionnaire. The formulation of the questions was based on the literature review. Construct validity was done by involving a statistician to ensure that each question measured exactly what it was supposed to.

According to Creswell (2014) there are measures to prevent threats to the validity of the study. In this study, preventative measures were put in place to ensure there were no threats to the validity of the questionnaire. The first was the reliability of the instrument. This was ensured by the fact that after developing the questionnaire, it was sent to a statistician to ensure its validity. Secondly, in most of the questions, there were three options, namely, yes, no or not sure. In some questions, the participants were given options to explain their feelings regarding the questions. To ensure that the participants answered all questions, the questionnaire did not allow skipping a question. Finally, regarding social desirability, the questions were interrelated, which made it almost impossible for participants to give answers that were not a true reflection of their feelings.

3.5.6.2 Quality criteria for the qualitative approach

In this study, trustworthiness was employed because it is associated with a qualitative research approach. Trustworthiness of the study assesses the quality of the data collected. According to Lincoln & Guba (1985) the trustworthiness of a research study is crucial in evaluating and establishing credibility, transferability, dependability, and conformability.

Credibility depends on the richness of the data and analysis and can be enhanced by triangulation (Patton 2002). To strengthen the credibility of this study,

methodological triangulation was employed. This involved the online survey and interviews. Triangulation is a qualitative research strategy to test validity through the convergence of information from different sources (Carter, Bryant-Lukosius, DiCenso, Blythe & Neville 2014). Furthermore, in enhancing credibility, data collection was prolonged to meet the need for including participants with different experiences and backgrounds to ensure variation and dimensionality of the core concepts.

The transferability of the findings was ensured by providing sufficient information on the past and current educational context in South Africa. Transferability is described as the level at which the findings of qualitative research can be transferred to similar situations with other respondents (Moodley 2013).

In this study, dependability ensured that should the same study be conducted; the same results would be achieved. The process as presented by the researcher was as clear and detailed as possible to produce the same or very similar findings given similar contexts (Creswell 2014). This was enhanced by implementing the research design effectively. It included evaluating the findings and the recommendations of the study to ensure that they supported the data collected from the participants.

Lincoln & Guba (1985) further explain that conformability establishes whether or not the research findings represent plausible information drawn from the participants' original data and is a correct interpretation of the participants' original views. In this study, conformability of results was strengthened by keeping a reflective journal in which all events that happened in the field, including personal reflections of participants in relation to the study, were recorded. This included raw data from interview notes and audio recordings from interviews. They helped in the crosschecking the inquiry process. Conformability is described as the level to which the findings of an inquiry could be confirmed or corroborated by other researchers (Baxter & Eyles 1997).

3.5.7 Research ethics

In this study, the procedure for ethical research principles was followed (Appendix A). According to Walshaw (2015), ethical application focuses primarily on the link between research methods and the participants. Prior to the commencement of data collection, a letter requesting the permission for collection of data in rural high schools of Mopani West District was sent to the Department of Basic Education (Appendix B). The district director responded by granting permission to conduct the study (Appendix C). The same letter for requesting permission was addressed to the circuit managers, the school principals and the mathematics subject advisors for mathematics who were purposively selected. It was accompanied by a letter from the District Director granting permission for the research so that they could be aware of the study to be conducted in their institutions. After educators and the DHs were purposively selected, they were invited to participate in the data collection. The main purpose for conducting this study was explained and clarified to the participants. A participation information sheet, which is a consent letter (Appendix D), and a voluntary participation form (Appendix E) were signed by participants who were willing to participate. The subject advisor for mathematics also provided the emails of the mathematics educators for Grades 10-12. The online survey was sent to all email addresses. On the cover page, it was also stated that the filling of the forms was voluntaryand was done in a way that encouraged the free choice of participation and that they could withdraw from the study at any point without giving a reason (McMillan &). Communication was in the form of emails, telephone calls, SMSs, and WhatsApp to confirm the availability of participants.

Respect, honesty, and sympathy among participants was emphasized and adhered to. Participants were assured that information to be shared during the study would be kept private and confidential, and they would not be exposed to any physical or psychological harm. The voluntary participation form, the transcribed and analysed semi-structured interview data as well as the completed online survey questionnaires will be locked in my cupboard in the office for five years. The audio will be password protected in my computer. According to

Mbatha (2016) the trustworthiness of the study should be judged by how ethically engaged the researcher was while conducting the study.

3.6 CONCLUSION

This chapter described in detail the research design of this study. It also explained how ethical considerations of the study were ensured. Chapter 4 focuses on the findings, analysis and interpretation of data.

CHAPTER FOUR: DATA ANALYSIS AND INTERPRETATION

4.1 INTRODUCTION

The previous chapter presented the research design and methodology used in this study. It considered the reason for using particular methodologies and also provided research methods and reasons for purposefully sampling the participants. This included attempting to differentiate the types of data collection techniques used in the study. This chapter presents the findings of this study, which seek to provide a report on the inquiry that attempted to answer the main research question, namely: ‘’What are the experiences of mathematics educators regarding the implementation of the Mathematics CAPS in Grades 10-12 in South Africa? Online survey and the semi structured interviews were analysed, guided by the main research question and the following sub-question: “What are the challenges experienced by mathematics educators regarding the implementation of the Mathematics CAPS in Grades 10 -12?

Data analysis is not only about generating the facts about the collected data, but it also entails the active process of interpretation (Leedy & Ormrod 2005). According to Ramabulana (2017) in order to address the main research question, data needs to be reduced to information that is valuable. In this chapter, data analysis started with the representation of quantitative data that was guided by an automatic interpretation of Google forms. Themes for the quantitative data were created to enable the discussion of the results of the quantitative data. Quantitative data collection was followed by the analysis of the interviews that described the qualitative data in this study. The transcription of interviews with the mathematics educators made it possible to describe the experiences of the participants in their own words. The significant statements, sentences, or quotes which were highlighted provided an understanding of how the mathematics educators experienced the implementation of the Mathematics CAPS. The findings of the data gathered were discussed and the themes to assist in answering the research questions were identified. The Deliverology approach was used as the theoretical framework and wasreferred to in the literature review in Chapter 2. The Deliverology approach emphasises the fact that for curriculum

implementation to be effective, curriculum developers should set clear skills, aims and values that are specific and measurable. The Deliverology approach supports regular implementation, analysis and monitoring of the curriculum. The findings of the research represented the overall aims and objectives of the study.

4.2 QUANTITATIVE DATA

In this study, the quantitative data from the online survey and the quantitative data of the interview participants were carried out to support the study. The online survey that used Google forms was made up of four identified categories/themes and the quantitative data of the interviews was mostly the bibliographic data of the participants.

4.2.1 Quantitative data from the online survey

Based on the research question, online survey questions were formulated. The questionnaire was made up of four sections. Section A comprised of six questions related to the bibliographic details of the participants. Section B consisted of five questions related to the pass rate of mathematics in the Mathematics CAPS. Section C was made up of five questions focussing on the challenges with the implementation of the Mathematics CAPS. Section D comprised of eight questions related to the support in the implementation of Mathematics CAPS. Overall, 110 Google forms were sent out to the participants and only 43 were returned. Responses were indicated by means of frequencies (f), percentages (%) in the form of pie charts and graphs. This quantitative data was mainly generated to support the qualitative data analysis. The visual representations of quantitative data from the survey are presented in the sub-sections below.

ECTION A: BIBLIOGRAPHIC DATA OF THE PARTICIPANTS OF THE SURVEY

Age	f	%
20-29	16	37.2
30-39	12	27.9
40-49	9	20.9
50-59	5	11.6
60 and above	1	2.4

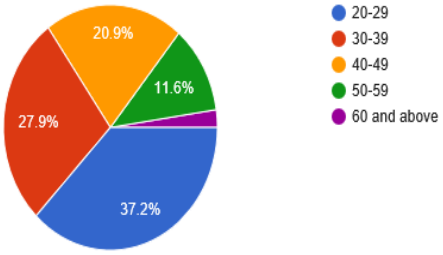

Figure A1: Age of the participants

Location	f	%
Bolobedu	9	20.9
Makhutswe – Lepelle	9	20.9
Ritavi	7	16.3
Thabina	18	41.9

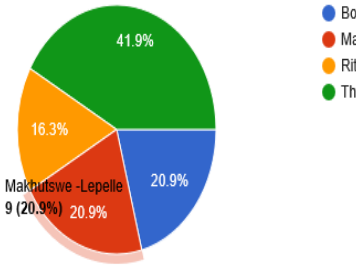

Figure A2: Location of the participants

Highest qualifications	F	%
Doctorate	0	0
Masters	4	9.3
Postgraduate	21	48.8
Undergraduate	12	27.9
Diploma	4	9.3
Certificate	2	4.7

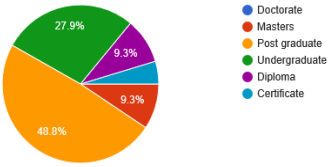

Figure A3: Highest qualifications of the participants

Years of employment	f	%
0-5	13	30.2
6-10	19	44.2
11-20	8	18.6
21 and above	3	7

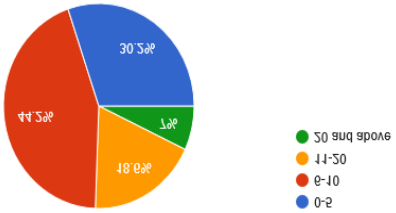

Figure A4: Years of employment of the participants

Value	Count	%
Grade 10	24	55.8
Grade 11	28	65.1
Grade 12	19	44.2

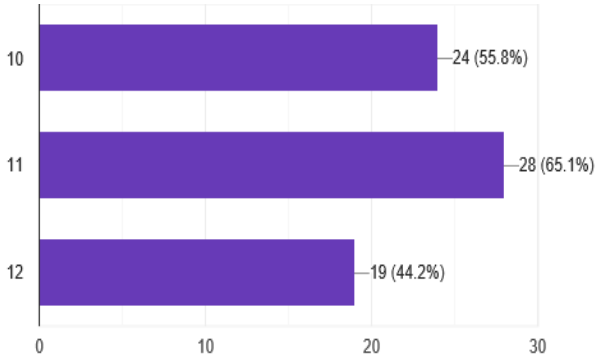

Figure A5: Grades that the participants were teaching

Home language	f	%
IsiNdebele	0	0
IsiXhosa	0	0
IsiZulu	2	4.6
Sepedi	35	81.4
Tshivenda	0	0
Xitsonga	3	7
Other	3	7

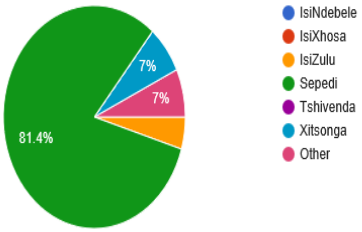

Figure A6: Home language of the participants

A total of 37.2% of the participants were between the ages of 20-29 and the majority (48.8%) of the participants had postgraduate degrees. Of the four clusters that took part in the study, 41.9% of the participants were from Thabina cluster. Of the total number of participants, the majority (44.2%) had 6-10 years of employment experience and (65.1%) of the participants were teaching mathematics Grade 11. It is also notable that 81.4% of the participants spoke Sepedi compared to the other minority languages.

SECTION B: EXAMINING THE MATHEMATICS PASS RATE IN THE CAPS CURRICULUM.

	f	%
Yes	36	83.7
No	6	14
Not sure	1	2.3

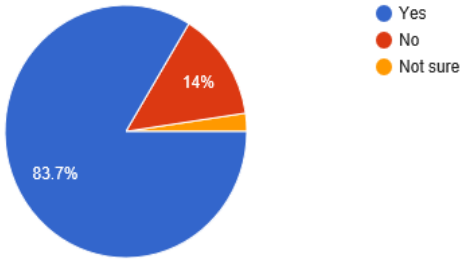

Figure B1: Do you have a low mathematics pass rate in this District?

	f	%
Yes	31	72.1
No	11	25.6
Not sure	1	2.3

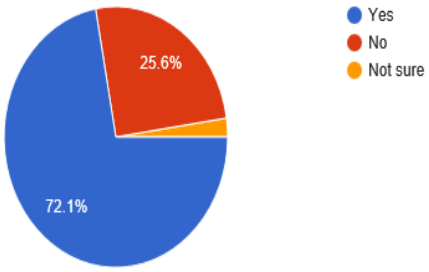

Figure B2: Do you experience a low mathematics pass rate in your school?

	f	%
National Department of Basic Education	3	7
Limpopo Department of Education	11	25.6
Mopani West District	14	32.6
Circuit office	9	20.9
Schools	5	11.6
Media	1	2.3
Gossip	0	0
Other	0	0

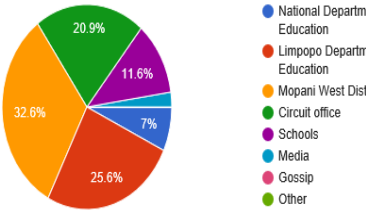

Figure B3: How did you hear about the mathematics pass rate?

	F	%
Yes	33	76.7
No	5	11.6
Not sure	5	11.6

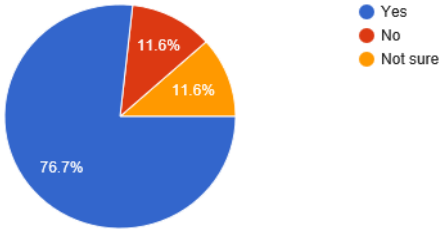

Figure B4: Do you think there is a relationship between the low mathematics pass rate and the implementation of the Mathematics CAPS?

	F	%
Yes	29	67.4
No	7	16.3
Not sure	7	16.3

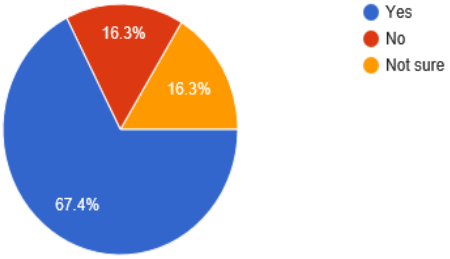

Figure B5: Do you think the implementation of Mathematics CAPS addresses the needs (e.g skills, knowledge and values) of a democratic South Africa?

The majority of the participants (83.7%) acknowledged that Mopani West District had a low pass rate in mathematics and even the schools in Mopani West District were experiencing a low mathematics pass rate. Most of the pass rate information comes from the Just of the participants heard this information from the district (32.6%). The relationship between the low mathematics pass rate and the implementation of the Mathematics CAPS was acknowledged by 76.7% of the participants. The majority of the participants (67.4%) agreed that the Mathematics CAPS addresses the needs of a democratic South Africa.

SECTION C: THE IMPLEMENTATION OF THE MATHEMATICS CAPS

	f	**%**
Yes	39	90.7
No	4	9.3

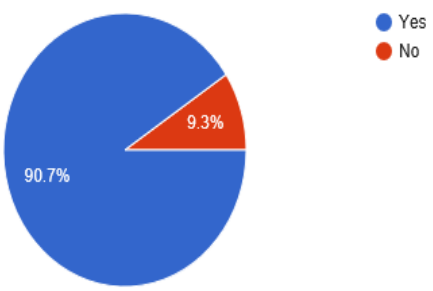

Figure C1: Do you think there are challenges with the implementation of Mathematics CAPS?

	f	**%**
Yes	29	67.4
No	11	25.6
Not sure	3	7

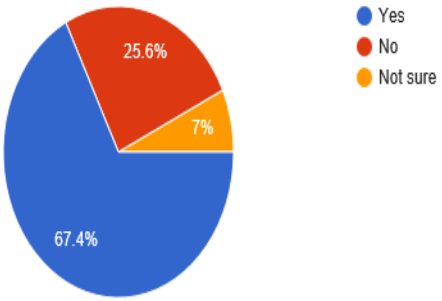

Figure C2: Do you think there are challenges with the appointment of relevant mathematics educators at your school?

	f	%
Yes	27	62.8
No	16	37.2

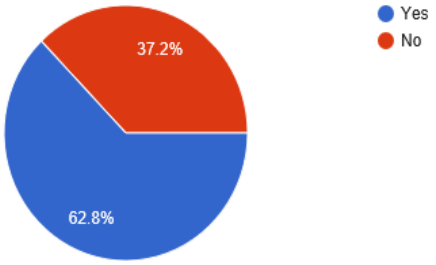

Figure C3: Are there challenges with the duties and responsibilities given to you as a mathematics educator?

	f	%
Yes	42	97.7
No	1	2.3

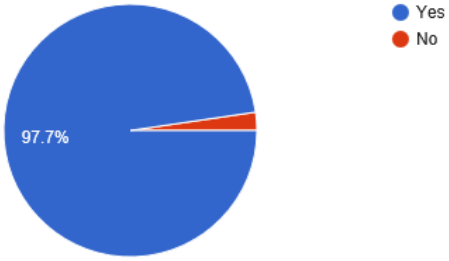

Figure C4: Do you think the pass rate in mathematics will improve if there is proper guidance with the implementation of the Mathematics CAPS?

	f	%
Yes	42	97.7
No	1	2.3

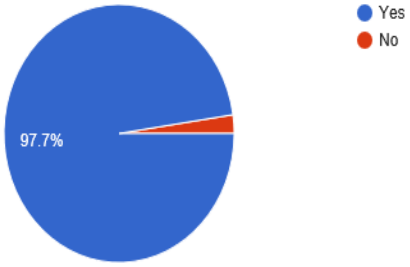

Figure C5: Do you think your teaching of mathematics will improve if you understand the CAPS document properly?

Generally, the participants (90.7%) reported that they experienced challenges with the implementation of the Mathematics CAPS. Many of the participants (67%) said that they experienced challenges with the appointment of mathematics educators in Grades 10-12, and 63% of them acknowledged that they experienced challenges in performing extra duties and responsibilities such as coaching sport or acting as Teacher Liaison Officer (TLO). Almost all participants (97.7%) reported that the pass rate in mathematics would improve if they understood the CAPS document properly and if there was proper guidance with the implementation of the curriculum.

SECTION D: SUPPORT FOR THE IMPLEMENTATION OF MATHEMATICS CAPS

	F	%
Yes	30	69.8
No	8	18.6
Not sure	5	11.6

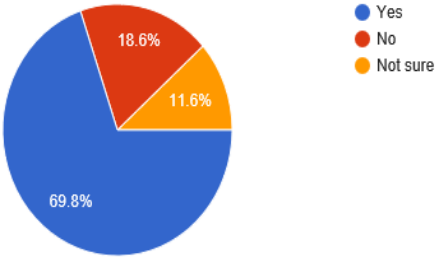

Figure D1: Do you have a school policy to support you in the implementation of the Mathematics CAPS?

	F	%
Yes	24	55.8
No	16	37.2
Not sure	3	7

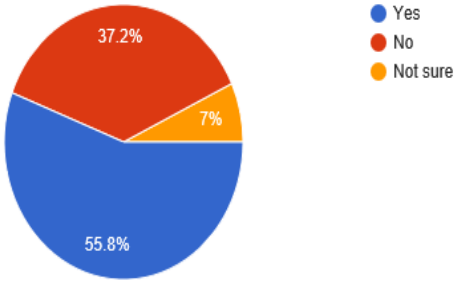

Figure D2: Do you experience problems with the school policy regarding the implementation of the Mathematics CAPS?

	F	%
Yes	24	55.8
No	11	25.6
Not sure	8	18.6

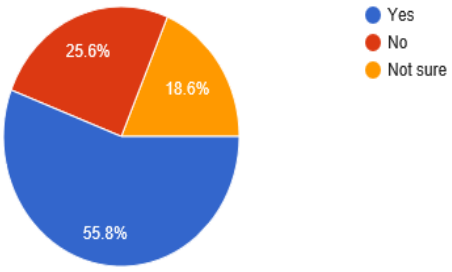

Figure D3: Does your school give you enough time to implement the Mathematics CAPS?

	f	%
Yes	24	55.8
No	16	37.2
Not applicable	3	7

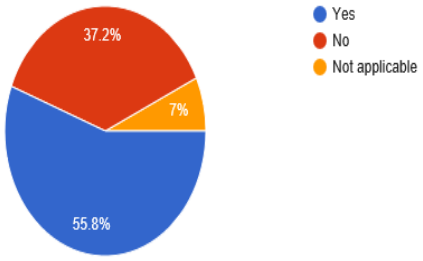

Figure D4: Do you get the support from the mathematics departmental head (DH) with the implementation of the Mathematics CAPS?

	F	%
Yes	27	62.8
No	9	20.9
Not sure	7	16.3

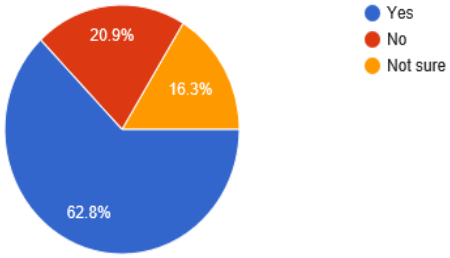

Figure D5: Do you get the support from the principal with the implementation of the Mathematics CAPS?

	F	%
Yes	27	62.8
No	14	32.2
Not sure	2	5

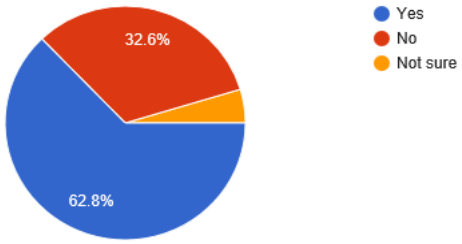

Figure D6: Do you meet with other mathematics educators in your school to discuss the better implementation of the Mathematics CAPS?

	f	%
Yes	20	46..5
No	22	51.2
Not sure	1	2.3

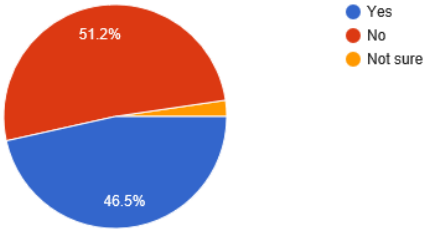

Figure D7: Do you meet with the community of mathematics educators from different schools in your province to discuss the better implementation of the Mathematics CAPS?

	f	%
Yes	22	51.2
No	14	32.6
Not sure	7	16.3

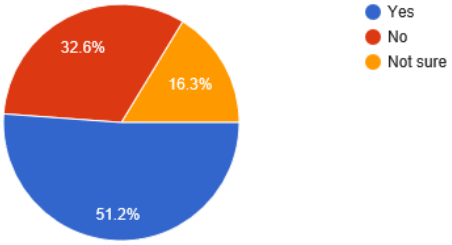

Figure D8: Do you get the support from the subject advisor of mathematics from the Department of Basic Education regarding the implementation of the Mathematics CAPS?

A total of 69.8% of the participants agreed that they have a school policy that supports them in implementing the Mathematics CAPS. The majority of the participants (55.8%) agreed that they experienced challenges with the school policy regarding the implementation of the Mathematics CAPS. A total of 55.8% of the participants said the schools gave them enough time to implement mathematics CAPS. Generally, the majority of the participants agreed that they get the support with the implementation of Mathematics CAPS even though we do not know the kind support they were given. 51.2% of the participants mentioned that they do not meet as a community of mathematics educators from different schools to support each other with the implementation of the Mathematics CAPS. More research need to be done on the quality of the research that the educators are receiving to support them with the implementation of CAPS.

4.2.2 Quantitative data from the interviewed participants.

Table 4.1 represents the profile of the interview participants and sets the context in which the data was collected. The following items are presented in the table: code for the schools, mathematics educators and their DHs; age; qualifications; years of teaching mathematics in the FET Phase and the names of curriculum changes experienced. This information was particularly useful in identifying the information of the participants.

4.2.2.1 The table of the profile of the interviewed participants

Table 4.1: Profile of the interviewed participants

Codes for mathe-matics educators and their DHs	**Age**	**Qualifications**	**Years of experience in teaching mathematics in the FET phase**	**Grades**	**Names of curriculum changes experienced**
E1	53	BEd honours in mathematics education	30	10	C2005, NCS and CAPS
E2	43	BEd Honours mathematics Education	20	11	C2005, NCS and CAPS
E3	45	PGCE and BEd Honours in inclusive education	22	10-12	C2005, NCS and CAPS
E4	44	BCom and BEd Honours	21	11	C2005, NCS and CAPS
E5	50	Secondary Teachers' Diploma. Majored in mathematics.	27	12	C2005, NCS and CAPS

E6	46	Secondary Teachers' Diploma, ACE in mathematics Intermediate and Senior Phases	23	10-12	C2005, NCS and CAPS
E7	46	Secondary Teachers' Diploma. Majored in geography and English, BEd Honours in education management	23	10-12	C2005, NCS and CAPS
E8	47	BEd in mathematics	24	12	C2005, NCS and CAPS
E9	50	BEd majored in mathematics and life sciences, BEd Honours in inclusive education	27	10	C2005, NCS and CAPS
E10	54	ACE in mathematics, BEd Honours in education management	31	11-12	C2005, NCS and CAPS
E11	43	BEd. Majored in mathematics and accounting	20	11-12	C2005, NCS and CAPS
E12	30	BEd Honours in mathematics education	6	10	CAPS
H1	49	Secondary Teachers' Diploma	26	10-12	C2005, NCS and CAPS

		majored in mathematics. BEd in mathematics			
H2	32	BEd Honours in mathematics education	9	8-9	NCS and CAPS

A total of fourteen participants from different rural high schools took part in the study. The educators were given codes E1 to E10 to protect their identities. Two of them were mathematics departmental heads (DHs) who were assigned codes H1 and H2. The ages of the participants ranged from 30 to 54. The average years of teaching experience was 22. It was expected that similar opinions and perspectives would be found, especially among those who shared similar contexts. Because of theeducator's knowledge, the participants could make valuable contributions to the phenomenon under study because they also met the criteria of having taught mathematics in the FET phase and having experienced curriculum changes.

4.3 QUALITATIVE DATA ANALYSIS

In this study, the qualitative data analysed was from the semi-structured interviews. These presented data served to understand the experiences by fourteen mathematics educators with the implementation of the Mathematics CAPS as per the purpose of this study. Guided by the research question, six themes emanated from the data, namely, challenges with the time and content coverage, sequencing of topics, school policy that supports the implementation of mathematics, the quality of the mathematics educators, support from the school management and support through the community of practice.

4.3.1 Time and content coverage of the Mathematics CAPS

In the Mathematics CAPS for Grades 10-12, the Annual Teaching Plan (ATP) specifies ten topics to be covered within the allocated periods. These topics also include the period for remedial work, revision, test and examinations.

mathematics educators are expected to perform duties such as teaching, doing remedial work and revision, and administering tests and examinations within the given time. Generally, the participants were worried that the time allocated for the teaching and learning of Mathematics CAPS Grades 10-12 was not enough. Participants commented that there was too much content per grade and they were often unable to complete the syllabus within the time allocated.

E3 had this to say:

> *"The topics such as Euclidean geometry, probability and statistics and measurement are being allocated short periods of time, yet they demand more time for teaching and learning. I fail to finish teaching them on time because they require abstract reasoning and a lot of explanation. Therefore, there is no time for revision and remedial work."*

H1 further said:

> *"The time allocated in the mathematics Annual Teaching Plans (ATPs) is not enough. In mathematics Grade 12, they refer to topics from previous grades. For example, in geometry Grade 12, there are eight theorems and six of them are from grade 11. In most cases, you may find that learners were not taught those topics and I have to go back and start teaching the basics such as lines, angles, triangles, quadrilaterals and so on but there is no time allocated for them. In order to cover the mathematics syllabus, I have to rush and leave the learners behind."*

E8 had this to say:

> *"I am struggling to complete the syllabus. There is no time to consolidate what has been taught because of the many topics that have to be dealt with within a short space of time. I have to deal with number patterns, sequence and series, Euclidean geometry, and trigonometry in one term. For an example, term one of this year began on 15/01 /2020 and*

on 08/03/2020 they had to write a test therefore you can`t even revise the work that will be in the coming test."

E2 explained:

> *"The time allocated for mathematics Grades 10-12 is not enough because there is too much content to be taught in each grade. In most cases I teach the simple topics and leave the demanding ones like Euclidean geometry. Therefore, learners progress to the next grade without some of the knowledge and skills of the previous grade."*

E9 and E10 identified the factors that hinder the implementation of the Mathematics CAPS.

E9 commented:

> *"The interruptions caused by workshops, meetings and too many extra mural activities make it difficult to cover the content on time. For example, term 1 is the longest term in a year; effective teaching and learning is supposed to take place, but the DBE organizes athletics activities and as educators we get tired and do not have enough time for the learners."*

E10 reported:

> *"The problem is that I fail to cover the syllabus because there is not enough time for teaching mathematics. The allocated time for the teaching and learning of mathematics is affected by absenteeism of the learners. The Mathematics CAPS is too long, and I tend to give the learners too much work and they do not finish to write the work given throughout the year. The incomplete work of the learners accumulates every time I give them work to do. At the end of the day, as a mathematics educator, I do not do justice to the learners by not covering the syllabus. I leave the learners behind*."

Generally, the participants pointed out that the time allocated for covering the content in Mathematics CAPS Grades 10-12, in particular to some of the topics such as Euclidean geometry, probability, statistics and measurement was inadequate. According to the DBE (2011a:7) the instructional time for teaching mathematics Grades 10-12 is 4-5 hours per week and the weight of each topic depends upon the allocated time and marks. Results showed that teaching and learning were not the only factors involved in the management of the mathematics syllabus. There was also revision and assessments, which require more time. The participants also mentioned that the time allocated for the implementing the Mathematics CAPS was also wasted by factors such as workshops, extra mural activities, learner absenteeism and meetings. Therefore, there is too much work to be done within a short period allocated to mathematics in the term. The content seems to be too much to the extent that educators fail to cover the syllabus on time. Educators mentioned that they often have to sacrifice time meant for their families and other commitments to implement intervention strategies such as teaching in the morning, afternoon, weekend and during the holidays in order to complete the syllabus. The participants use the congested pacesetters/ ATPs from the Department of Education as their guiding compass. Therefore, they end up rushing by following the Annual Teaching Plans (ATPs) thereby leaving the learners frustrated and confused. Accordingly, some participants indicated that they therefore choose to teach the simple topics and leave the ones they felt were difficult for them. Furthermore, there was also mention that learners were progressed to the next grade without having covered important concepts that should have been taught. The educator in the next grade would now have a problem of trying to cover concepts of the previous grade. This trend continues to Grade 12 and causes high failure rate. The discussion here is confirmed in Section B and C of 4.2.1 of the quantitative data from the survey that clarifies challenges with the implementation of CAPS that leads to high mathematics failure rates. In this study, when the DBE redesigns the Mathematics CAPS curriculum, time allocation should be done in consideration of the length and breadth of the topics.

4.3.2 Sequencing of topics in the Mathematics CAPS Grades 10-12

In the Mathematics CAPS Grades 10-12, the sequencing of topics within the terms depends on which topic must be taught first in order to use the information in the following topics. It is about being able to apply the information of the previous topics to build onto the future topics. This also includes how the content areas can be spread and revisited throughout the year. Most of the participants pointed out that the sequencing of topics within the terms is a problem because, in order to teach some topics, one needs the information that is allocated for the following term or the following year as background knowledge. This problem implies that the educator must start by teaching the future topic before teaching the current one. It could be that the educator might need to skip this topic until after the required topic has been taught. Because of the poor performance in Mathematics CAPS, the participants indicated that the Department of Basic Education tried to change the sequence and put difficult and demanding mathematics topics such as Euclidean geometry and probability in the first term. This was done to ensure that there was more time for teaching and learning of the topics mentioned. However, it seems that this has created problems because there are some topics that still need to be taught first to enhance the understanding of geometry and probability. Participants are therefore worried that there is no logical progression among the topics in the Mathematics CAPS Grades 10-12. This is because, for teaching and learning to be effective, basic knowledge of some of the topics is needed so that the next topic can be understood. For example, analytic geometry should be taught before Euclidean geometry. Some participants responded as follows:

E3 reported:

> *"When the DBE introduced the Mathematics CAPS, in Term 1 of the syllabus, the topics to be covered were patterns, sequence and series, functions, exponential and logarithms functions, finance growth and decay and trigonometry. Now, because of the high failure rate of learners, functions, exponential and logarithms, finance growth and decay have been removed. They have now replaced them with*

Euclidean geometry and probability which were in Term 3. For example, in order to teach Euclidean geometry effectively, I need the information of analytic geometry which is a topic for Term 2. Therefore, the topics of the Mathematics CAPS Grades 10-12 are not connected, each topic stands on its own. I become frustrated and confused when I have to teach the learners because I teach the Term 2 topic in term 1 and this affects the learners negatively."

H2 shared the same observation:

"In mathematics Grades 10-12, most of the concepts repeat themselves even though they are strengthened from one grade to another. You may find that learners were not taught some of the concepts which were supposed to be taught in the previous grade, and that creates a problem when they proceed to the next grade because they have to apply that particular knowledge. For them to be able to make sense of what I teach them, I need to teach the topics that are ahead or that were not completed in the previous grade. This is a problem because the whole syllabus is mixed up and not sequenced properly."

E11 had this to say:

"The sequencing of topics within the terms is a challenge because there is no connection among the topics. They have now moved the demanding topics such as Euclidean geometry and probability to the first term so that we can start with them. The problem is that the topics are now disorganized because they need basic knowledge of some of the other topics. We have to deal with nearly all the topics such as number patterns, sequence and series, functions, exponential and logarithms functions, finance and trigonometry, differential calculus and analytic geometry before we can teach Euclidean geometry and probability."

Generally, the participants are dissatisfied with the sequencing of topics within the terms in mathematics Grades 10-12. They are worried that when the Mathematics CAPS was introduced, demanding topics such as Euclidean geometry and probability were in the third term but now, they are in Term 1. This seems to have created a problem because there is no connection among the topics in the Mathematics CAPS. The participants are also worried that there is a content gap in some of the topics because some of the concepts were not taught in the previous grade. They indicated that sometimes some topics in Term 1 need the basic knowledge of some of the topics in Term 2. When the educator does not introduce the topic by giving information or an example of the prior knowledge based on a topic in Term 2, the learners become confused because they cannot visualize the relationship among the topics. Therefore, the educator also becomes stuck and has to go back and teach the learners the information which is in Term 2 or the concepts of the previous grade so that they can understand. This implies that the sequencing of the topics within the terms needs to be improved. Deliverology works if you follow its processes and engage people dedicated to its method of driving improvements (King 2016). This approach is based on the premise that in order to encourage effective implementation of the Mathematics CAPS, the DBE should set clear aims and goals. The above challenges are confirmed in 4.2.1 of Section B and C that indicated several challenges with the implementation of CAPS that require expert support from the Department of Education.

4.3.2.1 School Policy that supports the implementation of the Mathematics CAPS

A mathematics School Policy should set the minimum standard that helps educators with the implementation of the Mathematics CAPS. This can be done through improving the learning conditions that support the mathematics learners, supporting and improving the competencies of mathematics educators, attracting and retaining the mathematics educators as well as improving the mathematics educators' qualifications, skills and training and their working conditions. By supporting quality teaching and learning, the school policy can in turn support the implementation of the Mathematics CAPS. This is confirmed in 4.2.1 of Section

C that highlights the importance of support from the school policy and management. Therefore, schools are expected to develop their own quality mathematics policy that is appropriate to their context to support Mathematics CAPS. This is supported by the data from the online survey which stated that 55.8% of the participants experienced challenges with the school policies concerning the implementation of the curriculumParticipants had different feelings about this situation.

E3 pointed out:

> *"Our district office has developed the Mathematics District Policy to be implemented by the schools within the area. The policy contains, among others, the programme of assessment, number of informal assessments per week, contents in the teaching files, etc. This is a problem because we did not have a say in the development of such a policy. It is not implemented effectively in our school because we do not own it. Even our mathematics DH does not say anything about it."*

E10 reported:

> *"We use the mathematics policy from the district. The mathematics DHs do not do their job as required. They do not meet with us as the mathematics educators from time to time, to check if we are following what is stated in the policy."*

E1 had this to say:

> *"In our school, we are using the mathematics policy from the district. The challenge with the implementation of the Mathematics District Policy is that I am unable to understand and interpret some of the things, for example, the number of informal written tasks per week. According to the Mathematics District Policy, we have eight informal assessments per week including the examples but when they compile the audit of written work, the examples are no longer counted."*

H1 commented:

> *"In our school we have not yet drafted our own Mathematics School Policy. We are using the Mathematics District Policy. The challenge with the implementation of the Mathematics School Policy is the administrative work that needs to be done. We have to prepare three files, namely the master file, teachers file as well as the SBA file. There is not enough time because I also have classes to teach."*

E4 explained:

> *"We use the mathematics policy which was developed at the district level. This is a problem because we did not have a say in the development of such a policy. It is not implemented effectively in our school because we don't own it. Even our DH does not say anything about it."*

E2, E6 and E9 shared the same sentiment:

> *''Yes, the district has developed a policy to be implemented in our schools. I don`t experience challenges with the implementation of Mathematics CAPS policy."*

E8 agreed by saying:

> *''Yes, our school has a policy which aims at achieving a better and effective implementation of Mathematics CAPS curriculum. There are no challenges, the policy is user- friendly and comprehensive."*

E5 had this to say:

> *"Yes, the district has developed a mathematics policy to be implemented at schools, but it is not user-friendly. It is too congested. But I am tired of complaining because even if you complain there is no one who listens to you. I am just doing whatever they say I must do."*

E7 commented:

> *"Yes, we use the mathematics policy from the district. They expect us to do many informal tasks in a week and on top of that we have to do administrative work. This becomes too heavy for us. We don't have enough time."*

H2 pointed out*:*

> *''In our school we do not have a Mathematics School Policy for the implementation of mathematics, but we use the District mathematics Policy and Mathematics CAPS guidelines. We do not experience challenges with the mathematics policies."*

E11 supported the above by saying:

> *"The mathematics educators as well as their DHs do not adhere to the mathematics policies. For example, according to the mathematics policy the subject committee has to meet once in every quarter, but we don't do that."*

E12 reported:

> *''There are no challenges with the implementation of the Mathematics CAPS."*

Generally, the participants agreed that they were not getting quality support from the management of the schools. That meant that the school management gave support, but it was not quality and was not well thought of. In addition, they complained of interference by the department of education in enforcing school support policies that were not relevant to the school context. This finding was corroborated by the online survey which revealed that 70% of the participants said they are in possession of the policy for supporting the implementation of the Mathematics CAPS in the teaching files. However, the problem was that the

schools did not develop their own mathematics policies but obtained the mathematics policy from the district office. This implies that schools in this area should implement their own Mathematics District Policy.

Additionally, since the educators were not involved when the policy was developed, the participants were struggling to implement it at school level. They pointed out that the policy was not clear and that it had flaws. For example, when the audit of written work is counted, the examples given to the learners are not considered. This seemingly frustrates the mathematics educators because there is not enough time to do eight quality informal tasks within a week. This implies that thethe educators are unable to understand and to interpret the Mathematics District Policy. The Deliverology approach proposes that delivery units must support an organization`s leaders in developing a theory of action, identifying strategies to reach the stated goals and sequencing the strategies in the form of a delivery plan, but the plan needs to be tested, challenged and revised over time (McKay 2017). In this study, the School Management Team should support the DBE by developing policy that identifies the strategies to ensure the implementation of the Mathematics CAPS curriculum. Such a policy should be amended regularly if necessary.

4.3.3 Support from the Department of Education

4.3.3.1 Support by the mathematics subject advisors from the Department of Education

The mathematics subject advisors are expected to offer full support especially to the mathematics educators who are struggling with the implementation of the Mathematics CAPS. Due to the experiences and expertise the curriculum advisors possess, they are supposed to regularly visit schools that are performing poorly, identify challenges and recommend ways of improvement. About half (51.2%) of the participants from online survey said that they got the support of the mathematics subject advisor from the Department of Education. Educators expressed dissatisfaction with the quality of support they got from the curriculum advisors as reported below:

E1 supported the above finding:

> *"Our subject advisor comes once in a year to check the progress with the implementation of Mathematics CAPS. This includes asking questions while filling in the mathematics monitoring tool. For example, I will be asked about the improvement strategies that I am going to implement in mathematics Grades 10-12. I am in most cases not sure about what I need to improve on, and no one really checks whether the strategies I put down make sense. The subject advisor never makes a follow up or checks whether I will be implementing the strategies or not."*

E6 had this to say:

> *"The subject advisor does not help me in any way. When I ask for help with one of the mathematics topics, I am always promised that I will get the response in the second visit because she has to consult first. When the day comes, she promises to do it on another day. It is better to live with the burden on my shoulder because there is nothing that I can do."*

H2 responded:

> *"The mathematics subject advisor visits unexpectedly once after some time and I have to leave the learners unattended. In most cases, the curriculum advisor complains about the mistakes that I commit. For example, I am often blamed for not moderating the educator`s files correctly. Instead of having a mutual understanding when discussing the issue, I am told what and how to do things."*

Generally, the participants said that they got insdequate support from the mathematics subject advisor. They were dissatisfied with many issues regarding the visit by the curriculum advisor that included the subject adviser not making follow ups of whether the educators were implementing what they had discussed with them. When the participants asked for help with some of the mathematics aspects, they where not given the necessary attention. In addition, when the

curriculum advisors visited the assigned school for support with the implementation of the Mathematics CAPS, the curriculum advisor became a fault finder. Furthermore, the subject advisor made unannounced visits to the participants in order to do a witchhund and then hold support meetings during lesson times.

4.3.3.2 The quality of mathematics educators for grades 10-12

The Education Labour Relation Council (ELRC) has laid out procedures for appointing mathematics educators in the Limpopo Province. According to the Collective Agreement No.1 of 2008, the School Governing Body (SGB) and the Department of Basic Education should appoint educators who have relevant qualifications and knowledge. Generally, the participants were dissatisfied with the process of appointment of new mathematics educators. This was supported by 67% of the participants from the online survey who stated that there were challenges with the appointment of qualified mathematics educators. It appeared that some of the newly appointed mathematics educators lacked the knowledge of some aspects of the content of mathematics. There was a suspicion that the system of mathematics educator appointment was not carried out according to procedures.

E3 had this to say:

> *"The problem is that I did not specialise in mathematics at the institution of higher learning, and I am assigned to teach Grades 10-12. I did mathematics up to grade 12 hence I lack the knowledge of some of the concepts and there are no qualified or experienced mathematics educators to consult. Therefore, I do not tackle some of the topics that seem to be difficult."*

E1 responded as follows:

> *"During the appointment process, instead of appointing the right mathematics educators who qualify for the post, the panel of*

interviewers favours their friends and relatives, thus appointing educators who are not competent to teach mathematics Grades 10-12. This becomes a problem because they don't have the necessary skills and expertise of teaching mathematics at that level."

E7 added the following:

"Eish…I lack the necessary skills and knowledge to teach the Grades 10-12 learners and to tell the truth, I am struggling to teach the Mathematics CAPS because I am a geography educator. I got a D symbol in mathematics in Grade 12. I volunteered to teach mathematics Grades 10-12 because no one was ready to go and help the poor learners. Because of the lack of knowledge, skills and expertise to teach the Mathematics CAPS Grades 10-12, I end up omitting some of the topics or subtopics or compromising the depth at which the topic or subtopics have to be taught."

E10 explained:

"During the appointment process, the candidate shows the capabilities of being a mathematics educator. But when that educator goes to classroom you find that they lack some of the aspects. Therefore, they need to be supported with some of the mathematics content. It is a challenge because in some schools, you may find that there is no one who can help with the mentoring or induction."

Generally, the participants were unhappy with the process of the appointment of mathematics educators that teach mathematics Grades 10-12. Some newly appointed mathematics educators lacked the experience, skills and knowledge of teaching some topics in these grades. Because Mopani west district has a shortage of mathematics educators, any educator from other subjects like science, history or geography are assigned to teach Grade 10 to12 mathematics without any mentoring or induction. This affects the teaching of mathematics negativelyThe wrongly appointed educators end up not teaching all the content

in each grade and the learners go to the next grade without the necessary knowledge and skills. This challenge is confirmed in 4.2.1 of Section C where about 67% of the participants said that they were not happy with the process of the appointment of mathematics educators for Grades 10-12 mathematics. South Africa has experienced several curriculum changes, namely, C2005, RNCS, NCS and CAPS. One of the challenges in the implementation of mathematics CAPS has been the quality of mathematics educators.

4.3.4 Support from the School Management Team

The mathematics DH and the principal (school headmaster) are expected to support the mathematics educators with the implementation of the Mathematics CAPS. For example, this could include the provision of Teacher Support Materials (LTSM) such textbooks, scientific calculators, mathematics instruments and other resources. Support can also be offered in the form of financial resourcest for example to carry out extra lessons during weekends or holidays, organising training workshops for educators by external stakeholders or frequently holding support meetings with the staff at the school or from other schools. Outsourcing can also be a possibility as it brings in experts in particular difficult topics in mathematics. Participants were generally not satisfied with the support they got from the School Management Team. Therefore, it seems the educators were affected negatively because they did not get the necessary help that they needed from their SMT. Some of the participants responded as follows with respect to the support from the School Management Team:

E5 reported:

> *"I do not get enough support from the mathematics DH. Because of the high failure rate of the learners, I am forced to come to school and teach the learners mathematics in the morning, afternoon, weekend and over the holidays. I also use my own money for the transport to conduct the extra lessons during the weekends and holidays. When I request the Learner Teacher Support Material like scientific calculators and other*

mathematics textbooks so that I can get more information, I do not get the help."

E2 commented:

> *"I get minimal support from the mathematics DH. Because of work overload the mathematics DH demands that I do the extra work of moderating the formal tasks as well as filling in of forms and other documents in the teaching files which are required by the Department of Basic Education. This is a problem because I also have my own work to do."*

E6 responded:

> *"The support I get from the mathematics DH is not enough. The challenge is that our mathematics DH is managing many subjects including mathematics. Therefore, as a mathematics educator, I do not get enough attention from the mathematics DH because the Department of Basic Education always calls for meetings with the School Management Team and this affects the amount of quality time the management can afford to spend with us as mathematics educators."*

Firstly, the participants were not satisfied with the support they got from the school management because the SMT does not provide the necessary resources such as Learner Teacher Support Material and weekend transport money for the participants. mathematics educators' moderate formal tasks in the teaching files as an extra duty. Secondly, it seems as though the Department of Basic Education (DBE) overwhelms the SMT by giving it many administrative responsibilities. Therefore, SMT does not get enough time to offer support to the mathematics educators.

4.3.5 Support through the community of Mathematics Educators

4.3.5.1 Community of mathematics educatorswithin the school

In the implementation of the mathematics Grades 10-12 curriculum, mathematics educators were expected to hold support meetings in the schools where they discuss issues concerning the better implementation of the Mathematics CAPS. These include, for example, how to solve mathematics challenging topics and implement improvement strategies. Educators are also expected to orientate each other on what was done or not done in the previous grade. The participants did not meet with other mathematics educators in other schools to support the implementation of the Mathematics CAPS. This was supported by 62.8 % of participants in the online survey who said that they did not meet with other mathematics educators in other different schools for the better implementation of the Mathematics CAPS. It also seemed that the mathematics educators were not interested in the support meetings organized within the schools. For example, most of the educators chose not to be part of these internal meetings while others disrupted the deliberations that were organized within the school. Below are some of the participants' views.

E1 had this to say:

> *"As people who manage the mathematics curriculum at school level, one of our duties is to support each other where we are failing to understand. I, in most cases, do not have the confidence to help my colleagues. In addition, if they discover that there are areas that I do not understand, they use the information to mock me. Therefore, I would rather do the work on my own. We need to trust each other and get extra help in order for us to be able to help each other. Helping each other is very difficult because we all do not have knowledge and skills to assist each other. We cannot make sense of how the Mathematics CAPS should be handled."*

H1 commented:

> *'When we meet as mathematics educators in the school to discuss issues like underperforming in mathematics, some educators feel that there is a witch hunt. In my case, some educators would want to undermine me and make me look stupid. They take it personally that I do not understand mathematics or cannot teach mathematics. The meetings become unfruitful because of the lack of trust among us."*

E8 reported:

> *"Our mathematics support meetings are held once in a term. In most cases, the meetings are conducted from 12h30- 13h30.Therefore the time is not enough because we meet for only an hour. This affects the quality time and depth of deliberations on the issues at hand. The probability of coming with corrective measures and effective developmental programmes is compromised."*

E2 responded:

> *"Most of our mathematics educators are not interested in the subject meetings that are conducted. For example, when it is time for the meetings, some of the educators come late and do not participate. This is because the meetings are chaired by the mathematics DH who does not even know how to conduct the support meetings. The issues to be discussed are mixed up and we end up not benefitting enough from the support meetings."*

E5 commented:

> *"In our support meetings, we do not meet as mathematics educators alone. We meet as a Maths and Science department. The challenge is that we do not discuss specifically mathematics issues, but the Maths*

and Science departmental issues in general. Therefore, it is a one size fit all situation."

Generally, the participants commented that even though they tried to organize the internal school community of mathematics educators, the participants complained that the support meetings did not yield good resultsand did not add value to them. They were either conducted in a hurry or, some mathematics educators personalized issues, were passive during the meetings or got involved in unnecessary arguments . Therefore, the issues discussed lacked focus.

4.3.5.2 Community of mathematics educators from other schools

The mathematics community of educators is expected to meet and support each other for the better implementation of the Mathematics CAPS. The support meetings are supposed to help mathematics educators to have a common understanding of the implementation of the Mathematics CAPS. For example, mathematics educators in schools that are performing well can share their knowledge and expertise with the educators of other schools that are under-performing. The mathematics subject advisors from the District Office are expected to organize and plan the mathematics curriculum support meetings so that the meetings can be fruitful. Based on the 51.2% of the participants from the online survey, educators stated that they did not meet with the community of mathematics educators to discuss the implementation of the Mathematics CAPS. Educators expressed their unhappiness with this arrangement, as indicated in the following responses:

E4 explained:

"During the support meetings we meet for only two hours; we do not have enough time for discussing our issues because the subject advisor takes too much time talking about the issues that are not on our agenda. Therefore, we are unable to get into the depth of our problems. At the end of the day, I lose the concentration while listening to issues that are not relevant to us."

E8 said:

> *"The educator trainings we attend are for the sake of complying to their job descriptions as mathematics subject advisors. There is a year programme for attending the mathematics support meetings but it is not followed. To show that the support meetings are for compliance, often we get calls or know about the meetings at the last minute. In most cases, 10 out of the possible 50 mathematics educators attend the workshop and nothing much can be done with these few educators. This is an inconvenience to us. The district must do more to motivate the educators to attend."*

E5 responded:

> *"I am not interested in the subject meetings that are conducted because the arrangement to meet is done by the district and it is not very organized. For example, the venue of the meetings is far away from our schools therefore it is not easily accessible as I have to use public transport. I take thirty minutes to travel from the school where I teach to the venue of the meetings and the meetings are held from 12h00-14h00. When I arrive at the venue, I do not participate positively because I will be tired. Therefore, I am unable to engage fruitfully in the discussions of the problems and challenges that we encounter."*

E6 commented as follows:

> *"Our mathematics support meetings are held once in a term. I do not support these initiatives of supporting each other with the implementation of the Mathematics CAPS as I think that it is time wasted. This is because the seminars and workshops are conducted during the normal time for teaching and learning for two hours in the afternoon. If it is during the weekend, I also would not attend. If I can be rewarded in the form of certificates, I think it could help a lot."*

Generally, the participants were not interested in the meetings of mathematics educators from different schools to support each other with the Mathematics CAPS implementation matters. This is consonant with the online survey findings which indicated in Section 4.2.1 that only 46.5% of the participants that said that they meet with other mathematics educators from different schools. Educatorscommended that support meetings do not yield good results, because they do not occur often enough in the year and if the do, they are carried out during a short period of time. The participants indicated that most educators from other different schools do not participate and the few educators who attend cannot change or influence much in terms of the Mathematics CAPS implementation. In addition, the participants commented that the subject advisors who facilitate the in-service training spend most of the time talking about the issues that are not relevant to the implementation of CAPS. Some of the participants do not attend the support meetings because they do not get invited or the invitation comes on the day of the meeting. For educators who do not have their own cars, it is not possible to arrive at the venue of the meeting on time because they will be using public transport. The participants get tired while travelling for long distances to the venues and hence are unable to participate fruitfully during meetings. Furthermore, participants were worried that the support meetings are wasting time for teaching and learning because they are conducted during school hours.

4.4 CONCLUSION

This chapter presented a detailed account of the findings that emerged from the qualitative data analysis of the interviews and supported by the quantitative data from the online survey. The objective was to synthesize the collected data into formidable themes that would help to answer the research questions. There was a match because the data collected through online survey supported the data collected through the interviews. Generally, the data collected indicated the challenges experienced by mathematics educators with the implementation of the Mathematics CAPS. The analysis succeeded in bringing out important themes that came out of this study that were generated from the experiences that the mathematics educators had wit the implementation of the mathematics CAPS.

The results show that most mathematics educators still face challenges with the implementation of the Mathematics CAPS. Therefore, immediate intervention is needed to help the mathematics educators with the important assignment that they carry to increase the pass rate of mathematics. The data analysis in this chapter informs the last chapter, which focuses on the summary, recommendations and conclusion of the research.

CHAPTER FIVE: SUMMARY, RECOMMENDATIONS AND CONCLUSIONS.

5.1 INTRODUCTION

The main purpose of this study was to explore the experiences of educators with the implementation of Mathematics CAPS Grades 10-12 in South Africa, by responding to the following research question and sub questions.

What are the experiences of educators regarding the implementation of the Mathematics CAPS in Grades 10-12 in South Africa?

- What are the expectations of Mathematics CAPS in Grades 10-12?
- What are the challenges experienced by the mathematics educators regarding the implementation of Mathematics CAPS in Grades 10-12?
- What are the best practices that can be learned from the challenges that are experienced by educators in the implementation of the Mathematics CAPS Grades 10-12?

Therefore, the purpose of this chapter is to summarize the whole study and recommend some best practices that can be useful to the curriculum revision developers. Having introduced the chapter in 5.1, Section 5.2 summarizes the literature review and this is followed by the summary of the methodology of the study in Section 5.3. The summary of the results of the empirical study is documented in Section 5.4. This responds to the main themes of the study. Recommendations of the best practices for the better implementation of the Mathematics CAPS are provided in Section 5.5 and some suggestions for further research in the area are given in Section 5.6. Section 5.7 focuses on possible contributions of the study before stating the limitations in Section 5.8. The conclusion is given in Section 5.9.

5.2 SUMMARY OF THE RESULTS OF THE EMPIRICAL STUDY.

The first objective was responded to by the findings in the literature review in section 2.5.1, and the second by the empirical findings in the qualitative data

analysis. The third objective is discussed in the best practices in Section 5.5 of this chapter. In this study, seven themes emerged from the main research question and sub- questions.

The first theme was examining the mathematics pass rate in the Mathematics CAPS Grades 10-12. The general finding was that the whole Mopani West District had a low pass rate by the learners in mathematics, and most of the mathematics educators experienced challenges with the implementation of Mathematics CAPS. The general feeling was that the participants were keen to get help in order to implement the Mathematics CAPS better.

The second theme was that of the time and content coverage of Mathematics CAPS in Grades 10-12. The general finding was that mathematics educators do not get enough time to cover the content in mathematics Grades 10-12. Apparently, the time allocated to some of the demanding topics such as Euclidean geometry, Probability, Statistics and Measurement is not enough.

The third theme was sequencing of the topics within the terms in Grades 10-12. The finding was that the sequencing of the topics within the term/s orneeded to be improved. The topics that were supposed to be taught in the first term were moved to the other two terms thereby affecting logical sequencing. That meant application within topics became a problem as some topics needed the prior knowledge of topics that were now supposed to be taught later. For example, Euclidean geometry and Probability were removed from Term 3 and reallocated to Term 1. There seemed to be no consecutive connection and the topics were apparently mixed up.

The fourth theme related to the school policies that supported the implementation of Mathematics CAPS in Grades 10-12. The overall finding was that mathematics educators did not have their own school mathematics policy that governed the way they work to support the implementation of Mathematics CAPS curriculum in the schools. Insteady, the policy that they are using in the schools was developed at district level and the educators were struggling to implement it effectively because they were not part of its development and therefore did not

suit the educators' needs. This was supported by online survey findings in 4.2.1 of section D that 55.8 % of the participants had agreed that they experienced challenges with the school policy that support the implementation of mathematics. The fifth theme was the quality of the mathematics educators in Grades 10-12. The findings showed that there were challenges with the appointments of competent mathematics educators. Because of the shortage of qualified and experienced mathematics educators in the district and most parts of South Africa, the schools appointed educators who were not competent enough to teach mathematics grades 10-12. In some cases, it was found that educators were not even trained in the teaching of mathematics. This was also supported by data from online survey in 4.2.1 of section C that, 67.4% of the participants agreed that there are challenges with the appointment of mathematics educators.

The sixth theme concerned the support from the School Management Team (SMT). The overall finding was that mathematics educators did not get enough support from the SMT. For an example the SMT did not provide the necessary resources such as Learner Teacher Support Material (LTSM) and transport money for attending extra lessons during the holidays and over the weekend. Educators were also overburdened by helping the SMT in doing their work.

The last theme was the support through the community of mathematics educators. In this study, the community of mathematics educators and the mathematics subject advisors formed the community of practice. The finding regarding the mathematics educators in the schools was that most of them met to discuss the implementation of the Mathematics CAPS. However, the support meetings did not yield good results because they were organized from the department and were always conducted in haste. The findings relating to the support from the community of mathematics educators across the district were that most of the educators did not attend such meetings because they did not get the invitations or got the invitations after the meetings had been conducted. Sometimes venues were not accessible by public transport and the educators had to meet transport costs. Though the findings showed that the participants appreciated the support from the subject advisors for mathematics, however, the support offered by the curriculum advisors during these meetings was, in most

cases, not relevant to the educators' needs and no feedback was ever provided. In some cases, the curriculum advisors visited the educators in the schools during lesson times but there was never enough time to discuss issues of concern after the observation of a lesson.

5.3 RECOMMENDATIONS AND BEST PRACTICES IN THE IMPLEMENTATION OF MATHEMATICS CAPS

This study presented the challenges experienced by mathematics educators with the implementation of the Mathematics CAPS Grades 10-12. Based on the findings from the interviews, the mathematics educators made some suggestions on how the situation could be improved. The recommendations in this study are therefore aligned with the identified themes in Section 4.3. The recommendations relate to different levels of stakeholders in the education system, namely mathematics educators, School Management Team, subject advisors for mathematics in the district offices of the Department of education and the Department of Basic Education.

5.3.1 More time is needed for teaching Mathematics content in Grade 10-12

In Section 4.3.1, mathematics educators indicated that the amount of time allocated to the teaching of topics such as Euclidean geometry, Probability, Statistics and Measurement is inadequate. Therefore, it is recommended that there should be more time for teaching such topics. There should also be adequate time for revising the Grade 11' difficult areas because they constitute many marks in the Grade 12 examination. This will allow educators to have enough time for doing the corrections and revisions. One participant E3 supported this recommendation.

E3 had this to say:

> *"More time should be assigned to the teaching of topics such as Euclidean geometry, Probability, Statistics and Measurement, because they are more demanding and require abstract reasoning".*

Because of too many administration activities in the school, mathematics educators do not get enough time to concentrate on teaching and managing mathematics learning. For example, there are mathematics portfolios to be compiled, many assessment forms to be filled in, reports to be written. In addition, there are many registers, minutes, and many other things to attend to. These are a distraction from the real issue of managing and teaching mathematics. It is recommended that these administration activities be either reduced or other people must be employed to perform them on behalf of the mathematics educators. Furthermore, the mathematics educators should be given more time for planning and practising mathematics activities instead of being overloaded with extra mural duties for the School Managing Team (SMT). All these solutions to the challenges should be monitored by the district.

Furthermore, extramural events such as athletics, meetings, workshops or memorial services could be managed better to avoid taking too much time with them. Parents should be involved in the education of their children. For example, if a learner is absent from school, parents should be accountable by supervising the schoolwork given by educators.

5.3.2 Re-arranging of topics in Mathematics CAPS Grades 10-12

Under item 4.3.2, mathematics educators commented that they were not satisfied with the sequencing of the topics within the terms. They recommended that the sequencing of mathematics topics within the terms should be done properly to enable logical connection of the topics. That can be corrected by reverting to the original sequencing of topics that was used when Mathematics CAPS was introduced in 2012. At the beginning of the year there should be a briefing on the orientation and sequencing of mathematics topics by a team of competent

mathematics educators. The correct sequencing of the topics will enable the educators to fall back to examples used the previous lessons or in the previous term or year so that the learners can understand the relationship among concepts. Two participants E3 and E11 commented as follows in support of the above:

E3:

> *"The topics in the Mathematics CAPS should be correctly sequenced so that there can be consecutive connection of topics. The Department of Basic Education should rearrange the topics in the same order as they used to be when they introduced the Mathematics CAPS. In each grade I should teach a new concept or skill that is linked to the previous concept or skill".*

E11:

> *"There should be connections among the Mathematics CAPS topics so that learners can be able to visualize the relationship among them".*

The overall recommendation here is for a body of experts to be tasked putting the mathematics topics in an acceptable and logical flow.

5.3.2.1 There is need for reducing some of the sub-topics in the mathematics Grades 10-12 syllabus.

In Section 4.3.1 mathematics educators also pointed out that there was too much content in topics such as Euclidean geometry and Probability. It was therefore recommended that some of the subtopics in Euclidean geometry and Probability needed to be reduced so that the educators can be able to cover the syllabus. One participant E8 had this to say:

:

> *"The content of Mathematics CAPS is too congested, therefore the topics such as Euclidean geometry and Probability should be reduced*

to enable mathematics educators to cover the content. In Mathematics Grade 12, the time for teaching and learning is not enough. For example, educators were supposed to be teaching many topics in Term 1 because it is long, but it has a lot of activities such as workshops and athletics. The remaining half of Term 2 consists of holidays and the half yearly examination. After the half yearly examination, the Grade 12 learners write the trial examination".

Overall, the Department of Basic Education should think about the sub-topics that exist under the main topics of the Mathematics CAPS that are really necessary in order to clearly provide the time for the educators to complete the syllabus. Only the basics of Euclidean geometry and Probability should be taught in the earlier grades. Learners should only be exposed to more detailed and complex content that exists in the sub-topics in the higher grades.

5.3.3 The intervention programmes in Mathematics Grades 10-12 needed to be strengthened

It is recommended that mathematics extra classes need to be taken seriously during the school term as well as during the holidays. Therefore, extra classes should be compulsory and educators who will be involved in teaching them should be given more time and be subsidized for the extra hours they will have worked. E10 had this to say:

"Schools should have a strict code of conduct to address the absenteeism of the learners. For example, parents should be summoned to school to discuss the implications of absenteeism. This includes being given the responsibility of supervising the learner at home to do the extra work given by the educator. This will allow mathematics educators to finish the syllabus and do revision on time".

And E1 added:

> "*Mathematics educators should conduct extra lessons in the morning, afternoon as well as holidays and they should be compensated".*

The Department of Basic Education should strengthen the intervention strategies such as the catch-up programmes for covering the mathematics content. Every mathematics educator should go beyond the classroom environment, for example, by arranging morning and afternoon lessons so that learners can be assessed properly. The educators concerned should be compensated by the Department of Basic Education for extra work they would be doing. As much as possible, the time for teaching and learning should not be compromised. The Basic Department of Education should develop a policy that deals with disruptions at school level.

5.3.4 There is a need of school policies that support the implementation of the Mathematics CAPS Grades 10-12

In section 4.3.3, the mathematics educators reported that they were not happy with the lack of a school-based policy that could aid educators of mathematics with the implementation of Mathematics CAPS documents. The policy that was developed by the district always fell short of expectations. It was then recommended that schools should be allowed to develop their policies that support the implementation of Mathematics CAPS. This should be done in order to adapt the curriculum to the school environment. Mathematics educators from different schools could also meet to have a common understanding of the purpose and requirements to be included in the policies.

E3 reported:

> *"The schools should develop their own mathematics school policy guided by the Mathematics CAPS documents in accordance to the nature and context of the school. This would be implemented effectively because we will be owning the policy document".*

The overall recommendation was that the mathematics educators should meet as a circuit or district and have a common understanding of what is expected from a mathematics school policy. During the development of this policy, mathematics educators from different schools should be involved so that they can participate and contribute ideas.

5.3.5 There is a need for competent Mathematics Educators in Grades 10-12

In section 4.3.4, the mathematics educators reported that they were not satisfied with the procedure for appointing mathematics educators in different schools in the Mopani West District. This study recommends that the district officials should be present during the interviews and appointment of mathematics educators. Furthermore, during the interviews the candidate should model by presenting a mathematics topic or must be given a short mathematics test to write. This will allow the system to employ the relevant people for the job and prevent many educators who are not qualified to teach mathematics from taking the positions. E10 had this to say:

> *"Mathematics teaching posts must be filled by educators who should be subjected to presentations on certain topics to ascertain the strength and weaknesses of each candidate in the teaching of Mathematics".*

In section 4.3.5, the mathematics educators were worried that there were too few mathematics educators in schools to teach the subject. Therefore, the few educators are often overwhelmed with too much work and are therefore unable to carry out the work as required. This study recommends that more mathematics educators need to be employed in the district.

5.3.5.1 There is a need for mathematics curriculum support meetings

In the paragraph 4.3.6.1, it was reported that the mathematics support meetings do not yield good results because the mathematics adviser comes with many other issues that do not involve the teaching of mathematics.

E5 pointed out the following:

> *"During the mathematics support meetings only issues concerning mathematics should be discussed. So that the educators can share and discuss the better implementation of Mathematics CAPS freely".*

This study recommends that during the mathematics support meetings, issues to be discussed should involve mathematics teaching only. This will allow educators to discuss their challenges, find solutions to their problems and share the best practices of mathematics teaching in the Mathematics CAPS.

5.3.6 There is a need for the support of Mathematics Educators across the district by the Department of Education

In section 4.3.4, the mathematics educators pointed out that the new mathematics educators do not get enough support from the Department of Education in the teaching of mathematics. The study recommends that workshops or in service training should be held for all qualified and inexperienced mathematics educators. Follow-ups of the workshops should be ensured by class visits by mathematics DHs to evaluate the progress of the mathematics educators regarding the implementation of the Mathematics CAPS. Team teaching by mathematics educators should be encouraged and outsourcing should be allowed to bring in experts who can handle difficult topics.

E7 commendednded this way:

> *"Team teaching and outsourcing can help provide support to the mathematics educators who experience challenges in some of the mathematics concepts. However, outsourcing should only be arranged with someone with a good record in the teaching of mathematics".*

This study recommends that during the support meetings with the community of mathematics educators, guest speakers from the universities or other sections of the mathematics community should be invited. These will help in motivating the

mathematics educators and restoring the dignity of teaching of mathematics. The Mathematics CAPS document and its implementation must be discussed in these meetingsand feedback should be provided to help with the implementation of the Mathematics CAPS.

E4 commended as follows:

> *"The district or province should invite academics from the universities to be the key guest speakers in the training and workshop forums. Possibly, this can rekindle the passion in teachers to attend and share information in such gatherings. In addition, educators who participate in the mathematics meetings should be given certificates to motivate them. Some of the mathematics subject advisors should be present to give support and maintain discipline during the support meetings. After the meetings, comments from the mathematics educators stating the strengths and weaknesses of the meeting should be invited. Feedback needs to be provided to their immediate seniors for further discussion".*

This study recommends that the Department of Basic Education should employ more subject advisors for mathematics to help in managing the implementation and coordination of the Mathematics CAPS. Workshops concerning the Mathematics CAPS leadership and management need to be conductedin order for them to acquire more skills and knowledge of Mathematics CAPS. In these meeting human relations skills and communication skills should be dicussed so that they are able to offer support to the mathematics educators.

In section 4.3.5, mathematics educators expressed unhappiness with the support they got from the School Managing Team (SMT). This study recommends that SMT should support and motivate mathematics educators by getting extra help from outside the schools to help with the managing of mathematics teaching. Motivation should be provided both to the mathematics educators and learners. This can include inviting guest speakers from the Department of Education in the field of mathematics. The School Managing Team should limit the number of meetings conducted during school hours. For example, mathematics support

meetings should be organized once in a month and over the weekend because after teaching, the educators are tired and cannot fully participate. Motivation should be provided to the mathematics educators who attend the support meetings for example, by awarding certificates of attendance.

E2 said:

> *"The mathematics DHs should be trained on leadership and management skills. This will help in empowering them".*

5.4 SUGGESTIONS FOR FURTHER RESEARCH

The findings of the study add to the available research knowledge about the implementation of the Mathematics CAPS. During this research there was mention of the poor quality of mathematics educators in Grades 10-12. There is a need for further research on the relationship between mathematics low pass rate and the quality of mathematics educators. It could also be interesting to carry out further research on what exactly should be the skills, knowledge and values of a competent educator, who can teach to address the needs of a democratic South Africa. This study was conducted at different rural high schools in Mopani West District. It is recommended that further research be conducted at different schools in different provinces of South Africa that have a very high mathematics pass rate in order to determine how they implement the Mathematics CAPS. This will strengthen the current empirical findings and further assist in the practical implementation of the Mathematics CAPS. More research of the same nature could also be done for internal and external stakeholders such as learners, parents and other stakeholders outside the education system. This could provide perspectives that are of completely different nature as regards the implementation of the Mathematics CAPS.

5.5 POSSIBLE CONTRIBUTIONS

This study provides an awareness of challenges that are experienced by the mathematics educators with the implementation of the Mathematics CAPS

Grades 10-12. The study informs the DBE on how to improve the implementation of the Mathematics CAPS in South Africa. This includes improving the implementation of the curriculum through the information provided by the literature review in Chapter 2 and, findings from the online survey and the interviews. Furthermore, it could equip mathematics educators with the appropriate skills to ensure that they achieve the aims of the Mathematics CAPS through the positive implementation of this curriculum. This will, in turn, lead to the improvement of the quality of teaching and learning mathematics in Grades 10-12.

5.6 LIMITATIONS OF THE STUDY

One important limitation was the relatively small sample of 14 participants who were interviewed because the study fell into the Covid 19 pandemic. A larger number of participants might have contributed to a better variety of responses, in order to enrich the findings. Therefore, the views of these mathematics educators cannot be generalized to reflect the views of educators in other provinces and high schools in South Africa. The second limitation was that the study was conducted in one province. More research might need to be conducted in other provinces of South Africa to verify the findings. Another shortcoming was the lack of interest by many educators in the Mopani West District to complete the online survey questionnaire. The online survey was done during the Covid 19 pandemic lockdown and people were generally demotivated to work. This impacted on the amount of information that was collected from the mathematics educators. For example, out of the possible 110 online survey responses, this study only managed to receive 43. However, the limitations of this study did not affect its significance, instead, they enabled the researcher to be more creative in the investigation of the phenomenon.

5.7 CONCLUSION

The educational landscape of South Africa has taken another perspective. Curriculum change and reform have become the topics of much debate in the last few years. In response to the need to redress the imbalances of the past

education system in South Africa, various curriculum reforms were introduced. However, the implementation processes of the curriculum were hindered by numerous factors, one of which was that the curricula that was not fully understood.

This study aimed at exploring the implementation of the Mathematics CAPS in South Africa. The focus was on the mathematics educators who were teaching Grades 10-12 in rural areas. According to the findings of this study, mathematics educators undoubtedly still face too many challenges with the implementation of the Mathematics CAPS. The hindrances make it considerably difficult to ensure that effective teaching and learning of mathematics. However, it was encouraging to note that mathematics educators were willingness to work towards understanding the requirements regarding the implementation of the Mathematics CAPS in order to respond to the needs of each learner in their classes. The study noted that the success of the Mathematics CAPS depends on the sound design, interpretation and implementation of the processes that bind the curriculum. Possible contributions were presented, and recommendations were provided for the better practices in the implementationof the Mathematics CAPS.

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APPENDICES

APPENDIX A: ETHICAL CLEARENCE

UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE

Date: 2020/02/19

Ref: 2020/ 02/ 19/34956972/09/AM

Name: Mrs Manamela

Student No. 34956972

Decision: Ethics Approval from 2020/02/ 19 to 2023/02/ 19

Dear Mrs M Manamela

Researcher(s): Name: Mrs MI Manamela

E-mail address: irenemanamela@gmail.comTelephone: 0734736713

Supervisor(s): Name: Dr A Makina

E-mail address: makina@unisa.ac.zaTelephone: 012 429 6206

Title of research:

The implementation of mathematics curriculum and assessment policy statement in South Africa

Qualification: MEd Curriculum 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 2020/02/ 19 to 2023/02/19.

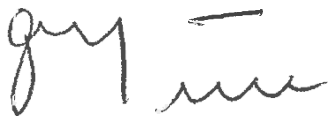
The low-risk application was reviewed by the Ethics Review Committee on 2020/02/19 in Compliance with the UNISA Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.

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.
3. Note: 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 of2003.
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 fieldwork activities may continue after the expiry date 2023/ 02/ 19. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

The reference number 2020/02/ 19/ 34956972/09/AM *should be clearly indicated on all forms of communication* with *the intended research participants, as well as with the Committee.*

Kind regards,



Prof AT Motlhabane

DEANChairpersonL: CEDU Rerc

motlhat@unisa.ac.za

ACTING EXECUTIVE

Sebatpm@unisa.ac.za

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
429 3111 Facsimile +27 12 429 4150

APPENDIX B: PERMISSION LETTER TO THE DISTRICT DIRECTOR.

LIMPOPO PROVINCE DEPARTMENT OF EDUCATION
MOPANI WEST DISTRICT DIRECTOR
TZANEEN
0850
15 June 2020

MANAMELA M.I
P.O BOX 3637
TZANEEN
0850

Dear Sir/ Madam

RE: REQUEST FOR PERMISSION TO CONDUCT Med RESEARCH STUDY IN MOPANI WEST DISTRICT OF LIMPOPO PROVINCE.

I am currently studying towards a master's in education in the department of curriculum studies at the University of South Africa under the supervision of Dr A Makina. I hereby request permission to conduct a study entitled: INVESTIGATING THE IMPLEMENTATION OF THE MATHEMATICS CURRICULUM AND ASSESSMENT POLICY STATEMENT IN SOUTH AFRICA. The aim of this study is to explore the experiences of educators with the implementation of the Mathematics CAPS curriculum in Grade 10-12 in South Africa. The purpose of this study is to help the Department of Basic Education to improve Mathematics CAPS curriculum relevant to grade 10-12 educators. The study will also stimulate national and international dialogue among policy makers and mathematics educators regarding mathematics education policy and program.

Qualitatve research approach supported by quantitative data will be employed in this study. The participants will be selected purposefully from a sample of rural high schools of Mopani west district, Limpopo Province. The participants will involve mathematics educators for grade 10-12 and the Departmental Heads for

mathematics. Online survey and interview will be used as instruments for collecting data. The semi-structured interviews will take approximately 30 minutes in length in the agreed classroom or office within the school premises after school hours. During semi structured interviews an audio record will be used, and written notes will be taken. Data will be collected over a period of five months.

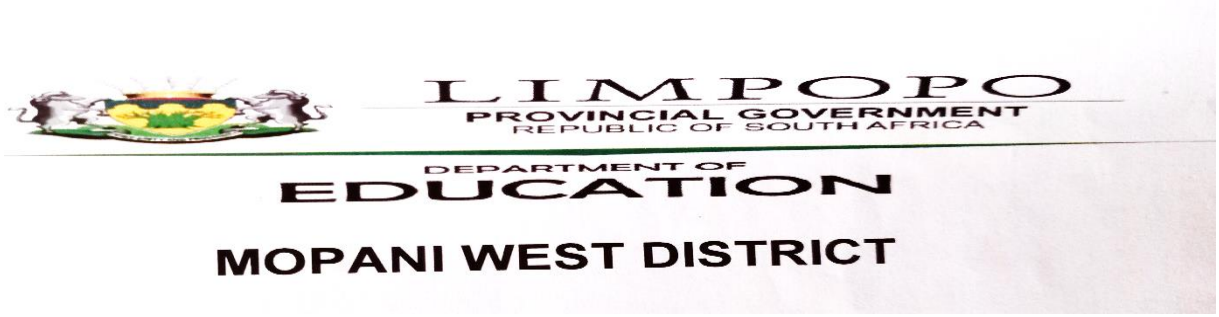
I will ensure confidentiality and anonymity of participants and data will only be used for the study mentioned above.

Yours faithfully

Manamela Mabareki Irene (073 473 6713)

Irenemanamela@gmail.com

APPENDIX C: PERMISSION LETTER FROM DISTRICT DIRECTOR



MOPANI WEST DISTRICT

REF: 2/2/2

Enq: MPENYANA M.B

To: Ms Manamela Mabareki Irene

Subject: **PERMISSION TO CONDUCT RESEARCH: THE IMPLEMENTATION OF THE MATHEMATICS CURRICULUM AND ASSESSMENT POLICY IN SOUTH AFRICA.**

1. The above matter refers
2. The department wishes to inform you that your request to conduct research on the above mentioned topic has been approved
3. Your focus should only be limited to the mathematics departmental head and mathematics educators on the selected high schools in Mopani West District.
4. The following conditions should be considered:

4.1. Arrangements should be made with the departmental heads and educators of the affected schools in Mopani West District

4.2. The research should not be conducted during examinations

4.3. During research, applicable research ethics should be adhered to, the principle of voluntary participation in the study.

4.4. Upon completion of the research study, the researcher shall share the finding and recommendations with the department.

5. The research should not have any financial implications to the Department of Education: Limpopo province

6. You are expected to produce this letter to the circuit and schools you intend to conduct your research

7. The department appreciated the contribution that you wish to make and wishes you success in your research

DISTRICT DIRECTOR

05/10/2020
DATE

Private Bag X4032 LANETN, 0850 Tel 015 506 6800 Fax No. 0865177632

The heartland of South Africa- development is about people!

APPENDIX D: PARTICIPANT INFORMATION SHEET (LETTER FOR CONSENT AND ASSENT).

Ethics clearance reference number:2020/02/19/34956972/09/AM
Date: 06/10/2020
Research permission reference number: 2020/02/19/34956972/09/AM
Title: Investigating the implementation of Mathematics Curriculum and Assessment Policy Statement in South Africa.

Dear Prospective Participant

My name is Mabareki Irene Manamela and I am doing research under the supervision of Dr Antonia Makina in the Department of Curriculum and Instructional Studies towards a Med in Curriculum and Instructional Studies at the University of South Africa. We are inviting you to participate in a study entitled '' Investigating the implementation of the Mathematics Curriculum and Assessment Policy Statement in South Africa''. If you decide to take part in this research, you will be given a written consent to sign and return to the researcher.

WHAT IS THE PURPOSE OF THE STUDY?

The purpose of this study is to help the Department of Basic Education to improve the quality of teaching and learning Mathematics CAPS content knowledge relevant to grade 10-12 educators through the information provided by grade10-12 mathematics educators. The study will also stimulate national and international dialogue among mathematics policy makers, and mathematics educators regarding the implementation of the Mathematics CAPS curriculum and programmes which will help to improve the academic results of mathematics grade 10-12. The study will also aim to explore the experiences of educators with the implementation of the Mathematics CAPS curriculum in grade 10-12 in South Africa, to achieve the following objectives:

- To determine the expectation of Mathematics CAPS curriculum in grade 10-12.

- To investigate the challenges experienced by the mathematics educators regarding the implementation of the Mathematics CAPS curriculum in grade 10-12.
- To recommend the best practices that can help educators in the implementation of Mathematics CAPS curriculum grade 10-12

The overall number of participants will be fourteen (twelve mathematics educators and two departmental heads for mathematics) in grade 10-12.

WHY BEING AM I INVITED TO PARTICIPATE?

You are invited to participate in this research because you are among the rural high school educators offering mathematics in Grade 10-12 in Mopani West District, and therefore have been trying to implement CAPS since it was introduced. You will therefore be having the information on how you experience the implementation of Mathematics CAPS to improve the student pass mark. You will be able to share your experiences in this study so as to contribute to the improvement of quality Mathematics education in South Africa. I obtained your contact details from the school principal with the consent from the Limpopo Department of Education.

WHAT IS THE NATURE OF MY PARTICIPATION IN THIS STUDY?

The data collection methods to be used in this study will be online survey and semi structured interviews. The first data collection to be conducted will be from an online survey. Online survey will be carried out to carry out a descriptive quantitative data. The questionnaire will be made up of four sections. Section A of the online survey consist of six questions related to the bibliographic information of the participants. Section B consist of five questions related to the examining the pass rate of mathematics against the Mathematics CAPS curriculum. Section C consist of five questions related to the challenges with the implementation of Mathematics CAPS curriculum. Section D consist of eight questions related to support in the implementation of Mathematics CAPS. From

section B the information deal with the support for the educators and is therefore related to the pass rate, the school policy, and the professional development of the educators within the Mathematics CAPS curriculum. You are expected to answer all the questions because you go to the next section. Secondly semi structured interviews will be employed. The semi structured interviews will take about thirty minutes to complete. The interview will be audio recorded, written notes will be taken and follow up questions may be asked during the interview. You are expected to answer interview questions as honest as possible. You will communicate suitable time for interviews outside of school hours. If there is a need for follow up questions you will be contacted.

CAN I WITHDRAW FROM THIS STUDY EVEN AFTER HAVING AGREED TO PARTICIPATE?

Participation in this study is voluntary and you are free to withdraw at any time and without giving a reason.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

This study will help the Basic Department of Education to improve the Mathematics CAPS document through the information provided by Grade 10-12 mathematics educators. The study will stimulate national and international dialogue among policy makers and Mathematics educators regarding Mathematics education policy and programmers to improve Mathematics results in South Africa.

ARE THERE ANY NEGATIVE CONSEQUENCES FOR ME IF I PARTICIPATE IN THE RESEARCH PROJECT?

No evident risks are foreseen in this study. The participant is advised to be involved in the research during their own free time.

WILL THE INFORMATION THAT I CONVEY TO THE RESEARCHER AND MY IDENTITY BE KEPT CONFIDENTIAL?

Your name will not be recorded anywhere and no one, apart from the researcher and identified members of the management, will know about your involvement in this research. No one will be able to connect you to the answers you give since you will be given a code number, or a pseudonym and you will be referred to in this way in the data. Your anonymous data may be used for other purposes such as research reports, journal articles, any publications, or other research reporting methods such as conference proceedings.

HOW WILL THE RESEARCHER(S) PROTECT THE SECURITY OF DATA?

Hard copies of participant`s data will be stored by the researcher for a period of five years in a locked cupboard/ filing cabinet in the office for future research or academic purposes. Electronic information will be stored on a password protected computer. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICIPATING IN THIS STUDY?

No compensation will be received for this participation.

HAS THE STUDY RECEIVED ETHICS APPROVAL?

This study has received approval from the Research Ethics Review Committee of the College of Curriculum and Instructional Studies at UNISA. A copy of the approval letter can be obtained from the researcher and my supervisor if you so wish. The study has also received permission from the Limpopo Department Of Education to collect the data in the sampled schools.

HOW WILL I BE INFORMED OF THE FINDINGS/RESULTS OF THE RESEARCH?

If you would like to be informed of the final research findings, please contact Mabareki Irene Manamela on 0734736713 or from email irenemanamela@gmail.com. The findings are accessible for 10 years from the date of publications as per UNISA research institution policy.

Should you require any further information or want to contact the researcher about any aspect of this study, feel free to contact the researcher.

Should you have concerns about the way in which the research has been conducted, you may contact Dr A Makina

Dr Makina
makina@unisa.ac.za
012 429 6206

Thank you.
Manamela Mabareki Irene

Signature : _____ Date: _____
Witness's signature: _____ Date: _____
Researcher's signature: _____ Date: _____

APPENDIX E: CONSENT TO PARTICIPATE IN THIS STUDY.

I, …….. (Participant's name), confirm that the person asking my consent to take part in this research has explained to me about the nature**,** procedure, potential benefits, and anticipated inconvenience of participation. I have read (or had explained to me) and understood the study as explained in the information sheet. I have had sufficient opportunity to ask questions and I am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable)

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

I agree to the recording of the semi structured interviews, the taking of written notes, audio recording and online survey. I have received a signed copy of the informed consent agreement.

Participant`s name & surname: _____ please print

Participants`signature_____ Date: _____

Researchers` name & surname: _____ please print

Researcher's signature: _____ Date: _____

APPENDIX F: ONLINE SURVEY QUESTIONNAIRE.

THE IMPLEMENTATION OF THE MATHEMATICS CAPS IN SOUTHAFRICA

This is a survey to investigate the problems with the implementation of the Mathematics CAPS. You are invited to participate voluntarily in this study, and you are free to withdraw at any time, without giving a reason. All information that you provide is considered completely confidential and codes will be used to identify individuals to ensure anonymity of your information. Permission from the UNISA Ethics Review Committee was granted. For enquiries feel free to contact Manamela MI at 0734736713/irenemanamela@gmail.com

* Required

A. BIBLIOGRAPHIC DATA

A1. AGE *

- o 20-29
- o 30-39
- o 40-49
- o 50-59
- o 60 and above

A2. LOCATION *

1. Bolobedu
2. Makhutswe -Lepelle
3. Ritavi
4. Thabina

A3. HIGHEST QUALIFICATIONS *

- o Doctorate
- o Masters
- o Postgraduate
- o Undergraduate
- o Diploma
- o Certificate

A4. YEARS OF EMPLOYMENT AS MATHEMATICS EDUCATOR *

- o 0-5
- o 6-10
- o 11-20
- o 20 and above

A5. GRADE(S) *

- o 10
- o 11
- o 12

A6. HOME LANGUAGE *

- o IsiNdebele
- o IsiXhosa
- o IsiZulu
- o Sepedi
- o Tshivenda
- o Xitsonga
- o Other

* Required

B. CHECKING THE PASS RATE WITHIN MATHEMATICS CAPS CURRICUM

B1. Do you have a low mathematics pass rate in this District? *

- o Yes
- o No
- o Not sure

B2. Do you experience a low mathematics pass rate in your school? *

- o Yes
- o No
- o Not sure

B3 How did you hear about the mathematics pass rate? *

- o National Department of Basic Education
- o Limpopo Department of Education
- o Mopani West District
- o Circuit office
- o Schools
- o Media

o Gossip

o Other

B4. Do you think there is a relationship between the low mathematics pass rate and the implementation of the Mathematics CAPS curriculum? *

o Yes

o No

o Not sure

B5. Do you think the Mathematics CAPS curriculum address the needs (e.g skills, knowledge and values) of a democratic South Africa? *

o Yes

o No

o Not sure

C. CHALLENGES WITH THE IMPLEMENTATION OF THE MATHEMATICS CAPS CURRICULUM

C1. Do you think there are challenges with the implementation of Mathematics CAPS curriculum? *

o Yes

o No

C2. Do you think there are challenges with the appointments of relevant mathematics educators at your school? *

o Yes

o No

o Not sure

C3. Do you think there are challenges with the duties and responsibilities given to you as a mathematics educator? *

o Yes

o No

C4. Do you think the pass rate of mathematics will improve if there is proper guidance with the implementation of CAPS? *

o Yes

o No

If no give a reason

C5. Do you think your teaching of mathematics will improve if you understand the CAPS document properly? *

o Yes

o No

If no give a reason

D. SUPPORT IN THE IMPLEMENTATION OF MATHEMATICS CAPS

D1. Do you have a school policy to support you in the implementation of the Mathematics CAPS curriculum? *

o Yes

o No

o Not sure

D2. Do you experience problems with the school policy regarding the implementation of the Mathematics CAPS curriculum? *

o Yes

o No

o Not sure

D3. Does your school give you enough time to implement the Mathematics CAPS curriculum? *

o Yes

o No

o Not sure

D4. Do you meet with other mathematics educators in your school to discuss the better implementation of Mathematics CAPS curriculum? *

o Yes

o No

o Not sure

D5. Do you ever meet with the community of mathematics educators from different schools in your province to discuss the better implementation of Mathematics CAPS? *

o Yes

o No

o Not sure

D6. Do you get the support from the mathematics Departmental Head (DH) with the implementation of the Mathematics CAPS curriculum? *

- o Yes
- o No
- o Not applicable

D7. Do you get the support from the principal with the implementation of the Mathematics CAPS curriculum? *

- o Yes
- o No
- o Not sure

D8. Do you get the support from the mathematics subject advisor from the Department of Basic Education regarding the implementation of Mathematics CAPS curriculum? *

- o Yes
- o No
- o Not sure

APPENDIX G: INTERVIEW QUESTIONS

TOPIC: THE IMPLEMENTATION OF THE MATHEMATICS CAPS IN SOUTH AFRICA
CHALLENGES AND THE IMPROVEMENTS WITH THE IMPLEMENTATION OF MATHEMATICS CAPS CURRICULUM GRADE 10-12

1. What challenges are you facing with regard to the incorporation of aims and skills from the CAPS curriculum into the teaching and learning of mathematics?
   - What do you think should be improved to ensure the effective incorporation of the aims and skills from CAPS into teaching and learning of mathematics?

2. What challenges are you facing regarding the covering of contents according to weight per topic as required by Mathematics CAPS curriculum?
   - What do you think should be improved to ensure the effective covering of content according to weight per topic as required by Mathematics CAPS curriculum?
   - Do you feel the weighting of the content is adequate?

3. What challenges are you facing regarding the sequencing of topics within the terms as advised through the CAPS document? Is the progression of the concepts and skills to be taught from one grade to another in order?
   - What do you think should be improved to ensure the effective sequencing of topics within the terms?
   - What do you think should be improved to ensure the effective progression of the concepts and skills to be taught from one grade to another?

4. What challenges are you facing regarding the assessment of the learners is advised from the Mathematics CAPS document?
   - What do you think should be improved to ensure the effective assessment of learners in the Mathematics CAPS classroom?

5. What challenges are you facing regarding the management of assessment records that includes records sheets and teaching files in mathematics as required by Mathematics CAPS guideline?
   - What do you think should be improved to ensure the effective management of assessment records that include records sheets and teaching files in Mathematics CAPS curriculum?

6. Does your school have a policy that helps mathematics educators with the better implementation of the Mathematics CAPS curriculum?
   - Do you experience problems with the school policy regarding the implementation of the Mathematics CAPS curriculum?
   - What do you think should be improved to ensure the effective implementation of mathematics school policy?

7. Do you think there are challenges with the appointments of mathematics educators?
   - What challenges are you facing regarding the appointments of mathematics educators in your school?
   - What do you think should be improved to ensure the proper appointment of mathematics educators?
   - Do you meet with other mathematics educators in your school to discuss the better implementation of Mathematics CAPS curriculum?
   - What challenges are you facing regarding the meetings of mathematics educators within the school in support of the implementation of Mathematics CAPS curriculum?
   - What do you think should be improved during the meetings to ensure the effective implementation of the Mathematics CAPS curriculum?

8. Do you ever meet as a community of mathematics educators to support each other with the implementation of the Mathematics CAPS curriculum?
   - What problems are you facing regarding the meetings with the community of mathematics educators from different schools?
   - What do you think should be improved to ensure the effective meetings with the community of athematics educators in support of the implementation of Mathematics CAPS curriculum?

9. Do you get the support from the mathematics DH and the principal for you to implement Mathematics CAPS curriculum?
   - What problems do you experience regarding the support you get from the DH and the principal with the implementation of Mathematics CAPS curriculum?
   - What do you think should be done to ensure the effective support from the mathematics DH and the principal regarding the implementation of Mathematics CAPS curriculum?

10. Do you get the support of the subject advisor for mathematics from the department of education regarding the implementation of Mathematics CAPS curriculum?
   - What challenges are you facing regarding the Mathematics CAPS meetings with the subject advisor for mathematics in support of the implementation of Mathematics CAPS curriculum?
   - What support do you think the subject advisors for mathematics could give to help you with implementing the Mathematics CAPS curriculum better?

APPENDIX H: CERTIFICATE OF EDITING

BLANDINA MAKINA
Freelance Language Practitioner
Formerly Associate Professor,
Department of English Studies, Unisa

Email:makinablandina@gmail.com
Telephone +27 12 9934566
Cell: 0846843301

CERTIFICATE OF EDITING

This serves to confirm that copy-editing and proofreading services were rendered to:

MABAREKI IRENE MANAMELA

for dissertation entitled
THE IMPLEMENTATION OF THE MATHEMATICS CURRICULUM AND ASSESSMENT POLICY STATEMENT IN SOUTH AFRICA

I uphold the following editing standards:

- ***proofreading for mechanical errors such as spelling, punctuation, grammar, cohesion, vocabulary, syntax***
- ***copy-editing that includes commenting on structure, organisation and logical flow of content, unnecessary repetition***
- ***providing comments on areas of concern***
- ***returning the document with track changes for the author to accept***

I confirm that I have met the above standards of editing and professional ethical practice.
The content of the work edited remains that of the student.

Blandina Makina **Date 6 March 2022**

Post-Graduate Course on Editing Principles and Practices (2002) University of Pretoria
***Member of the Professional Editors' Guild (Membership number MAK003*)**