TEACHERS' EXPERIENCES OF THE IMPLEMENTATION OF THE MATHEMATICS CURRICULUM AND ASSESSMENT POLICY STATEMENT AT THE FURTHER EDUCATION AND TRAINING (FET) PHASE: CASE STUDY

NTOMBEKHAYA VIVIAN DUBE

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BY

NTOMBEKHAYA VIVIAN DUBE
STUDENT NUMBER: 2014 14 792

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ABSTRACT

South Africa is amongst many countries that experience curriculum problems. The Curriculum and Assessment Policy Statement (CAPS) represents a shift from the traditional way of teaching and learning to a more interactive approach. In this new way of teaching, teachers seem to be lost and apply teaching in the way that suits them. Teachers are required to implement curriculum changes and become re-skilled through qualification interventions, but it is questionable whether the challenges that the teachers themselves perceive as important are taken into consideration. The purpose of the study was to investigate experiences of the teachers on the implementation of the Mathematics Curriculum and Assessment Policy Statement (CAPS) curriculum. This hermeneutic study employed an interpretive and constructivist paradigm. The researcher adopted a case study and a qualitative research approach for this study because the aim was to understand and describe teachers' practices and experiences on the implementation of the Mathematics CAPS curriculum, which is a social phenomenon that includes ideas, thoughts, and actions. This study concerns human action from the perspective of the participants whereby the researcher describes the lived experience of participants as revealed through individual interviews. It is vitally important to recognise our task as researchers who have to continue questioning, probing, and exploring the conditions around us. In South Africa, we need to make harsh decisions in curriculum to address social injustices and inequalities. The available evidence suggests that attention should be payed to curriculum agents during the initial stage of the curriculum dissemination and the availability of the resources in the schools in order for the curriculum implementation to be effective.

DECLARATION

I declare that the dissertation with the title of “Teachers’ experiences on the implementation of Mathematics Curriculum and Assessment Policy Statement curriculum at the Further Education and Training (FET) Phase: Case Study” is my own work; submitted to University of Fort Hare on the 16 of November 2015. This dissertation has not been submitted to any other institution and all the sources I used appear in my references.

23 March 2016

Ntombekhaya Vivian Dube

DATE

STATEMENT BY THE SUPERVISOR

This dissertation is submitted with/without my approval.

23 March 2016

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Professor E. O. Adu Date

Supervisor

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Above all, I thank my Lord because without Him nothing can happen. Sometimes when I lose hope and pray, My Lord Almighty always answers me positively.

DEDICATION

This work is dedicated to my late mother, Lulama Princess Dube, and my brother, Wiseman Papama Dube.

ACRONYMS

ACE	Advance Certificate in Education
BED	Bachelor of Education
BSC	Bachelor of Science
CAPS	Curriculum Assessment and Policy Statement
CNE	Christian National Education
C2005	Curriculum 2005
DOA	Department of Agriculture
DOBA	Department of Basic Education
DOE	Department of Education
EMIS	Education's Management Information System
FET	Further Education and Training
GET	General Education and Training
GDE	Gauteng Department of Education
KMR	Knowledge Management and Research Directorate
LSEN	Learners with Special Education Needs

MEC	Member of the Executive Council
NCS	National Curriculum Statement
NGOs	Non-Governmental Organisations
NQF	National Qualification Framework (NQF)
NSE	Norms and Standards for Educators
OBE	Outcome-Based Education
OECD	Organisation for Economic Co-operation and Development
PCK	Pedagogical Content Knowledge
PGCE	Post-Graduate Certificate in Education
RME	Realistic Mathematics Education
RNCS	Revised National Curriculum Statement
SDAs	School Development Associations
SDCs	School Development Committees
SGB	School Governing Body

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CHAPTER 1

INTRODUCTION TO THE STUDY

1.1 Introduction and background

Education in most countries has a problem. The new government of South Africa decided to change many things such as to democratise education after the election in 1994. Under those political issues the implementation of a new education system was also considered. South Africa is amongst those countries that experience curriculum problems (Carl, 2009:17). Curriculum change is not something that is unique to South Africa. It occurs internationally on an ongoing basis and reflects changes in the society. According to Provenzo cited in (Morgan, 2001:1), “Education as a professional field is constantly changing. Change in values takes place, new curricula are introduced and new technologies define how we teach and learn.”

The first post democratic curriculum change in South African education, namely Curriculum 2005, involved a radical shift in the pedagogical system towards a competence-based approach called Outcomes Based Education (OBE) in which the main focus was on the assessment of outcomes. The introduction of the Curriculum 2005 (C2005) led to the various changes of approaches in the education system in South Africa (Jansen, 2003:3). These changes involved so many things in Mathematics such as a focus on Mathematical reasoning, problem solving, and communication. It is necessary to review all these changes as time goes on since everything is changing from generation to generation.

In April 2002 a Revised National Curriculum Statement (RNCS) which was the second approach was declared the new official curriculum policy and started to be implemented in 2004. The Revised National Curriculum Statement was implemented in schools (Chisholm,

2004:14) through Learning Programmes that are “structured and systematic arrangements of activities that promote the attainment of learning outcomes and assessment standards for the Phase” (Department of Education, 2002b:15). In terms of subjects each and every learner from Grade 10 was forced to study Mathematics. In 2006 an additional subject called Mathematical Literacy was introduced in the Further Education and Training (FET) band (AMESA, 2010:223). From 2006 it was compulsory for each learner in FET to select either Mathematics or Mathematical literacy in his/her subjects. This change caused problems since South Africa already had a shortage of Mathematics teachers. Adler and Davis (2006:277) posit that “most of the teachers who teach Mathematics were either unqualified or under qualified to teach the subject”.

The topics in Mathematics were changed wherein Geometry was not compulsory for every learner. It was Paper 3 and the learners had a choice of writing this paper. In the National Curriculum Statement (DoE, 2003b), there was a marked change of focus in the teaching of Mathematical topics. For example, in one of the four FET learning outcomes, ‘Space, Shape and Measurement’, there was a new emphasis on transformation geometry. Also the Revised National Curriculum Statement had many critics; this resulted in it being reviewed.

The panel, mandated in July 2009 by the Minister of Basic Education to investigate the curriculum implementation challenges, came up with findings. The changes made to the Revised National Curriculum Statement (RNCS), especially with regards to content, assessment and learner outcomes, were used as background to the introduction of Curriculum and Assessment Policy Statement (CAPS).

The third approach was called the Curriculum and Assessment Policy Statement (CAPS). The new curriculum policy did not divide into two policy documents as before. The two previous policy documents were amended, and a single comprehensive document known as the National Curriculum Statement Grade R-12 (NCS) was developed. The Curriculum and Assessment Policy Statement (CAPS) that was added to the altered policy, states that NCS was an attempt at assisting Mathematics teachers to focus more on Mathematical content so as to be able to assist learners better. The CAPS document was developed with the aim of improving learner performance in Mathematics.

This third curriculum change was implemented in January 2012. The NCS (DOBE, 2011) document is not the same as NCS (DoE, 2003b) in that it did not divide into the four learning outcomes; this new document has ten different topics. This is a significant change as it emphasises Mathematics content more than learning outcomes. Each content area contributes towards the acquisition of the specific skills. The Department of Basic Education (2011:9) and CAMI Education (2010:1) state that “the main topics in the FET Mathematics Curriculum are Functions; Number Patterns, Sequences, Series; Finance, Growth and Decay; Algebra; Differential Calculus; Probability; Euclidean Geometry and Measurement; Analytical Geometry; Trigonometry; and Statistics”.

The CAPS document defines Mathematics as “a human activity that involves observing, representing and investigating patterns and qualitative relationships in physical and social phenomena and between Mathematical objects themselves. It helps to develop mental processes that enhance logical and critical thinking; accuracy and problem solving that will contribute in decision-making” (Department of Basic Education, 2011:8).

By looking at the topics of Mathematics and the definition of Mathematics, the researcher saw that the learner developed many skills of humanity. In all those skills, the learner had to use critical thinking to come to conclusions. In order for that to occur, the involvement of the learner to construct something by himself after observation was needed. The teacher must guide him/her to solve Mathematical problems. By doing so, the learner is able to find his/her misconceptions in a particular topic.

After this renewal, not everything had changed from the previous approaches in the sense that CAPS is based on OBE. The National Department of Education expects every teacher to implement the Curriculum and Assessment Policy Statement (CAPS) in his or her classroom (FET CAPS Guide, 2012:2). The new curriculum encourages teachers to be facilitators (Brodie, 2011:3) although it does not explain deeper about this. “However, teachers are given very little guidance in another document called the Department of Basic Education’s Guidelines for Inclusive Teaching and Learning (2010) as to what such participation actually might look like” (Brodie, 2011:3). When teachers try to facilitate student learning, they do so within a context defined by the curriculum, the classroom, the school, the community and the society within which they live.

The new curriculum represents a shift from the traditional way of teaching and learning to a more interactive approach. In this new way of teaching, teachers seem to be lost and apply teaching in the way that suits them. Teachers of Mathematics do not know what they must do inside their classrooms to make the learners actively involved in the lessons. According to Prevedel (2003:14), a learner-driven approach draws upon constructivism, which is a theory of learning that assumes that people learn by relating new information and skills to what they already know and can do. They should practice new information and skills in a supportive environment.

Teachers are required to implement curriculum changes and become re-skilled through qualification interventions, but it is questionable whether the challenges that the teachers themselves perceive as important are taken into consideration. All these affect the effectiveness of the curriculum implementation. There have been debates on whether the new curriculum will be successfully implemented in South Africa. Paulson (2009:79) is of the opinion that a lack of training offered to educators is one obstacle that inhibits the proper implementation of the new curriculum.

The South African curriculum documents described learner-centred pedagogy in terms of processes involving group work and individual activities related to relevant every day, real world problems. Learner-centred pedagogy is the most effective approach to develop the learners' thinking skills and achieving the learning outcomes for socio-economically disadvantaged learners Brodie, Lelliot and Davis (2002:541). Furthermore, teachers had a limited understanding of the concept "learner-centred approach" and interpreted this as group work (Brodie et al, 2002:542). The problem which exists now is that in learner-centred classrooms the teacher seems to disappear into a facilitative background role, while learners emerge as the initiators and creators of teaching. The approach of learner-centredness correlates with the third principle which states that "high knowledge and high skills: the minimum standards of knowledge and skills to be achieved at each grade are specified and set high, achievable standards in all subjects" (DOBE, 2011:4).

In order to achieve the aims of the curriculum the teacher has to develop the learner to achieve the above principle. Teachers must be able to use these principles to design effective learning experiences, and they must be able to reflect on these experiences, but in fact teachers still seem to struggle to translate their knowledge and experience into practice. According to Reed, Davis and Nyabanyaba (2002:123) "Reflective teaching"

implies taking responsibility for one's own professional development as well as taking part in curriculum development. The teachers encounter problems to implement this practically in their classrooms.

Brodie, Lelliot, and Davis (2002:541) argue that the policy of education encourages the learners to stand up for themselves not to wait for the teacher to do everything in the classroom. It seems as if what is inside the policy is difficult for the teachers to practice inside their classrooms. Hargreaves, Sayed and Jansen (2001) cited in Jansen (2002:118) refer to this as a "dislocation between policy vision and practical realities in schools and classrooms which remains a problem". The teacher can apply the question and answer method to make the learners actively involved in the lesson. Through the question and answer method it is easy for the teacher to identify the barriers and misunderstandings of the learner. The question and answer method also develops the learners' thinking skills and cognitive development skills for the outside world. By applying this method the teacher is applying the first purpose of the CAPS document. It is clear that the manner in which teachers perceive these policies has a major impact on how they will implement them in the classroom.

Fullan (1991:12) cited in Paulson (2009:32) argues that it is important to see whether the teachers apply the policies inside their classrooms because there will be no educational change until the teachers practices what is written in the policies. Teachers' own perceptions of their skills, knowledge, attitudes and values, as well as their willingness and ability to implement the Curriculum and Assessment Policy Statement, will ultimately determine how they will put the curriculum into practice. Avalos (2006:2) is of the opinion that "many teachers adopt an attitude of acceptance (conserving rather than changing), or in the best of cases an attitude of creative adoption".

The continuous change of curriculum affects the effective teaching of Mathematics in secondary schools. The structure of Mathematics is totally different to the previous one in the sense that this one develops the skills, concepts and content learners are expected to achieve at each grade level. All this depends on the teachers teaching the subject as well as the learning resources available to do it.

The society of Gauteng expects greater things from their learners. They expect them to contribute to the society after learning. This means that the teachers in Gauteng have to assist the learners by all means to achieve this expected goal. Above all this province is the smallest but most populous in all the provinces of South Africa. "It has a population of 12 272 263 people which is 23.7% of the total population of 51 770 560 of South Africa" (Census, 2011). In order to implement Mathematics a thorough knowledge of Mathematical content as well as pedagogical skill is needed. Carl (2009:118) is of the opinion that the teachers' personal knowledge of Mathematic as well as the views about Mathematics has a strong influence to the practices, interpretation as well as in the resistance on change. Avalos (2006:2) is of the opinion that what is expected of teachers is that they should be willing to undertake or implement what the system sets forth, and in this aim, they are not supported. Avalos (2006:2) added that many teachers adopt an attitude of acceptance, or in the best of cases an attitude of creative adoption.

When we consider the standard of education in Gauteng, there are 74 823 teachers in public and private schools in Gauteng. The number of teachers in public schools is 59 357 and 15 456 teachers are teaching in private school (EMIS, 2013). The majority were women in public and private schools: they numbered 53 754 compared with a small minority of 21 069 male teachers. This shows that women dominate the gender distribution of teachers in Gauteng province. This does not happen in Gauteng province only. An

increased ratio of female teachers has recently manifested itself as a world-wide trend, characteristic of all levels of education, although particularly noticeable in pre-primary and primary education. This shortage of male candidates in the teaching profession has a number of effects on learners, one of which is that it tends to undermine attempts to attract male candidates into the teaching profession.

Although there are a high number of female teachers compared to male teachers, certain fields like Science and Mathematics does not fall under this circumstance especially in secondary schools. This presents a challenge to education authorities either to encourage more female educators to specialise in these learning areas or to design strategies to attract more males into taking these subjects in the teaching profession. Qualified teachers are amongst a nation's most valuable resources as they contribute towards ensuring quality education, and a continued flow of skilled young people into the economy. Young people do not interpret the teaching profession like that; instead of that they undermine the teaching profession and make it the last resort when selecting a career. After the introduction of Mathematical Literacy in FET, it resulted in a shortage of teachers specialising in Mathematics because Mathematics is like a language in the sense that Mathematics is compulsory for all the learners.

All the topics of Mathematics need a person who has a thorough knowledge of them to guide the learner in a constructive way of thinking to apply the knowledge that s/he gains in the previous years. Geometry is difficult even for those people who specialised with Mathematics in their colleges of education. If that is the case, how much more to those teachers who did not specialised with it but are forced to teach it in their working places. Brodie (2004:35) states that in topics like analytic geometry and Euclidean geometry a learner passes through the five levels when assisted by appropriate instructional

experiences, and a learner cannot achieve one level of thinking without passing through the previous levels. De Villiers (2004:34) and Brodie (2004:35) argue that the learner uses rote learning if the teacher teaches in another level whilst the learner has not passed the previous level. The teacher presents the new information at a lower level to assist learners who are not operating at the appropriate level to learn. Sometimes the teacher presents the new information at a lower level due to the teacher's own lack of knowledge of geometry.

The teacher uses a lower level trying to reach the level of the learners. This simply means that these learners will not develop because they are using the same standard of assessment. Level reduction is a significant factor in the poor teaching of geometry and has incredible implications for teachers of geometry in particular and Mathematics in general. It would appear that unless a teacher is aware of van Hiele's levels of learning and can recognise the levels at which their students are operating little real geometry will be taught or learnt in the classroom (Brodie, 2004:35). How can a teacher produce students who are able to organise, manage themselves and their activities responsible, and work effectively if the teacher does not have a sound knowledge of the subject that s/he teaches? Misallocation of teachers is one of the factors that results in the bad performance of learners in Mathematics. This misallocation of teachers occurs mostly in poorer schools since they have no money to pay teachers by themselves. These schools depend on the government to pay the teachers who are teaching in their schools.

After democracy, schools were divided into five quintiles in order for the government to fund them according to their poverty ranking. By doing so, the government was trying to close the gap between the schools. There are schools where all the learners do not pay school fees at all. In other schools, some learners do not pay school fees whilst the other

learners in the same school pay school fees. All these have an impact on the equipment as well as the workers of the school.

Another problem experienced by the teachers of Gauteng is the problem of multilingualism. The impact of multilingualism on Mathematics attainment is far from straightforward and the role played by language in a Mathematics classroom is complex. A number of different researchers have attempted to reduce this complexity by focusing in more depth on the relationship between language proficiency and Mathematical attainment. Barwell (2009:7) states that, “for teachers, there is a difficult balance to be struck between attention to Mathematics and attention to language”.

Although it stressed that inside the classroom the medium of instruction should be one language, which is English, Mathematical language is very different and most learners have language barriers. In that case the teacher has to translate that English to a learner’s language. This causes problems in a class where the learners do not speak the same language. Educators perceive that learners’ ability to listen, read and write have deteriorated but are quite emphatic that this trend started even before the implementation of CAPS. Pimm (2001:21) states that most of the teachers have a problem of changing the informal spoken language by the learners to the formal written language. Pimm (2001:18) further states that teachers of Mathematics should provide pupils with some means to make the Mathematics register for their own purposes.

One of the reasons that caused migration to Gauteng is that Gauteng has many factories, mines and small businesses. There are few unemployment people in this province compared to other provinces and the Africans have the highest rate of unemployment compared to other nations. The Statistics South Africa (2005:9) states- that “unemployment

is estimated at 7- 9.1% among white residents, 12.3 - 18.7% among Asians, 27- 33.5% among coloureds and 33.5 - 38.5% among black residents".

All this contributes a lot to the education of black people. The social and economic factor is one of the inhibitors of curriculum development. To be successful in the implementation of curriculum, as in any other well-developed system, it requires the necessary home, social and economic conditions such as appropriate books, libraries, toys, computers, and other equipment from early childhood for educational success in later life. The majority of South Africans do not have ready access to these tools. The acquisition of these codes of knowledge is all worthwhile and desirable, especially for the children of the historically disempowered. Berkhout *et al* (2010:187) is of the opinion that the socio-economic conditions in families determine the quality of the learning environment at home.

At present there are many resource constraints in the system. These are basic facilities, books and other learning materials, the number of schools, class sizes and the conditions of schools. Christie (2008:216) suggests that those schools that perform poorly will need more support in terms of resources to uplift the standard of education in our country and to become a winning nation. For effective implementation, communication between the curriculum designers and the large number of bodies and role players involved at different levels is necessary. It is clear that it affects negatively the effectiveness of the curriculum if the teachers are involved only when the curriculum is implemented.

This affects the performance of the learners in Mathematics. Christie (2008:215); Jacobs and Brandt (2012:423); Berkhout *et al* (2010:84) complained about the poor performance of learners in Mathematics. Even in the Dinaledi programme out of those 550 participating schools of South Africa, Mathematics showed much slower improvement between 2009

and 2011(2012). In addition, the recent report by Evens (2013) states that South Africa is ranked second last in the world for Mathematics and Science education. Sometimes poor performance in any subject results in the hatred of that subject by the students. Campbell and Prew (2014) report that “the Basic Education Department’s report indicates a 17% decline in the number of candidates who wrote Mathematics between 2009 and 2013 from 290 400 to 241 400”.

1.2 Problem statement

The teacher is the main source of curriculum implementation. The effectiveness of the curriculum depends on both the teacher and the learner. In order for the implementation to be effective, the teachers who are going to implement the curriculum should be involved from the start. The curriculum designers do not understand the learners but they want somebody (teacher) to implement the curriculum and they want the teacher to achieve all the curriculum goals. In order for anything to succeed, there must be communication between all the people involved. Shalem (2003:33) cited in Berkhout *et al* (2010:176) highlights Taylor’s criticism of the involvement of Non-Governmental Organisations (NGOs) in teacher training. The facilitators from NGOs run short workshop-based programmes, which tend to focus more attention on the provision of information and orientation about policies rather than equipping teachers with the subject content.

Similarly, Naicker (2000:5) cited in Berkhout *et al* (2010:176) clarifies that in-service teacher training has been conducted in the afternoons for only a few hours. In the afternoons, the teachers wanted to solve their own problems so they ended up not attending those workshops while even those who attend gain nothing because of time. Carl (2009:133) argues that this implementation must not be a mere carrying out of instructions

but should recognise that developments take place within instructional-learning situations. The curriculum designers only write what should be done in policy documents. The teachers receive training from the facilitators. Teachers receive training on the whole year syllabus for a period of only three days. Most of the time the facilitators themselves do not understand what is inside the documents. These teachers have to use some equipment to implement the Mathematics curriculum in order for the learners to understand clearly. Most of the time those resources are not available in their schools.

These changes, however, present some tough challenges. The curriculum change are sometimes compiled by people who never taught before. do not know the situation of the schools. The curriculum transformation process in South Africa was initiated after the 1994 elections, and has been steadily implemented since then. The current design of the curriculum has been learnt and applied by educators on a wide scale, but the results of it were not good at all. If the current proposed approach is planned in a proper way, then educators would have to work together with the curriculum designers at the same time. Since the teachers were not been involved in the planning detail, this presented major struggles for teachers implementing the curriculum and using learning programmes, and for the materials used.

The broad curriculum is implemented at national level, while a specific subject syllabus is implemented at school and classroom level. Carl (2009:130) states that since 1997 lots of mistakes were made concerning curriculum dissemination. Teachers expected to implement the curriculum with little in-service training that occurred during their holidays. The needs of the teachers were not considered and this might have resulted in teachers feeling disempowered. Because of this, there have been many public and academic debates about the policies, the structures and processes and implementation of this

programme. Structures, processes and policies have been increasing in their presence over the 15-year period to promote and implement the policy. Carl (2009:133) argues that the involvement of the instructional leaders and teachers determines successful and effective curriculum implementation. The curriculum implementation depends on the level on which the initial design was made and for whom it was envisaged.

Successful implementation of the curriculum depends on the extent to which all consumers are informed and have been prepared for the envisaged change and whether they are prepared to associate themselves with it. Berkhout *et al* (2010:87) argue that education reformers in South Africa are concerned about Mathematics teaching in South Africa because of the poor performance in Mathematics of our learners compared to the performance of the learners in other countries. Teaching has thus been under intense scrutiny in recent years.

The conditions of teaching, the characteristics of teachers, the nature of the curriculum, teacher education, participation of the learners, and systems of supervision and evaluation that equip teachers to teach can influence the practices and experiences of the teacher in the implementation of the curriculum. This study explores the teachers' experiences of the implementation of the Mathematics CAPS curriculum at FET level. The knowledge of teachers' experiences on the implementation of the Mathematics CAPS curriculum can provide insight into teachers' decision-making processes and reveal the impacts of effective curriculum implementation.

1.3 Research objectives

The researcher believes that the transformation of education in South Africa came with many new challenges especially to the government schools. Therefore, the following are the objectives of the study which the researcher wants to ascertain:

- The teachers' experiences regarding the implementation of the new Mathematics curriculum,
- How far has the CAPS influenced Mathematics curriculum,
- The effects of curriculum change on teaching of Mathematics.

1.4 Research questions

In order to understand how the problem would be addressed, the researcher sought answers to the following questions:

1.4.1. Main research question

The main research question is:

What are the teachers' experiences of the implementation of Mathematics CAPS curriculum at FET level?

1.4.2. Sub-research questions

The questions that were used to explore the main question of this study are:

- How far has CAPS influenced the Mathematics curriculum?

- What are the constraints or factors that might be affecting the effectiveness of the implementation of the Mathematics CAPS curriculum?

The researcher used various methods which are interviews and documents to search for knowledge in the form of research methodology to achieve the above objectives so that methodological triangulation would be possible.

1.5 Purpose of the study

The researcher's particular emphasis is on the teachers' knowledge of the Mathematics CAPS curriculum and the effects of curriculum change on the teaching of Mathematics in their classrooms in a sample of FET teachers in one of the South African provinces. The researcher's intention was to provide insight into developing a study that would exploit possibly large differences in teacher preparation and effective implementation of Mathematics CAPS curriculum in their classrooms. This study focuses on the role that teacher skills and practice play in South African curriculum implementation. Once the roots of the problems identified in the education system then the problems decrease and most of the things will run smoothly in the department of education.

The reason for the researcher to choose this study is that this continuous change of Mathematics curriculum affects effective teaching in secondary schools. Instead of motivating the teachers, it chases them away from this career of teaching. Old teachers are tired of learning new things now and again. The teachers need support to empower their skills in the curriculum in order for them to reach the goals of the curriculum. The curriculum implementation cannot be effective without co-relationship between the teachers and the curriculum designers. There must be curriculum-empowered people who

guide the teachers and who assist the teachers in the implementation of the curriculum. Those empowered people must train them and have regular workshops then visits the schools to find that what is written in the policies is correctly applied inside the classroom.

In the previous sections it was revealed that the learner performance is poor which can be the result of the disempowerment of teachers in the implementation of the curriculum. In addition, the researchers like Avalos (2006:2) and Hargreaves, Sayed, and Jansen (2001) cited in Jansen (2002:18) mention the gap between the practice and the policies, which shows that the teachers are confused. The aims of the curriculum and the principles of the curriculum need teachers with knowledge and skills to achieve the goals of the curriculum. In order for the learner to think constructively and be actively involved in the classroom, guidance by authorised people is needed.

1.6 Significance of the study

Teachers' experiences about Mathematics, teaching, and learning have been identified as one of the key obstacles to curriculum reform. Carl (2009:118) states that the curriculum leaders should take note of intrapersonal characteristics of the members of the social structure in the process of dissemination and renewal. The negation of intrapersonal characteristics causes miscarry of the whole curriculum development process.

This study contends that Mathematics reform efforts need to include the subject of Mathematics in order to understand the challenges that teachers implementing this subject face. It also provides for a theoretical analysis that is different and new for reform efforts in teaching of Mathematics. In advancing a new theoretical perspective on Mathematics reform, the researcher endeavoured to empower scholarly understanding and knowledge on the 'curriculum-practice impasse' in educational change settings. The researcher raises

questions related to teachers' sense of their identities as Mathematic educators with implications for theory, experience, and mandatory curriculum research. The researcher augments parent involvement in school matters and unity with teachers in the uplifting of their children's knowledge in Mathematics.

1.7 Scope of study

The study focuses on FET educators of Mathematics in Sedibeng. Teachers have different experiences with regard to Mathematics teaching and learning. The researcher feels that this continuous change affects the teachers' experiences in teaching and learning. Researchers and reformers have proposed a need to work to change views in order for reforms to be effective (Carl, 2009:118).

1.8 Definition of concepts

Assessment

Assessment is the way used by the teacher to check the learners' understanding of a particular lesson. Carl (2009:97) describes assessment as the systematic evaluation of a student's ability to demonstrate the achievement of the learning goals intended in a curriculum.

Constructivism

Constructivism is a theory that enforces active participation of a learner by observing, listening then interpreting that information individually to solve the problem. Paulson (2009:25) defines constructivism as an epistemology, a theory of knowledge used to explain how we know what we know.

Curriculum

Curriculum is a system planned for the teacher to follow in any subject of the school. According to Chikumbu and Makamure (2000:8) the curriculum is viewed as a composite whole including the learner, the teacher, teaching and learning methodologies, anticipated and unanticipated experiences, and outputs and outcomes possible within a learning situation.

Curriculum design

Curriculum design is the curriculum that is planned at national level for the Department. Carl (2009:38) defines the curriculum design as the phase during which a new curriculum is planned, or during which the re-planning and review of an existing curriculum is done after a full re-evaluation has been carried out.

Curriculum framework

Curriculum framework is a document designed for a specific subject. Carl (2009:33) defines ‘framework’ as a written document in which general policy for one or more instructional presentations in a particular subject is set out and it contains the following: the broad objectives of the instructional presentation(s), the similarly selected and classified core contents in the form of subject/themes as heading, and guidelines.

Curriculum implementation

Curriculum implementation is the third phase of curriculum development, which is done by the teacher in the classroom. Curriculum implementation refers to how the planned or officially designed course of study is translated by the teacher into syllabuses, schemes of work and lessons to be delivered to students (Chikumbu and Makamure, 2000:51).

Educator

An educator is any person with more knowledge who is in charge of giving the information to other people. According to the Department of Education (2002a:3) 'educator' was preferred to that of 'teacher' in order to incorporate all those who teach, educate or train other persons at any institution or assists in rendering educational services or education auxiliary or support services provided by or in an education department.

Learner-centredness

Learner-centredness is an approach developed to motivate the learner to be independent of the teacher to solve the problems using prior knowledge. Paulson (2009:22) defines learner-centredness as the principle of systematically recognising learners' world-views and lived experiences as well as prior learning in the development of curricula that will allow learners to reach their learning objectives and aspirations.

Mathematics curriculum

Mathematics curriculum is the curriculum designed for the Mathematics subject. Paulson (2009:30) describes Mathematics curriculum as a sequence of Mathematics courses as well as other school-sponsored functions for the purpose of encouraging students to do Mathematics.

Mathematical language

Mathematical language is the language used in Mathematics in the form of symbols, numbers, and equations. Pimm (2001:139) defines Mathematical language as the language, that is used for Mathematical activity to help construct, express, and communicate the Mathematical meanings.

Norms and Standards for Educators

Norms and Standards for Educators are the rules applied by the teacher in teaching and learning to develop their curriculum skills. According Parker and Deacon (2012:9) the Norms and Standards for Educators were intended to articulate and enhance teacher development and to provide the state with regulatory mechanisms as part of a 'total' strategy for teacher development and accountability.

Outcomes-Based Education (OBE)

Outcomes-Based Education is the approach designed by Spady, which focuses and organises everything in an educational system around what is essential for all learners to be able to do successfully at the end of their learning experiences. Spady (1994:18) cited in Paulson (2009:72) defines OBE as "high-quality, culminating demonstrations of significant learning in content".

Pedagogical Content Knowledge

Pedagogical Content Knowledge is the knowledge that is transmitted to the learner by a person who is well developed in the content and who is able to pass on that knowledge in a manner whereby the learner gains something at the end. According to Shulman (1986), an educator and researcher noticed that all students need a teacher who is more than knowledgeable about their subjects. They also need one who can teach their specific subjects clearly and effectively. He called this combination of content and teaching knowledge, 'pedagogical content knowledge'.

Quintile

Quintile is the rating of the school in terms of the economic status in order for the government to share the finance equally with those schools that belong to the same level. Motala, Dieltiens, Carrim, Kgobe, Moyo and Rembe (2007) state that the National Norms and Standards for School Funding proposals for amendments, 2004, in practice describe the quintile as the level of poverty of the school that determines how poor each learner is, but a national quintile is nevertheless one fifth of the country's learners, not schools.

Reform

Reform is to change from a particular way of living to a newly develop one. According to the Oxford dictionary, 'reform' means that teachers have to change from something they are familiar with to the unknown, in this case such things as OBE, constructivist notions of teaching and learning and inclusive education.

Teacher qualifications

Teacher qualifications are the achievements obtained by someone in the field of teaching as a professional teaching somebody. According to the Oxford dictionary teacher qualification is the formal recognition and certification of learning achievement awarded by an accredited institution for somebody to become a professional teacher.

1.9 Research layout

This study consists of six chapters, which are as follows:

Chapter 1: Provides an introduction and background to the study.

Chapter 2: Presents the literature review

Chapter 3: Presents the theoretical framework underpinning the study.

Chapter 4: Presents the research design and methodology of the study.

Chapter 5: Presents the interpretation and analysis of data.

Chapter 6: Presents the conclusions, recommendations and reflections of the researcher.

1.10 Chapter summary

In this chapter, the researcher gave an overview of the research by summarising the problem. The statement of problem and the aims of the study were presented, as well as a summary of certain relevant concepts. The method of research and demarcation of the research area were also mentioned. The next chapter provides the literature on curriculum implementation of Mathematics.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The previous chapter introduced the major issues of the study. This chapter will review the literature that underpins the study. Paulson (2009:30) is of the opinion that a definition of curriculum is more difficult in that it means different things to different people and hence there is often enormous confusion when discussions on the subject of curriculums take place.

The concept of ‘curriculum implementation’ is used to frame the research reported in this study. The impact of curriculum implementation is influenced by many factors. Some of them are the components which Carl (2009:75) explains as components of situation analysis which are teacher, learners, content and school environment. Chikumbu and Makamure (2000:50) mention the above including resource material and facilities, stakeholders, culture and ideology, instructional supervision and assessment, teachers’ qualifications, experience, content knowledge and pedagogical content knowledge within the curriculum. In this chapter, the researcher describes the impact, which the introduction of the CAPS has had on schooling, teaching and learning, and teachers in particular. In the literature, it is evident that teachers' experiences have an impact on how effectively they implement the CAPS.

2.2 Curriculum

Curriculum is always explained in the context in which it is used. This study is concerned about the Mathematical curriculum. The curriculum includes key aspects of teaching and

learning such as: content, rationale and underlying philosophy, process, structure of the learning process, and how the learning will be demonstrated in creative ways. For the purpose of this study curriculum is a product of curriculum policy documents containing official intention and policy-in-practice.

The specific aim of Mathematics, which says, to promote accessibility of Mathematical content to **all learners** (DOBE, 2011:8) is confusing. When the teachers are looking to achieve that specific aim, they concentrate to the ability of the learners in a classroom. During the workshops the facilitators encourage the teachers to give the learners different activities according to their cognitive abilities. What is confusing is that all learners of the same grade are writing the same paper during examination, the examination is not divided according to the learners' cognitive abilities. The question paper contains different types of questions according to Bloom's taxonomy. The curriculum development process was rushed, and the teachers were not well developed about this new curriculum. Chikumbu and Makamure (2000:12) state that "the curriculum is viewed as a composite whole including the learner, the teacher, teaching and learning methodologies, anticipated and unanticipated experiences, outputs and outcomes possible within a learning institution". This lack of curriculum development resulted in different outputs than the expected ones.

2.3 Curriculum implementation

The curriculum development comprises of four phases, which are curriculum design, curriculum dissemination, curriculum implementation and curriculum assessment. Curriculum implementation is the third phase of curriculum development. This phase comprises of three components, which are the teacher, learner, and the curriculum in order for it to occur. The teacher is the sender, the learner is the receiver, and the curriculum is

what the sender (teacher) sends to the receiver (learner). The whole process is the curriculum implementation. Chikumbu and Makamure (2000:50) state that, “implementation takes place as the learner acquires the planned or intended experiences, knowledge, skills, ideas, and attitudes that are aimed at enabling the same learner to function effectively in a society”.

Both the teacher and the learner have to function in the process of curriculum implementation. In order for the learner to acquire knowledge, the sender (teacher) must be well developed in the Mathematics content. The problem facing our country is that in some schools the teachers are teaching Mathematics whilst they did not specialise in it. They were selected to teach it because of the shortage of teachers specialised in Mathematics. Those teachers encounter problems in some topics so they decide to leave out those topics. Shalem (2003:33) cited in Berkhout *et al* (2010:176) highlights Taylor’s criticism of the involvement of NGOs in teacher training as “short workshop-based programmes, which tend to focus more attention on the provision of information and orientation about policies rather than equipping teachers with the subject content”.

To transfer this knowledge to the learner the teacher has to follow some strategies. In the process the communication between the sender and the receiver can breakdown. Once the communication breakdown occurred, the outcomes of this process become negative. Assistance is needed from the above authority, which is the subject advisor or the facilitator, to develop the teacher to achieve this process of curriculum implementation. Carl (2009:130) argues that, “New curricula were introduced and teachers were expected to implement them, initially with little in-service training and later with training during their holidays. The needs of teachers were not always considered and this might have resulted in teachers feeling disempowered”. Similarly, Naicker (2000:5) cited in Berkhout *et al*

(2010:176) clarifies that in-service teacher training has been conducted in the afternoons for only a few hours. Because of the development that they received from this training, they implemented what they thought was correct. Carl (2009:59) claims that curriculum development needs enough time to motivate teachers and explain new information thoroughly.

In our country the curriculum implementation was not effective from 1994 until 2012 as the teachers experienced so many changes in the curriculum. The support that the teachers got was not good enough for them to apply what was needed in their classrooms. All these changes in our country occurred because the curriculum was not thoroughly planned. The success of the curriculum implementation depends on the way in which the curriculum was planned, designed and disseminated beforehand (Carl, 2009:134).

Ellis (2012:57) states that curriculum implementation involves activities for professional development, consultation, support, and monitoring of the programme's implementation which should be performed by all members of the district implementation team, composed of the principal, a district administrator, master teachers, and the external consultants. The active involvement of all stakeholders has good result in the curriculum implementation. The above discussions are pertinent to the study since they discuss the experience that the teachers have to implement Mathematics CAPS curriculum, which is the answer to the objectives of this study.

2.4 Implementing agents of the curriculum

The teacher is the implementing agent of the curriculum. This agent needs to be empowered to implement the curriculum inside the classroom. Carl (2009:7) defines empowerment as "a process of growth and development through which a person goes

which enables him/her to take independent decisions and to act autonomously and independently with a view to making a contribution towards the development of his/her particular environment". The teachers in our country were expected to implement what was written in the policy documents without empowerment. Even if they were trained for the teaching profession, they were not trained to implement the new curriculum in the CAPS document.

The first important aspect is that the teacher needs assistance from another person who has more knowledge than him/her to develop himself/herself in the curriculum if there are changes in the curriculum. That authorised person develops the skills of that teacher in implementing the curriculum accurately inside the classroom. In order for the curriculum to be relevant and meaningful, specific knowledge, skills and proficiency are needed. The teachers in our country were not supported enough to apply good practice in their classrooms. The CAPS document mentions the words like 'model', 'learner centre', and 'constructive way' without mentioning clearly the meaning of those words.

A second important aspect is the nature of supervision and control in the school's system. As an empowered person, the teacher will rather act as a facilitator (Carl, 2009:2; Paulson, 2009:39) and make learners realise that they have a share not only in their own learning process but in the learning process of others as well. Learners must develop a feeling of autonomy and the opportunity for this purpose must be created by a dominant authority figure (the teacher). Stone (1995) cited in Carl (2009:6) argues that empowered teachers and children become intrinsically motivated, responsible and independent. It is difficult for this to happen practically. The learners in our schools interpret democracy incorrectly. They do not want to engage themselves in their work. This lack of concentration caused the teachers to concentrate to the learners who try their best in learning.

Doerr and Lesh (2003:126) are of the opinion that “knowledge is situated and grounded in contexts and constraints of practice, they foreground teachers’ knowledge in terms of being pluralistic multidimensional, variable, contextualised and continual”. All these multidimensional models need teachers’ knowledge to apply them in order for the learners to observe, acquire, or learn them so that they can be able to apply them too. Doerr and Lesh (2003:129) argue that “the modelling perspective uses what teachers already know to express, test, revise and refine their content knowledge and extend the knowledge into more powerful forms of classroom practice by attending to the pedagogical content knowledge as well as psychological, historical, affective and practical factors”. The teachers follow the textbooks and teach according to the textbooks. They do not have an idea of how to guide the learners in Mathematics to visualise the problem in different forms to come up with conclusions.

All the above discussions are pertinent to this study since they show how the CAPS influenced the Mathematics curriculum. One could argue that teachers’ practices and experiences shape and strengthen the curriculum development process in a country. Teachers’ practices on curriculum innovation and the curriculum implementation process are necessary in ensuring the success of a curriculum. It is important that teachers’ experiences about curriculum review be investigated as this will determine their acceptance or rejection of such revisions.

2.5 Factors that influence the curriculum implementation

The curriculum designers developed the curriculum at the macro level (at governmental or departmental level) and implemented by the practitioners (teachers in schools) at the micro level. In order for the curriculum implementation to be successful, some factors with certain

characteristics are needed. In the literature the following factors that influence the curriculum implementation were listed the teacher, learners, content, content knowledge, stakeholders, school environment, culture and ideology, instructional supervision and assessment (Chikumbu and Makamure, 2000:50). The lack of the above factors, affect the effectiveness of the curriculum implementation. Most of them have been mentioned since the first curriculum reformation in 1994 in our country but even now the teachers are complaining about them. The factors that affect this study are stated in the findings of this study, which can be found in chapter five.

2.5.1 The teacher

In order for the curriculum to reach the learner, the teacher needs to implement it. The teacher should have some qualities to implement the curriculum effectively. If some of those qualities are lacking in the teacher, this affects the curriculum implementation negatively. Carl (2009:77) argues that “The relevant teachers’ view on education in the broad sense, their view on learners and on the subject, the extent of the teachers’ curriculum knowledge and skills, their subject knowledge, their qualifications, their teaching experience, their successes, their flexibility, their leadership style and their teaching ability play an important part in the curriculum implementation”. Teachers must be involved in curriculum planning and development so that they can implement and modify the curriculum for the benefit of their learners.

2.5.2 The learners

The learners hold the key to what is transmitted to them. Chikumbu and Makamure (2000:51) are of the opinion that learners are also a critical element in curriculum implementation. The performance of the learners revealed the success of the curriculum

implementation. The learners extend their knowledge by using resources around their environment. Chikumbu and Makamure (2000:52) added that home background and learner ability could determine what is actually achieved in the classroom.

2.5.3 Content

Learning contents should be linked with objectives, extent, relevance, degree of difficulty, available resources, demands and requirements of the syllabus, depth of study, classification, time scheduling, textbooks available and structure of subject content (Carl, 2009:77).

2.5.4 Content knowledge

In order for the curriculum to be, effective, effective content knowledge is needed from the teacher to develop the learners for their future. The teacher who is well develop in the content that s/he teaches does not follow the structure of the textbook but arranges the content in a particular sequence suitable for the learners. Nkopodi and Sunday (2013:473) and Jacobs and Brandt (2012:424) state that the teacher with adequate content knowledge will be able to select activities that motivate the thinking skills of learners to achieve the learning outcomes, and be able to create a classroom environment that promotes the active participation of the learners. If the teacher's knowledge of the subject is lacking or limited, that thing affects the performance of the learners since the secondary school learners write national papers during examinations.

Shulman (1986:8) concurs and further identifies content knowledge, pedagogical knowledge and pedagogical content knowledge as components of the professional knowledge of teachers. This implies that the teacher should not only possess academic knowledge, but should also be able to practically apply that in an understandable

manner. Pedagogical content knowledge training is needed in most teachers of Mathematics in our country. This type of teacher training would result in the good production of Mathematics in our country. This is what South Africa should look at in an effort to reduce the number of learners experiencing difficulties in Mathematics.

2.5.5 Stakeholders

Stakeholders include parents, parent and teacher' associations, school development associations (SDAs) and school development committees (SDCs) in South Africa, religious organisations, local authorities, companies, and private school proprietors. Not all the stakeholders think the same way about education. Education should be the responsibility of all stakeholders, and they should work together to ensure that learning programmes are effective and beneficial to all. Some stakeholders may find the educational practice threatening and challenging. Berkhout *et al* (2010:175) state that the effective implementation involves all the stakeholders to work hand in hand with the teachers to reach the goals of the curriculum because policy alone cannot succeed in altering ingrained beliefs.

2.5.6 The school environment

One other factor that influences curriculum implementation concerns the particular circumstances of each school. Schools located in rich socio-economic environments and those that have adequate human and material resources can implement the curriculum to an extent that would be difficult or impossible for schools in poor economic environments. The nature of the school curriculum, types and number of classrooms, number of learners in the school, language medium, number of teachers, community within which the school is situated, level of teachers' curriculum knowledge and ability,

quality of subject team systems, availability of resources in the library and suitability contribute in promoting curriculum development.

2.5.7 Culture and ideology

Unity is needed from the people in certain areas; the community must not divide itself according to culture. The people must put first the curriculum needs Chikumbu and Makamure (2000:53) state that culture and ideological differences within a society can influence curriculum implementation. It is essential to look at the broader community and the relevant school's local community. Needs can vary from those of a more physical nature, for example food, clothing and housing, to more psychological and norm-orientated needs, such as freedom, peace, values, education, teaching, literacy, understanding of other cultures, career matters, vocation guidance, an academic or more technically orientated curriculum and family guidance. Berkhout *et al* (2010:84) are of the opinion that education starts with the involvement of parent who promotes moral values in the home.

2.5.8 Instructional supervision

The instructional supervision is also a factor that affects curriculum implementation. Chikumbu and Makamure (2000:53) state that effective curriculum implementation does not take place in a school where the head is incapable of executing supervisory functions. Instructional supervision is not based on the principal head or department only; it also based on the subject advisors and facilitators. Those people in the district should guide the teachers in the curriculum implementation to make curriculum implementation effective.

2.5.9 Assessment

Assessment is also a factor that affects curriculum implementation. Chikumbu and Makamure (2000:53) state that assessment affects the achievement of the broad goals and objectives of the curriculum. McCarty and Davis (1992:15) cited in Carl (2009:140) state that assessment reflects what a learner knows and indicates how s/he learns best and is a dialogue between teacher and learner.

2.6 Curriculum change in Mathematics education

Curriculum is supposed to change as the generations change. Freire (1993:6) cited in Jacobs and Brandt (2012:421) believes that "education functions as an instrument to facilitate the integration of the younger generation into the logic of the present system, or it becomes the practice of freedom by which men and women participate in the transformation of their world".

Education works as a transformer of young people from their way of living to the modern way of living. It is important that each person in the teaching organisation be kept fully informed and involved with a view to taking the best decisions and thus to ensuring optimal development. Carl (2009:112) is of the opinion that "renewal and change are often unsuccessful when sight is lost of certain critical factors in regard to people's readiness for change and development".

During a period of change the person involved in that change perceives things differently. It is wise for the curriculum designers to change the teachers' attitudes and to support them in all spheres when they review the curriculum. According to Czajkowski and Patterson (1980:160) cited in Carl (2009:112) "a critical factor in successful change and curriculum development is the level of preparedness for such a change on the part of those involved".

There are some factors or causes which often lead to resistance to change such as involvement and preparedness of all stakeholders and which must be taken into account during the dissemination phase. Meaningful curriculum renewal is only possible if there is active involvement and dynamic leadership. It is often necessary to break down resistance to change and to create a renewal climate. The people involved may experience that they are being dealt with truly as professional people. The teachers should be well developed in all spheres of the curriculum by the curriculum leaders. Carl (2009:118) states that the curriculum must consider the intrapersonal characteristics of all the stakeholders.

The main topics in the FET Mathematics Curriculum are “Functions; Number Patterns, Sequences, Series; Finance, Growth and Decay; Algebra; Differential Calculus; Probability; Euclidean Geometry and Measurement; Analytical Geometry; Trigonometry; and Statistics” (DOBE, 2011:9).

The new curriculum in South Africa represents a shift from the traditional way of teaching and learning to a modelling approach. Paulson (2009:46) describes Mathematical modelling as “a process of looking at a situation, formulating a problem, finding a Mathematical core, working within that core, and coming back to see what Mathematics tells us about the original problem. The Mathematics that learners may settle on may be a mix of geometry, algebra, trigonometry, data analysis, and probability. There may be a need to use computers or graphing calculators, spreadsheets, or other utilities in generating the Mathematical model”.

In the above definition, many Mathematical topics like geometry, algebra, trigonometry, data analysis, and probabilities are included which the student has to know. Technical equipment or resources are needed to develop the Mathematical skills of a learner. If we

can compare the new topics and the above definition of Mathematical modelling, one can see the reason for the curriculum designers to add the topics that they added in Mathematics curriculum. More - over, the CAPS document explains that “Mathematical modelling provides learners with the means to analyse and describe their world Mathematically, and so allows learners to deepen their understanding of Mathematics while adding to their Mathematical tools for solving real-world problems” (Department of Basic Education, 2011:8; DoE, 2003:10).

The curriculum designers try their best to match the topics of Mathematics with the curriculum framework. In order for this model approach to occur, there are certain characteristics which are the nature of Mathematics, the nature of problem solving, the nature of teaching, the nature of experts and the nature of learning. The following table provides a comparison between the traditional versus the modelling approach regarding these characteristics.

Table 2.1 Traditional versus modelling approach

	Traditional Perspective	**Modelling Perspective**
Nature of Mathematics	The objectives of instruction are stated in the form: *Given ... the student will...* That is, knowledge is described using a list of mechanistic condition-action rules (definitions,	Knowledge is likened not to a machine, but to a living organism. Many of the most important *cognitive objectives* of mathematics instruction are descriptive or explanatory systems (i.e.,

	facts, skills) some of which are higher order metacognitive rules for making decisions about (i) which lower level rules should be used in a particular situation, and (ii) how lower level rules should be stored and retrieved when needed.	mathematical models) used to generate predictions, constructions, or manipulations in real life problem solving situations or whose underlying patterns can be explored for their own sakes.
Nature of Problem Solving	In general, problem solving is described as *getting from givens to goals when the path is not obvious*. But in Mathematics classrooms problem solving is generally restricted to answering questions that are posed by others, within situations that are described by others, to get from givens to goals that are specified by others,	Important aspects of real life problem solving involve developing useful ways to interpret the nature of givens, goals, possible solution paths, and patterns and regularities beneath the surface of things. Solutions typically involve several "modeling cycles" in which descriptions, explanations, and predictions are gradually refined and

	using strings of facts and rules that are restricted in ways that are artificial and unrealistic. In this way, students' responses can be evaluated by making simple comparisons to the responses expected by the authority (the tutor).	elaborated. Therefore, several levels and types of responses are nearly always acceptable (depending on purposes and circumstances); Students themselves must be able to judge the relative usefulness of alternative models.
Nature of Experts	Humans are characterized as information processors; outstanding students (teachers, experts) are those who flawlessly remember and execute factual and procedural rules - and who are clever at assembling these facts and rules in ritualized settings.	Experts are people who have developed powerful models for constructing, manipulating, and making sense of structurally interesting systems; they are people who are proficient at adapting, and extending, or refining their models to fit new situations.
Nature of Learning	Learning is viewed as a	Learning involves model

	process of gradually adding, deleting, linking, uncoupling, and debugging mechanistic condition/action rules (definitions, facts, or skills). Therefore, if the precise state of knowledge is known for an expert (E) and for a given novice (N), then the difference between these two states is portrayed as the subtracted difference (E-N)	building, theory building, and system building; and these constructs develop along dimensions such as concrete-to-abstract, particular-to-general, undifferentiated-to-refined, Intuitive-to-analytic-to axiomatic, situated-to decontextualized, and fragmented-to-integrated. So evolution involves differentiating, integrating, and refining unstable systems - not simply linking together of stable rules; it involves discontinuities and conceptual reorganisations - such as when students go beyond thinking WITH a given model to also think ABOUT

		it.
Nature of Teaching	Teaching involves mainly (i) demonstrating relevant facts, rules, skills, and processes, (ii) monitoring activities in which students repeat and practice the preceding items, and (iii) correcting errors that occur.	Teaching focuses on carefully structuring experiences so that students confront the need for mathematically significant constructs, and responses involve constructing, refining, integrating, or extending relevant constructs.

Source: Lesh (2012:92)

If we compare the characteristics of both the traditional and model perspectives, one can see that this model approach is very complex. Developing a curriculum with a complex set of interrelated goals takes time and input from many people inside and outside education department. Ellis (2012:48) states that, “The most productive focus for reform is on the process rather than the product, because the product is constantly changing in response to changes in society and no one static product meets the needs of a dynamic system”.

The curriculum development process involves three important aspects which are the policy, implementation and the curriculum goals. The curriculum designers design the curriculum and present it in the form of policies which should be implemented by the teachers in the

classroom where performance of the learners reveal the curriculum goals whether they were reached or not. Communication breakdown between the involved people resulted in non-effectiveness of the curriculum. Boris and Herrington (2003:60) state that, “In education, there is frequently a mismatch between the intended, the implemented, and the attained curriculum (Cuban, 1993). The intended curriculum is the one prescribed by policy makers, the implemented curriculum is the one that is actually carried out by teachers in their classrooms, and the attained curriculum is the one learnt by students (Howson and Wilson, 1986). Part of the mismatch is due to the fact that teachers and students work on more limited goals than those proposed by curriculum developers, teacher educators, writers of syllabuses, and textbook authors”.

Education authorities expect more changes to be implemented and expect perfect results or outcomes in a short period of time. The implementers (the teachers) of the curriculum struggle to reach what was expected from them. The reason for the teachers to struggle is that they do not get enough support to reach the goals of the curriculum designers. Clarke (1997) cited in Boris and Herrington (2003:60) identified 12 factors that influence the change process. These factors are: “reform movement in general; principal and school community; internal support personnel; spirit of collegiality, collaboration, and experimentation; grade level team of teachers; innovative curriculum materials; in service program; external support personnel; researcher acting as a participant observant and critical friend; outcomes valued by the teacher; day to day conditions under which teachers work; and teacher knowledge”.

A number of minor adjustments to the content of the NCS Mathematics curriculum were also introduced.

Grade 10:

a) New for trigonometry:

The reciprocal trigonometric functions are introduced.

Derivation of the values of the trigonometric functions for the special angles.

b) New for probability:

Comparison of theoretical probability & relative frequency.

Use of Venn diagrams to assist in solving problems.

Identify mutually exclusive & complementary events.

Use the law P (A or B) = P (A) + P (B) – P (A and B)

Grade 11

a) Geometry - New: Geometry of circles is covered, including tangent theorems.

b) Statistics – New: Bivariate data has moved to Grade 12.

c) Probability – New: Identify dependent and independent events, use Venn diagrams, contingency tables and tree diagrams to solve probability problems.

Grade 12:

a) Geometry – NEW: The geometry of similar triangles is covered, including Pythagorean

Theorem proved by similarity.

b) Probability – NEW: Fundamental counting principles are covered and then incorporated

into probability problems.

c) Algebra – New: Remainder and factor theorem covered.

d) Statistics – New: Bivariate data studied, including scatter plots; regression lines and correlation coefficients".

All the above changes on content, rationale and methodology answer the objectives of this study and the findings of it will appear in chapter five.

2.7 Curriculum reform and teachers' experiences

Teachers have to change from their familiar way of teaching to the new way of teaching. Boris and Herrington (2003:62) state that not only did teachers feel unfamiliar with the content change but they also had to align to a new way of teaching. This new way of teaching involves so many things like CAPS, constructivist notions of teaching and learning, and inclusive education. All these changes confuse so many people since their perception are different. Boris and Herrington (2003:59) are of the opinion that "teachers' beliefs represent implicit assumptions about curriculum, schooling, students, teaching and learning, and knowledge and act as cognitive and affective filters through which new knowledge and experience is interpreted and enacted".

Many researchers complain that in the last twenty years teachers have been swamped with magical instructional recipes such as Outcomes Base Education, Revised National Curriculum Statement, National Curriculum Statement and Curriculum and Assessment Policy Statement (Boris and Herrington, 2003:63). The CAPS challenges teachers to move

to an OBE approach in an extremely short period, as well as to attend to learners who have barriers to learning, in an inclusive classroom (Lessing and de Witt, 2007:56). Boris and Herrington (2003:63) state that many of these innovations represent large-scale changes that were poorly defined in operational terms and without positive gains in student learning.

In addition, these programmes required new roles and teachers' responsibilities that were too demanding (Boris and Herrington, 2003:62). While these changes have allowed teachers some autonomy, they have also caused stress, since many teachers are not adequately equipped with the necessary skills to deal with such changes (Lessing and de Witt, 2007:57).

Prawat (1990) cited in Boris and Herrington (2003:61) affirms that teachers can be either conveyances of or obstacles to change. If the teacher experiences problems to apply what is written in the policy, the teacher resists change and applies the traditional way of teaching. Sinclair and Mckinnon (1987) cited in Boris and Herrington (2003:61) argue that, “aborted reforms affect teachers' morale causing stress, cynicism, burnout syndromes, anxiety, and scepticism”.

Most of the researchers argue that the categories of affect are based on mental systems, and that these mental systems have a crucial influence on all the processes of students’ Mathematics learning and teachers’ Mathematics teaching. Carl (2009:119) argues that, “The rapid pace and top-down manner in which these radical changes have been introduced by the Department of Education without proper consultation with teachers and principals has caused resistance and feeling of discouragement”.

Inadequacy in the reform initiatives by the people in authority can ultimately have a negative effect on student performance, which in turn suggests that teachers need support

to cope with reform. Boris and Herrington (2003:62) state that these reforms were often disseminated using a traditional approach in which teachers presented with a prepared product and a rigid set of procedures to follow. Likewise, Steyn and van Niekerk (2005:126) state that, “Many global reform initiatives have ignored the people involved and concentrated primarily on the system in which they work”.

This means that the curriculum designers did not consider the teachers’ experiences. When they review the curriculum, they concentrate only on what they want to do. Boris and Herrington (2003:62) state that many educational reforms in Mathematics have had a top down approach (Chisholm, 2003:4; Carl, 2009:118; Paulson, 2009:78) that did not take into account Mathematics teachers' experiences and belittle the fact that the ultimate fate of an innovation would seem to depend upon user decisions.

Parker and Deacon (2012:13) state that policy makers need to be able to track how policy was implemented. According to Robinson (2003:23), “If teachers do not identify with the policy and do not have a sense of purpose, passion, and desire, the goals of the policy will surely be undermined.” Robinson identifies four categories in terms of which teachers’ experience of the process of policy reform understood.

Robinson (2003:26) states that, “The first category, ‘personal motivation’, includes personal engagement, ownership, and a positive attitude. A second category connected to teacher educators' experience of policy reform is professional interaction, or ‘communities of practitioners’ who can support the process of redesign and change in the school and classroom levels. The third category is ‘systemic support’, that is to say, change requires a reform supportive infrastructure, effective communication networks and adequate financial resources. The fourth category concerns the global and national social, political, and

economic context, which might help or hinder teacher educator approaches to the challenges of change, and also either sustain or undermine their own personal motivation and commitment".

Robinson suggests that there must be communication between the people in authority and the teachers. Teachers must be supported to implement the curriculum. There must be school visits where those in charge could see that the teachers really apply what was needed and are assisted if necessary. This cannot succeed if those people who visit the teachers do not have adequate knowledge of what should be done. Also resources should be there. Those in authority must not expect miracles to occur.

2.7.1 Policy requirements: CAPS

Educational policy has been developed since 1994 in various documents such as green and white papers. The fundamental policy framework of the Ministry of Education is set out in the White Paper on Education and Training. The national policy initiatives have affected the provision and structure of teacher education. The National Qualification Framework (NQF) was a key tool in transforming the fragmented and unequal system of education and training in South Africa after 1994. According to Mrs Angie Motshekga who is the Minister of Basic Education in South Africa, the Curriculum and Assessment Policy Statement (CAPS) was not a new curriculum but a review of the Revised National Curriculum Statement (RNCS).

Du Plessis (2012:1) views CAPS as a content-based approach. The curriculum designers identified the content that the learners have to learn. They put forward the knowledge and skills that they want the learners to achieve to become better citizens of the future. Du Plessis (2012:1) views CAPS as an adjustment to what we teach

(curriculum) and not how we teach (teaching methods). The methods of implementing the curriculum depend on the teacher because s/he is the one who knows his/her learners better than everybody. Most of the teachers understand what is written in the CAPS document but in fact teachers still seem to struggle to apply their knowledge and experience in practice. It seems as if what is inside the policy is difficult for the teachers to practice inside their classrooms. Hargreaves, Sayed and Jansen (2001) cited in Jansen (2002:118) refer to this as a "dislocation between policy vision and practical realities in schools and classrooms which remains a problem". This study acknowledges the above discussions because it shows the teachers' experiences in the implementation of the CAPS curriculum.

2.7.2 Policy imperatives (Norms and Standards of Education)

The second national initiative, the Norms and Standards for Educators (NSE) meant that "providers of teacher education had to interpret the seven roles of educators as aspects of a whole rather than seven individual functions that had to be taught and assessed separately" (Kruss, 2009:21). These seven roles are based on the constructivist theory, which acknowledges that the teacher is not a transmitter of knowledge, but rather a facilitator and provider of experiences from which learners will learn. Similarly, learners are not absorbers of knowledge, but active participants in constructing their own meanings, based on strongly held perceptions.

The Norms and Standards for Educators in South Africa were intended to impact on how the curriculum is translated into practice. It provides indicators of what orientation programmes should focus on in relation to the curriculum. According to the Department of Education (2002:38), the policy describes the roles, their associated set of applied

competencies (norms) and qualifications (standards) for the development of educators. The policy is designed to guide the on-going education and training of educators including both pre-service and in-service education and training, and is the over-arching term for three interconnected kinds of competence – practical, foundational, and reflexive.

Practical competence is the demonstrated ability, in an authentic context, to consider a range of possibilities for action, to make considered decisions about which possibility to follow, and to perform the chosen action. The teachers must have a sound knowledge of the principles that guide good teaching practice, use these principles to design effective learning experiences, reflect on what they do, and change their practices according to what they learn from their experience. A number of discrete practical, foundational, and reflexive competencies were identified for each of the seven roles.

Teachers would therefore not be able to improve their effectiveness in terms of teaching and learning because of their lack of knowledge of these seven roles. Teachers might, however, obtain more knowledge concerning these roles by implementing them in an integrated way rather than treating each role as an isolated entity. Furthermore, grassroots conditions in schools and the capacity of the newly formed teacher education departments in universities were not taken into consideration. According to the Organisation for Economic Co-operation and Development (OECD, 2009:297), “The top-down approach of policy, a compressed time scale and in adequate preparation and resources have given rise to a situation in which teachers and teacher educators are often forced to resort to shallow coping with the new policies and their requirements”.

Policies such as the Norms and Standards for Educators spell out the official expectations with regard to the roles of teachers vis-à-vis the new curriculum but they seem to ignore factors such as specific context in identity construction and how teachers' identities link with successful maintaining of policy. The above-mentioned character traits should be considered to align policy with practice, and to draw up education programmes that teachers can identify with. Moletsane (2002:323) believes that South African teacher education has been inadequate because of a lack of focus on teacher identities. She also criticises the Norms and Standards for Educators on the grounds that these regulations limit the extent to which innovative and responsive programmes can be developed, and ignore the diverse life histories and contexts of teachers.

Harley, Barasa, Betram, Mattson and Timm (2000:78) suggest that it is impossible for every teacher to perform every role, and ascribing roles to individuals ignores the role of schools as organisations and cultures with their own divisions of labour. The role, which states that as a learning mediator, teachers need to be critical about what is taking place in their own classrooms is an example. The above role means that teachers need to be sensitive to the diverse needs of learners, and try to break the impediments that make learners unable to write, to read, or to grasp the content of the learning area. This is difficult for the teachers in the Further Education and Training phase, especially in the Mathematics subject because the learners select the subjects of their own choices in grade nine. Most of the time those subjects that they selected are not the subjects that they master but the subjects that they want to study. The teachers are not allowed to choose the subjects for the learners. This is illegal. Sometimes, even if the teacher advises the learner to change the subjects the learners refuse. According to Harley *et al*

(2000:79), teachers' roles are socially defined and cannot be prescribed by policy unless they can apply policy in a reflexive and developmental way; the policy becomes a way of regulative policing.

From this statement, one can assume that there is a gap between the roles teachers have to engage in, and their identities. In the apartheid era, teachers' identities were formed by powerful bureaucratic and political compliance with state education. Jansen (2001:243) states that teachers in the democratic ideal are expected to be knowledge producers, to take charge of their own classrooms, and to initiate discussions, empower learners and apply constructivist notions of teaching and learning.

Jansen (2002:119) states that policy pronouncements often require role changes, which conflict with teachers' professional, emotional, or political identities. Some teachers understand the policy, but mistakenly adopt one or more of these roles exclusively, instead of integrating all the roles to develop a wide range of competencies that they can draw from at appropriate times, to enhance their practice. Jansen (2002:118) argues that a major reason why we are unable to bridge the distance between policy and practice is that policy images conflict with teachers' identities as practitioners.

This assumption is strengthened by what Hargreaves and Sayed (1998) cited in Jansen (2002:118) refer to as "a dislocation between policy vision and practical realities in schools and classrooms", which remains a vexing problem. Many teachers understand what the Norms and Standards entail, but cannot manifest this understanding in practice (Harley *et al*, 2000:88). Some of the teachers understand what is written down in the policy documents but find it difficult to apply because the learners in the same classroom have different abilities especially in Mathematics. Berkhout *et al* (2010:254) argue that,

“In terms of teacher training, the seven roles, and the related competences impose unrealistic demands on beginner teachers. The above discussions are pertinent to this study because they show the experience of teachers in their teaching and learning.

2.8 Chapter summary

In this chapter the researcher has reviewed the literature on teachers’ experiences of curriculum as a composite whole including the teacher, learner, teaching and learning methodologies, anticipated and unanticipated experiences, and outputs and outcomes possible within a learning environment (Chikumbu and Makamure, 2000:12). The following chapter provides the theoretical framework that underpins the study.

CHAPTER 3

THEORETICAL FRAMEWORK

3.1 Introduction

The previous chapter reviewed the literature correlates with this study. This chapter provides the theoretical framework that underpins the study. Swanson (2013:1) defines the theoretical framework as “a structure that can hold or support a theory of a research study. The theoretical framework introduces and describes the theory that explains why the research problem under study exists”.

This study addresses the relation between the existing practices of school Mathematics teaching and curriculum requirements. Theoretical frameworks are important in exploratory studies, where somebody really does not know much about what is going on, and is trying to learn more (Swanson, 2013:2).

Truths and the full complexity of life cannot be captured by a single theory, and theory is useful when it can provide a set of organised principles that together with contextual knowledge can generate insights into specific situations (Swart and Pettipher, 2005:9). Theories help teachers to conceptualise learning communication, promote interpersonal relationships between teachers and learners, and help teachers to implement professional ethics. This study utilised the Realistic Mathematics Education (RME) and the constructive perspective and these are further explained and justified below. RME and the constructive perspective were utilised in order to explore the teachers’ experiences of the implementation of CAPS in the FET phase.

3.2 Realistic Mathematics Education (RME)

This theory is relevant to the study because it emphasises an interaction between the teacher and the learner in Mathematics within the classroom. Freudenthal (1983) cited in Paulson (2009: 15) state that this approach was applied in 1971 with the view about Mathematics, how is Mathematics learn and how should Mathematics be taught.

Freudenthal (1983) cited in Paulson (2009:15) states that RME puts forward two views, firstly, that Mathematics is connected to reality and, secondly, that Mathematics is a human activity. A major challenge to people is that Mathematics is concerned with numbers and "solving for x" which is nothing to do with real life. According to them, this "solving for x" does not concern human activity. The teacher must enlighten the learners that Mathematics is concerned about reality in the form of numbers and that Mathematical problems focus on human matters.

Freudenthal (1983) cited in Paulson (2009:15) states that, "The second view of Mathematics as a human activity emphasises the organisation of Mathematics education as a process of guided reinvention through mathematisation, where learners can experience similar processes compared to the processes by which Mathematics was invented". This second view of Mathematics describes the way of equipping learners with Mathematics that encourages active participation and a critical approach to learning rather than rote learning. The researcher acknowledges this second view because together with the constructed knowledge it can generate insight into teachers' experiences on the implementation of the Mathematics CAPS curriculum.

There are two types of mathematisation. These types are horizontal and vertical mathematisations. Paulson (2009:37-38) argues that, "Horizontal mathematisation involves

the process of using real life experiences to enter into the world of Mathematical symbols whereas vertical mathematisation describes the movement within the world of Mathematical symbol".

From the RME perspective, students are seen as re-inventors, with teachers guiding and making conscious to students the mathematisation of reality, with an eye to encouraging students to reflect on the process. The learner solves a Mathematical problem on his/her own using the Mathematical skills that s/he observes from the teacher to come up with a solution. The CAPS curriculum document enforces the process of mathematisation, which enables the learner with high knowledge and high skills to become independent of the teacher. The process of guided reinvention gives the relation between the existing practices of teaching and the CAPS curriculum requirement of implementing the Mathematics.

Gordon (2009:39) states that learners are not absorbers of knowledge, but active participants in constructing their own meanings, based on strongly held perceptions. The teacher does not solve all the problems; also the learners are responsible for participating actively by reproducing what they learn. This is the third principle of OBE, which encourages the teacher to have high expectations for all learners. High expectations cannot be effective without guiding the learner to achieve significant outcomes to high standards. The process of guided reinvention, which is the instructional guidance by the teacher supported by students' engagement in problem solving, group work, and an individual activity, play a crucial role in teaching and learning.

3.2.1 Starting in reality

The starting point of any instructional sequence should involve situations that are experientially real to students so that they can immediately engage in personally meaningful Mathematical activity (Gravemeiijer, 1990 cited in Paulson, 2009:16). Such problems often involve everyday life settings or fictitious scenarios, although Mathematics itself can also serve as a context of interest. The researcher acknowledges that the RME maintains that reality plays a pertinent role in Mathematical activity. If reality is not included in Mathematical activity, then the knowledge of Mathematics is associated with non-living organisms.

3.2.2 Identifying the learning lines

A second tenet of RME is that “The starting point should also be justifiable by the potential end point of a learning sequence” (Encyclopaedia Britannica, 2012:2). In order to reach the outcomes, thorough planning is needed which includes the key features and resources of the domain necessary for the students to discover, construct for themselves, and relating them in the process of learning. The starting points for a domain continue to function as paradigm cases that involve rich imagery and increases abstract activity. The informal Mathematical activity should result in formal Mathematical concepts. This tenet encourages listening skill from the start and identifying of important facts which the learner is going to use to reinvent Mathematical problems independently to reach the outcomes. Through this process, the teacher is implementing the CAPS curriculum.

3.2.3 Interconnectivity

The third tenet of RME is based on “the observation that real phenomena is which Mathematical structures and concepts manifest themselves lead to interconnections within and between content strands as well as connections with other disciplines (e.g., biological sciences, physics, sociology, and so on). Although the maps developed for each of ten different main content areas, or topics, contain unique terms, representations, and procedures, instruction in actual classrooms inevitably involve the intertwining of these topics” (Paulson, 2009:17). The learner in this tenet integrating the concepts within the Mathematics contents and comes up with a proper solution and integrates what s/he learns in Mathematics with what s/he learns in other subjects.

3.2.4 Students’ creation of Mathematical models

RME’s fourth tenet is that instructional sequences should involve activities in which students reveal and create models of their informal Mathematical activity (Encyclopaedia Britannica, 2012:1). Gravermeijer (1994) cited in Paulson (2009:17) argues that “RME’s heuristic for laying out long learning lines for students involves a conjecture about the role that emergent models play in the students’ learning, namely that students’ models of their informal Mathematical activity can evolve into models for increasingly abstract Mathematical reasoning”. Gravemeijer explained this bottom-up progression with four levels of progressive mathematisation. It is bottom-up because the learners construct models for themselves through the guidance of the teacher.

3.2.5 Interactive instruction

RME’s fifth tenet is that in classrooms the learning process can be maximised when it occurs within the context of interactive instruction. According to the Encyclopaedia

Britannica (2012:1) the teacher's role in the RME instructional process involves capitalising on students' reasoning and continually introducing and negotiating with students the emergence of shared terms, symbols, rules, and strategies, with an eye to encouraging students to reflect on what they learn.

3.2.6 Levels of reasoning

The responsibility for promoting students' understanding cannot rest entirely on the teacher's ability to respond to "teachable moments" as students engage in rich Mathematical activities. Curriculum-embedded prompts and questions can also facilitate the development of students' understanding. The different levels of questions can be characterised as follows:

Level 1: Reproduction, procedures, concepts, and definition

De Lange (2014:14) states that "This level deals with knowing facts, representing, recognising equivalents, recalling Mathematical objects and properties, performing routine procedures, applying standard algorithms, and developing technical skills, as well as dealing and operating with statements and expressions containing symbols and formulas in 'standard' form".

Level 2: Connections and integration for problem solving

At this level, students start making connections within and between the different domains in Mathematics, integrate information in order to solve simple problems, and have a choice of strategies and a choice in the use of Mathematical tools. At this level, students are also expected to handle different representations appropriate to the

situation and purpose and need to be able to distinguish and relate a variety of statements.

Level 3: Mathematisation, Mathematical thinking, generalization, and insight

De Lange (2014:15) argues, “At this level, students are asked to Mathematise situations, recognise, and extract the Mathematics embedded in the situation and use Mathematics to solve the problem, analyse, interpret, develop models and strategies, and make Mathematical arguments, proofs, and generalisations”.

3.2.7 Assessment

It is worth emphasising that the content and reasoning goals are consistent with its assessment programme. Assessment tasks need to reveal to teachers the representations, strategies, and assumptions students make when solving problems. Teachers who desire to teach for students’ understanding recognise the need for a broader perspective of classroom assessment, as articulated by the principles.

The above tenets of the RME theorem describe the way of teaching Mathematics inside the classroom to reach the goals of teaching and learning of Mathematics. These are the micro-implementation of Mathematics in a particular classroom. This theorem develops learners with the knowledge, skills, and values that are needed for self-fulfilment, and meaningful participation in society as citizen of a free country (DOBE, 2011:4). This means that the teacher is preparing the learner for life and giving him/her access to a basic human right. In order for the teacher to implement the curriculum effectively, the application of this theory is needed.

3.3 Constructivism theory

This theory is relevant to the study because the aim is to understand how teachers taught learners to actively construct new ideas and derive meaning from those ideas, which they constructed on their own. The literature expounds many types of constructivism some of which are the formativists, integrated environmentalists, and the problem-solving models (Ernest, 1995 cited in Paulson, 2009:21). The current Mathematics education reforms supporting a constructivist perspective suggest that active learning processes must occur in the classroom. For example, Mathematics in the CAPS document, while not adopting an explicit constructivist position, states that "The National Curriculum Statement Grades R-12 is based on the principle of encouraging an active and critical approach to learning, rather than to rote and uncritical learning of given truths" (DOBE, 2011:4).

All the constructivisms embrace the basic principle of the active role of learning. Learning is transferred onto the learner's cognitive structures through the social interaction between the learner and teacher. The learner's prior knowledge and learning environment are important for this process of learning. The learners use their senses to observe and experiment (Davis, 1990 cited in Paulson, 2009:20) and then they actively create, interpret and reorganise knowledge in individual ways (Gordon, 2009:39, 48). An active learning activity can foster either active mental experiences or passive mental experiences, just as a passive learning activity can foster either active mental experiences or passive mental experiences.

It is crucial that the active nature of learning encouraged by the CAPS document is aligned with active mental experiences which result in strong acts of construction if

learners are to achieve the desired Mathematical understanding (Herrington, 1990 cited in Paulson, 2009:20). The major problem facing the use of active learning activities in secondary schools is the tendency by most of the teachers to believe that active learning activities always promote active mental experiences. Hennessy (1993) cited in Paulson (2009:20) comments that few teachers of today's classrooms encourage pupils to perceive what they are doing as the construction of knowledge. Many Mathematics learners think that to be successful in class they do not need to create and operate on meaningful mental constructs: they merely need to learn to follow the teacher's instructions (Cobb, Wood, Yackel and McNeal, 1992 cited in Paulson, 2009:20)

In the process of active role the learners use prior knowledge and resources in their environment to construct Mathematical knowledge (Paulson, 2009:23). Von Glasersfeld (1993:33) cited in Paulson (2009:23) called this the first principle of constructivism. When the teacher is using this theory, s/he is training his/her learners to be able to form their own methods of solving Mathematical problem. The above discussions are pertinent for this study and do concur with the research question which asks how far has CAPS influenced Mathematics teaching and learning.

3.3.1 Learners' prior knowledge

Everything that the learner learns in the classroom should be kept in his/her mind to use later. The learner connects his/her prior knowledge to a new topic in order for him/her to remember the new concepts. Vygotsky (1978) cited in Paulson (2009: 24) called this the Zone of Proximal Development (ZPD). Vygotsky (1978) cited in Paulson (2009:24) defined the ZPD as the difference between what a learners can do using his prior knowledge without help and what s/he can do with the help from a teacher or more

knowledgeable peers. Vygotsky's theory takes a constructivist perspective of the social environment as a facilitator of development and learning.

A teacher can guide learners by asking focused questions that can enable the learners to fill the knowledge gaps that they may have. Vygotsky (1978) cited in Paulson (2009:24) called this scaffolding. Based on the correct assessment of learners' prior knowledge the teacher can set structured or unstructured activities that can enable learners to manipulate, investigate, reason and make explorations that may lead to the construction of important Mathematical relationships and principles. Once this is done incorrectly, it causes some problems in the implementation of the curriculum. The above discussions are pertinent for this study and do concur with the constraints that might be affecting the effectiveness of the implementation of the Mathematics CAPS curriculum.

3.3.2 Learning environment

The learning environment concerns people or the areas that are conducive for learning. The responsibility for learning is located in the learners themselves and not primarily with the teacher. Paulson (2009:25) states that learners, as constructors of Mathematical knowledge are members of a socio-cultural group from which they draw innumerable resources and invaluable direction. Ferguson (2005:1) is of the opinion that "Group members can contribute more to a learner's understanding than what an individual learner is capable of". In encouraging classroom environments that foster learner autonomy, Resnick (1996) cited in Ferguson (2005:1) states that "cognition and intelligence are not properties of an individual learner but rather arise from interactions of a person with the surrounding environment (including other people and artefacts)".

Classrooms in which learners can communicate their point of views on how to solve Mathematical problems can provide them with rich opportunities to explore, test, experience, negotiate, and argue to defend their positions. In ideal constructivist learning environments, the teacher is a facilitator or a senior learner who ensures that all learners are given equal opportunities to experiment with ideas around their current understanding. The above discussions are pertinent to this study and they concur on how far CAPS has influenced the teaching and learning of Mathematics.

3.4 Chapter summary

In this chapter, the researcher provided particular Mathematical perspectives, which are Realistic Mathematics Education and the constructive perspective, through which to examine the relation between the researcher's topics and these perspectives. The next chapter provides the research design and the methodology that underpins the study.

CHAPTER 4

RESEARCH DESIGN AND METHODOLOGY

4.1 Introduction

The previous chapter discussed the theoretical framework of the study. This chapter discusses the research design as well as the methodology of the study. This study was designed to explore the teachers' implementation of the Mathematics CAPS curriculum to help to understand its relation to the variation in student learning gains, if any. This study takes us beyond the scope of other studies to gain a better understanding of the influence of teachers' experiences on the implementation of the curriculum, which has an impact on student performance. In this chapter the researcher is going to explain the following: research paradigm, research design, research approach, population, sample, sampling techniques, data collection, research instrument, data collection procedure, data analysis, validity and reliability and ethical measures.

4.2 Research paradigm

Berkhout *et al* (2010:33) defines 'paradigm' as a set of beliefs and practices that guide a field and represent the worldview that defines for its holder the nature of the 'world', the individual's place in it and the range of possible relationships to that world and its parts. According to Babbie and Mouton (2001:645), a paradigm is a model/framework for observation and understanding, which shapes both what we see and how we understand it. The paradigm serves as a guide to the investigation. Therefore, a research design or plan cannot be isolated from the researcher's paradigmatic perspective on the world of research.

The purpose of research and how it will be conducted are all influenced by the researcher's paradigmatic beliefs. Paradigms as basic belief system are based on ontological, epistemological and methodological assumptions (Guba and Lincoln, 1994:107). When defining a paradigmatic perspective as a researcher, the interplay between the ontology, epistemology, the research question, meta-theoretical underpinnings and methodology become prominent (Mason 2002:59). How we think the social world is constituted is our ontology and shapes how we think we can know about it. Conversely, the way we look, which is the epistemology and methods we use to search for that knowledge, is the methodological paradigm. According to Kuhn in Hatch (2002:498), four research paradigms may be identified, based on the argument that schools of scientific thought reach paradigm status. The following table represents the different types of paradigms as well as the ontology, epistemology, methodology and the product of each paradigm.

Table 4.1: An illustration of different research paradigms (Hatch 2002: 498)

Paradigm	**Ontology** **Nature of reality**	**Epistemology** **What can be known**	**Methodology** **How knowledge is gained**	**Product: Forms of knowledge produced**
Positivist	Reality is out there to be studied, captured and understood	How the world is really ordered, knower is distinct from the known.	Experiments, quasi-experiments, surveys, correlation studies	Facts, theories, laws and predictions

Post positivist	Reality exists but is never apprehended	Approximation of reality, researcher is data collector.	Rigorously defined qualitative methods frequency counts, low level statistics	Generalisations, descriptions, patterns, grounded theory
Constructivist	Multiple realities are constructed	Knowledge as a human construction, researcher and participant construct understandings	Naturalistic qualitative methods	Case studies, narratives, interpretations, reconstructions
Critical/Feminist	The apprehended world makes a material difference in terms of race, gender and class	Knowledge as subjective and political. Researcher's values frame of enquiry.	Transformative inquiry	Value mediated critiques that challenge existing power structures and promote resistance

Paradigm is the central part of the research design because both of them are concerned with the nature of the research question and on the manner in which the research question is to be studied.

On the basis of the main and sub-research questions, this hermeneutic study employed an interpretive and constructivist paradigm. According to Piper and Stronach (2004:31) hermeneutics begins with the premise that the task of researchers in the human sciences is to understand the others. Piper and Stronach, (2004:32) consider that understanding requires that one has objective knowledge of which there is scientific grasp and which is based on dichotomous thinking (Piper and Stronach, 2004:33).

The interpretive paradigm highlights a new interpretation of the existing text as the researcher had prior knowledge about the study since she has been in this field for several years thus the researcher provides the meaningfulness of human action and thinking. A constructivist paradigm assumes that knowledge is socially constructed by people and this has implications for their lives and, through their interactions, for the lives of others. In this research, the main concerned is the reality of implementation of Mathematics CAPS curriculum in FET schools.

In an interpretive paradigm, the ontological dimension acknowledges that internal reality consists of the subjective experiences of individuals, and that lived experiences should be considered. From the perspective of a constructivist paradigm, the ontological dimension accepts that multiple realities are constructed. The ontological perspective of this study acknowledges that the perspectives of the teachers exist as a result of subjective experiences and socially constructed realities and that lived experiences should be considered (Terre Blanche, Durrheim, Painter, 2006:6) and those perspectives are different

from one another. The teacher shares his/her knowledge by exploring his or her practices and experiences.

In an interpretive paradigm, the epistemological dimension maintains that understanding is gained through interaction and empathetic listening. The constructivist paradigm considers that knowledge is constructed by the observers by asking what kind of things people do, how they do them, what purposes activities serve and what they mean to them. In the epistemological perspective of this study the researcher become interested in meanings, symbols, beliefs, ideas and feelings given or attached to objects or events, activities and others by participants in the setting (Bailey, 2007:53).

The methodological dimension from the interpretive paradigm relies on the subjective relationship between the researcher and the participants. In the constructivist paradigm, naturalistic qualitative methods are used. The researcher attempts to find the meanings attached by teachers, to the phenomenon of teachers' experiences of the implementation of the Mathematics CAPS curriculum in FET. In this inquiry, the researcher describes the lived experience of participants as revealed through individual interviews.

4.3 Research approach

There are two modes of enquiry to research; these modes are quantitative and qualitative approaches. According to Macmillan and Schumacher (2010:15), quantitative research presents statistical results with numbers; qualitative research presents data as a narration with words. A qualitative research approach was appropriate for this study because the aim was to understand and describe teachers' practices and experiences on the implementation of the Mathematics CAPS curriculum, which is a social phenomenon that includes ideas, thoughts, and actions (Macmillan and Schumacher, 2010:396).

This study concerns human action from the perspective of the participants, thus the qualitative research approach is useful for it (Macmillan and Schumacher, 2010:15). Human emotions or experiences are not easy to quantify or assign numerically; therefore, a qualitative approach is appropriate. This study involves implementation of the curriculum and, in order for the implementation of the curriculum to be effective, the development of policy and the development of the implementing agents of the curriculum (the teachers) are also needed, so the social interaction between the curriculum designers and the implementing agents is included in this study.

4.4 Research design

According to Macmillan and Schumacher (2010:30-31), “A research design describes the procedures for conducting the study, including when, from whom, and under what conditions the data will be obtained”. Yin (2003:21) states that research design is a blueprint or a detailed plan of the method which one intends to use to conduct a research.

There are five interactive modes of inquiry, which are ethnography, phenomenology, case study, grounded theory, and critical studies (Macmillan and Schumacher, 2010:35). This study sought to identify how far has CAPS influence the Mathematics curriculum. In addition, how do the teachers’ experiences affect the implementation of the new Mathematics curriculum? The researcher adopted a case study and the approach was a qualitative approach. This is because Yin (2003:1) states that, “Case studies are the preferred strategy when ‘how’ or ‘why’ questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real life context”. Similarly, Macmillan and Schumacher (2010:397) state that, “most

qualitative questions focus on analytical topics involving the ‘how’ and ‘why’ of a phenomenon”.

Knowledge is acquired socially; therefore, communication between the mediators who play key roles in education reforms as agents of change who work directly with students in the classroom was necessary. In order to conduct this study, the researcher needed to find teachers teaching Mathematics in FET. This search was not easy since there are few teachers who specialised in Mathematics. Moreover, many teachers in Gauteng province resigned in 2014 after the government came up with something that will affect their pensions when they retire. In addition, the teachers are reluctant to participate in the research because they do not want their content knowledge to be disclosed in public.

Since this is a case study, it can act as pilots that generate hypotheses that can be explored and tested further by other researchers (Cohen, Manion and Morrison, 2007:107). As this study was conducted within the five-year cycle of the CAPS curriculum implementation date, it can serve to provide through a richly descriptive narrative a window of evidence for further research and study. Secondly, this study was not only a means to an end but an end in itself. This study was significant in its own right, for it had generated tentative explanations and interpretations of the poorly understood phenomenon of implementing Mathematical curriculum in FET, the findings of which might elicit broader implications for curriculum design and curriculum implementation. Macmillan and Schumacher (2010:398) are of the opinion that “Qualitative research uses a case study design meaning that the data analysis focuses on one phenomenon, which the researcher selects to understand in depth regardless of the number of sites or participants for the study”.

Therefore, the researcher of this study used a case study design since the data analysis of this study focuses on one phenomenon, which is CAPS implementation. The researcher elected to examine and to understand the teachers' experiences in depth regardless of the number of sites, participants, or documents, which could be used for the study. The researcher used an emergent design for choosing sites and participants and beginning data collection in which each decision depends on prior information.

4.5 Population

Macmillan and Schumacher (2010:169) describe population as a group of people who are joined together with the purpose of generalising the findings of the research. The population comprised of teachers in Gauteng province, a geographically small but the most populous province of the South Africa's nine provinces. The target population of this study consisted of teachers in the Sedibeng district municipality, the Ekurhuleni district municipality and the West Rand district municipality.

4.6 Sample

Macmillan and Schumacher (2010:169) state that data was collected from the sample, which represents a population. From this population the researcher selected a sample of nine teachers from three different schools to conduct the research. The design was limited to include only Further Education and Training (FET) phase teachers because the main research question focus on the teachers' experiences of the implementation of the Mathematics CAPS curriculum in the FET phase. The sample schools were located in three districts in the Gauteng Province, namely the Sedibeng, West Rand and Ekurhuleni districts. These district municipalities were very different in terms of socio-economic backgrounds. Table 4-2 indicates the differences in population of all the municipalities of

Gauteng Provinces. Ekurhuleni is the East Rand; Pretoria is included in the City of Tshwane and the Sedibeng (including former Vereeniging and Vanderbijlpark).

Table 4-2 Population of Gauteng by district municipality

Municipality	**Number**	**%**
City of Johannesburg	4 434 830	36.1
Ekurhuleni	3 178 470	25.9
City of Tshwane	2 921 490	23.8
Sedibeng	916 484	7.5
West Rand	820 995	6.7
Gauteng	12 272 269	100

Source: Statistics South Africa, 2011

The above six municipalities of Gauteng are different in poverty rates, which contribute a lot to the education of a learner. The school environment is one of the factors that influence the curriculum implementation (See 2.5.6). The Department of Agriculture (DOA: 2005) gives us a clear picture of the six municipalities of Gauteng. Ekurhuleni District includes a number of mining towns and their surrounding townships. After the job losses on the mines in this District so many people became jobless that resulted in poverty in towns and townships. This did not affect Ekurhuleni District but the whole Provinces of South Africa. Creecy, the Member of the Executive Council (MEC) of Finance in Gauteng Province states that, “Although the percentage of those living under conditions of extreme poverty

has declined, poverty remains a great challenge for the domestic economy and its various regions, especially Gauteng" (Socio-Economic Review and Outlook, 2015: 28). Creecy, the MEC of Finance in Gauteng Province, added that "The African population group had the highest percentage of people living in poverty at 41.1 per cent in 2004, but this declined to 38.7 per cent in 2013. It is the only population group that has shown a decline between the two years. In 2004, the coloured population group was the second highest group of people living in poverty at 26.8 per cent. This increased to 27.8 per cent in 2013. The percentage of people living in poverty remains a concern for policy-makers because it is still relatively high" (Socio-Economic Review and Outlook, 2015: 28). The following table show the distribution of the poverty rate of 2011.

Table 4.3 Poverty measures by province

Province	**Poverty Rate**
Mpumalanga	52.1%
Limpopo	63.8%
Free State	41.2%
Gauteng	22.9%
KwaZulu-Natal	56.6%
North West	50.5%
Northern Cape	46.8%

Eastern Cape	60.8%
Western Cape	24.7%
Total	45.5%

Source: Statistic South Africa (2014:31)

As the researcher stated above that the sample schools were located in three different district municipalities. One of the reasons why the researcher selected these schools is that these three schools are amongst the schools that were trained on the new CAPS. Sampling decisions are made for the purpose of obtaining the richest possible source of information in order to answer the research questions. As stated by Hardon, Hodgkin, Fresle, (2004:57) in qualitative studies researchers aim to identify information-rich cases or informants. Information-rich cases are those from which one can draw information about issues of central importance to the purpose of the research.

The school in Ekurhuleni district municipality was an African school located in an informal settlement. Another school was located in Sedibeng district municipality. Sedibeng area has industries of metal, steel, chemicals and engineering. Most of the people from Eastern Cape Province stay in the mine hostels. The poverty rate in Sedibeng was second highest in the province in 2005, at 39.2% (Gauteng Department of Agriculture, 2005). According to the Gauteng Municipality (2005), the people in this district are characterised by high levels of unemployment, illiteracy, low skills, and ill health. One of my sample schools is located in the town of Vanderbijlpark and this school is a multi-racial school. One of the sample schools is located in Kagiso, which is in the West Rand municipality. This school is a government school and is an African school; it is situated in semi-poor area.

The researcher recognised that even though nine teachers allow for an intensive case research, they by no means represent a significant statistical sample. However, they should provide the deep insights required for the purpose of this study as Cohen, Manion and Morrison (2007:93) note “size depends on the purpose (and style) of the study”. Furthermore if the “findings support the propositions the results may represent a strong start toward theoretical replication” (Yin, 2003:47).

Nine teachers is also a manageable sample for one researcher and provide an adequate opportunity to access in-depth qualitative information. Exploring the uncharted area of CAPS implementation of Mathematics curriculum in South Africa through nine teachers, over a seven months period, will bring to light the difficulties and experiences these teachers experienced with the implementation process of the new CAPS curriculum.

One of the participants was a former facilitator of Mathematics in the Gauteng West District. This district rated number one in almost all the years except 2014 in matric results, in Gauteng and nationally. In 2015 it was number two. This participant was one of the CAPS trainers. She knows the concepts and policies related to CAPS curriculum. The facilitator had information on how the curriculum was implemented in the particular schools as she was working with curriculum processes in the circuit. One of the participants was a tutor of Master Maths for more than 20 years. Master Maths is one of the best professional extra maths tuition programmes at more than 140 centres throughout Southern Africa. Most of the students who achieve the best results in Mathematics attend extra classes at Master Maths. The former facilitator and the other participants started teaching in primary school, as we know that the primary teachers have more patience than secondary teachers do. The last six participants started teaching in secondary school but two of them currently are the deputy principals.

The researcher used a relatively small sample, as she wanted to write in depth across teachers' responses across the different items. This would allow the researcher to analyse teachers' experiences. The selected sample enabled the researcher to generalise about the entire teacher population in the Gauteng.

4.7 Sampling techniques

Qualitative researchers may use different types of sampling. Macmillan and Schumacher (2010:401) state that purposeful sampling incorporates site selection, comprehensive sampling, maximum variation sampling, comprehensive selection, network sampling, and sampling by case type. They added that purposeful sampling, network sampling, and sampling by case type are all types of purposeful sampling.

Patton (1990:169) cited in Macmillan and Schumacher (2010:400) state that "purposeful sampling is the selection of information-rich cases for an in-depth study". The researcher selected participants who would be advantageous to the study. In other words, these samples were chosen because they were likely to be knowledgeable and informative about the specific phenomena the researcher wished to investigate. Macmillan and Schumacher (2010:403) are of the opinion that network sampling is sometimes referred to as snowball sampling because each participant is named by a preceding individual. It is used in ethnographic interviews. Examples of sampling by case type are extreme-case, intensive-case, typical-case, unique-case, reputational-case, critical-case, and concept/theory-based sampling (Macmillan and Schumacher, 2010:403).

The purpose of sampling is for the selection of some elements in a population so that some conclusions about the entire population may be drawn. In this study, the purposive sampling technique was used because teachers were selected on the grounds of different

quality profiles, different schools, different socio-economic backgrounds, and the FET-Band. Macmillan and Schumacher (2010:402) argue that purposive sampling has more chances of obtaining correct information about the study because the participants chosen have the experience of the phenomenon. The researcher selected the nine teachers that would primarily form the units of this study. The criteria that the researcher used include:

- Experience, the participants needed to have different levels of teaching experience,
- Qualification, the participants needed to have different qualifications from a three year diploma upwards, and
- Community standing, the participants needed to be recommended by the community at large.

The nine teachers that the researcher wanted to be part of the study were the teachers who were highly experienced, innovative and thought of as good Mathematics educators by the pupils of the schools and by the communities. This sampling technique would allow the researcher access to individuals, who any reasonable person would assume, would have the ability and expertise to implement the Mathematics curriculum as intended. In doing this, the researcher would focus on the nuance variable of deep understanding, that the researcher wished to explore, and not on the content knowledge, qualifications and years of experience, with respect to classroom enactment.

4.8 Data collection methods

The researcher used various methods to collect data so that methodological triangulation would be possible. This is because the inclusion of multiple sources of evidence allowed

for the development of converging lines of inquiry that could be used to corroborate findings (Yin, 2009:115-116). As soon as the project was approved, the researcher began to collect data.

4.8.1 The research instrumentation

The data collected for this case study was done by means of interviews, and documents analysis, which are two of the three main sources of data collection for qualitative research. Nowadays, it is difficult to do classroom observation, which is the third source of data collection. The researcher has to consult the political parties also in order for him or her to conduct a study. The researcher used the following techniques to collect data.

4.8.1.1 The interviews

Qualitative interviews may take several forms: the informal conversational interview, the interview guide approach, and the standardised open-ended interview (Macmillan and Schumacher, 2010:443). The interviews conducted with the nine respondents were used to pursue the research questions in a flexible manner as well as acquiring further information that pertained both to the purpose of the study and the rich-descriptive write up of the case study. The interview schedules were semi-structured and as such allowed scope and exploration with open-ended questions.

Additionally, the open-ended questions allowed for flexibility during interviews in terms of pursuing responses that were relevant, different, or unexpected. Cohen *et al* (2007:255) argue that, “It is the open-ended responses that might contain the ‘gems’ or information that might not be caught up in the questionnaires as they can catch the authenticity, richness, and depth of response, honesty, and candour which are the hallmarks of qualitative data”. The questions that inferred the researcher’s feelings

were avoided by doing so the researcher allowed for more truthful responses from the teachers in terms of why they were doing and feeling as they did.

The intention of the researcher was to audiotape the interviews but once the researcher noticed that the tape recorder distracted the process or became the focus point, the researcher stopped using it. The researcher recorded all the replies of that participant manually and verbatim. The researcher continued using the tape recorder in other sessions. The interviews amounted to 25 minutes for each participant. The interviews were does in April. They were delayed because of teachers' reluctance to participate in research, strikes occurred in Gauteng and because of ethical requirements (a form needed to be signed by each participant before the session start, an approval letter from the Head Office to inform the principals of the teachers needed to be participants).

4.8.1.2 Documents reviews

Documentation was also used as one of the data collection techniques. The documents that the researcher used were the Curriculum and Assessment Policy Statement (CAPS) document for Mathematics, the Teachers' Handbook for Mathematics, and the Learning Program Guidelines. The school and staff timetables and any documentation pertaining to staff development in the Mathematics department were additionally perused.

The strength of using documentation as a data collection tool was not only that it further enabled triangulation through corroboration and augmentation (Yin, 2003:35) but also that the above said documents were independent of the "whims of human beings whose cooperation was essential for collecting data through interviews and

observations" (Merriam, 2002:13). Having stated that, it is important to acknowledge, however, that teacher cooperation was still essential in acquiring the documents, but less so in the analysis of the data contained therein.

As a final instrument, a researcher's journal was also kept in order to further enhance the data collection. The researcher used it to reflect upon her daily observations, noting new ideas, difficulties, mistakes, confusions, and breakthroughs that she had made. The journal also enabled her to identify her extant and emerging subjectivities and in so doing, monitored them to reduce subjectivity in the analysis process. The nature of the data collected was word, images and categories, which were sorted, coded, and stored in a systematic recording methods.

4.8.2 Data collection procedures

After receiving the ethical form from the university, the researcher wrote a letter to ask for permission to have access to schools which she wished to use in the study. The letter was directed to the director of Knowledge Management and Research Directorate (KMR) in the Gauteng Department of Education (GDE). The researcher filled in the Gauteng Department of Education Research Request form (Annexure A) which was designed to ensure that all applicants provided the GDE with all relevant details pertaining to the research study to be undertaken (Guide for Conducting Research in GDE Institutions, 2012:3). In those forms the declaration by the researcher and the declaration by the supervisor were included.

The researcher and the supervisor signed the declaration forms from the GDE to authenticate the information provided and to agree to abide by the conditions as prescribed by the GDE. The research coordination entity provided all the relevant

documents before the researcher was granted access to the schools as required. Those relevant documents were: the semi-structured interview schedules which were intended to be used, the research proposal, the ethical clearance form, the application form and the application letter. The Knowledge Management and Research Directorate checked whether all the information in those documents was in line with the research question.

This procedure was done for almost a month; there after it was approved. The researcher took the approval letter to the district office and two letters were taken to each school, one to the principal and another to the chairperson of the School Governing Body (SGB). The plan was to interview three teachers and a principal in each school but, because no one was forced to take part, the researcher ended up collecting data from nine teachers in three different schools. Participants were given informed consent forms to sign before interviews were conducted.

On arriving at the first school to begin the fieldwork, it was difficult to gain access to conduct the interviews. It was difficult to meet the principal of school number one to explain the reason for the visit. The school was a private school with many black teachers and only two coloured ones. The learners of the school are only Africans. In the administration they took the researcher to the Head of Department of Physical Science who was there during the holidays with some students of Physical Science. She told the researcher that she is teaching Mathematical Literacy. She asked the researcher to come on the opening day to meet the Mathematics department teachers.

When the researcher came back, the teachers were not there, not even the Head of Department. At the administration they told the researcher that they knock off by 14:30. The Head of Department called the researcher to come again on Friday in the same

week. During the holidays, the researcher went to the second school on the same day. After speaking with the Head of Department in the first school, the researcher went to the next school. Both of these schools were private schools. The second school was former white school in relatively affluent surroundings with enrolments that are now predominantly black. In the second school, most of the staff members are whites. The principal was enthusiastic and she called for the deputy principal who was busy with his students so that the researcher could explain the research to him. Since it was during school holidays, the deputy principal asked the researcher to come on Monday when the schools opened.

The deputy principal was willing to participate and he assured the researcher that on Monday he would speak with the Mathematics teachers. When the researcher arrived on Tuesday the teacher was ready, and the fieldwork commenced on that day. The first participant was an old woman. The researcher did not use the voice recorder for the first participant because the researcher noticed that she was distracted by it. The researcher wrote down everything. On Wednesday the second participant who was the deputy principal was ready. On Thursday the third participant was ready. So three participants were interviewed in the second school. The interviews in the second school were successful.

On Friday the researcher went to school number three. When the researcher was there, the educator who had agreed to the Head of Department of Science Department to partake in the study had a funeral when the fieldwork was to commence. The Head of Department sent the researcher to the Head of Department of Mathematics to explain the visit. In this school the principal was reluctant and the Head of Department had not discussed the study with colleagues.

Although reassurance was given that research or its results would not be used against them, even where teachers had been informed, and the purpose discussed with them beforehand the teachers become reluctant to partake. The Head of Department in school number three told the researcher that she was going to submit the work schedules to the district office; on the following Monday it was a holiday. The Head of Department asked the researcher to come back on Tuesday, and she promised to wait for the researcher. When the researcher came on Tuesday, every teacher was already out of school. The researcher noticed that they were playing hide and seek. Research at that site did not materialise. Such lack of communication between the Head of Department and teachers served as one piece of information about conditions in the school. These disruptions to the fieldwork presented the researcher with technicalities that needed resolution. The researcher decided to go to other districts.

The researcher spoke with the former facilitator of Mathematics of Gauteng West District. The district is in West Rand municipality. The researcher explained the research to the former facilitator; the former facilitator was not working at that time. The researcher arranges time to visit her for interviews. On the 28th of April, that former facilitator was appointed in a high school in West Rand. The former facilitator spoke with other two Mathematics teachers in her school. In school number four, the interviews materialised and were successful because three participants were interviewed.

At work the researcher is teaching IsiXhosa, which is one of the problems that complicated the data collection process in the sense that the researcher knows the teachers who teach isiXhosa. The curriculum implementation is affected by teaching the subject whereby the teacher did not specialise in it (See 6.3.9). Moreover Mathematics teachers did not want to be “judge” by a language teacher. If the researcher taught

Mathematics, data collection would not be complicated because of cluster meetings. In other schools where the researcher spoke with the principal to use her school, the principal did not call the researcher back. When the researcher phoned the school, they did not allow the researcher to speak with the principal. The researcher is tutoring Mathematics at UNISA. Mathematics is studies by Bachelor of Science students and Bachelor of Education students. Most of the students in the class were Mathematics teachers. The researcher spoke with them during tutorial classes; fortunately for her, she found three teachers of Ekurhuleni municipality who were teaching in the same school. The interviews in the third school also went well.

4.8.3 Data Analysis

The data analysis was conducted throughout the data collection process. In this study the researcher used transcribing, coding, categorising and theming to analyse data. Verbatim conversations were used and the raw data was placed into logical, meaningful categories in order to examine it in a holistic fashion. Peer review throughout the study was used in order to confer thoroughness and credibility to the analysis. This method furthered and developed triangulation during the analysis process, which was necessary for this qualitative inquiry.

Macmillan and Schumacher (2010:603) define triangulation as the “qualitative cross-validation among multiple data sources, data collection strategies, time periods, and theoretical schemes”. The researcher compares different sources in different schools. The participants had different qualifications, different experiences, different backgrounds at various times. In this study the researcher used mostly interviews and policy documents to interpret and analyse data. The researcher compared these different

sources, situations, and strategies to see whether the same pattern keeps recurring. The researcher was doing this to find regularities in the data.

Coding techniques were used to categorise the responses according to the individual points of view. The researcher used the strategy of emerging themes to group the data into units of content. These emerging themes enabled their conversion into meaningful analytical units. Emerging themes were used to refine and revise the data collected. The researcher found that the use of a structured emerging themes served the purpose of data analysis. The themes drawn from the categories were grouped according to the research instrument. The open-ended questions and interviews elicited large amounts of narrative text, which were made more manageable by using a structured coded emerging themes. “This iterative and interactional approach pointed to redirecting the data collection in several instances as it allowed for the testing of emerging concepts, themes against subsequent data” (Macmillan and Schumacher, 2010:468). The codes were guided initially by the theoretical propositions. This methodical approach supplemented the trustworthiness of the findings.

In analysing the data, the researcher followed the four steps advocated by Yin (2003:127) for a high quality case study analysis. Firstly, the researcher began by “Ensuring that she would ‘attend to all the evidence’ so that the interpretations made were not ‘vulnerable to alternative interpretations’. Secondly, where needed and where possible the researcher’s analysis addressed ‘all major rival interpretations’ as a means to ensure and achieve a deep and meaningful understanding of the results. Thirdly, the researcher looked at the ‘most significant aspects’ of the study, the propositions, and how they related to the findings, so that the analysis did not diverge from the actual purpose of the study. Lastly, the researcher used what refers to as ‘prior, expert

knowledge' to develop a rich and descriptive narrative true to the findings" (Yin, 2003:127-128). This 'expert knowledge' included twenty-one years of the researcher's teaching experience in Mathematics.

4.9 Trustworthiness

To ensure valid results, Lincoln, and Guba's (1994:300) model of trustworthiness of qualitative research was used (Cohen *et al,* 2007:139). This model identifies four aspects of trustworthiness, applied to both quantitative and qualitative research, namely credibility, conformability, transferability, and dependability (Cohen *et al,* 2007:139). Trustworthiness was constructed through a factual and truthful report of what the study had revealed, and through the analysis of the various sources of evidence. These sources of evidence were constructed as proof of evidence so that any interested individuals who wish to validate, refute, or construct alternative meanings for the findings (Yin, 2003:109) can trace them. Furthermore, the draft report was given to the director of Knowledge Management and Research Directorate (KMR), the Gauteng Department of Education (GDE), to the schools where the interviews were taken to be reviewed. Active Campaign (2009:1) states that, "Any research worth its weight is concerned with whether what is being measured is what is intended to be measured and considers the ways in which observations are influenced by the circumstances in which they are made".

4.9.1 Credibility

According to Guba and Lincoln (1994:307), credibility in qualitative research is the ability of the researcher to demonstrate a prolonged period of engagement with participants, to provide evidence of persistent observation, and to triangulate by using different sources, different methods and sometimes multiple investigators. To ensure that credibility was

achieved the researcher conducted in-depth interviews with teachers who had been in teaching practice during the introduction of CAPS or before that time. Interviews allowed the researcher to collect more information, after which the participants were able to verbalise their views.

4.9.2 Conformability

Conformability refers to the extent to which findings are free from bias (Guba & Lincoln 1994:318). The researcher disclosed her personal beliefs and biases about the implementation of the Mathematics CAPS curriculum to the participants; and was further self-aware of these beliefs and perceptions throughout the study, as to how they may potentially bias the research process and interpretations drawn.

4.9.3 Transferability

Transferability refers to the extent to which the results of qualitative research can be transferred to other settings and contexts (Guba and Lincoln 1994: 316). Lincoln and Guba (1985) cited in Macmillan and Schumacher (2010:407) state that, “It is not the qualitative researcher’s task to provide an index for transferability; it is the responsibility of the individual who is generalising. The researchers should provide sufficiently rich data for readers and users of research to allow comparison.

4.10 Ethical measures

In this section, ethical issues pertaining to the respondents in terms of permission, informed consent, rights of participants, confidentiality and anonymity were discussed. The main aim was to do well for the research participants and avoid any harm (Macmillan and Schumacher, 2010:420). The right and dignity of the nine participants were respected

during and after the study. The names of the participant will not appear in the analysis and the place where the study was conducted will not appear.

4.10.1 Ethical clearance

The researcher was given approval on 25 February 2015 by the University‘s Research Ethics Committee to conduct her research as from the date of the ethical clearance certificate using the research instrument(s) which she produced for the Research Ethics Committee.

4.10.2 Permission

The researcher applied for permission to conduct research on the 19th of March 2015. Within a week she was collecting all the documents needed. She completed all the documents on the 27th of March 2015. On the 2nd of April 2015 the researcher was granted permission to conduct her study. From the 7th of April 2015 to the 20th of April 2015, the researcher presented the approval letter to the District Office Senior Manager confirming that permission had been granted for the research to be conducted and then she presented the letter to the principals and the chairpersons of the School Governing Bodies (SGB’s) of the three selected schools.

4.10.3 Informed consent

Informed consent was obtained from all the participants as was permission from all the relevant authorities and schools before the fieldwork proceeded. All that informed consent was taken back to the university. Obtaining informed consent implies that adequate information is given about the goal of the investigation and the procedures to be followed during the investigation. The possible advantages, disadvantages and

dangers to which respondents may be exposed, as well as the credibility of the researcher were communicated to potential subjects or their legal representatives. Informing participants was done in a way to encourage free choice of participation (Macmillan and Schumacher, 2010:421).

4.10.4 Confidentiality and anonymity

According to Macmillan and Schumacher (2010:421) confidentiality is a continuation of privacy. Confidentiality refers to agreements between persons that limit others' access to private information (Macmillan and Schumacher, 2010:422). Interviews are commonly seen as 'testing knowledge' or 'revealing some information' during which the self-esteem is judge and have become highly sensitive in nature. It became imperative that the nine teachers in this study understood that the study would not affect their standing in the school or in the teaching profession in any way or that the research would not be used against them. The researcher ensured that their identity would be kept confidential in the report. This confidentiality, however, precluded the research sites, as the researcher had to obtain permission from the principals of these schools to conduct the study. The researcher explained to each participant that the data was being collected for academic purposes and all the information would be treated confidentially. Each new participant in the study was informed about the purpose of the study and was assured of confidentiality and anonymity.

4.10.5 Protection from harm and privacy

The researcher claimed that no harm to participants resulted from the study. Participants would be protected from unwarranted physical and mental discomfort, distress, harm, danger or deprivation (Macmillan and Schumacher, 2010:422). The researcher would

not expose the true identity and personal information of the participants. Additionally it was made clear what the purpose of the study was, the foreseen benefits to them and the researcher and the discomforts that might arise. Such honesty was essential for building a trusting relationship with participants, which was fundamental to this qualitative research.

4.11 Chapter summary

This chapter described the qualitative research design that was employed to study the research questions of the study. The researcher explained the rationale for the research and highlighted the background of the research sites as well as the difficulties encountered in finding willing participants. An overview was also given on the dynamic adaptation of the design as initially thought out and as affected by the realities of actual fieldwork. Ethical consideration and issues of trustworthiness were also accounted for herein. Chapter 5 follows and gives the interpretation and analysis of data as well as the findings on how the teachers have experienced the implementation of the Mathematics CAPS curriculum.

CHAPTER 5

DATA INTERPRETATION, ANALYSIS, AND DISCUSSION OF FINDINGS

5.1 Introduction

The previous chapter describes the qualitative research design that was employed to investigate the research questions of the study. This chapter outlines the findings of the case study. It provides a wealth of data of teachers and schools in one South African province. The purpose of the study was to discover teachers' experiences on the implementation of the CAPS curriculum. The data does provide a clear picture of the education process in Gauteng Province.

The emerging themes from the data generated following the methodological strategy outlined in chapter four were interpreted and analysed. Data was compared with the literature reviewed, which was the point of initiating a literature review in this study. Lastly, the findings were discussed and the findings have been grouped into categories that capture the emerging themes of the case study. The emerging data might point the way to future studies in Mathematics, in particular, as a field, and how it pertains to educational changes of the curriculum.

5.2 Coding

In the interpretation and analysis of the data, the participants were coded as AS1 to CS3, which refers to participant A of school number one to participant C of school number three. Coding techniques were used to categorise the responses according to the individual points of view. This was also done because it was very important to protect each respondent's identity. The actual words of the participants were typed in italics.

5.3 Interpretation and analysis

In an attempt to establish the teachers' experiences of the implementation of the Mathematics CAPS curriculum, the sub-topics of the interviews were fused into three main topics. The first section focuses on the personal information. The second section focuses on the information about the influence on the Mathematics curriculum by CAPS. The third section focuses on the constraints or factors that might be affecting the effectiveness of the Mathematics CAPS curriculum.

Theme 1: Personal information

1. Start teaching,
2. Grades taught,
3. Study curriculum theory.

Theme 2: How far has CAPS influenced the Mathematics curriculum?

1. Difference in Mathematics curriculum,
2. Challenges in teaching,
3. Challenges for learners,
4. Confidence of your learners to compete with the outside world.

Theme 3: The constraints that might affect the effectiveness of the Mathematics CAPS curriculum

1. Development in application of teaching strategies,
2. Empowerment of teachers' professionalism,
3. Involvement in curriculum dissemination,

4. Resources,
5. Difference in learners' performance after the workshops.

5.3.1 Interpretation and analysis of theme one (Personal information)

The sample had more male participants than female ones; 46% of the sample were female participants and 54% of the sample were male participants. One of the participants of the sample was the former facilitator of Mathematics in the Gauteng West Region. This region almost always has number one matric results provincially and nationally. Two participants of the sample are the deputy principals. The following table represents the gender and the teaching experience of the sample.

Table 5.1 Gender and teaching experience

Participant	Gender	Start	Years of teaching	Grades taught
AS1	F	1981	35	8,9,10,11,12
BS1	M	2001	15	8,10,11,12
CS1	F	1994	22	4,5,6,7,8,9,10,11,12
AS2	F	2010	6	8,9,10
BS2	M	2010	6	10,11,12
CS2	F	1992	24	1,7,8,9,10,11,12
AS3	M	2012	4	10,11,12

BS3	M	2000	16	9,10,11,12
CS3	M	2000	16	10,11,12

The participants had teaching experience from four years to thirty-five years. From the responses in Table 5.1, it can be seen that the largest percentages of the Further Education and Training teachers used in the study, had taught for more than six years. This means that in the sample there are teachers who were teaching even before the implementation of Outcome-Based Education. In addition, most of the sample experienced this change, as well as the revision and renew of the curriculum.

55% of the participants in this study have an experience of teaching of more than ten years. This means that 55% of the participants in this study experienced all this change, revision and renewal of the curriculum in South Africa. The Department of Education (2008) states that "It should be noted that the South African education sector has experienced multiple curriculum reviews since 1994, as the school curriculum needed to be revised to reflect the new democratic values and principles contained in the Constitution of South Africa". These participants trained in the old system, so their knowledge of curriculum 2005 up to CAPS is limited. These teachers were not well equipped in their pre-service training for a curriculum that expects more of them than the apartheid curriculum. These are the generation trained before the development of Outcomes Based Education (OBE). These teachers might find it very difficult to implement the CAPS curriculum because their perceptions, values, and beliefs were formed by the Christian National Education (CNE) policy (apartheid curriculum).

Berkhout *et al* (2010:73) states that “the official values stated in the policy documents of the Department of Education during that time claim a Christian character, distinctly different from black or coloured or Indian schools, in order to justify racially separate systems which fitted the apartheid ideology”. The CAPS, for example, requires teachers to adopt a facilitative role in the classroom while the CNE expected educators to follow a rigorous teacher-centred approach in the classroom. The following table shows whether or not the participants studied the curriculum theory in their profession training.

Table 5.2 Study of Curriculum Theory

Participant	AS1	BS1	CS1	AS2	BS2	CS2	AS3	BS3	CS3
Studied Curriculum theory	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Qualifications	BSC	BSC	ACE	BED	BED	ACE	BED	BSC	BED

Only participant A and participant B of school number 1 and participant A in school number 3 did not study curriculum theory. Those participants studied for a Bachelor of Science and specialised in Mathematics then they did a PGCE. Those teachers studied the practice of teaching for one year, unlike those teachers who studied for a Bachelor of Education who did practice teaching for three years. This means that the BSC students lack knowledge and skills in curriculum. The workshops done in their field cannot be enough to help them gain knowledge because they were conducted within a short time. These participants indicated lack of a support structure that deals with curriculum support in schools. In terms of implementation, they need thorough training. The other

six participants in the sample indicated that they studied curriculum theory; some of them indicated that they studied curriculum theory in their advanced certificates. Although they studied it, they did not practice it inside their classrooms. Moreover, the curriculum in South Africa changes now and again. They indicated that if they understand just a little bit of what is needed then that approach is revised or renew which makes it difficult for them to implement those changes effectively inside their classrooms.

Although most of the participants in this study studied curriculum theory in their pre-service teaching, as changes come one after another they seem to be confused. It is difficult for them to apply the changes inside their classrooms. It becomes apparent that these teachers need enough curriculum support and extended time of training by subject advisors. The literature reviewed emphasised that at times of change even the most well adjusted individual or cohesive family or organisation will need extra support. This tells us that, despite the fact that teachers have had their theoretical training, they are often confused when faced with fast changes in their classrooms (Berkhout *et al,* 2010:176; Carl, 2009:118). As a result of the confusion, they were obliged to move back to their original way of teaching and decided to abandon the new method.

5.3.2 Interpretation and analysis of theme two (How far has CAPS influenced the Mathematics curriculum?)

Through the questions of this theme, it was easy for the researcher to find out the disadvantages of CAPS for the Mathematics curriculum. All these changes of curriculum occurred in different socio-economic environments in South Africa. This theme was divided according to the following sub-themes: Challenges for learners, Difference in

Mathematics curriculum, Challenges in teaching, and Confidence about the learners' ability to compete with the outside world.

5.3.2.1 Challenges for learners

Most of the participants complained about the way of thinking of learners in the classroom. The learners seem not to be ready to take responsibility for their own learning activities. They seemed to enjoy a classroom that is teacher-centred. This was evident in the words of AS1 who said, "*The learners have different abilities which take time for the lower ability learners to understand the content as schedule by the work schedule. I have to go to another section whilst most of the students are far behind".* BS1 said, *"The learners do not practice well".* CS1 and CS3 said that, "*Learners have an attitude towards Mathematics that attitude influence their performance".* This was affirmed by AS2: "*CAPS need learners to practice learner-centred approach". BS2 and BS3 said that: "Learners done not want to do geometry".* CS2 said that, "*Learners do not have foundation when they enter FET that thing make lot of challenges for them to understand Mathematics language,* whilst AS3 said that, *"Learners are struggling in Mathematics because they do not try to solve their homework by themselves they want the teachers to solve the problems in the class on the following day".*

In order for a learner to pass Mathematics, the active participation of the learner is needed and s/he needs to practice the activities s/he learns inside the classroom. In chapter three in RME theory the process of guided reinvention was supported by students' engagement in problem solving, a collective as well as an individual activity, in which whole-class discussions which centre on conjecture, explanation, and justification play a crucial role. Also in the tenets of RME mentioned in chapter three

the active participation of learner is needed in order to be able to construct Mathematical models. In the constructivism approach mentioned in chapter three the learner has to experience and observe so that s/he can represent, produce or construct a Mathematical solution through the process of horizontal or vertical mathematisation. In addition, the CAPS document encourages active and critical learning whereby the learner identifies and solves Mathematical problems and make decisions using critical and creative thinking.

5.3.2.2 Difference in Mathematics curriculum

77% of the participants did not view the new changes in curriculum as solution oriented. According to teachers' comments on the effects of new changes in curriculum, it is obvious that they feel that it is affecting their teaching in a negative way. As soon as the teachers got the information about the curriculum change, they became unstable and willing to know what is new. Change can arouse emotions and despair; at the same time, if taken positively, they can raise hope, growth, and progress. There were many changes in the Mathematics curriculum.

66% of the participants complained about the change in topics of Mathematics. This was evident in words of AS1 and CS1: "*Geometry was taken back to the curriculum".* This was affirmed by AS3, BS2 and CS2 who said, *"They amended old chapters in trigonometry".* In addition, BS1 responded that, "*There are new concepts. Topics like probability and geometry are new. In addition, geometry was not compulsory for every student it was paper 3 and the student decide whether s/he want to do that paper. Now it is compulsory in paper 2".* Communication and socialisation play a lot especially in the working place. In the literature review which is in chapter two it is mentioned that

communication breakdown in curriculum change has a negative impact on curriculum implementation.

5.3.2.3 Challenges in teaching

After the introduction of the CAPS curriculum, teachers experienced challenges in teaching. The challenges that they experienced revolved around the new approach in the sense that some of them were the challenges concerning the application of the policies, content, learners. In the question concerning the challenges that the teachers experience in teaching, they responded like this:

AS1, CS1 and BS3 complained that: *"We spend our time in administrative work instead of the curriculum".* CS2 responded that: "*There is a challenge to complete the syllabus if you want the learners to understand everything that you teach in class".* BS1 responded that: *"We have to plan thoroughly before we enter the classrooms because some topics are new". It is also difficult to teach in multilingual classroom. Sometimes if the learners do not understand it became easy for him or her if you translate the question in home language. We are teaching the learners with different home languages".*

The teaching profession is a difficult profession because the teacher has to look after the learners as well as the authorities inside the school and in the district. The teacher has to complete a certain work for a certain amount of work for a certain period. What is the use of the syllabus completion whilst the teacher is on 'the track' alone leaving the learners behind? At the end of the day, s/he has to answer about the poor performance of learners. In the literature review, it is indicated that the teacher is the master of his or her classroom. The class teacher knows the learners in his/her class better than

anybody. The teacher must decide for himself the best teaching methods that are suitable for his/her learners.

5.3.2.4 Confidence about the learners to compete with the outside world

Four participants of the sample had doubts about their teaching skills and the knowledge that they gave their learners. They do not trust their learners in terms of knowledge of Mathematics. The lack of confidence by Mathematics teachers is one of the main factors that might be affecting their success to implement the Mathematics curriculum effectively. This was evident in words of AS1, "*I am not confident, student become confuse when they are writing when you revise with them it is when they remember that they did that in class".*

It seems as if teachers' lack of knowledge in their new approach and subject matter has affected the success of the new approach in the teaching and learning of Mathematics. As a result, their lack of deep and coherent understanding of the subject matter may also limit their ability to design and use higher order thinking skills to probe students' understanding needed by the constructivist approach in the teaching of Mathematics.

Five of the participants are confident about their teaching skills. These participants will probably not regard the syllabus or learning area guideline as a recipe from which one may not deviate, but rather as an opportunity to experiment and to make the curriculum relevant and meaningful. These participants are completely sure about their empowerment. This was affirmed by CS1, *"Yes they can compete; the implementation of the curriculum is the problem the content is up to the standard. I am using the traditional way of teaching as long as the students gained something to solve Mathematical problems".* In addition, AS2 responded that: "*If the paper is translated the learners can*

compete with the outside world. Due to language barrier they need their teacher to explain question to question".

Participant CS1 is reluctant to change. He is using the traditional way of teaching. In the literature review it is mentioned that teachers resist changing because of inhibiting factors. If the teachers resist changing, when will they develop to apply the new curriculum? As we know, practice makes perfect. If they implement the new curriculum approach inside their classrooms, they will be able to correct their mistakes. This is one of the reasons effective curriculum implementation delay in our country. According to the specific skills of Mathematics described in the CAPS document, a learner should develop the correct use of the language of Mathematic but the learners of participant AS2 will struggle to develop this skill because they are dependent to the teacher.

5.3.3 Interpretation and analysis of theme three (The constraints that might be affecting the effectiveness of the Mathematics CAPS curriculum)

Through the questions under this theme, it was easy for the researcher to find out the factors that might affect the effectiveness of CAPS in the Mathematics curriculum. All these changes of curriculum occurred in different socio-economic environments in South Africa. This theme was divided according to the following sub-themes: Development in application of teaching strategies, Empowerment of teachers' professionalism, Involvement of teachers in the curriculum change, Resources, and Difference in learners' performance after the workshops.

5.3.3.1 Development in application of teaching strategies

By attending the CAPS training there was something that they needed to develop at the end of the day. These participants were prepared for any change. Their attitude towards

dissemination determines how acceptable this CAPS curriculum will eventually be. The needs of teachers were not always considered and this might have resulted in teachers feeling disempowered. These are some of the responses from the question about the development in the application of the teaching strategies.

CS2 said, "*There is no development because the question papers of teachers are not standardised. The district had to set standardised question papers to train the learners".* AS3 said, "*There is no development. Other schools have no school calendars. This is lacking because of school visits, if there were subject advisors, facilitators or any official who visit our schools and assist us where it is needed"*. In addition, BS3 said, "*There is no development in teaching strategies. People who conduct workshops must be well trained so that they can give us more information about the things, which we should apply in CAPS. Sometimes if we ask questions in the workshops the facilitators ask us to share our views and not give us the correct way of solving the problems that we encounter in our classrooms*".

The findings suggest the teachers were inadequately trained for the demands and challenges of the new CAPS curriculum, which they think, might be affecting the effective implementation of new changes, more specifically in Mathematics, as they see it as a more demanding subject. For the teachers to understand this constructive way of teaching, which the CAPS document advocates, they need thorough training.

5.3.3.2 Empowerment of teachers' professionalism

In the question which asked, whether the curriculum empowers the teachers' professionalism, the participants gave different responses according to their own opinions. Each participant gave a reason for his/her response. In the literature review it

was stated that the teachers' professionalism is empowered by attending departmental workshops, educational training, and doing reading researches. 88% of the participants attended the CAPS training with the hope of empowering their teacher profession. Those participants did not gain what they expected at the CAPS training workshops. The training was not enough for the teachers to capture everything and implement it in their classrooms.

This was evident in words of AS1: "*The curriculum does not empower teachers' professionalism and their capacity to develop learners' knowledge and understanding of present generation. The present generation lives in the world of advanced technology they are even more advanced than we do. The learners are using their cell phones to search some information of their own".* This was affirmed by BS3 and CS3. BS3 responded, "*The curriculum does not empower teacher's professionalism to develop learners' knowledge and understanding. In the cluster meetings I noticed that many teachers ignore probabilities and some of geometry topics".* AS2 said*, "We attended the workshop in June holidays, for three days then we implement that the following year. The training was not enough even those people who trained us had not enough knowledge of what they were doing. It was worse on the last day everybody wanted to leave".*CS3 responded that, "*It doesn't. If the learners' knowledge were conducive we were supposed to see that in their performance".*

Curriculum needed to change from generation to generation. The teachers needed support to implement what is expected from them because most of the teachers in the system were trained before this generation. In the literature review, it is stated that teachers needed curriculum development, especially if there is curriculum change, review or the revision of a curriculum. The teachers needed to be empowered to

become the experts of model approach described in chapter two. In order for the teachers to succeed in the curriculum implementation, there must be support from the curriculum developers.

One participant put the blame on teachers, this participant saw empowerment in the curriculum. This was evident in AS2's response: "*It does because most of the schools have enough computers in their school labs but the teachers do not use them, they expect special teachers of computer to assist the learners to search for any information"*. This participant did not want to put the blame on one side. We have to work together as the constructive approach said the learner must use resources around the environment to construct something. The teacher as a guide must guide the learner to use the computer to search for information on the computer.

5.3.3.3 Involvement of teachers in the curriculum change

The teachers are the curriculum agents; the success of the curriculum implementation depends on their involvement in the development of the curriculum. The teachers are among the stakeholders. They were supposed to be represented before curriculum change occurred. The entire group of participants complained about the lack of involvement of teachers during the process of curriculum change. By involving the teacher during that stage of development those teachers who were involved would assists the teachers during the implementation phase. The teachers would be able to apply the nature of teaching described in chapter two, which is expected from them to reach the goals of the curriculum. The teachers were regarded as recipients and are expected to apply the curriculum that has been developed by specialists somewhere

else without them being involved in the planning process. This means that this was a top-down approach.

5.3.3.4 Resources

Although there is a wish that the curriculum development must get improvement from all the angles, planning remains one of the problems faced by the people who are involved in curriculum development. It seems as if the conditions of the schools are not conducive for the positive effects of teaching and learning of Mathematics. Some communities may resist a domineering culture or government ideology and hence affect the implementation of the centrally planned curriculum.

This was evident in words by AS1 who said, "*Our school is not located in town it has no money to buy enough equipment".* AS3 who said*, "Unavailability of text book in grade ten is the burning issue that should have been taken into consideration by government. If a learner does not have a textbook, the idea of implementing new policy becomes practically impossible.* BS1 responded: "*In most black schools, the learners cannot solve their schoolwork inside the school because of technological equipment even in their homes because of socio economic background. That thing has an influence in their pass rate".*

Adequate teaching of this modern generation needs good technical resources for the learners to observe practically as we know that what you see is easier to remember than what you hear. According to the nature of Mathematics as per the model approach described in chapter two, in the topics of geometry a sketchpad is needed for the learners to be able to construct different shapes and solve geometrical problems.

5.3.3.5 Difference in learners' performance after the workshops

Many things affect the learners' performance. Most of the participants associated resources and learner performance. These participants mentioned that the learners' performance did not improve in their schools because of the socio-economic factors. This was evident in the words of participant AS1: "*I did not see the difference in learners' performance. Our school is not located in town it has no money to buy enough equipment".* In addition, BS1 affirmed this by saying, "*I did not see the difference in learners' performance. There is no equipment in school to develop the leaner understanding. The parents who have no financial problems took their child to extra classes or have tutors for their children to assist them in Mathematics. Sometimes the students are afraid to ask question in front of other students because they will laugh at him/her but it will be easy for them to ask if it is one to one communication. The parents of our students do not afford that".* In addition, CS1 said that, "*I did not see the difference in learners' performance. There is shortage of resources".*

The policy emphasises the importance of changing the methods of teaching to accommodate the pace of different learners, including those with barriers. The teachers adapt the curriculum so that their needs can be met, but when it comes to setting common exam papers those learners are not catered for. In turn, their performance is not good because neither their pace nor level of understanding is catered for, creating a negative spiral. Some of the participants associated the poor performance of the learners with the language barrier in learners. The different populations in the classroom make it a greater challenge to accommodate all learners' languages. This causes the lack of proficiency in the language of teaching as learners still struggle to read and write. Although the teacher handbook for Mathematics stresses that English is the language

which must be used inside the classroom, sometime the teachers have to explain something in their mother tongue in order for the learners to understand better.

5.4 Discussion of the findings

The finding compared to the CAPS document of Mathematics were further described and discussed. The findings are given in point form where each point is discussed, followed by the evidence from the literature.

5.4.1 Constructive ways of thinking among learners

The participants complained about the learners' way of thinking. Some responded that new changes need learners who are ready for the new changes, which seem not to be the case from the learners that they have. According to the CAPS document, teachers are the facilitators who should promote a learner-centred approach inside their classrooms, and according to RME theorists, teachers are there to guide the learners.

Paulson (2009:16) argues that, "The process of guided reinvention is supported by the engagement of a learner in problem solving. For constructivists, Mathematical knowledge does not simply exist out there waiting to be discovered, but it is constructed by learners using resources in their environment in order for them to achieve one of the specific aims of Mathematics which is to develop problem-solving and cognitive skills". According to Gordon (2009:39, 48) from a constructivist perspective learning Mathematics entails learners actively create, interpret and reorganise knowledge in individual ways. According to Olivier (2015:15), there are growing levels of learner underperformance in literacy and numeracy. There is also clear evidence that implementation of the curriculum has so many things revolving around in it that this has an impact on the performance of learners which needs to be considered (Paulson, 2009:91).

Likewise, Carnoy (2007:23) is of the opinion that most researchers are now concluding that a more demanding curriculum should be taught by teachers with high content knowledge skills to improve the learners' performance. Those teachers should be supervised and assisted where it is needed in order to reach high levels of competence in their practice. In the literature, it is stated that learners of South Africa are performing poorly in Mathematics as compared to the learners in other countries. A recent report by Sarah Evens stated that "South Africa is ranked in Mathematics and Science education second last in the world" (Even, 2013).

5.4.2 Difference in the topics of the Mathematics CAPS curriculum

Most of the teachers mention the difference in topics. The topics, which are included, are the topics, which are difficult to most teachers who are teaching Mathematics. The teachers did not study these topics in their pre-service training and some of these topics were difficult for them during that time of pre-service training.

According to the literature, it is stated that the main change across the FET phase is that most of the work covered previously in the optional Paper 3 for Mathematics is now included in the core Mathematics curriculum. These sections are Euclidean Geometry and Probability. To allow for this, Linear Programming, Transformational Geometry and Recursive Sequences have been removed from the new curriculum. A number of minor adjustments to the content of the NCS Mathematics curriculum were also introduced (Olivier, 2015:17).

5.4.3 Value of Mathematics

Most educators believe that the curriculum is too difficult for the cohort of students doing the subject. The new curriculum in South Africa represents a shift from the traditional way

of teaching and learning to a modelling approach. The results given by teachers interviewed indicated that the schools lack capacity to support change in the teaching and learning of Mathematics. Carl (2009:120) indicated that the reason to support innovation is to inhibit the implementation of new ideas and practices in a school. Mousley (1990) cited in Boris and Herrington (2003:62) states that it is difficult to change teaching style. Also Martin (1993b) cited in Boris and Herrington (2003: 62) added that change will cause feelings of discomfort that can be unpleasant and intimidating. According to the literature, it is stated that developing a curriculum with a complex set of interrelated goals takes time and input from many people.

5.4.4 Lack of confidence

Teachers seem not to have a clear understanding of the new changes in curriculum and in some instances they seem to be ignorant or resist taking responsibility for the implementation of the new changes. Lack of confidence by Mathematics teachers is one of the main factors that might be affecting their success to implement the Mathematics curriculum effectively. Carl (2009:6) argues that empowered persons feel that they can take an active part and can contribute to make a real difference. Carl (2009:116) states that there are various reasons that make consumers resist to change where insufficient support by education leaders, lack of motivation, and lack of understanding of the nature of the change are some of them.

5.4.5 Need for further training

According to the findings of the present case study, teachers indicated that they did not see any reason for them to change the way they teach since they have not received training that is sufficient for them to implement effectively the new changes. Most of the

teachers need another CAPS training. They did not see any development as far as application of teaching strategies and assessment is concerned.

The literature review indicated that a lack of training offered to educators has been cited as one obstacle that inhibited the proper implementation of the new curriculum (Paulson, 2009:80). Jacobs and Brandt (2012:422) stated that also politicians complained about the poor support given to teachers in the new curriculum implementation. One of the recommendations that was made by the panel, which was selected by the Minister of Basic Education in 2010, was the increased focus on strengthening of teacher and in-service training (Olivier, 2015:16). Carl (2009:130) argues that, “New curricula were introduced and teachers were expected to implement them, initially with little in-service training and later with training during their holidays. In addition, Shalem (2003:33) cited in Berkhout *et al* (2010:176) highlights Taylor’s criticism of the involvement of NGOs in teacher training as “short workshop-based programmes, which tend to focus more attention on the provision of information and orientation about policies rather than equipping teachers with the subject content”.

5.4.6 Too much administrative work

In the research findings, teachers also indicated that the new changes have affected their work by bringing administrative work. This administrative work reduces the time of preparing work for the next day. Teachers complained of administrative work since the OBE approach was introduced. Jansen (2002:151) pointed out that the management of OBE multiplied the administrative burdens placed on teachers. Olivier (2015:15) also reports that teachers complained about being overburdened by administrative tasks. In

addition, Jacobs and Brandt (2012:422) complained that teachers are loaded with extra administration tasks.

5.4.7 Involvement of teachers in the curriculum dissemination

It is important that each person in the teaching organisation be kept fully informed and involved with a view to taking the best decisions and thus to ensure optimal development. Most of the participants complained about the lack of involvement of teachers in the curriculum dissemination. According to the literature, meaningful curriculum renewal is possible only if there is an active involvement and dynamic leadership. The curriculum changes can be successful only if all consumers are effectively involved. Carl (2009:111) states that each person in the teaching organisation should be informed and involved in the curriculum development.

Carl (2009:76); Paulson (2009:78) state that teachers are regarded as passive receivers who have no input in the curriculum development. Carl (2009:119) argues that the top-down manner in which changes have been introduced caused resistance.

Carl (2009:114) further argues that “Change endeavours to make provision for and satisfy the needs of specific groups. Georgiades (1980:74) cited in Carl (2009:114) states that meaningful change demands commitment to improve education.

5.4.8 Lack of resources

In most schools, especially those school which are no fee schools, the teachers do not use technological equipment other than scientific calculators because of the lack of resources in the school. Harley and Wedekind (2004:47) argue that, “Well-organised and well-resourced schools are more advantageous in terms of content knowledge teaching

than under-resourced schools". Poor resources are one of the major constraints that affect the quality of the teaching of Mathematics in the schools because Mathematics is the most demanding subject in the school.

Haroon (2004:8) states that teaching Mathematics is a complicated enterprise that requires wise choice of resources, suitable pacing and sequencing of content and creation of classrooms that promote active participation of learners. Jacobs and Brandt (2012:424) argue that the working conditions of South African teachers with lack of time, resources, and electricity create difficulties to teach the outcomes-based curriculum. Chikumbu and Makamure, (2000:52) state that no meaningful teaching and learning take place without adequate resource material.

5.4.9 Language barrier in learners

The language barrier also affects the success of the implementation of the Mathematics curriculum change. The literature revealed that the effects of curriculum have always been experienced by teachers and learners long before the beginning of new change that are taking place in South Africa and other countries. Pimm (2001:20) argues that, "The impact of multilingualism on Mathematics attainment is far from straightforward and the role played by language in a Mathematics classroom is complex". For a student who is new or learning the classroom language, there are clearly challenges in participating in and learning Mathematics (Setati and Adler, 2003 cited in Barwell, 2009:4). Brown, 1982 cited in Pimm (2001:21) states that all teachers are facing difficulty to encourage the learners to move from informal spoken language to the formal written language of Mathematical activities.

5.4.10 Complicated policy documents

The principles of the Mathematic CAPS document are complicated. The teacher can interpret them incorrectly. The principle which states that, “Encouraging an active and critical approach to learning, rather than rote and uncritical learning of given truths” (DOBE, 2011:4) is complicated. The major problem facing the use of active learning activities in secondary schools is the tendency by most of the teachers to believe that active learning activities always promote active mental experiences. It is crucial that the active nature of learning encouraged by CAPS document is aligned with active mental experiences which result in strong acts of construction if learners are to achieve the desired Mathematical understanding (Herrington, 1990 cited in Paulson, 2009:20). An active learning activity can foster either active mental experiences or passive mental experiences, just as a passive learning activity can foster either active mental experiences or passive mental experiences.

5.5 Chapter summary

This chapter discussed the research findings presented by the respondents who are teachers. The findings mainly focused on the research objectives and the constraints experienced by teachers in the implementation of Mathematics CAPS curriculum. The teachers’ experiences affect the practice of the teachers and affect the effectiveness of the implementation of the curriculum. Many factors disadvantage the teachers to implement the Mathematics curriculum effectively. Because of those factors, the majority of this group of teachers were partially able to implement and use the Curriculum and Assessment Policy Statement effectively, and they struggled to implement and utilise the curriculum effectively

on a consistent basis. In the final chapter, conclusions and recommendations are made which may assist teachers to fulfil their tasks more effectively.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The previous chapter presented the analysis and discussion of findings. The current chapter presents the conclusions and recommendations of the study. The main aim of this study was to investigate the teachers' experiences of the implementation of Mathematics CAPS curriculum in the FET phase.

In order to remind the reader, the study was driven by the following:

The main research question is:

What are the teachers' experiences of the implementation of the Mathematics CAPS curriculum in the FET phase?

Sub-research questions:

The questions that were used to explore the main question of this study are:

- How far has CAPS influenced Mathematics curriculum?
- What are the constraints or factors that might be affecting the effectiveness of the implementation of the Mathematics CAPS curriculum?

This part of the research revisits the research questions mentioned above, summarises the findings of the research results and offers conclusions based on the findings. As a result, it is necessary to make a brief summary of it. Recommendations for future research are also

presented. The researcher also reflects on the research process that has been undertaken. The conclusion reflects on whether the main research aim and research questions have been met by the outcomes of the study. They also indicate how this study could be considered significant.

6.2 Conclusions

The findings seem to suggest that the views of the teachers can assist the curriculum designers to develop the curriculum. Underlying factors were shown by the literature, for instance the influences which the apartheid curriculum had on the perceptions, beliefs, and values of teachers who taught during the apartheid regime, and the huge impact this has had on the way these teachers implement the CAPS. Based on the findings in the literature study and from the analysis of the findings, conclusions and recommendations are made below.

6.2.1 Active participation of learners

The learners need to be responsible for their work. They should not be dependent on the teacher; the teachers are there to guide them. Learners should practice what they learn in class thoroughly at home in order for them to solve all levels of Mathematical questions. The learners need to solve simple questions first, then solve medium type problems, then difficult questions.

We cannot blame the teachers only about the performance of learners since home background and learner ability can determine what is actually achieved in the classroom (Chikumbu and Makamure, 2000: 52). The child can perform well in class through the help of the following groups of people: parents, parents'associations and teachers' associations, School Development Associations (SDAs) and School Development

Committees (SDCs), religious organisations, local authorities, companies and private school proprietors.

6.2.2 Change of syllabus of Mathematics

The CAPS curriculum does not consider only the professional knowledge in order for the teacher to teach at the higher levels but it also draws attention to the learner-centred approach and what the learner should achieve when s/he enter higher institution, which correlates with the new Constitution.

6.2.3 Value of Mathematics

At the macro-level, a national curriculum committee would not normally prescribe teaching methods in a syllabus, as this may possibly dampen teacher initiative. Normally the subject teacher must find an answer to the question of “What is the best method of achieving the aims and implementing the planned lesson?”

6.2.4 Quality of training

The quality of training that the teachers have varies since their training institutions were different academically. Pre-service teachers study the Mathematical syllabus of the levels that they are going to teach in the field whilst in other institutions the pre-service teachers study the more advanced syllabus than that of their teaching levels. The point is that most teachers in the system had little knowledge of the curriculum.

6.2.5 Development of teachers in curriculum

The data from these three schools of the sample revealed a secondary school system characterised by a low average level of teacher skills and knowledge of the

implementation of the Mathematics CAPS curriculum. There have been consistent complaints that the short-term training provided for teachers to implement the new CAPS curriculum has not been effective. Teachers were inadequately trained for the demands and challenges of the new CAPS curriculum. This had a negative influence on the effectiveness of implementation of the Mathematics curriculum.

The sample provides evidence that curriculum development is needed in order for them to work hand in hand with the curriculum designers to achieve the goals expected from them. As a result, even though teachers have their own theoretical training, it is necessary for them to receive extra support, as they are often confused when faced with fast changes.

In addition, the time of training can have an impact on attendance. Poor attendance has an effect on the development of the curriculum. The development of curriculum affects the effectiveness of the curriculum implementation. Lastly, the effectiveness of the curriculum affects the performance of the learners.

6.2.6 Administrative tasks

The uncertainty and the increasing complexity, which characterise the educational settings in which they are expected to operate, compel teachers to always try to keep abreast of educational challenges and changes. The role of teachers is broadening and, in many contexts, they are now expected to perform tasks that they have never performed before. At the same time, they experience increased public scrutiny and accountability, which are often associated with new forms of managerialism.

6.2.7 Involvement of stakeholders

Curriculum planners must involve the teachers of that particular subject in their planning, curriculum change or review of any subject so that they may be bound to curriculum development. All person involved must have the maximum opportunity to provide input to the changes, because their support during the implementation phase may be obtained.

6.2.8 Socio-economic background

This study was conducted in very different schools in terms of socio-economic background. The curriculum change should be implemented in all the schools of South Africa whether the school is situated in a poor or a rich area.

Factors such as geographic demarcation in terms of rural and urban areas, coupled with the perceptions, belief systems and values, which are attached to the people who are living in those communities, have an impact on how the curriculum is understood and implemented, and needs to be considered. Curriculum developers should consider this inconsistency when they design and develop a new national curriculum.

The social background of a learner and the resources available in the school has an impact on learning. The fees and the commitment by the government also affect the availability of resources as well as the teaching and learning environment. These factors play a crucial role in the implementation of the curriculum.

6.2.9 Qualifications of teachers

The pool of qualified Mathematics teachers in secondary schools is small. Teachers who lack content and pedagogic content knowledge are likely to have trouble on top of their existing shortcomings in terms of CAPS principles and practices especially the principle of

high knowledge and high skills. Challenges of learners like language barriers resulted in underperformance of learners because the teachers did not solve those challenges from the start.

6.2.10 Complicated policy documents

The principle of active learning is complex in the sense that the majority of Mathematics teachers in secondary schools believe that active learning activities always promote active mental experiences which is not true. Most of the teachers think that when learners solve the Mathematical problems in the classroom their mental experiences are also active. Those teachers were surprised by the poor performance of those learners during examinations.

6.2.11 Concluding remarks

The study was driven by the following objectives:

- The teachers' experiences regarding the implementation of the new Mathematics curriculum,
- How far has the CAPS influenced the Mathematics curriculum,
- The effects of curriculum change on the teaching of Mathematics.

In conclusion, the objectives of the study were met and all research questions answered; the participants responded to the best of their ability on their experiences regarding the implementation of the Mathematics CAPS curriculum. The study indicates that, although Gauteng Department of Education has a structured plan for the implementation of

Mathematics CAPS curriculum in FET, the needs of the teachers must be considered.

There are still some factors which affect the effectiveness of the implementation of the Mathematics CAPS curriculum and policy issues at macro-level. The government must provide the districts with guidance on how to implement the Mathematics curriculum in order to assist the teachers in their classrooms. There is clear evidence that the application of all the changes of the Mathematics curriculum will take a long time to be implemented.

6.3 Recommendations

Based on the conclusions of this case study, a model for planning of new changes in the curriculum has been proposed. To be successful in the implementation of curriculum, the government, teachers, curriculum planners, parents, politicians and members of the community should work hand in hand to ensure effective curriculum development. No system of education is perfect, and no system will 'work' unless teachers and administrators are committed to it.

6.3.1 Active participation of learners

The learners need to be responsible in their work. They should not be dependent on the teacher; the teachers are there to guide them. Learners should practice what they learn in class thoroughly at home in order for them to solve all levels of Mathematical questions. The learners need to solve simple questions first, then solve medium type problems and then difficult questions.

There must be Mathematics Olympics to motivate learners in Mathematics. These Olympics must be done at district level first where the learners will compete with other

learners from different school; there-after the competition will be held at provincial and national levels where the learners will get awards or bursaries to further their studies in Mathematics. This will be done to encourage the learners to work hard in class to obtain the awards at the end.

6.3.2 Change of syllabus of Mathematics

The curriculum designers must inform the teachers about any change in the syllabus and give them enough information about the reasons for changing the syllabus.

6.3.3 Value of Mathematics

To keep the value of Mathematics even the facilitators must be well trained in order for them to equip the teachers with more information and be able to answer their questions correctly in the workshops. Successful implementation of CAPS curriculum requires teachers to be able to contextualise the principles of CAPS to suit their particular situation.

6.3.4 Quality of pre-service teachers

The government must see to it that the syllabus in the tertiary institutions is similar; the pre-service teachers must study the advanced Mathematics curriculum rather than the one they are going to teach after training in order for them to be more advance than the learners which they teach in their classrooms. The quality of training that the pre-service teachers have must be the same in all the institutions. If the teachers are studying a particular course, the modules must be the same.

6.3.5 Prior training of teachers

The prior training of teachers must be done according to the future needs of new curriculum development. The training must be done properly so that the teachers understand what is needed in order for them to achieve the goals of the curriculum. The teachers must be empowered, supported and monitoring on new changes in curriculum. Workshops must be done to train the teachers to set standardised question papers for Mathematics.

6.3.6 Administrative work

The teachers must have a work schedule with lesson plans, follow that work schedule, and use their own methods of introducing the lesson to the learners not write lesson plans first before they enter the classrooms.

6.3.7 Involvement of stakeholders

All people involved must have enough time to provide input to the envisaged changes in order for them to participate up to the best of their ability during the implementation phase.

6.3.8 Provision of resources

Factors such as the utilisation of human capital, time, and resources must be considered in advance. The provisioning of resources must be done according to socio-economic needs. Resources should match the needs of the new developments in the curriculum.

6.3.9 Teacher qualifications

Teacher qualifications must be considered, and teachers must teach the subjects in which

they specialise during their training.

6.3.10 Vague policy documents

Each point in the policy document should be written clearly, so that the readers cannot misinterpret them. They must not just be written in point form; the points must be followed by explanations.

6.4 Chapter summary

It was also been discovered that most schools in the rural areas lack support and monitoring to enable the effectiveness of the new changes in curriculum. It has also been found that the attitudes of teachers towards new changes in curriculum contribute to the negative effects of the new curriculum in many schools in the rural areas. The research also discovered that the inadequate skills and knowledge by people who are responsible for curriculum implementation affect the real effectiveness of new curriculum development. As a result, the Department of Education still has a responsibility for making sure that all schools, which are under-resourced have enough resources needed by the new changes as curriculum developments are on-going processes that are supposed to take place in every changing society.

The literature has shown that teachers' perceptions and understanding of the new changes in curriculum left them with challenges of choosing to accept or reject the changes. It has also been shown in the literature that when teachers are differentially empowered with the needs of the new changes, it ends up backfiring on the effectiveness of the new changes that are expected to be implemented in the curriculum.

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APPENDIX A

RESEARCH INSTRUMENT

How far has CAPS influenced the Mathematics curriculum?

1. When did you start teaching?
2. Which grades were you teaching?
3. In your qualifications have you studied curriculum theory?
4. Have you attended CAPS training?
5. When did you attend the workshops for curriculum development?
6. After CAPS training do you see the difference in the Mathematics curriculum?
7. Which challenges do you experience in teaching as educators?
8. Which challenges do you experience in learners?

The effects of curriculum change on teaching of Mathematics

9. As an educator when did you get information about curriculum change?

9.1 Did you get information before the curriculum change or during the time of implementation?

9.2 Do you think that has an influence in teaching?

9.3 How?

10. In your school or in you district is there any person who was involved in curriculum dissemination.

10.1 Do you think that has an impact in the implementation of the curriculum?

10.2 If yes how?

10.3 If no, how?

11. If you were among curriculum designers, what would you suggest to your colleagues before the development of the curriculum?

12. Through your observation as a teacher, are there any links in-between phases (subject, content and age) as to make learners understanding be developed?

12.1 If yes, can you specify that makes you to say that there is a link?

12.2 If no, what do you think is lacking/ what needs to be revisited?

13. Are you confident enough that your learners can compete with the outside world using the skills and knowledge you equipped them with?

The constraints that might be affecting the effectiveness of the implementation of the new mathematics curriculum

14. is there any development in as far as application of teaching strategies and assessment is concerned?

14.1 If no, what causes that?

14.2 If yes, what causes that?

15. Has the curriculum empower teachers' professionalism and their capacity to develop learners' knowledge and understanding of present generation?

15.1 If no, how?

15.2 If yes, how?

16. Do you see the difference in your learners' performance after the workshops?

16.1 If no, why is that so?

16.2 If yes, can you convince me if that is true?

17. Do you think curriculum change is necessary?

17.1 Can you specify?

University of Fort Hare
Together in Excellence

ETHICAL CLEARANCE CERTIFICATE
REC-270710-028-RA Level 01

Certificate Reference Number:	ADU091SDUB01
Project title:	**Teacher's views on the implementation of the mathematics CAPS curriculum at FET: Case study**
Nature of Project:	Masters
Principal Researcher:	Ntombekhaya Vivian Dube
Supervisor:	Prof E Adu
Co-supervisor:	

On behalf of the University of Fort Hare's Research Ethics Committee (UREC) I hereby give ethical approval in respect of the undertakings contained in the above-mentioned project and research instrument(s). Should any other instruments be used, these require separate authorization. The Researcher may therefore commence with the research as from the date of this certificate, using the reference number indicated above.

Please note that the UREC must be informed immediately of

- Any material change in the conditions or undertakings mentioned in the document
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research

APPENDIX C

8 Royce Villas

Royce Street

VANDERBIJLPARK

1911

9 March 2015

The Director

Department of Education

Sedibeng West District

Dear Sir/ Madam

PERMISSION TO CONDUCT MY RESEARCH

I ask the permission to conduct my research in the secondary school of Sedibeng West district. I am a master student at Fort Hare University. I am a teacher at Moshate Secondary School.

I am studying Master's Degree; I am specializing in Mathematics Curriculum Studies.

I want to conduct interviews in the principal and any two Mathematics FET teachers in three different schools. My research topic is **Teachers' views on the implementation of the Mathematics CAPS curriculum at FET: Case Study.** The researcher is interested in finding out more about effective implementation of CAPS. The researcher is carrying out this research

to learn about the ways in which teachers' views on the implementation of mathematics CAPS curriculum.

Our University of Fort Hare /Faculty of Education are asking people from your sample to answer some questions, which we hope will benefit your community and possibly other communities in the future.

If possible, my faculty would like to come back to this area once I have completed my study to inform you and your communityof what the results are and discuss my findings and proposals around the research and what this means for people in this area.

The researcher included the following:

Research proposal;

GDE research application form;

Ethical clearance form;

Research instrument.

Yours faithfully

Ntombekhaya Vivian Dube (Miss)

APPENDIX D

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

For administrative use:
Reference no: D2015/447

GDE RESEARCH APPROVAL LETTER

Date:	**2 April 2015**
Validity of Research Approval:	**2 April 2015 to 2 October 2015**
Name of Researcher:	**Dube N.V.**
Address of Researcher:	**8 Royce Villas; Royce Street; C W 5; Vanderbiljpark; 1911**
Telephone / Fax Number/s:	**078 122 2647**
Email address:	**ntombekhaya.dube@gmail.com**
Research Topic:	**Teachers' views on the implementation of the Mathematics CAPS curriculum at FET: Case Study**
Number and type of schools:	**THREE Secondary Schools**
District/s/HO	**Sedibeng West**

Re: Approval in Respect of Request to Conduct Research

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

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

CONDITIONS FOR CONDUCTING RESEARCH IN GDE

1. The District/Head Office Senior Manager/s concerned must be presented with a copy of this letter;
2. A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB);

Office of the Director: Knowledge Management and Research
9th Floor, 111 Commissioner Street, Johannesburg, 2001
P.O. Box 7710, Johannesburg, 2000 Tel: (011) 355 0506
Email: David.Makhado@gauteng.gov.za
Website: www.education.gpg.gov.za

APPENDIX E

If possible, my faculty would like to come back to this area once I have completed my study to inform you and your community of what the results are and discuss my findings and proposals around the research and what this means for people in this area.

INFORMED CONSENT

I hereby agree to participate in research regarding Teachers' views on the implementation of the Mathematics CAPS curriculum at FET: Case Study. I understand that I am participating freely and without being forced in any way to do so. I also understand that I can stop this interview at any point should I not want to continue and that this decision will not in any way affect me negatively.

I understand that this is a research project whose purpose is not necessarily to benefit me personally.

I have received the telephone number of a person to contact should I need to speak about any issues which may arise in this interview.

I understand that this consent form will not be linked to the questionnaire, and that my answers will remain confidential.

I understand that if at all possible, feedback will be given to my community on the results of the completed research.

.....
Signature of researcher

15/09/2015
Date:

I hereby agree to the tape recording of my participation in the study

.....
Signature of participant

15/09/2015
Date:

If possible, my faculty would like to come back to this area once I have completed my study to inform you and your community of what the results are and discuss my findings and proposals around the research and what this means for people in this area.

INFORMED CONSENT

I hereby agree to participate in research regarding Teachers' views on the implementation of the Mathematics CAPS curriculum at FET: Case Study. I understand that I am participating freely and without being forced in any way to do so. I also understand that I can stop this interview at any point should I not want to continue and that this decision will not in any way affect me negatively.

I understand that this is a research project whose purpose is not necessarily to benefit me personally.

I have received the telephone number of a person to contact should I need to speak about any issues which may arise in this interview.

I understand that this consent form will not be linked to the questionnaire, and that my answers will remain confidential.

I understand that if at all possible, feedback will be given to my community on the results of the completed research.

.....

Signature of researcher **Date:** 16/04/2015

I hereby agree to the tape recording of my participation in the study

.....

Signature of participant **Date:** 16/04/15

INFORMED CONSENT

I hereby agree to participate in research regarding Teachers' views on the implementation of the Mathematics CAPS curriculum at FET: Case Study. I understand that I am participating freely and without being forced in any way to do so. I also understand that I can stop this interview at any point should I not want to continue and that this decision will not in any way affect me negatively.

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N Ble 23:04:2015

Signature of researcher **Date**:

I hereby agree to the tape recording of my participation in the study

EMabizela .....

Signature of participant **Date**: 23/04/2015

INFORMED CONSENT

I hereby agree to participate in research regarding Teachers' views on the implementation of the Mathematics CAPS curriculum at FET: Case Study. I understand that I am participating freely and without being forced in any way to do so. I also understand that I can stop this interview at any point should I not want to continue and that this decision will not in any way affect me negatively.

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I understand that if at all possible, feedback will be given to my community on the results of the completed research.

.....

Signature of researcher **Date**: 30.04.2015

I hereby agree to the tape recording of my participation in the study

.....

Signature of participant **Date**: 30.04.2015

INFORMED CONSENT

I hereby agree to participate in research regarding Teachers' views on the implementation of the Mathematics CAPS curriculum at FET: Case Study. I understand that I am participating freely and without being forced in any way to do so. I also understand that I can stop this interview at any point should I not want to continue and that this decision will not in any way affect me negatively.

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I understand that if at all possible, feedback will be given to my community on the results of the completed research.

.....

Signature of researcher **Date**: 01 : 05 : 2015

I hereby agree to the tape recording of my participation in the study

.....

Signature of participant **Date**: 01 : 05 : 2015

INFORMED CONSENT

I hereby agree to participate in research regarding Teachers' views on the implementation of the Mathematics CAPS curriculum at FET: Case Study. I understand that I am participating freely and without being forced in any way to do so. I also understand that I can stop this interview at any point should I not want to continue and that this decision will not in any way affect me negatively.

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I understand that if at all possible, feedback will be given to my community on the results of the completed research.

.....

Signature of researcher **Date**: 01.05.2015

I hereby agree to the tape recording of my participation in the study

.....

Signature of participant **Date**: 01.05.2015

INFORMED CONSENT

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I understand that if at all possible, feedback will be given to my community on the results of the completed research.

.....

Signature of researcher **Date:** 03/05/2015

I hereby agree to the tape recording of my participation in the study

.....

Signature of participant **Date:** 03/05/2015

INFORMED CONSENT

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I understand that if at all possible, feedback will be given to my community on the results of the completed research.

.....

Signature of researcher **Date**: 03/05/2015

I hereby agree to the tape recording of my participation in the study

.....

Signature of participant **Date**: 03/05/15

INFORMED CONSENT

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I understand that if at all possible, feedback will be given to my community on the results of the completed research.

.... 02.05.2015

Signature of researcher **Date**:

I hereby agree to the tape recording of my participation in the study

.... 02.05.2015

Signature of participant **Date**:

APPENDIX F

Dr S.E. Mthiyane, 11 Rethman Street, New Germany, 3610

2 November 2015

LANGUAGE CLEARANCE CERTIFICATE

TO WHOM IT MAY CONCERN

This serves to inform that I have read the final dissertation titled:

TEACHERS' VIEWS ON THE IMPLEMENTATION OF THE MATHEMATICS CAPS CURRICULUM AT THE FET: CASE STUDY, by NTOMBEKHAYA DUBE (201414792)

To the best of my knowledge, all the proposed amendments have been effected and the work is free of spelling and grammatical errors. I am of the view that the quality of language used meets generally accepted academic standards.

Yours faithfully

S.E. Mthiyane

Dr S.E. Mthiyane (Senior Lecturer – Wits School of Education)
B.A (English & Education), (UNIZULU); B.Ed (Hons.); M.Ed; PhD (UKZN).