MATHEMATICS TEACHERS' VIEWS AND CHALLENGES ON THE IMPLEMENTATION OF THE COMPULSORY MATHEMATICS CURRICULUM IN OTJOZONDJUPA REGION

A THESIS SUBMITTED IN PARTIAL FULFILMENT

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BY

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APPROVAL PAGE

This research has been examined and is APPROVED as meeting the required standards for partial fulfilment of the requirements of the degree of Masters of Education.

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External Examiner	Date

DECLARATION

I, Rauna Angula, hereby declare that this thesis: *Mathematics teachers' views and challenges on the implementation of the compulsory Mathematics curriculum in Otjozondjupa region* is a true reflection of my own research, and that this work, or part thereof has not been submitted for a degree in any other institution of higher education.

……. ……..……

Rauna Angula Date

DEDICATION

To my grandmother, Hilja Ndapewa Nalupe, for her love, wisdom and integrity that served as a source of inspiration to me. To my mother, Maria Jambeka Nahole, for her unfailing love, good upbringing and unconditional support.

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ABSTRACT

Since 2012, the Ministry of Education has made Mathematics a compulsory subject at senior secondary school level (Grade 11 and 12). The study investigated the Mathematics teachers' views and challenges on the implementation of the compulsory Mathematics curriculum at senior secondary level in the Otjozondjupa region. In particular, the study addressed the following questions: 1) what are the Grade 11 and 12 Mathematics teachers' views on the implementation of the compulsory Mathematics curriculum in the Otjozondjupa Region? 2) to what extent are the teachers motivated in the teaching of the compulsory Mathematics curriculum? 3) what are the challenges experienced by teachers in the teaching of the compulsory Mathematics curriculum? 4) what do teachers perceive as possible solutions to ameliorate these perceived challenges?

The study employed a mixed-method approach in two sequential phases. In the first phase, a questionnaire with closed-ended and open-ended questions was used to gather quantitative data from 20 Mathematics teachers that were randomly selected from the population under study. Thereafter, the responses were used to purposefully select 10 Mathematics teachers for phase two, in which qualitative data were collected by means of semi-structured interviews. Quantitative data were analysed using frequency tables and graphs. Thematic analysis was used to analyse the qualitative data.

Findings of the study indicated that majority of the Mathematics teachers were of the view that Mathematics is important for all learners while few of the Mathematics teachers believed that Mathematics is a difficult subject and not all learners should study

Mathematics at senior secondary school level. It also emerged that teachers were not consulted concerning the designing of the compulsory Mathematics curriculum. As a result of making Mathematics compulsory at senior secondary level, Mathematics teachers experience challenges such as high teacher-learner ratios, lack of support from relevant educational leaders, overcrowded Mathematics classrooms, inadequate time allocated for Mathematics lessons, lack of discipline among learners in the Mathematics classrooms and a lack of teaching aids and resources. These challenges made it difficult for the Mathematics teachers to successfully implement the compulsory Mathematics curriculum.

The study recommends that the Ministry of Education addresses these challenges in order to enhance the teaching and learning of compulsory Mathematics. It is critical that enough resources be provided so that the three Mathematics levels (core, extended and higher level) can be taught in separate classes.

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LIST OF ACRONYMS

MoE	Ministry of Education
MEC	Ministry of Education and Culture
MASTEP	Mathematics and Science Teachers Extension Programme
NIED	National Institute for Educational Development
INSET	In-service Education and Training

CHAPTER 1: INTRODUCTION

1.1 Orientation of the Study

Smith (2004) describes Mathematics as of central importance to modern society, because it provides the vital underpinning of the knowledge economy. He further noted that Mathematics forms the basis of most scientific and industrial research and development. Increasingly, many complex systems and structures in the modern world can only be understood using Mathematics and much of the design and control of high-technology systems depend on mathematical inputs and outputs (Smith, 2004).

Before 2012, Mathematics had been a compulsory subject from Grade 1 up to Grade 10 in Namibia. In Grade 11 and 12, subjects had been grouped in four different fields of study, namely: the Natural Science and Mathematics (Mathematics, Biology and Physical Science), the Commerce (Accounting, Economics and Business Studies), Technical (Design and Technology, Physical Science and Mathematics) and the Social Sciences (History, Development Studies and Geography). Two of these fields of study, the Natural Science and Mathematics field and the Technical field had Mathematics as a compulsory subject. Learners from the other fields (Commerce and Social Sciences) had a choice to either take Mathematics or any other subject of their choice as an additional subject to their field of study (Ministry of Education, 2010).

The Ministry of Education (MoE) (2010) noted that Mathematics is a language on its own, a way of thinking and communicating which every person needs. In this regard, numerical skills are required in creating logical models for understanding, and being able

to think in terms of relations of quantity, size, shape and space and computations. It is for these reasons that as from January 2012 Mathematics has been made compulsory for all learners in Grades 1 – 12 nationwide, and thus has become part of all the fields of study in the National Curriculum for Basic Education (MoE, 2010).

Chen (2010) notes the following regarding curriculum change;

> "We are living in an age which has been witnessing more and more educational changes. Curriculum reforms, as a kind of significant educational change, have been taking place in a wide variety of domains of subjects. Particularly, in the field of mathematics education, the mathematics curricula of various countries and regions around the world have experienced their reforms at the turn of the 21st century, and all these reforms aim at preparing younger generation…" (p. 1).
>
> This is echoed by Wong, Han and Lee (2004) when they state that all these reforms aim at preparing the younger generation for an era in which "the economy is globalized and the society is knowledge-based and information-rich" (p. 28).

However, according to Fullan (2001) implementing an innovation is an overwhelming undertaking, because it involves changes in multiple dimensions, including materials, teaching approaches and beliefs. Among these, changes in beliefs are most important and also most difficult to achieve. Further, Fullan pointed out that "changes in beliefs and understanding are the foundation of achieving lasting reform" (p.45). Without the changes in beliefs, changes in practices may be cosmetic and superficial, and thus reform

may be fragile and transient (Cuba, 1990). In addition, the importance of changes in beliefs of implementers has also been recognized by many other researchers (Ding, 2006; Spillane, Reiser, & Reimer, 2002; Xu, 2003).

It is against this background that the researcher decided to conduct this study to find out the views and challenges that the Mathematics teachers could have gone through during and after the process of curriculum reform to implement Mathematics as a compulsory subject at senior secondary school level.

1.2 Statement of the Problem

In recognising the importance that Mathematics as a subject plays in fulfilling Vision 2030, from 2012 the Ministry of Education made Mathematics a compulsory subject at senior secondary school level (Grade 11 and 12) for the development of science, technology and commerce (MoE, 2010). MoE believes that mathematical skills, knowledge, concepts and processes, enable the learner to investigate, model and interpret numerical and spatial relationships and patterns that exist in the world (MoE, 2010).

However, Ponte, Matos, Guimaraes, Leal and Canavarro (1994) reported that during the reform of the Education system in Portugal teachers believed that the new curriculum would bring significant improvements for Mathematics learning. But during the implementation of the new curriculum, the same teachers felt overwhelmed with work and were not well prepared to successfully implement the reforms. In a related case on implementation of a new curriculum in Nigeria, Bandele and Faremi (2012) reported that

teachers and instructors reported some of the challenges they faced. These included unstable government policy, lack of standardised workshop practical work, lack of in-service training for teachers, outdated equipment and lack of related modern instructional material. To further elucidate on challenges that teachers face on implementation of mandatory curricula, Sidiropoulous (2008) also reports in her study that teachers in South Africa experienced the following challenges: lack of textbooks, big class sizes, inadequate resources, and unmotivated learners that do not do well in Mathematics when it is mandatory.

Implementation difficulties of new curricula are recorded extensively in literature according to Sidiropolous (2008). She states further that "in developing countries it is often the case that a shortage of resources, both material and in terms of human capacity, affect the implementation pathway of curricula as intended" (Sidiropolous, p. 169).

It is possible that Mathematics teachers in Namibia too may lack motivation and skills to assist low performing learners Mathematics, and some learners may lack skills in Mathematics to cope with Grade 11 and 12 Mathematics. According to the Mathematics and Science Teachers Extension Programme [MASTEP] (2002), among the many challenges of curriculum implementation, inexperience in implementation of the curriculum and co-operation and communication between policy-makers and implementers are some of the challenges faced in Namibia.

To the best of the researcher's knowledge, no study has specifically been carried out in Namibia related to teachers' views and challenges on the implementation of a

curriculum with Mathematics as a compulsory subject at senior secondary school level. Given this background, the study aimed at investigating Mathematics teachers' views and challenges faced in the implementation of the compulsory Mathematics curriculum at senior secondary school level in the Otjozondjupa Region.

1.3 Questions of the Study

The study addressed the following questions:

1. What are the Grade 11 and 12 Mathematics teachers' views on the implementation of the compulsory Mathematics curriculum in the Otjozondjupa Region?
2. To what extent are the teachers motivated in the teaching of the compulsory Mathematics curriculum?
3. What are the challenges experienced by teachers in the teaching of the compulsory Mathematics curriculum?
4. What do teachers perceive as possible solutions to ameliorate the perceived challenges?

1.4 Significance of the Study

The study might provide MoE officials, teachers, learners and the community with insights into the views and challenges of teaching compulsory Mathematics in the Otjozondjupa region. The findings might be useful to the MoE in formulating policies

with respect to improving the quality of teaching and learning of Mathematics in Otjozondjupa region.

1.5 Limitations of the Study

One of the limitations faced by the researcher was that during interviews most teachers preferred to be interviewed in Afrikaans. They felt they could express themselves better in Afrikaans. However, English is the official language in schools so the researcher interviewed the teachers in English. This may have resulted in some valuable information being lost.

1.6 Delimitations of the Study

The study was limited to the Grade 11 and 12 Mathematics teachers' views and challenges faced in the implementation of the compulsory Mathematics curriculum in the Otjozondjupa Region. The Grade 11 and 12 Mathematics teachers were the ones that were directly affected by the change and hence it was of importance to hear their views regarding the teaching of compulsory Mathematics in order to seek for ways to ameliorate the challenges faced.

1.7 Definition of terms

It is essential to define terms that could be misunderstood in order to establish a frame of reference in which the researcher approached the problem (Best and Kahn, 1993). Accordingly, the following terms should be understood as defined herein:

- **Curriculum:** Chen (2010) defines curriculum as "educational documents, such as standards or syllabus which are devised based on certain theoretical principles, stipulate the details of objectives, content, pedagogy, assessment and resource etc. and serve the compilation of textbooks" (p. 13). Particularly, in this study, 'curriculum' is defined as the official policy for teaching, learning, and assessment and gives direction to planning, organising and implementing teaching and learning in schools.
- **Implementation:** Implementation refers to the actual use of innovation or what an innovation consists of in practice (Fullan, 2001). In this study, implementation takes place as the learner acquires the planned or intended experiences, knowledge, skills, ideas and attitudes that are aimed at enabling the learner to function effectively in a society.
- **Curriculum implementation:** Curriculum implementation entails putting into practice the officially prescribed courses of study, syllabuses and subjects (MoE, 2010). In this study, curriculum implementation therefore 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.
- **Ameliorate:** defined as making something (bad or unsatisfactory) better (Oxford English Dictionary, 2006). In this study, ameliorate refers to the reduction of the challenges that teachers might have been facing in the implementation of the compulsory Mathematics curriculum.

- **Views:** In this research, a view is understood to mean the feelings, thoughts and opinions or ideas that the teachers perceive and acknowledge at a particular moment in time and context (Jiao, 2005).
- **Motivation:** According to Oyedeji (1998), motivation is something innate within the individual, a kind of energizer or driving force, a desire or an urge that causes the individual to perform. In this study, motivation is defined as a process of arousing enthusiasm in a teacher so that he/she can perform his/her duties with pleasure and high interest in pursuance of the school goals.

CHAPTER 2: THEORETICAL FRAMEWORK AND LITERATURE REVIEW

This Chapter reviews the literature under the headings: theoretical framework; curriculum implementation; Mathematics education reform; teacher motivation in the teaching and learning of Mathematics; views and attitudes towards Mathematics Education; challenges in the teaching and learning of Mathematics. Due to limited literature in Namibia on the problem of interest, literature was drawn from studies done in other countries.

2.1 Theoretical Framework

A theoretical framework is a set of concepts and relationships within which the problem is formulated and solved. "It is a concise description of the major variables operating within the arena of the problem to be pursued together with the researcher's overarching view of how the variables interact to produce a more powerful or comprehensive model of relevant phenomena that has not heretofore been available for shedding light on the problem" (Badugela, 2012, p. 11).

This study is informed by the theory of curriculum implementation (Rogan & Grayson, 2003). They state that although research has already affirmed the various factors compounding the complexity of curriculum delivery, a focus on the "what" of desired educational change, neglecting the "how", and a lack of clearly thought-out implementation strategies have brought out failures of well-intentioned, well-designed curriculum reform programmes, especially in the developing countries. Bringing a new curriculum or implementing curriculum change involves three distinct steps namely:

initiation, implementation and routinization (Waugh & Godfrey, 1995). The authors further state that in most planned changes that occur the focus is almost exclusively placed on formulation of policy (initiation phase) and the implementation phase is hurried in order to get to the routinization stage. It was therefore this neglect in the implementation stage that led to Rogan and Grayson (2003) coming up with the theory of curriculum implementation. The theory uses three constructs that form the heart of curriculum implementation, namely: profile of implementation, capacity to innovate and outside support. These three constructs can all be measured by means of indicators and are broad enough to include related factors, or sub-constructs. The following Figure 1 puts these constructs and sub-constructs into a framework.

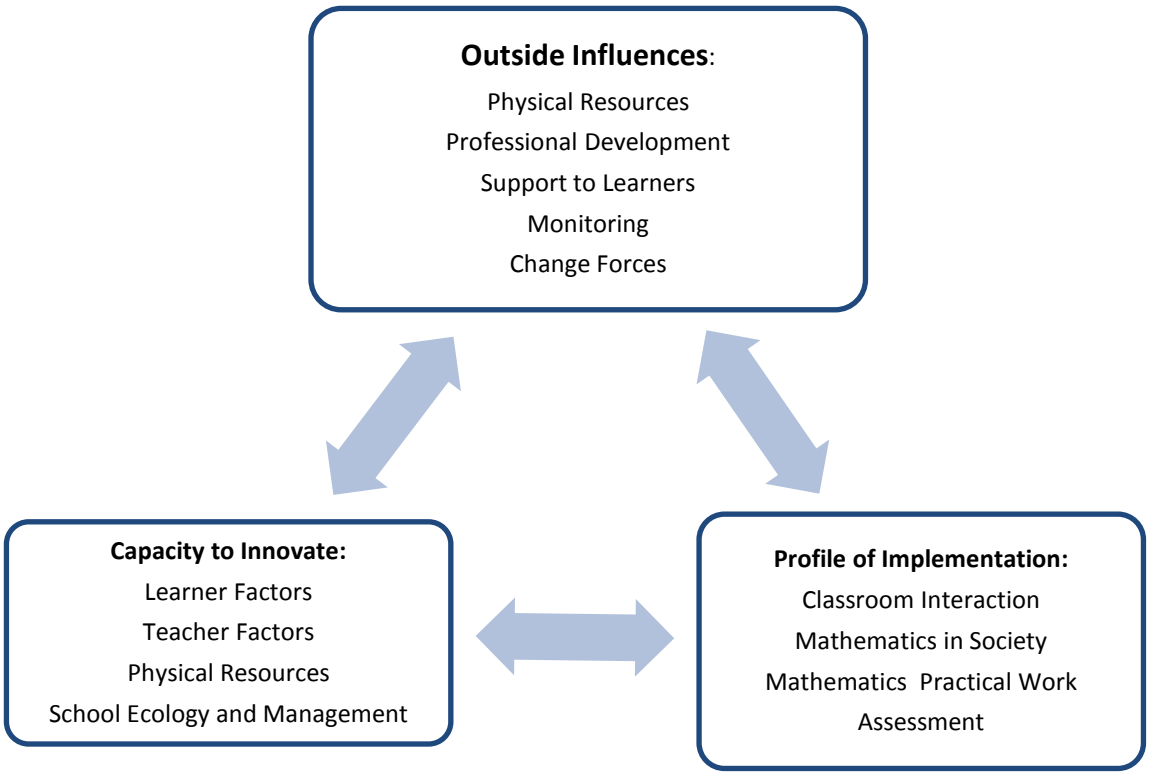

Figure 1: The constructs and sub-constructs of the Rogan-Grayson (2003) framework

Figure 1 shows the three constructs, their sub-constructs and linkages. It is believed that links to sub-constructs might influence practice. For example, the profile of implementation (taken as the desired outcome) shows how the intentions purported in the curriculum are manifesting in practice in the form of classroom interactions, Mathematics practical work, assessment and Mathematics in society. The other two profiles, 'capacity to innovate' and 'outside influences' show how contexts of schools may support or inhibit implementation of a curriculum. However, Aldous-Mycock (2009) noted that the sub-construct 'Physical resources' occurs within both the capacity

to innovate construct as well as the outside influences construct. “Within the capacity to innovate construct physical resources refer to what is already available in terms of buildings, laboratories, libraries and curriculum materials. Within the outside influences construct, physical resources refers to further provision of resources to supplement what exists within the schools” (p. 39). Links like these have been shown to be very important in recent curriculum implementations as previous reforms were mostly concentrated on the quality of work put into designing the innovation but not how it was implemented (Stenhouse, 1975; Hord, 1987; Havelock & Zlotolow, 1995).

It could be said that the profile of implementation gives a tangible description of what takes place inside the classroom (Tawana, 2009). The secondary part of the model, the construct ‘capacity to innovate’ outlines a number of indicators for the implementers that are internal to the school that may affect implementation. The last part of the model, under outside influences, consists of a number of pointers such as physical resources, professional development, support to learners, monitoring and change forces, to which those who intend to change a curriculum should pay attention.

First the profile of implementation and how it relates to this study will now be expounded.

2.1.1 The Profile of Implementation

The profile of implementation outlines the types and extent to which the ideals of a curriculum are being put into practice (Tawana, 2009), which will be a Mathematics curriculum in this case. According to the framework of Rogan and Grayson (2003), process changes occur in four sub-constructs, as shown in Figure 1. Identifying the profile of implementation is crucial for this study because it offers a map of the learning activities that go on inside the classroom, constituting the nature of interactions coming from learners, the types of engagement in hands-on and communication discourse in line with modern views of teaching and learning (Mortimer & Scott, 2003; Lave & Wenger, 1991). Aldous-Mycock (2009) reveals that in recent years Mathematics educators have suggested various directions for improving classroom learning. For instance, Mathematics instruction or classroom interactions should present learners with Mathematical knowledge in more authentic contexts (Roth, 1997). Therefore, to inspire meaningful learning there is a need to encourage learner discussions, argumentations, social negotiations skills, and cooperative learning (Newton, Driver, & Osborne, 1999). Moreover, Lave (1996) and Wenger (1998) state that in modern learning participation can be equated to learning. They further note that through participation, Mathematics is seen as having potential to help learners develop problem solving skills and apply knowledge in solving everyday problems. The profile of implementation also accommodates other classroom activities, such as, the integration of Mathematics and society which is an essential component of the Mathematics curriculum (Aldous-Mycock, 2009). In conclusion, Hofstein and Kesner (2006) elaborate that involving

Mathematics and society in instruction, is helpful in enhancing learners' skills, creativeness, Mathematical attitudes, decision making, and epistemological views about Mathematics.

The second construct 'capacity to innovate' will now be reviewed.

2.1.2 The Capacity to Innovate

Charting out learning activities becomes imperative as there is an assured link between the degree of implementation and contexts of the schools (Rogan and Aldous, 2005). Hence charting up current practice and contexts would help to understand and elaborate factors affecting classroom activities such as teaching and learning. According to Loucks-Horsley et al. (1998) capacity factors are broad indicators coming from physical resources, teacher and learner factors, as well as the school setup. They further noted that these are crucial structures in determining what leads to effectiveness in learning, but, these factors can also act as hindrances to implementation. For example, a well-resourced school is in a good position to support learning activities, whilst an impoverished school only has modest chances.

Moreover, Kelly (1999) and Garegae (2003) revealed that work and study conditions of teachers and learners, language of instruction, school ethos which include functionality of school and leadership patterns, can easily influence the extent of teaching and learning. They further emphasise that these broad areas portray the importance of well-developed capacity in carrying out quality teaching and learning.

2.1.3 Support from Outside Agencies

Provision of resources is crucial to learning and functionality of the school (Hewson, Kahle, Scantleybury, & Davies, 2001). According to their study, one of the core indicators of access to quality Mathematics education was identified as the availability of resources and teacher support. A positive support base to bring a favourable climate in school is critical as an unfavourable climate interferes with learners' opportunities to learn (Tawana, 2009). On the same note, Hewson et al. (2001) observe that negative environments may lead to learners disengaging from school and learning. The support Hewson et al. referred to is offered in the form of material things such as human resources, buildings and books, whereas non-material support can be viewed as taking the form of in-service professional development and monitoring of the implementation process. Brown and Schulze (2002) observed that human resources support brings a good environment for the health and welfare of the institution.

The theoretical framework helps to ensure a smooth change in curriculum reform or implementation and was mainly designed for developing countries (Aldous-Mycock, 2009). Since Namibia is a developing country, the theoretical framework strongly supports this study. Furthermore, because the theoretical framework recognises that in implementing a curriculum, policy makers are more interested in the "what" more than in the "how", one of the objectives of this study is to find out whether policy makers provide guidelines on how to implement a curriculum and, therefore, the theoretical framework relates well with this study. The researcher therefore assumes that teachers

are or were facing challenges in implementing the compulsory Mathematics curriculum in Otjozondjupa region in Namibia.

2.2 Literature Review

The review of related literature involves the systematic identification, location, and analysis of documents containing information related to the research problem (Gay et al., 2011).

Educators perform well if there is certainty and stability in the curriculum and education system. Here Piaget's (1977) ideas of assimilation and accommodation can be cited. Educators who were trained at colleges and universities for a particular curriculum have to assimilate and accommodate the new education dispensation regarding curriculum transformation and change. Thus, Mathematics teachers have to assimilate and accommodate these changes in order to implement the compulsory Mathematics curriculum at senior secondary level effectively and efficiently.

2.2.1 Curriculum Implementation

Curriculum implementation entails putting into practice the officially prescribed courses of study, syllabuses and subjects. "It involves helping the learner acquire knowledge or experience. It is important to note that curriculum implementation cannot take place without the learner. The learner is therefore the central figure in the curriculum implementation process. 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" (University of Zimbabwe, 1995, p. 8). Viewed from this perspective, curriculum implementation also refers to the stage when the curriculum itself, as an educational programme, is put into effect. "Putting the curriculum into operation requires an implementing agent" (Ngara, Ngwarai & Ngara, 2013, p. 385).

Similarly, Stenhouse (1979) identifies the teacher as the agent in the curriculum implementation process. He argues that implementation is the manner in which the teacher selects and mixes the various aspects of knowledge contained in a curriculum document or syllabus. Implementation takes place when the "teacher-constructed syllabus, the teacher's personality, the teaching materials and the teaching environment interact with the learner" (University of Zimbabwe, 1995, p. 9).

Hence, in this study, 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.

2.2.1.1 Curriculum

Curriculum can be defined in different ways, and its definition varies depending on how a particular author conducts his or her work (Connelly & Lantz, 1991). A curriculum can be understood and analysed at different levels. Therefore, when studying a curriculum, researchers need to be aware of the complexity of a curriculum, and operationally define it to guide the subsequent data collection and analysis. Chen (2010) defines curriculum as "educational documents, such as standards or syllabus which are devised based on

certain theoretical principles, stipulate the details of objectives, content, pedagogy, assessment and resource etc. and serve the compilation of textbooks" (p. 13). Similarly, MoE (2010, p.1) defines curriculum as "a framework for devising syllabuses, learning materials and textbooks to be used in the various subjects and areas of learning, from which teachers' schemes of work and lesson plans can be developed, so that the goals and aims will be put into practice in a consistent manner".

Particularly in this study, 'curriculum' is defined as the official policy for teaching, learning, and assessment and gives direction to planning, organising and implementing teaching and learning in schools.

2.2.1.2 Implementation

Implementation refers to the actual use of innovation or what an innovation consists of in practice (Fullan, 2001). He adds that implementation consists of the process of "putting into practice an idea, program, or set of activities and structures new to the people attempting or expected to change" (Fullan, 2001, p. 69). Therefore in this study, implementation takes place when the teacher and the curriculum materials interact with the learner.

2.2.1.3 Implementing Agents

Fullan (1991) explains that successful reform necessitates teachers that are ready to change, and teachers that have the required resources to implement and sustain change. Additionally, Fullan describes reform to be local and restricted by the 'ownership' that

teachers ascribe to it in the classroom. On the same note, MoE (2010) indicated that the greatest challenge of curriculum reform is in the implementation of the curriculum, and it is therefore essential that all teachers, who are the implementers of the curriculum, take ownership and implement it with commitment.

2.2.1.4 Factors that influence curriculum implementation

2.2.1.4.1 The implementing agents

Curriculum implementers view their role in curriculum implementation as an autonomous one. They select and decide what to teach from the prescribed syllabus or curriculum. Since the implementation takes place through the interaction of the learner and the planned learning opportunities, the role and influence of the curriculum implementers in the process is indisputable (University of Zimbabwe, 1995).

If the curriculum is what teachers and students create together, as Wolfson (1997) states in *Curriculum Implementation*, the implementing agents must play a more vital role in designing the curriculum. The implementers must be involved in curriculum planning and development so that they can implement and modify the curriculum for the benefit of their learners.

2.2.1.4.2 The learner

Learners are also a critical element in curriculum implementation. While teachers are the key arbiters of classroom practice, the learners hold the key to what is actually transmitted and adopted from the official curriculum. The official curriculum can be quite different from the curriculum that is actually implemented. The learner factor

influences the curriculum implementers in their selection of learning experiences, hence the need to consider diverse characteristics of learners in curriculum implementation (University of Zimbabwe, 1995). For example, home background and learner ability in Mathematics can determine what is actually achieved in the classroom.

2.2.1.4.3 Resources, materials and facilities

From experience, one is aware that no meaningful teaching and learning can take place without adequate resource materials. This applies to curriculum implementation as well.

For the officially designed curriculum to be fully implemented as per plan, the Ministry of Education should supply schools with adequate resources such as textbooks, teaching aids and stationeries in order to enable curriculum implementers and learners to play their role satisfactorily in the curriculum implementation process. The University of Zimbabwe (1995) suggested that "the government …must also provide physical facilities such as classrooms, laboratories, workshops, and libraries in order to create an environment in which implementation can take place" (p. 2). Therefore, workshops for curriculum implementers on implementation guidelines, the availability and quality of resources and the availability of appropriate facilities have a great influence on the implementation of the compulsory Mathematics curriculum.

2.2.1.4.4 Instructional Supervision

According to Chikumbu and Makamure (2000) curriculum implementation cannot be achieved unless it has been made possible through the supervisory function of the school management. They note that this can be achieved through deploying staff; allocating enough time to subjects taught at the school; providing teaching and learning materials; and creating an atmosphere conducive for effective teaching and learning.

Moreover, University of Zimbabwe (1995) adds that the school management should monitor and guide curriculum implementation by ensuring that schemes of work, lesson plans and records of marks are prepared regularly. The school management should therefore create a climate of social responsibility to ensure successful implementation of desired curriculum changes. Chikumbu and Makamure (2000) further state that effective curriculum implementation does not take place in a school where the school management is incapable of executing supervisory functions. This implies that for the successful implementation of the compulsory Mathematics curriculum at senior secondary school level, monitoring and guidance should be carried out by the school management.

2.2.1.5 The neglected phase in curriculum change

No matter how laudable education policies/programmes are, poor implementation of school curriculum would lead to poor quality education which in effect undermines capacity building and sustainable development in any nation (Duze, 2011). Several researchers found that Nigeria's educational system has continued to fail in delivering

the intended outcomes of the curriculum due to poor implementation as a result of the serious administrative constraints encountered by school management and teachers (Duze, 2011; Nwangwu, 2007; Okebukola, 2006).

Moreover, Duze (2011) observed that the policy-makers and planners as well as political officials most of the time idealize the education programmes in Nigeria without putting into place feasible routes to implementation and without involving the real school implementers all through policy formulation and programme design/planning as a result of undue politicization of education.

Duze (2011) considers these as major administrative constraints affecting curriculum development and implementation in Nigeria and as stumbling blocks to education for sustainable development. Foremost in identified administrative constraints was the planner-executor constraint, which tended to rub across all the other constraints identified, to adversely affect curriculum development and implementation in Nigeria (Duze, 2011; Nwangwu, 2007; Okebukela, 2006; Ntukidem & Etudor, 2003). Ntukidem and Etudor (2003) indicate that these, "in the order of severity …were manpower, acceptance, planning process, teacher demand and supply, environment, sociological, and manual methods of operation constraints" (p.45). It can clearly be understood that a lack of proper planning might lead to poor implementation of the compulsory Mathematics curriculum in Namibia.

Successful implementation of new programme requires planning, appropriate strategies, and staff development.

Patterson and Czaijkowski (1979) indicated that:

> The stark reality about curriculum change is that it seldom happens as expected. While those who work with curriculum have suspected this for some time, recent investigations have confirmed it. The most common explanation is that curriculum planners fail to attend adequately to implementation. They make their way through the initiation, development, and adoption phases of curriculum change, but then they do not take the necessary steps to achieve a satisfactory level of implementation. Their innovations do not enter the classroom; they do not affect day-to-day interaction between teachers and learners… (p. 204).

They further commented that there are three components of implementation that seem most often neglected, namely: planning for implementation, applying change strategies, and conducting staff development. Under these three components, they outlined the following:

2.2.1.5.1 Planning

Sarason (1971) reveals that much of the joy for those involved in the curriculum change process lies in creating, initiating, and developing the curriculum. Therefore, too little attention is given to planning for implementation. Often by the time a new curriculum framework has been approved and textbook materials ordered, it is time for curriculum leaders to start creating, initiating, and developing something else (Patterson & Czaijkowski, 1979). Curriculum change often ends with the adoption phase. Often planning suffers from several inadequacies. Resources are often insufficient. Failure to

plan for the involvement of those implementing the curriculum is another source of neglect. As Fullan and Pomfret (1997) state:

> Research has shown time and time again that there is no substitute for the primacy of personal contact among implementers, and between implementers and planners/consultants, if the difficult process of unlearning old roles and learning new one is to occur. Equally clear is the absence of such opportunities on a regular basis during the planning and implementation of most innovations (p. 391).

Teachers may not have to make all the decisions but, at the very least, there must be ways for them to develop a feeling of commitment towards those decisions. A related mistake in planning occurs in overlooking the importance of communication during the implementation process. One cannot assume that teachers will implement a new curriculum successfully if only they understand it well enough. Therefore, planning for implementation requires formal channels for two-way communication among those involved in the implementation process.

2.2.1.5.2 Strategies

Depending on the situation, several different strategies may be appropriate for the implementation process. Fullan (2001) notes that most models for bringing about curriculum change assume a strategy of reason. The leader uses logic to get potential implementers to see the need for a particular curriculum change. Advocates of this strategy assume that when teachers are more knowledgeable, they will try to reduce the

discrepancy between what is and what ought to be (Fullan & Pomfret, 1997). Unfortunately, the strategy of reason is rarely successful.

Moreover, Patterson and Czaijkowski (1979) note that although not universally effective, power strategies have been used successfully for achieving implementation. They explained that a power strategy is one that usually emanates from the top down and the school or teachers have little control over the decision. Fullan and Pomfret (1997) reveal that conditions appropriate for a power strategy include situations where change must occur rapidly and where the implementers are opposed to the change that the change strategist decides it will be productive to change behaviour first and hope that attitude change will follow.

According to Patterson and Czaijkowski (1979) one of the most successful strategies for implementing change is influence. They emphasise that other labels used to describe it are persuasion, seduction, and manipulation. The major premise of this strategy is that implementation will take place successfully if conditions are made sufficiently appealing for the implementers. For example, if a feature associated with a new school curriculum is additional planning time for teachers, the teachers may become committed to implementation because of the increased planning opportunity, not the innovation per se. The decision of which strategy or combination of strategies to use depends on the basis of commitment for change, the incentive for changing, and the setting in which the change is to occur (Fullan, 2001). Therefore, consideration of these factors can help reduce the high mortality rate of implementation efforts.

2.2.1.5.3 Staff Development

Several recent studies have found that implementation fails because curriculum leaders neglected to provide adequate staff development opportunities (Berman & McLaughlin (1979); Joseph (1987); Fullan & Pomfret (1997)). It is assumed that teachers already have the expertise to implement the change. Joseph (1987) and Fullan and Pomfret (1997) indicate that two areas of staff development deserve mention here. First is re-education: the development or refinement of competencies necessary to implement the innovation or it may include a series of sharing sessions among colleagues on teaching ideas of a new curriculum. Second is resocialisation: the development or refinement of roles and role relationships required for implementation. This means changing certain interactive skills, attitudes, and habits of the staff. As Fullan and Pomfret (1997) describe role relationships, it means teachers being able to "…recognize the range of behavioural alternatives open to them, ascertain which ones are applicable in a given setting, and change accordingly" (Fullan and Pomfret, 1997, p. 363). This shows the importance of resocialisation for the implementation to be successful.

2.2.2 Mathematics Education Reform

According to Simon (2013), Mathematics education reform, as conceptualized in the United States and a number of other countries, presents a fundamental change in the teaching of Mathematics and the results it produces for students. On the other hand, Bell et al. (2010) indicate that as progress is made in the direction of reform, teacher education and professional development during the last two decades have been largely

unsuccessful in preparing teachers to enact the reform vision. Chapman & Heater (2010) note that, even with the significant growth of the literature on teacher education and professional development, "change is still problematic in terms of achieving it in practice as intended by planned interventions" (p. 446).

2.2.2.1 Curriculum change

Change is a phenomenon that affects all aspects of a person's life and brings about alterations in both personal and employment spheres. Bertels (2003) describes change as the process of analysing the past to elicit present actions required for the future. It involves "moving from a present state, through a transitional state, to a future desired state" (Badugela, 2012, p.11). The focus of change is to introduce an innovation that produces something better, hence the implementation of the compulsory Mathematics curriculum in Namibia.

2.2.2.2 Management of curriculum change for effective curriculum implementation

Change as a process needs to be managed. The school management, as the key figure around which much of the school's activities revolve, to a great extent determines the school's success or failure when change is implemented. An educational leader should lead the change; not merely be subject to it (Van der Horst and McDonald, 2001).

According to Briggs and Sommefeldt (2002), the school management should know how to manage change and lead the process of change. School management should ensure that they have the necessary policy documents, circulars and guidelines at hand, and they

should study those documents and internalise all the fundamentals of the curriculum change. Briggs and Sommefeldt also acknowledged that change means that the school management should work through the following phases with the teachers: diagnosing the problem, planning the change, implementing the change and reviewing the developments. They further emphasised that working as a team with teachers should ensure that those who are affected by the implementation process of change are involved in the planning from the beginning.

They concluded by saying that irrespective of who makes the final decision, teachers should feel that they are consulted as a group as well as individuals, and that their opinions have some influence on the final decision.

Moreover, Kobola (2007) indicates that resistance to change can be caused by different factors at different levels. At the individual level, some individuals exhibit resistance to change if they perceive a lack of personal control over unfolding events; other individuals have negative attitudes toward change based upon their previous experiences of organisational change. Their attitudes are based on a lack of trust and misunderstanding of the intentions of change. At a group level, resistance to change is caused by group cohesiveness, social norms, participation in decision-making and autonomy for self-determination of actions. In this case, the distribution of organizational power and authority mediates the levels of resistance under different circumstances. Any change that emanates from outside the group is likely to be perceived as a threat to the status quo because the group values highly its social

interactions but possesses little power to influence the change process. At organizational level, factors such as organizational structure, climate, culture and strategy contribute to change.

The analysis by Badugela (2012) revealed that for the curriculum to be implemented successfully, participation is a crucial source of legitimacy for policy decisions, especially in educational policy. Badugela found that no teachers were involved in the decision to adopt a new curriculum in South Africa. She also added that, even though teachers were called on to become involved in the elaboration and the implementation of the curriculum, the decision to proceed had already been made. Unfortunately, participation is sometimes confused with consultation.

Therefore, it implies that for schools to be transformed and improved, the school management should ensure that teachers understand what they are doing, why they are doing it and how they should do it.

2.2.3 Teacher motivation in the teaching and learning of Mathematics

Educators do well in curriculum implementation when they are motivated. According to Maslow's (1943) theory, people have the need for esteem. This includes factors such as recognition, attention, social status and accomplishment. The atmosphere in our education system should motivate Mathematics teachers to work hard for the successful implementation of the compulsory Mathematics curriculum at senior secondary school level. Mathematics teachers must feel that they are supported by the school management, advisory teachers and inspectors for them to successfully implement the compulsory

Mathematics curriculum. Their efforts should be recognized and they should be rewarded for outstanding achievements. Therefore, the school management should lead the implementation of the new curriculum in the school, for they are the key troupes in facilitating, guiding and supervising of the implementation process (Ngara et al., 2013).

According to Hoy and Miskel (2008), instructional leadership encompasses those actions the management takes and delegates to others to promote growth in student learning. Instructional leadership of the management has a positive and direct effect on student achievement (Fullan, 2010). Thus, it is clear that the purpose of the management instructional leadership role is to facilitate effective teaching and learning.

On the same note, the Ministry of Education and Culture (MEC) (1993) emphasises that effective teaching and learning is more than simply gathering and memorising information. The MEC further notes that learners must become skilled at using information, not only in school or in other educational programmes but throughout their lives; often in ways that were not anticipated during their schooling. Hence, they should become skilled in determining what information they need to address a particular problem. This view sets high expectations for our teachers. Based on this, MEC (1993) notes that effective teaching and learning requires teachers who are not only competent in their subjects but who can also respond creatively to new situations.

Manson (2004) also added that effective leadership from the school management is essential in proper implementation of a curriculum. He indicated that an instructional leader provides curriculum direction for the teachers, inspires and energizes them,

motivates and mediates educational policy to the teachers, mentors and supports the teachers and monitors their progress. Furthermore, he stated that teachers would not operate effectively in an environment where the leader is not providing directions in matters related to the new curriculum. Therefore, teachers would lack information if the leader who is supposed to provide it is not there for them. Thus, “both strong motivation and enhanced skills on a very large scale are required” (Fullan, 2011, p. 3).

2.2.3.1 Monitoring and support in the implementation of the curriculum

For educational programmes to be successfully implemented, ongoing interaction between policy-makers and implementers is necessary. Ngara et al. (2013) indicated that programme coordinators need assistance and guidance as a new programme is being implemented. Interaction can be made meaningful if researches or assessments are carried out formatively as programmes are being implemented. They further note that provision of support services enhances implementation of a programme, and support can also be given through programme monitoring. Thus, pave the way for adjustments as implementation goes on.

More importantly, the school management, advisory teachers and inspectors should manage the process of teaching and learning within the schools in accordance with the curriculum policy documents and other policies. Monitoring and supporting the implementation of the curriculum are among the roles of the school management, advisory teachers and inspectors. Manson (2004, p. 47 – 48) referring to South Africa’s

C2005 Revised National Curriculum Statement indicates that the management should monitor and support the following:

- Content teaching: ensure that the content for teaching and learning is in line with the assessment standards.
- Integration in planning and presentation: ensure that assessment standards and various teaching methods are properly integrated.
- Learning outcomes and assessment standards: ensure that learning outcomes and assessment standards are correctly sequenced to allow progression.
- Learner-centred and learner-paced centred: ensure that the teaching pace is determined by the learners' learning progress.
- Application of the new curriculum principles such as progression and inclusivity: ensure that learners with various learning barriers are considered during planning and presentation.
- Continuous assessment: ensure that once-off assessments, for instance in the form of examination, are avoided in favour of continuous assessments.
- Drafting of time-tables: ensure that allocation of periods to learning areas is in line with the new curriculum.
- Remedial work: ensure that learners with learning difficulties receive the necessary assistance that enables them to learn.

Cunningham and Cordeiro (2000) see monitoring and support in the context of class visits as an instructional supervisory method. They note that class visits create the opportunity for the school management and advisory teachers to observe teachers' work, provide motivation and exercise influence (Cunningham and Cordeiro, 2000). During these supervisory visits, the teachers also have the opportunity to talk to the management and advisory teachers about the problems they encounter in teaching the curriculum.

Therefore, the school management and advisory teachers should conduct class visits and give support to the Mathematics teachers (Badugela, 2012). The proper implementation of the compulsory Mathematics curriculum requires effective monitoring by the school management and advisory teachers. Similarly, Bandele & Faremi (2012) note that for effective curriculum implementation, extra resources, support and monitoring are needed. Monitoring will therefore determine success and also determine deficiencies and challenges which teachers are encountering. After monitoring have been done and challenges diagnosed, corrective measures, support and other intervention strategies could then be taken to assist the Mathematics teachers and that on its own would be a way of empowering the teachers.

2.2.3.2 Teacher training and workshops

A problem of inadequate Mathematics teacher training is alleged to be one of the fundamental issues that lead to poor implementation of the compulsory Mathematics curriculum (Phorabatho, 2009). When a new policy is implemented in schools, both experienced and new Mathematics teachers need to get used to it and be trained in the

new system (Department of Education, 2000). Ramroop (2004) supports this statement and argues that, “if people who need to be the driving force behind the change are not equipped with knowledge, skills, and attitude to empower them to be a positive force of change, then any change attempt is sure to fail” (p. 5). Van der Merwe (2002) contends that Mathematics teachers are more likely to respond positively to initiatives if they are given additional support during its planning and developmental stages.

Furthermore, the Department of Education (2000) states that In-service Education and Training (INSET) should be conceived as an ongoing process of professional development. INSET is thus seen as a process whereby Mathematics teachers continuously renew and update their skills, knowledge and attitudes during their career.

This implies that for the Namibian Mathematics teachers to respond positively to change and successfully implement the compulsory Mathematics curriculum at senior secondary school level, they need to be supported throughout the development and implementation phases of the curriculum. Therefore, Mathematics teachers should be involved in training workshops in order to update their skills and knowledge in the teaching of Mathematics.

2.2.4 Views and Attitudes towards Mathematics Education

Thompson (1992) found that researchers who have studied teachers’ thoughts and decision-making processes during instruction have questioned the rationality of teachers’ behaviour by pointing to findings that suggest that their behaviour are mostly instinctive and intuitive, as opposed to reflective and rational. Insofar as teachers’ behaviour is

rational, Thompson notes that it is reasonable to assume that their conceptions of the subject matter and its teaching will have some bearing on their actions.

"On the assumption that the successful implementation of any policy is largely dependent on educators being positive about it, a great deal of research has sought to examine teachers' attitudes towards the implementation of any new curriculum in schools" (Avramidis & Norwich, 2002, p. 129). The researcher pointed out earlier that there is a host of factors to account for success in implementation, but being positive about the implementation of a curriculum is also a factor that can contribute to that success. Therefore, the researcher assumes that Mathematics teachers might successfully implement the curriculum provided that they are positive, among other factors, about the implementation of the compulsory Mathematics curriculum at senior secondary schools in Otjozondjupa region.

However, Guskey (2002) indicates that even if the teachers' behaviour are mostly flexible and spontaneous, it remains worthwhile to examine their conceptions and attitudes because of the potential influence that these might have in the formulation of behaviour patterns which may become habituated. If teachers' characteristic patterns of behaviour are indeed a function of their views, beliefs, and preferences about the subject matter and its teaching, then any "attempt to improve the quality of Mathematics teaching must begin with an understanding of the conceptions held by the teachers and how these are related to their instructional practice" (Thompson, 1992, p. 106). She emphasised that failure to recognise the role that the teachers' conceptions and attitudes

might play in shaping their behaviour is likely to result in misguided efforts to improve the quality of Mathematics teaching and learning in schools.

Ponte et al. (1994) documented that the Education system in Portugal is in the midst of a period of intensive reform. In particular, they discuss the teachers' and learners' views and attitudes toward Mathematics, Mathematics teaching and curriculum innovation. They found that teachers struggled with a contradiction: whilst they approved the new orientations, which were seen as adequate and innovative, they complained about the design and implementation of the programme. Ponte at al. also found that teachers believed that the new curriculum would bring significant improvements for Mathematics learning, but the teachers felt overwhelmed with work and were not well prepared to successfully implement the reforms. The teachers criticized the Portuguese Ministry of Education for not reducing significantly their teaching load, not giving them a free day, less teaching hours in a week, and no other grades to teach besides those in the reform programme to make it successful (Ponte et al., 1994). Since Portugal is a developed country and yet experiencing such problems with the implementation of a curriculum, one might expect a developing country such as Namibia to experience a similar situation as experienced in Portugal with the implementation of the compulsory Mathematics curriculum.

2.2.5 Challenges in the Teaching and Learning of Mathematics

Curriculum as a set of education plans should be prepared and adapted based on the learning situation and future demand. Mulyasa (2006) states that "the Indonesian

government took a careful step by implementing the concept of a school-based curriculum in order to deal with the main educational problems, such as the demand for teachers to be skilled and trained" (p. 52). Amongst others, this step gave authority for schools to arrange, improve or develop and evaluate their curriculum by considering social, cultural, financial, and local potentials; as well as society's needs, results and other aspects that affect the education process in the school or in the area where the curriculum was applied.

Moreover, Tadesse and Meaza (2007) indicate the following challenges of the school-based curriculum: inadequate supervision, lack of financial and material support, and negative attitudes of teachers towards the new curriculum. The researcher would like to find out whether Mathematics teachers in Namibia might be facing similar problems as those highlighted by Tadesse and Meaza. Hence the need for better prepared school teachers, many of whom, especially in the previously disadvantaged groups, were inadequately prepared for basic teaching, let alone comprehending the new curriculum process. Curriculum implementation, therefore, favours well-resourced schools with well-skilled, motivated and well-qualified teachers.

However, a study conducted in the United State of America by Rosenstein (1997) states that any analysis of Mathematics education will identify a range of challenges. He based his opinion on the following issues which he deems core areas of concern: a sense of fear and failure regarding Mathematics among a majority of children, a curriculum that disappoints at the same time the talented majority and the non-participating majority,

crude methods of assessment that encourage perception of Mathematics as mechanical computation, and lastly, a lack of teacher preparation and support in the teaching of Mathematics. It would be of interest to see whether the implementation of compulsory Mathematics at senior secondary school level resulted in any of these challenges, and also get the teachers' views on the possible solutions to ameliorate these challenges.

Similarly, Fischer (2010) notes that the education system in Namibia is confronted with many problems inherited from the pre-independence period. Lack of infrastructure, lack of trained personnel, high failure rates, an insufficient teacher-learner ratio and a lack of quality learning materials for all learners, are among the major problems facing the Namibian Education system (Fischer, 2010). He concludes that, even though the government and donors were able to at least reduce these problems during the last ten years, they remain a problem, especially in some of the poorer rural schools in the country.

Furthermore, Mathematics and Science Teachers Extension Programme (MASTEP) (2002) found that when it comes to management structures, support and monitoring of programmes in schools, there is a lack of support and in-service training for teachers, unsupportive management at some schools, inexperience in implementation of the curriculum, lack of subject-specific control and assistance by inspectors and advisory teachers owing to understaffing, a lack of co-operation and communication between policy-makers and implementers, and no formal or consistent policy on teacher supervision. Correspondingly, Bandele and Faremi (2012) conducted a study in South

West Nigeria and found that the major challenges facing the implementation of a curriculum are lack of in-service training and poor conditions of service of teachers and instructors, outdated equipment, shortage of financial and human resources, unstable government policies, lack of standard workshops for teachers, and a lack of related modern instructional materials. Thus, all these create more difficulties in implementing a curriculum successfully.

Additionally Sidiropoulus (2008) reported in her study that teachers complained of having big classes, learners being very weak in Mathematics and continuously require individual attention. She indicated that there was a lack of adequate resources and learners that are weak in Mathematics were not motivated to do mandatory Mathematics. She also found that teachers cannot give attention to individual learners because there are so many of them in one class. If attention is given to individual learners then the teachers will not finish the syllabus.

On the same note, Stephanus (2008) found that Mathematics Education in the senior secondary schools in Namibia is affected by many factors. “These include the lack of teaching and learning materials and other resources, management styles, learners’ mathematical background, teachers’ effectiveness in teaching Mathematics, quality and frequency of learners’ work, lack of contextual teaching, and lack of monitoring and evaluation-based system” (p. 90). This might mean that if these challenges are not addressed before the implementation of the compulsory Mathematics curriculum in the

senior secondary schools, it may cause more problems in the teaching and learning of Mathematics in the Otjozondjupa region, and the country as a whole.

In contrast to the above mentioned challenges, Lapus (2008) states that the implementation of the new curriculum in the Philippines included well-orchestrated delivery system such as the provision of teachers, enough textbooks and other resources. Lapus (2008) further observed that, the Department of Education ensured that there was equity in spreading its meagre resources. This explains why the Philippines strengthened its basic education information system to be able to capture accurate school-level statistics as the basis for the development of crucial learning resources such as enough teachers, classrooms, furniture and textbooks.

2.3 Summary

This chapter presented the theoretical framework underpinning this study. The theoretical framework helps to ensure a smooth change in curriculum reform or implementation and was mainly designed for developing countries. The chapter also reviewed literature under the headings: curriculum implementation; overview of Mathematics education reform; teacher motivation in the teaching and learning of Mathematics; views and attitudes towards Mathematics education; and challenges in the teaching and learning of Mathematics. The next chapter presents the methodology of this study.

CHAPTER 3: RESEARCH METHODOLOGY

This chapter describes the methods that were used to collect and analyse the data from the participants. This included the research design, population, sample and sampling techniques, the research instruments, ethical considerations, data collection procedure, and data analysis.

3.1 Research Design

The study was grounded in an interpretive paradigm and employed a mixed-method approach to generate both quantitative and qualitative data in two sequential phases. The design used in this research was explanatory sequential design in which the researcher was interested in following up on the quantitative results with qualitative data (Edmonds, & Kennedy, 2013; Creswell, 2014). The design was chosen for its usefulness since the researcher was interested in explaining with some degree of depth the findings from the first phase of the study with qualitative data collected in the second phase.

The research process was conducted in two distinct phases. In the first phase quantitative data were collected by means of a closed-ended and open-ended questionnaire from 20 Grade 11 and 12 Mathematics teachers in the senior secondary schools in Otjozondjupa region in order to obtain information on their views and challenges on the implementation of the compulsory Mathematics curriculum in the Country (Creswell, 2014, p. 224). Thereafter, the statistical data were scored and used to purposefully select the ten Mathematics teachers from whom qualitative data were collected by means of semi-structured interviews. The interviews elaborated on the statistical data and gave in-

depth information about views and challenges that the teachers hold about the implementation of the compulsory Mathematics curriculum. In his explanation, Creswell (2014, p. 224) states that "The key idea of this method is that the qualitative data collection builds directly on the quantitative results".

In the second phase, quantitative data from phase one were analysed and used to formulate interview questions for phase two. Teachers who represented extreme views (i.e. teachers who held views that were very positive and those who held views that were very negative) were thus purposively selected to participate in the second phase (Creswell, 2014). In-depth interviews were conducted in second phase to probe and provide rich information. Therefore, the questionnaire in phase one of the study was used to generate a sample of information rich individuals that participated in the second phase.

3.2 Population

Johnson and Christensen (2012, p. 218) define a population as "the large group to which a researcher wants to generalise the sample results", the total group that one is interested in learning more about. The population in this study comprised 23 Grade 11 and 12 Mathematics teachers in the Otjozondjupa region. There are 14 secondary schools in the region, and each secondary school has 1, 2 or 3 Mathematics teachers teaching at senior secondary school level (Ministry of Education, 2014).

The researcher chose the Grade 11 and 12 Mathematics teachers since they are responsible for teaching Mathematics at this level and are directly affected by the reform

to teach compulsory Mathematics. Thus they provided rich information to answer the researcher's questions.

3.3 Sample and Sampling Procedure

A random sample of 12 out of 14 secondary schools was selected from the defined population. The name of each secondary school was written on a piece of paper, and placed into a box (Gay et al., 2011). The researcher asked a colleague to help select 12 papers from the box. The 12 selected schools became part of the sample. All the Grade 11 and 12 Mathematics teachers from the 12 selected schools were asked to participate in the study. Thus a total of 20 Mathematics teachers participated in the study.

All the participants were required to complete the questionnaire first. Based on the participants' answers on the questionnaire, the researcher then purposively selected 10 participants (50% of the participants) that were interviewed. The interviews provided the researcher with in-depth and rich information regarding the Mathematics teachers' views and challenges faced in the implementation of the compulsory Mathematics curriculum at senior secondary school level and possible solutions.

3.4 Research Instruments

The following instruments were used in the study during data collection process.

3.4.1 Questionnaire

In order to enable the participants to freely express their own opinions and experiences, a questionnaire was used for the study (Creswell, 2012). The study employed closed-

ended (four-point Likert rating scale) and open-ended questions in the questionnaire to gather data about the views and challenges of Mathematics teachers on the implementation of the compulsory Mathematics curriculum. Likert rating scales are useful when a behaviour, attitude, or phenomenon of interest needs to be evaluated on a continuum of, say, inadequate to excellent, never to always or strongly disapprove to strongly approve (Leedy, & Ormrod, 2012).

The questions were structured in such a way as to address the research questions. The questionnaire was divided into three sections: Section A dealt with the biographical information and consisted of six questions. Section B comprised of statements dealing with the teachers' views and challenges in the implementation of the compulsory Mathematics curriculum and consisted of 35 questions. Section C consisted of two open-ended questions where respondents were allowed to express their own opinions on how to ameliorate the challenges faced in teaching compulsory Mathematics.

3.4.2 Semi-Structured Interviews

Interviews are conducted to explore and probe participants' responses to gather in-depth data about their experiences and feelings (Gay et al., 2011). Therefore, in this study an interview was conducted to provide the researcher with in-depth and rich information regarding the Mathematics teachers' views and challenges in the implementation of the compulsory Mathematics curriculum at senior secondary school level in the Otjozondjupa region, and the possible solutions to ameliorate these challenges. Data that emerged from the questionnaire were used as a basis for semi-structured interviews, as

well as selecting participants for the interview. The interviews were tape recorded in order to capture all the rich information from the purposefully selected participants.

3.5 Pilot study

The questionnaire and the interview guide were piloted with Grade 11 and 12 Mathematics teachers in two senior secondary schools in the Khomas educational region that were not targeted to take part in the main study to determine whether the questionnaire and the interview guide would elicit the intended responses. This was done to ensure that both items in the questionnaire and the interview guide were clear and did not lead to misinterpretation. During the pilot study, the respondents understood the instruments and answered the questions accordingly. No adjustments were made to the research instruments afterwards.

3.6 Validity and reliability of the measuring instruments

According to De Vos and Strydom (2005), a valid instrument is one that does what it is intended to do. That is measuring what it is supposed to measure and yielding scores whose differences reflect the true differences of the variable being measured rather than random or constant errors. Therefore, in this study to ensure validity of the instruments, the questionnaire and the interview guide were given to the researcher's supervisors for comments and suggestions before administering them to the participants.

In quantitative research, reliability traditionally refers to the extent to which ones' findings could be replicated should the study be repeated, with the aim of developing

cause and effect relationship among variables (Creswell, 2012). De Vos and Strydom (2005) add that reliability refers in general to the extent to which independent administration of the same instrument consistently yields the same or similar results under comparable conditions. Reliability is primarily concerned not with what is being measured but with how well it is being measured. In this regard, the researcher gave the questionnaire to supervisors who made changes and corrections which were included in the final instruments, and piloted them afterwards in order to test and ensure reliability as described herein.

3.7 Data Collection Procedure

Upon permission being granted for the researcher to collect data at the selected secondary schools (see Appendix F), the researcher administered the questionnaire (see Appendix H) to the selected 20 senior secondary school Mathematics teachers in the sample. The participants were expected to complete the questionnaire within the same day, but that was not possible since the participants felt that they needed enough time to complete the questionnaire. Therefore, the completed questionnaires were collected from schools by the researcher on the next day, and analysed. Thereafter, interviews with 10 purposively selected Mathematics teachers followed. The interviews lasted approximately 25 minutes and were carried out in the participants' own setting to avoid disruption of daily activities. The interviews were tape recorded and transcribed after each interview. Permission was sought from the participants to be tape recorded with the assurance of anonymity.

3.8 Data Analysis

Creswell (2014, p.224) states that in an explanatory sequential design:

> "The quantitative and qualitative databases are analysed separately. The quantitative results are then used to plan the qualitative follow-up. One important area is that the quantitative results cannot only inform the sampling procedure but it can also point toward the types of qualitative questions to ask participants in the second phase. Because analysis proceeds independently for each phase, this design is useful for the student research and perhaps easier to accomplish because one database builds on the other…"

On that same note, Creswell (2014) also cautions that "…a misstep at this point by beginning researchers is to merge the two databases." He explains further that "the intent of the design is to have the qualitative data help to provide more depth, more insight into quantitative results" (p. 225).

3.8.1 Phase 1

The data collected from the questionnaires were analysed using frequency tables and graphs.

3.8.2 Phase 2

The second phase focused on analysing qualitative data that helped provide more depth, more insight into the quantitative data. This phase also helped in providing a richly textured and more nuanced understanding of the Mathematics teachers' views and

challenges on the implementation of the compulsory Mathematics curriculum. Thus, the analysed data from the questionnaire were used as the basis for semi-structured interviews. Thematic analysis was used to analyse the semi-structured interview data. Thematic analysis is a process of coding qualitative information (Boyatzis, 1998). Therefore the researcher developed codes, words or phrases that served as labels for sections of the data. Thus, the themes that emerged from this process were gradually grouped to provide a rich and deep characterization of Mathematics teachers' views and challenges in the implementation of compulsory Mathematics at senior secondary level.

3.9 Research Ethics

Ethical clearance was first sought with the University of Namibia (UNAM) Postgraduate Studies Committee (see Appendix B). Thereafter, a letter was sent to the Permanent Secretary of Ministry of Education (see Appendix C), and then to the Director of Education in the Otjozondjupa Region (see Appendix E), the Inspectors of the different circuits and the Principals of the Secondary Schools requesting permission to conduct the research. The participants received full information about the purpose and objectives of the study, to enable them to make informed decisions whether to participate in the research. They were informed that they were free to withdraw from the study anytime. All participants willingly agreed to take part in the study. The information provided by the respondents was treated with the utmost confidentiality and anonymity. The teachers' names did not appear on the questionnaires or in the final thesis report. The study did not in any way harm the participants either physically or psychologically.

Finally, the researcher promised to share the research findings with the Otjozondjupa Regional Office upon completion of the study and also promised to strive to be objective, honest and to report on the process accurately and with integrity.

CHAPTER 4: DATA ANALYSIS, INTERPRETION AND DISCUSSION

The preceding chapter dealt with the methodology and research techniques used in this research, which explored the views and challenges of the Mathematics teachers on the implementation of the compulsory Mathematics curriculum at the senior secondary school level in Otjozondjupa region.

This chapter presents the findings from the questionnaires administered to the selected Grade 11 and 12 Mathematics teachers as well as the interviews conducted with ten Grade 11 and 12 Mathematics teachers who were purposefully selected from the chosen sample. The participants were all from the selected senior secondary schools in Otjozondjupa region, and the purpose was to assess their views and challenges faced in the implementation of the compulsory Mathematics curriculum.

The results obtained are presented according to the questions of the study. Drawing from the questionnaires and interview data, I first present the biographical information of the Mathematics teachers; followed by the views of Mathematics teachers, motivation and challenges faced by the teachers in the implementation of the compulsory Mathematics curriculum at senior secondary school level.

4.1 Data presentation and discussion

Data from the questionnaire is presented in the form of tables to show the participants' level of agreement that was indicated using a four point Likert scale with Strongly Agree, Agree, Disagree and Strongly Disagree. The participants' responses from the

questionnaire are then supported by qualitative data that were collected in the form of interviews with 10 selected participants from the sample.

4.2 Biographical information of the participants

4.2.1 Gender

A total number of 20 Mathematics teachers took part in the study, of which 12 were female and eight were male.

4.2.2 Age

The age groups of the respondents are summarised in the following table.

Table 1: Age groups of respondents

Age group	Frequency
Under 25	0
25 – 29	3
30 – 34	8
35 – 39	2
40 – 44	2
45 – 49	2
Above 49	3
Total	**20**

From Table 1, it can be seen that the age group of 30 – 34 years has the highest frequency followed by the age groups of 25 – 29 years and above 49 years, with three participants in each.

4.2.3 Qualifications

The qualifications of the Mathematics teachers in the study are given in Table 2.

Table 2: Qualifications of respondents

Qualification	Frequency
BETD	3
BED	5
MED	0
OTHERS	12
Total	**20**

When the qualifications of the Mathematics teachers who participated were analysed, it emerged that 12 Mathematics teachers indicated 'Others'. These included one Mathematics teacher who had Masters of Science degree (Agriculture), three had Bachelor of Education (Honours) degrees, one had Higher Education Diploma (HED), one had Advanced Certificate in Education (ACE), three had Bachelor of Arts Honours degrees plus HED, one had Basic Education Teaching Diploma (BETD) plus ACE, and one had BETD plus Mathematics and Science Teachers Extension Programme (MASTEP).

The results in Table 2 further show that five of the respondents had a teaching Bachelor of Education (BED) degree and the remaining three of the respondents had a Basic Education Teaching Diploma (BETD).

4.2.4 Teaching Experience

The teaching experiences of the participants are presented in Table 3.

Table 3: Teaching experience of respondents

Number of years	Frequency
0 – 2	1
3 – 5	3
6 – 8	4
9 – 11	5
12 – 14	1
15 – 17	1
18 – 20	1
Above 20	4
Total	**20**

Table 3 shows that five of the Mathematics teachers had 9 – 11 years teaching experience. This was followed by four respondents with experience as Mathematics teachers of 6 – 8 years and another four with more than 20 years of teaching experience.

4.2.5 Average number of learners in the Mathematics classroom

Mathematics teachers were asked to indicate the average number of learners in their classrooms. Their responses are given in Table 4.

Table 4: Number of learners in the mathematics classrooms

Number of learners	Frequency
Less than 25 learners	5
26 – 30	0
31 – 35	2
36 – 40	10
41 – 45	3
More than 45 learners	0
Total	**20**

According to Table 4, 10 of the respondents indicated that the average number of learners in their classes is in the range 36 – 40 learners. Table 4 further reveals that five respondents had less than 25 learners.

4.2.6 School location

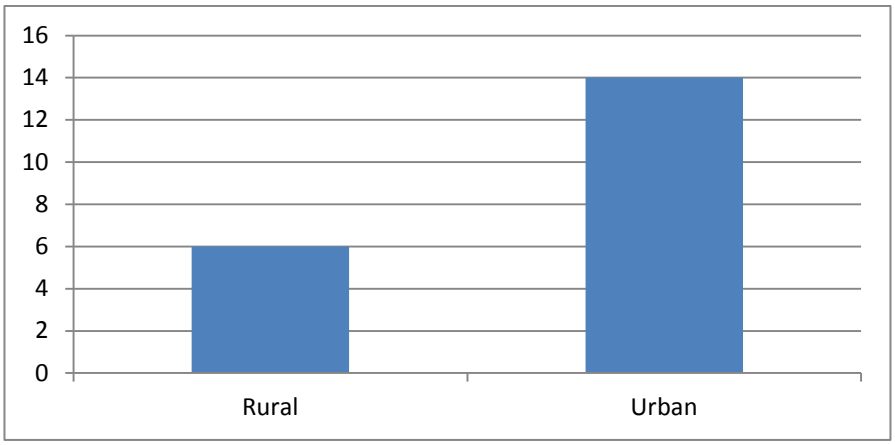

Figure 2: School location

Fourteen of the Mathematics teachers indicated that their schools are located in the urban areas, while six indicated that their schools are located in the rural areas (see Figure 2).

4.3 Teachers' views on the implementation of compulsory Mathematics

The following are findings with regard to the Mathematics teachers' views on the implementation of the compulsory Mathematics curriculum. A four point Likert Scale was used, using Strongly Agree, Agree, Disagree and Strongly Disagree. Table 5 shows the participants' responses on the 11 statements that required the Mathematics teachers to indicate their level of agreement.

Table 5: Teachers' views on the implementation of compulsory Mathematics

Statements	Strongly Agree	Agree	Disagree	Strongly Disagree	Total
	Fr	Fr	Fr	Fr	
1. Mathematics is an important subject for the future of all learners.	14	6	0	0	20
2. All learners at senior secondary level should study Mathematics.	8	5	5	2	20
3. Mathematics is a difficult subject, and it cannot be managed by all the learners at senior secondary level.	2	9	9	0	20
4. Learners in the Social Science and Commerce fields do not need mathematics.	1	1	14	4	20
5. Mathematics taught in Primary school and Junior secondary school does not prepare learners well for senior secondary level mathematics.	4	5	10	1	20
6. I think Mathematics is an easy subject for learners to understand.	1	9	10	0	20
7. Not all learners have the necessary capabilities to solve mathematical problems at senior secondary level.	7	8	5	0	20
8. Senior secondary level Mathematics is essential to all learners for their Tertiary Education.	5	11	3	1	20
9. Some of the learners do not have an interest in Mathematics as a subject, because they feel that they will not be needing mathematics in their future careers.	10	6	4	0	20
10. Mathematics teachers were not consulted in the decision to make Mathematics compulsory	9	8	3	0	20

at senior secondary level.					
11. Mathematics teachers were adequately prepared to teach compulsory Mathematics at the senior secondary level.	2	9	7	2	20

Key: Fr = Frequency

4.3.1 Importance of Mathematics

Table 5 shows that all 20 Mathematics teachers are in agreement with the statement: *Mathematics is an important subject for the future of all learners*, with 14 teachers strongly agreeing and six teachers agreeing. The Mathematics teachers supported this statement in the interviews, explaining that Mathematics is necessary for the learners' tertiary education and is needed for problem solving skills. These findings agree with the views of MoE (2010) who notes that Mathematics is a language on its own, a way of thinking and communicating which every person needs. The result also agrees with the views of Smith (2004) who describes Mathematics as of central importance to modern society, because it provides the vital underpinning of the knowledge economy.

The responses to statement 3 in Table 5 show that despite the importance of Mathematics, 11 out of 20 Mathematics teachers believe that Mathematics is a difficult subject and that some of the learners lack Mathematical skills and, therefore, these Mathematics teachers do not agree that all learners should study Mathematics at senior secondary school level.

4.3.2 Involvement of teachers in the decision-making process of the curriculum

In Table 5, the results further show that 17 out of 20 Mathematics teachers indicated that they were not consulted in the decision-making process to make Mathematics compulsory at senior secondary school level. From the interview some of the teachers elaborated on this by indicating that the decision-makers might have fear of the teachers' reactions on the decision to make Mathematics compulsory. Two of the Mathematics teachers commented that:

Teacher C: *No, I was not consulted. I was only invited to a workshop after compulsory Mathematics had already been implemented. They did not consult the Mathematics teachers because the teachers will not have agreed to the making of Mathematics compulsory for they know the difficulties that it will bring along. I think that is why the curriculum developers decided on it without consulting the Mathematics teachers.*

Teacher E: *No. All I got as a Mathematics teacher was a circular from the Ministry that Mathematics will be compulsory the following year. Nothing was attached to that. We just had to agree to it because the Ministry has decided that as a country all secondary schools must implement compulsory Mathematics.*

However, it is important to involve teachers in the planning and designing of new educational policies. According to Wolfson (1997), curriculum implementers must be involved in curriculum planning and development so that they can implement and modify the curriculum for the benefit of their learners.

4.3.3 Teacher preparedness to teach compulsory Mathematics

From Table 5, 11 out of 20 Mathematics teachers indicated that they were adequately prepared to teach compulsory Mathematics, with two teachers strongly agreeing and nine agreeing. However, from the interview most of the teachers who said they were prepared indicated that they were merely prepared because they have the knowledge, experience and skills to teach Mathematics, but they were neither prepared to teach large classes nor to teach different levels of Mathematics in one class. Three of the Mathematics teachers said:

Teacher B: *I was prepared as a Mathematics teacher. We were prepared to teach Mathematics to all the learners at teacher training institutes such as Unam or at a college. The question is: are we prepared maybe to teach different levels, like core, extended and higher level in the same class? We were not prepared to teach these combinations of levels in one class.*

Teacher D: *Yes, because of my years of experience, but maybe the young Mathematics teachers or those teachers who have not been in the teaching profession for long were not prepared.*

Teacher H: *I was not fully prepared, although I am qualified to teach secondary phase. We were not provided with skills and information as to how we should conduct ordinary level and higher level in the same class. I had to come up with mechanism to deal with this problem myself.*

4.4 Teacher motivation in the teaching of compulsory Mathematics

Table 6 shows the participants' responses on the twelve statements regarding teacher motivation in the teaching of compulsory Mathematics. The teachers were asked to indicate their levels of agreement with each statement using a four point Likert scale i.e. Strongly Agree, Agree, Disagree and Strongly Disagree.

Table 6: Teacher motivation in the teaching of compulsory Mathematics

Statements	Strongly Agree	Agree	Disagree	Strongly Disagree	Total
	Fr	Fr	Fr	Fr	
1. The school management gave support and assistance to Mathematics teachers during the implementation process of compulsory Mathematics at senior secondary level.	2	8	7	3	20
2. Workshops were conducted for Mathematics teachers to address the implementation of the compulsory Mathematics curriculum at senior secondary level.	1	10	7	2	20
3. Mathematics teachers gave their input on the implementation of the compulsory Mathematics curriculum at senior secondary level.	2	3	9	4	18
4. Mathematics teachers received support and assistance in the implementation process from the Mathematics Advisory Teachers in the region.	1	3	12	4	20
5. Mathematics Advisory teachers did not visit my school often enough to monitor the implementation process of the compulsory Mathematics curriculum.	13	4	3	0	20
6. There was co-operation and communication between policy-makers and curriculum implementers (Mathematics teachers) about the decision to make Mathematics compulsory at senior secondary level.	1	3	9	5	18
7. Mathematics teachers implemented the curriculum on their own without the necessary support, encouragement and assistance from the school management.	2	11	5	2	20
8. Mathematics teachers implemented the	2	11	7	0	20

curriculum on their own without the necessary support, encouragement and assistance from the Mathematics Advisory teachers					
9. Mathematics teachers implemented the curriculum on their own without the necessary support, encouragement and assistance from the inspectors in the region.	5	12	2	1	20
10. Parents showed support, assistance and encouragement to the learners and teachers by attending parents' and teachers' meetings to discuss the introduction of compulsory Mathematics at the senior secondary level.	0	2	9	9	20
11. There was no monitoring of teachers and learners in the implementation of compulsory Mathematics by the school management.	2	12	5	1	20
12. There was no monitoring of teacher and learners in the implementation process from the Mathematics Advisory teachers.	2	15	3	0	20

Key: Fr = Frequency

4.4.1 Support and Assistance

Table 6 seeks mostly to find out whether Mathematics teachers received support and assistance to guide them through the implementation process of compulsory Mathematics. According to Manson (2004) monitoring and supporting the implementation of a curriculum are among the roles of the school management and advisory teachers. Therefore, the researcher looks at support and assistance from the following:

4.4.1.1 School Management

From table 6, the results show an even split with half of the Mathematics teachers in agreement while the other half in disagreement that they received support and assistance from the school management. Mathematics teachers that are in agreement felt that the

school management tried their best in motivating and encouraging them with the implementation process. This view is supported by Maslow (1943) who state that educators do well in curriculum implementation when they are motivated. However, the teachers feel that it was not enough support since, for example, the schools did not employ more teachers so that different levels of Mathematics can be taught in separate classes.

For successful implementation of a curriculum, Briggs and Sommefeldt (2002) note that the school management should ensure that they provide teachers with the necessary policy documents, circulars and implementation guidelines at hand. Therefore, Mathematics teachers were supposed to feel that they are supported by the school management for them to successfully implement compulsory Mathematics.

4.4.1.2 Mathematics Advisory Teachers and Inspectors

Table 6 further shows that there was little support and assistance from the Mathematics advisory teachers and Inspectors. The majority of the Mathematics teachers reported in the interview that the Mathematics advisory teachers and Inspectors did not make efforts to assist them. Two Mathematics teachers commented that:

Teacher G: *No, because there was no support from whichever side to assist us with the implementation process.*

Teacher J: *Advisory teachers do not have the required leadership skills and support system in place to assist us, especially with the content itself, apart from just motivating and encouraging us.*

Several researchers note that an educational leader should know how to manage change and lead the process of change for they are the key troupes in facilitating, guiding and supervising of teachers in schools (Briggs & Sommefeldt, 2002; Ngara et al., 2013). Therefore, it is the responsibility of the Mathematics advisory teachers and Inspectors to make sure that the teachers are supported and assisted in order to implement the curriculum effectively and efficiently.

4.4.2 In-service professional development

Table 6 shows that 11 out of 20 Mathematics teachers agreed that there were workshops conducted to address the implementation of compulsory Mathematics at senior secondary level, as opposed by the nine Mathematics teachers. From the interviews with the Mathematics teachers, they indicated that they have only attended several workshops in the region organised by the Namibian Mathematics Union in collaboration with Old Mutual.

However, these workshops had nothing to do with the implementation of compulsory Mathematics at senior secondary school level. They were conducted to help the Grade 10 and 12 Mathematics teachers in Otjozondjupa region improve on the teaching of Mathematics. By default these workshops can have a positive effect on the teaching of compulsory Mathematics. One of the Mathematics teachers said:

Teacher E: *There are usually Mathematics workshops in the region, but these workshops are sponsored by Old Mutual for the Mathematics teachers in the region to help us improve our teaching. These workshops are not preparing us to cope with implementation, because in these workshops we are not taught or guided on how we should teach the different levels in one class or how to cope with the challenges that we are facing with the implementation of compulsory Mathematics.*

According to Bandele and Faremi (2012), lack of in-service training and lack of standard workshops for teachers are among the factors that create difficulties in implementing a curriculum successfully. Moreover, Phorabatho (2009) notes that a problem of inadequate Mathematics teachers training is alleged to be one of the fundamental issues that lead to poor implementation of compulsory Mathematics. Thus, the Mathematics teachers require training workshops focusing on the implementation of compulsory Mathematics.

4.4.3 Communication between policy-makers and curriculum implementers

In Table 6, 14 Mathematics teachers disagreed with the statement: There was co-operation and communication between policy-makers and curriculum implementers about the decision to make Mathematics compulsory at senior secondary school level.

In response to this statement, the Mathematics teachers reported in the interviews that there was no communication, since they were not consulted. They only received a circular from the Ministry of Education through the schools informing them of the implementation date. Two of the Mathematics teachers argued that:

Teacher C: *No, we were only told after the decision was already made. We were not asked to share our views and ideas about the implementation of compulsory Mathematics.*

Teacher J: *Teachers are never involved during the decision-making process. We only get the results of the decision taken within a certain group of individuals who planned it and we must then implement it.*

Teachers may not have to make all the decisions but, at the very least, there must be ways for them to develop a feeling of commitment towards those decisions. A related mistake in planning occurs in overlooking the importance of communication during the implementation process (Fullan and Pomfret, 1997). One cannot assume that teachers will implement a new curriculum successfully if only they understand it well enough. Therefore, planning for implementation requires formal channels for two-way communication among those involved in the implementation process.

4.4.4 Monitoring and guidance

Statements 11 and 12 in Table 6 concern the monitoring of teachers and learners in the implementation of compulsory Mathematics by the school management and Mathematics advisory teachers. The majority of the Mathematics teachers agreed that there was no monitoring by the school management and Mathematics advisory teachers with regard to the implementation of compulsory Mathematics.

However, five out of ten Mathematics teachers reported in the interviews that they were monitored by the school management during the implementation process. The Mathematics teachers expressed that the school management started off by making sure that Mathematics was offered to each and every learner at senior secondary school level. They also organised regular class visits. The class visits agree with Cunningham and Cordeiro (2000) who indicated that class visits create the opportunity for the school management and advisory teachers to observe teachers' work and provide motivation and guidance. In addition, Mathematics teachers reported that the school management also analysed the learners' results at the end of the year to check learners' progress in Mathematics. University of Zimbabwe (1995) note that, the school management monitors and guides curriculum implementation through ensuring that schemes of work, lesson plans and records of marks are prepared regularly. Chikumbu and Makamure (2000) added that effective curriculum implementation takes place in a school where the school management is capable of executing supervisory functions. This implies that for the successful implementation of compulsory Mathematics at senior secondary school level, monitoring and guidance should be carried out effectively by the school management.

Moreover, during the interview all the Mathematics teachers revealed that they have never been visited, supported, assisted or monitored by the Mathematics advisory teachers with regard to the implementation of compulsory Mathematics at senior secondary school level in Otjozondjupa region. Two of the Mathematics teachers said:

Teacher I: *I never saw an advisory teacher coming to monitor the implementation of compulsory Mathematics.*

Teacher G: *Monitoring from the school management is there in the sense that the results that one is producing at the end of the year are being monitored. Advisory teachers did not monitor anything.*

This implies that Mathematics teachers did not receive mentorship, guidance or support from the educational leaders. Manson (2004) emphasises that instructional leaders should provide curriculum direction for the teachers, inspire and energise them, motivate and mediate educational policies to the teachers, mentor and support the teachers and monitor progress.

4.5 Challenges experienced by teachers in the teaching of compulsory Mathematics

Table 7 show the participants' responses on the 12 statements regarding the challenges Mathematics teachers faced in the teaching of compulsory Mathematics at senior secondary school level in Otjozondjupa region. The teachers were asked to indicate their levels of agreement with each statement using a four point Likert scale i.e. Strongly Agree, Agree, Disagree and Strongly Disagree.

Table 7: Challenges experienced by teachers in the teaching of compulsory Mathematics

Statements	Strongly Agree	Agree	Disagree	Strongly Disagree	Total
	Fr	Fr	Fr	Fr	
1. The policy-makers focus on the policy formulation and not how it will be implemented.	8	12	0	0	20
2. The teachers were not well prepared for the change in order to successfully implement the compulsory Mathematics reform.	5	12	3	0	20
3. There are no textbooks for all the learners at senior secondary level to successfully implement compulsory mathematics.	2	5	8	5	20
4. There is lack of furniture in the Mathematics classrooms due to a large number of learners taking mathematics now.	4	4	8	4	20
5. Classrooms are now too crowded for Mathematics teachers to provide individual learner assistance in the classroom.	9	6	4	1	20
6. Mathematics teachers feel overwhelmed with work due to an increase in the number of learners.	7	8	4	1	20
7. Mathematics teachers at senior secondary school have been relieved from teaching other classes to enable them to concentrate on the implementation of compulsory Mathematics teaching at senior secondary level.	2	3	10	5	20
8. Time allocated for Mathematics lessons on the time-table is not enough to cover the syllabus in time.	2	6	9	3	20
9. There are both fast and slow learners in one class which makes coverage of the Mathematics curriculum difficult.	8	10	2	0	20
10. Compensatory (remedial) teaching for Mathematics is not possible given the large number of learners now taking Mathematics at senior secondary level.	7	7	6	0	20
11. Many learners take Mathematics at the Core level because it is easier.	13	5	1	1	20
12. Many learners find extended Mathematics more difficult to obtain a better grade at senior secondary.	12	8	0	0	20

Key: Fr = Frequency

4.5.1 Focus on formulation of policy and neglect implementation

With regard to the teachers' responses in Table 7, all the 20 Mathematics teachers were in agreement that the policy-makers only focus on the formulation of policies and not on how to implement them. The Mathematics teachers reported in the interview that policy-makers only send out policies to the schools for teachers to implement them, but no guidelines or mechanisms of how to implement policies are provided. Therefore the Mathematics teachers indicated that the policy-makers are only concerned with planning and designing of new policies, and neglect the implementation phase. Three of the Mathematics teachers commented that:

Teacher A: *Yes, they focus more on policies. There are some real issues that were supposed to be taken notice of by them, issues such as, not everybody like Mathematics or not everybody would need Mathematics when he/she finishes with secondary school. To them the issue was Mathematics must be compulsory, yet they did not provide guidelines as to how the implementation process should take place. They were more concerned with the designing and planning of the policy rather than the implementation itself.*

Teacher B: *Yes, they looked at the benefit of having compulsory Mathematics, and maybe yes they did not pay attention to the implementation process. Their focus was more on the formulation of the policy because of the benefits that Mathematics can bring. But as for the implementation, there was not much that was done.*

Teacher F: *Yes, I agree because what the policy-makers do is that they formulate, come up with the new ideas and then they send out new policies to schools for the schools to implement them. They are not being supportive at all and they are not helping out the schools on how to implement these policies. At the end of the day they will blame the schools for poor implementation, and they forgot about themselves. I believe that they are supposed to call in the Mathematics teachers and direct them on what to do, because as we speak there is no direction that was given at all.*

Patterson and Czaijkowski (1979) note the stark reality about curriculum change that it rarely happens as expected. The most common explanation is that curriculum planners fail to attend adequately to implementation. They make their way through the initiation and developmental phases of the curriculum change, but they do not take the necessary steps to achieve a satisfactory level of implementation (Patterson and Czaijkowski, 1979). This implies that curriculum planners tend to neglect the implementation phase once they are through with the initiation phase. Thus, for the successful implementation of compulsory Mathematics, the Mathematics teachers must be made to understand what they are doing, why they are doing it and how they should do it.

4.5.2 Teacher preparedness for change

Table 7 further shows that 17 out of 20 Mathematics teachers agreed that they were not well prepared for the change in order to successfully implement the compulsory Mathematics reform. Of the 17 Mathematics teachers, five teachers strongly agreed and 12 teachers agreed. The Mathematics teachers expressed in the interview that they have

the knowledge and skills to teach Mathematics. However, they were not prepared for the circumstances that came with compulsory Mathematics, especially teaching three different levels (Core, Extended and Higher level) of Mathematics in one class, and increased class sizes.

Change is a phenomenon that affects all aspects of a person's life and brings about alterations in both personal and employment spheres. For the Mathematics teachers to accept change, Fullan (2001) notes that educational leaders should use logic to get potential implementers to see the need for a curriculum change. Fullan (1991) adds that successful reform necessitates teachers that are ready to change, and teachers that have the required resources to implement and sustain change. Thus, successful implementation will take place if conditions are made sufficiently appealing for the Mathematics teachers.

4.5.3 Availability of resources

Provision of resources is crucial to learning and functionality of a school (Hewson, Kahle, Scantleybury, & Davies, 2001).

Table 7 shows that, with the exception of very few schools, the schools are well equipped with resources such as textbooks and furniture for all the learners at senior secondary school level. This finding is supported by the University of Zimbabwe (1995) who state that the government must provide, among others, physical facilities such as classrooms, and teaching resources in order to create an environment in which implementation can take place. However, in the interview sessions, the Mathematics

teachers emphasised that they have a lack of Mathematics teaching aids such as classroom posters, projectors, calculators and mathematical instruments for use on the chalkboard, and also for the learners use. Two of the Mathematics teachers said:

Teacher F: *I agree. Since all the learners are taking Mathematics now, classes will obviously be full. Furniture is not enough for each and every learner. Mathematics textbooks that are being provided by the government are not enough as well.*

Teacher I: *I do agree, there is a lack of some of the resources, but we have enough textbooks and furniture for all the learners. Of course, we are lacking teaching aids, projectors, mathematical sets and calculators to mention just a few.*

In the Philippines the implementation of the new curriculum included well-orchestrated delivery system such as the provision of teachers, enough textbooks and other resources (Lapus, 2008). This resulted in a curriculum being successfully implemented in the Philippines. Tadesse and Meaza (2007) conclude that curriculum implementation, therefore, favours well-resourced schools with well-skilled and motivated teachers. On the same note, Brown and Schulze (2002) observed that human resources support brings a good environment for the health and welfare of the institution. Thus, for compulsory Mathematics to be successfully implemented, senior secondary schools must have been well-equipped with all the necessary teaching utilities and resources.

4.5.4 Increased class sizes and workload

In response to overcrowded Mathematics classrooms as a result of the implementation of compulsory Mathematics, Table 7 shows that 15 out of 20 Mathematics teachers agree that classrooms are overcrowded. Of the 15 Mathematics teachers, nine strongly agreed and six agreed with the statement. 15 of the Mathematics teachers agreed that they feel overwhelmed with a lot of work due to the increase in the number of learners.

The responses of the Mathematics teachers on increased class size and workload from the interviews is categorised under the following themes. These themes emerged from the Mathematics teachers responses.

4.5.4.1 Teacher-learner ratio and over crowdedness

Mathematics teachers mentioned that there is a high teacher-learner ratio in the Mathematics classrooms. They indicated that the classrooms are overcrowded to an extent that some of the learners find it difficult to pay attention to the teacher or master the mathematical concepts that are taught. This situation, in most cases, makes it difficult for teachers to provide the necessary support and individual attention to individual learners in the Mathematics classroom. This result is similar to the findings of Sidiropoulus (2008) who reported in her study that teachers complained of having big classes and learners being very weak in Mathematics and they continuously require individual attention. She added that teachers cannot give attention to individual learners because there are so many of them in one class. Ponte et al. (1994) also reported in their

findings that teachers felt overwhelmed with work, and they are criticizing the Portuguese Ministry of Education for not reducing significantly their teaching load.

In this study the Mathematics teachers believe that an overcrowded classroom environment is negative for teaching and learning and hinders the successful implementation of the compulsory Mathematics curriculum.

4.5.4.2 Time allocated for Mathematics lessons

The Mathematics teachers indicated that the time allocated to Mathematics lessons on the timetable is not sufficient, most of the Mathematics lessons on the timetable are single periods which are about 45 minutes long. One of the Mathematics teachers commented that:

Teacher I: *We are unable to give attention to each and every learner in a large group within a limited time of 45 minutes because the learners are too many and the time is short.*

The Mathematics teachers felt that if they should have double lessons for Mathematics, or if the duration of the lessons can be increased to one hour, it may create room to assist all the learners. In support of this result are Chikumbu and Makamure (2000) who state that effective curriculum implementation can be achieved through deploying of teachers, allocating enough time to subjects taught at the school and creating an atmosphere conducive for effective teaching and learning by the school management.

4.5.4.3 Discipline

Overcrowded classroom can lead to disciplinary problems in the Mathematics classroom. One of the Mathematics teachers indicated that:

Teacher D: *We are experiencing disciplinary problems in the Mathematics classroom due to the number of learners in the classes.*

This can only mean that Mathematics teachers might be able to manage their classes provided that the number of learners in each class is reduced to less than 35 learners per teacher at senior secondary schools as per ministerial norm.

4.5.4.4 Assessment

The mathematics teachers indicated that an increase in the number of learners have led to an increase in their workload. Two of the Mathematics teachers argued that:

Teacher C: *Now that we are dealing with more learners, we are getting more scripts of tests, exercises, assignments and examinations to mark.*

Teacher F: *There is a problem of marking all the learners' books because the learners are too many. We have about 40 to 45 learners in one class, and we have to mark all the learners' tests, homework books and activities that we are giving for assessment purposes.*

It can be concluded that with an increase in the number learners and in the workload, Mathematics teachers might end up compromising on the quality of assessments.

4.5.5 Effect of learner differences on the coverage of Mathematics curriculum

Table 7 further shows that 18 out of 20 Mathematics teachers agreed that teaching both fast and slow learners in one class makes the coverage of the Mathematics curriculum difficult. The Mathematics teachers expressed in the interviews that they are facing challenges in teaching both fast and slow learners in one class with regard to three levels of Mathematics; core, extended and higher level. The Mathematics teachers explained that it is a challenge because they have to make sure that each and every learner has understood the lesson before they proceed to the next topic in the syllabus. Teaching both fast and slow learners in the same class makes it difficult to cover the syllabus, because these learners have different thinking capabilities. When teaching at a pace of the slow learners, the fast learners get easily bored and frustrated.

Therefore, it is best if the three levels of Mathematics; core, extended and higher level are separated and taught in different classes for better teaching and learning, and for the completion of the Mathematics curriculum well on time.

4.6 Solutions to ameliorate challenges in the teaching of compulsory Mathematics

In an effort to give the teachers an unrestricted scope for suggestions, two open-ended questions were offered, whereby teachers had to make suggestions about what they think could be possible solutions to ameliorate the challenges faced in the teaching of compulsory Mathematics at senior secondary level.

4.6.1 Suggested solutions to ameliorate the challenges

Table 8 displays Mathematics teachers' suggestions on ways to ameliorate the challenges that they are facing as a result of implementing the compulsory Mathematics curriculum at senior secondary school level in Otjozondjupa region.

Table 8: Suggested solutions to ameliorate challenges faced by Mathematics teachers

Teacher	Responses
A	Reverse back to Mathematics as an optional subject.
B	Primary school teachers' should lay good foundation of Mathematics in lower grades.
C	Amend curriculum to accommodate slow learners. Policy-makers should consult Mathematics teachers, and advisory teachers should support and assist us.
D	Allocate smaller class groups. Appoint more teachers.
E	Mathematics teachers should be trained on how to link Mathematics to real-life situations.
F	Teachers must be made well prepared for the implementation. Support from advisories.
G	The three levels should be taught separately.
H	The government should provide enough resources to the schools.
I	Content of textbook should be revised to go hand-in-hand with the syllabus requirements.
J	Reduce the number of learners to 35 as per ministerial norm.
M	Mathematics should be made more practical and applicable for learners.
O	Learners need to be motivated and encouraged to like the subject.
P	The government should provide in-service training and workshops to prepare teachers.
R	Policy-makers must make a follow-up on whether the policy was implemented successfully.

Table 8 shows ways that might successfully address the challenges that Grade 11 and 12 Mathematics teachers are facing with respect to the implementation of the compulsory Mathematics curriculum in Otjozondjupa region.

4.6.2 Other challenges in the implementation of compulsory Mathematics

Mathematics teachers were asked to mention other challenges they predict in the implementation of the compulsory Mathematics curriculum at senior secondary level in Otjozondjupa region. Their responses are presented in Table 9.

Table 9: Challenges predicted by mathematics teachers

Teacher	Responses
A	The government is compromising the learners' future by making Mathematics compulsory.
B	Shortage of Mathematics teachers in the future.
C	Overcrowded classrooms.
E	Learners being discouraged to continue with secondary phase due to compulsory Mathematics.
F	Mathematics teachers might leave the teaching profession due to frustrations of teaching learners that show no interest in the subject.
G	Learners that are weak in Mathematics will develop a negative attitude towards Mathematics.
I	More ungraded learners in Mathematics.
J	Teachers will become lazy to mark learners' books due to limited time per Mathematics lesson, and having class size of 40 to 45 learners in one class.
L	Learner who performed poorly in Mathematics at junior phase will find it difficult to cope with Mathematics at secondary phase.
M	Learner have different thinking abilities, therefore more problems will arise if we continue to teach the three levels in one class.
P	High failure rate of learners in Mathematics in the Country.
S	Poor results if we continue to teach the three levels in one class.

Table 9 shows the challenges perceived by the Mathematics teachers in Otjozondjupa region. These challenges could arise if the current challenges with regard to the introduction of the compulsory Mathematics curriculum at senior secondary school level are not addressed. If not addressed, these could cause more problems in the teaching and learning of Mathematics in the Otjozondjupa region, and the Country as a whole.

4.7 Summary

This chapter presented, analysed, interpreted and discussed data on the views of Mathematics teachers, teacher motivation and challenges experienced by Mathematics teachers in the implementation of the compulsory Mathematics curriculum at senior secondary school level in Otjozondjupa region. Suggestions by Mathematics teachers to ameliorate the experienced challenges are also presented. The data were collected through questionnaire and interview. In the next chapter, the summary, conclusion and recommendations are presented.

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter provides the summary, as well as the conclusion and recommendations of the study.

5.1 SUMMARY

This study sought to investigate the Mathematics teachers' views and challenges faced in the implementation of the compulsory Mathematics curriculum at senior secondary school level in Otjozondjupa Region, Namibia.

The following four questions were addressed:

1. What are the Grade 11 and 12 Mathematics teachers' views on the implementation of the compulsory Mathematics curriculum in the Otjozondjupa Region?
2. To what extent are the teachers motivated in the teaching of the compulsory Mathematics curriculum?
3. What are the challenges experienced by teachers in the teaching of the compulsory Mathematics curriculum?
4. What do teachers perceive as possible solutions to ameliorate these perceived challenges?

The researcher employed an explanatory sequential mixed-method design, using both quantitative and qualitative research designs. The study employed closed-ended (Likert scale) and open-ended questions in the questionnaire. Data that emerged from the

questionnaire were used in the qualitative interviews to collect in-depth information from the participants (Creswell, 2012). The population of the study comprised 20 Grade 11 and 12 Mathematics teachers in the Otjozondjupa region. The researcher chose the Grade 11 and 12 Mathematics teachers since they are responsible for teaching Mathematics at this level and are directly affected by the implementation of the compulsory Mathematics curriculum, and thus they provided rich information to answer the researcher's questions. A random sample of 12 out of 14 secondary schools was selected from the defined population. All the Grade 11 and 12 Mathematics teachers from the 12 selected schools participated in the study. Thus a total of 20 Mathematics teachers participated in the study, and all the participants were required to complete the questionnaire. The data collected from the questionnaire were analysed using frequency tables and graphs.

Based on the participants' answers on the questionnaire, the researcher purposively selected 10 participants that were interviewed. The analysed data from the questionnaire were used as the basis for semi-structured interview questions. The interviews provided the researcher with in-depth and rich information regarding the Mathematics teachers' views and challenges in the implementation of the compulsory Mathematics curriculum at senior secondary school level in the Otjozondjupa region, and the possible solutions to ameliorate these challenges. The interviews were tape recorded and transcribed. The data collected from the interviews were analysed using thematic analysis.

For ethical reasons, the participants received full information about the purpose and objectives of the study. They were informed that they were free to withdraw from the study at anytime, and their information was treated with the utmost confidentiality and anonymity. The teachers' names did not appear on the questionnaires or in the report of this study.

Findings of the study indicated that Mathematics teachers at senior secondary school level felt that Mathematics was important for the future of all learners, although one of the Mathematics teachers suggested that the Ministry of Education should do away with the compulsory Mathematics curriculum. About a half of the Mathematics teachers believed that Mathematics was a difficult subject and not all the learners should study Mathematics at senior secondary school level. It also emerged that teachers were not consulted concerning the planning and designing of the new curriculum. They only received a circular from the Ministry of Education through the schools informing them of the implementation date. Half of the Mathematics teachers indicated that the school management monitored, gave support and assistance to the Mathematics teachers in the implementation of compulsory Mathematics at senior secondary school level, but this was not the case with the Mathematics advisory teachers. Mathematics teachers experienced various challenges with the implementation of compulsory Mathematics, due to a lack of proper planning of the implementation process. These challenges include, among others, high teacher-learner ratios, overcrowded Mathematics classrooms, inadequate time allocated for Mathematics lessons, lack of discipline among learners in the Mathematics classrooms and a lack of teaching aids and resources.

5.2 CONCLUSION

From the results, it is clear that the Mathematics teachers indicated that they have the knowledge, experience and skills to teach Mathematics. However, changes in the teaching environment can affect the teaching and learning process. If the implementation of the curriculum is not well planned, it can make it difficult for teachers to teach effectively and efficiently.

It is very important for teachers to be involved in the whole process of curriculum change, from the planning/designing phase to the implementation phase. Teachers should provide feedback to the Ministry of Education on the challenges they are experiencing in the implementation of the curriculum to ensure that the necessary improvements are made.

It can be concluded in this study that teachers felt left out and might not be implementing the teaching of compulsory Mathematics as envisaged by the curriculum developers.

5.3 RECOMMENDATIONS

On the basis of the findings of this study, the following recommendations are provided:

1. A platform should be created by the National Institute for Educational Development (NIED) where policy-makers and Mathematics teachers will both be involved in the decision-making process of new policies.

2. Policy-makers should provide guidelines on how to implement policies in schools, and they should also make a follow-up at the schools to observe whether the curriculum was being implemented successfully.
3. Since Mathematics is compulsory for all the learners at senior secondary school level, a pass in Grade 10 Mathematics should be made a requirement for a learner to be able to proceed to senior secondary phase. Learners who fail Grade 10 Mathematics should be allowed to repeat Grade 10 as it is currently the case with Grade 8 and Grade 9.
4. Mathematics Advisory teachers with support from the Ministry of Education should prepare teachers for any change in the curriculum through in-service and workshop trainings for the effective teaching of Mathematics.
5. The researcher found that some of the senior secondary schools in Otjozondjupa region have a shortage of resources (e.g. textbooks, furniture and teaching resources). Therefore, the Ministry of Education should provide adequate resources to the senior secondary schools for better teaching and learning of Mathematics.
6. Mathematics teachers complained about overcrowded classrooms due to the implementation of compulsory Mathematics. In some of the secondary schools in Otjozondjupa region, there was on average 36 to 40 learners in a class. As per the Ministry of Education norms, there should be less than 35 learners per teacher in secondary schools. Therefore, the Ministry of Education should employ more Mathematics teachers and build more classrooms to alleviate this problem.

7. It is recommended further that research on compulsory Mathematics at senior secondary school level be carried out at a national level with a large sample.

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Appendix A: Research Permission Letter

UNIVERSITY OF NAMIBIA

Private Bag 13301, 340 Mandume Ndemufayo Avenue, Pionerspark, Windhoek, Namibia

The School of Postgraduate Studies
P.Bag13301
Windhoek, Namibia
Tel: 2063523

E-mail: cshaimemanya@unam.na

Date: 15 June 18, 2014

TO WHOM IT MAY CONCERN

RE: RESEARCH PERMISSION LETTER

1. This letter serves to inform that student: **Rauna Angula** (Student number:- **200326660)** is a registered student in the Department of **Mathematics, Science and Sport Education** at the University of Namibia. His/her research proposal was reviewed and successfully met the University of Namibia requirements.
2. The purpose of this letter is to kindly notify you that the student has been granted permission to carry out postgraduate studies research. The School of Post Graduate Studies has approved the research to be carried out by the student for purposes of fulfilling the requirements of the degree being pursued.
3. The proposal adheres to ethical principles.

Thank you so much in advance and many regards.

Yours truly,

Name of Main Supervisor: Prof C. Kasanda

Signed:----------

Dr. C. N.S. Shaimemanya

Signed: ----------

Director: School of Postgraduate Studies

Appendix B: Ethical Clearance Certificate

UNIVERSITY OF NAMIBIA

ETHICAL CLEARANCE CERTIFICATE

Ethical Clearance Reference Number: SEC/FOE/43/2014 **Date: July 16, 2014**

This Ethical Clearance Certificate is issued by the University of Namibia Research Ethics Committee (UREC) in accordance with the University of Namibia's **Research Ethics Policy and Guidelines. Ethical** approval is given in respect of undertakings contained in the Research Project outlined below. This Certificate is issued on the recommendations of the ethical evaluation done by the Faculty/Centre/Campus Research & Publications Committee sitting with the Postgraduate Studies Committee.

Title of Project: MATHEMATICS TEACHERS' VIEWS AND CHALLENGES ON THE IMPLEMENTATION OF COMPULSORY MATHEMATICS IN OTJOZONDJUPA REGION

Nature/Level of Project: Masters

Principal Researcher: RAUNA ANGULA (student No: 200326660)

Host Department & Faculty: Mathematics, Science and Sports Education, Faculty of Education

Supervisor (s): Prof. C. Kasanda(Main)Mr. N. Gaoseb (Co-)

Take note of the following:

(a) Any significant changes in the conditions or undertakings outlined in the approved Proposal must be communicated to the UREC. An application to make amendments may be necessary.

(b) Any breaches of ethical undertakings or practices that have an impact on ethical conduct of the research must be reported to the UREC.

(c) The Principal Researcher must report issues of ethical compliance to the UREC (through the Chairperson of the Faculty/Centre/Campus Research & Publications Committee) at the end of the Project or as may be requested by UREC.

(d) The UREC retains the right to:

(i). withdraw or amend this Ethical Clearance if any unethical practices (as outlined in the Research Ethics Policy) have been detected or suspected,

(ii). request for an ethical compliance report at any point during the course of the research.

UREC wishes you the best in your research.

Prof. I. Mapaure
UNAM Research Coordinator
ON BEHALF OF UREC

Appendix C: Letter to the Permanent Secretary of Education

P.O. Box 40
Okahandja
Namibia
31 July 2014

To: The Permanent Secretary
Ministry of Education
Private Bag 43186
Windhoek

Dear Sir

Re: Request for permission to conduct an Educational Research in the Otjozondjupa Region on the topic: "Mathematics teachers' views and challenges on the implementation of the compulsory Mathematics curriculum".

I am a registered student at the University of Namibia pursuing a Master's degree in Mathematics Education. In partial fulfilment of the requirements for the completion of this degree, I am required to conduct a research project on the topic stated above during the month of September 2014.

Since 2012, the Ministry of Education has made mathematics a compulsory subject at senior secondary school level (Grade 11 and 12) for the development of science, technology and commerce. Therefore, the goal of my research is to investigate the "Mathematics teachers' views and challenges on the implementation of the compulsory Mathematics curriculum", in the Otjozondjupa region.

I kindly request your good office to allow me to use the senior secondary schools in the Otjozondjupa region as my research site for the research project. If granted permission,

the first phase of the research project will involve distributing a questionnaire to 20 randomly selected Grade 11 and 12 Mathematics teachers in the senior secondary schools in the Otjozondjupa region. The second phase of the research project will involve an interview with 10 Mathematics teachers that will be chosen on the basis of the results of the first phase of the research.

The Mathematics teachers will receive full information about the purpose and objectives of the study. Their information will be treated with the utmost confidentiality and anonymity. The teachers' names will not appear on the questionnaires or in the final thesis report. This study will not in any way harm the participants either physically or psychologically.

The findings of this study might be useful to the Ministry of Education in formulating policies with respect to improving the quality of teaching and learning of mathematics in Otjozondjupa region, and the country as a whole.

I look forward to a favourable response from your good office.

Yours Sincerely,

Rauna Angula

Masters Student

University of Namibia

Appendix D: Letter of approval from the Permanent Secretary of Education

REPUBLIC OF NAMIBIA

MINISTRY OF EDUCATION

Enquiries: Mr C. Muchila
E-mail: Cavin.Muchila@moe.gov.na
Tel: +264 61 2933200
Fax: +264 61 2933922

Private Bag 13186,
WINDHOEK
Namibia

File no: 11/1/1

06 August 2014

To: Ms Rauna Angula
P. O Box 40
Okahandja

Dear Ms Angula

SUBJECT: PERMISSION TO CONDUCT A RESEARCH STUDY IN OTJOZONDJUPA REGION

Your correspondence regarding the subject above, seeking permission to conduct a research study in Otjozondjupa Region has reference.

Kindly be informed that the Ministry does not have any objection to your request to conduct a research study at identified schools in the region concerned.

You are, however, kindly advised to contact the Regional Council Office, Directorate of Education, for authorisation to go into the schools and for proper information coordination.

Also take note that the research activities should not interfere with the normal school programmes. Participation by teachers or learners should be on a voluntary basis.

By copy of this letter, the Regional Education Director are made aware of your request.

Sincerely yours

MINISTRY OF EDUCATION Office of the Permanent Secretary 06 AUG 2014 Namibia

.....
Mr. Alfred Ilukena
PERMANENT SECRETARY
cc: Director of Education: Otjozondjupa

All official correspondence must be addressed to the Permanent Secretary

Appendix E: Letter to the Director of Otjozondjupa Region

P.O. Box 40

Okahandja

Namibia

08 August 2014

To: The Director

Ministry of Education

P.O.Box 2618

Otjiwarongo

Dear Mrs. Caley

Re: Request for permission to conduct an Educational Research in the Otjozondjupa Region on the topic: "Mathematics teachers' views and challenges on the implementation of the compulsory Mathematics curriculum".

I am a registered student at the University of Namibia pursuing a Master's degree in Mathematics Education. In partial fulfilment of the requirements for the completion of this degree, I am required to conduct a research project on the topic stated above during the month of September 2014.

Since 2012, the Ministry of Education has made mathematics a compulsory subject at senior secondary school level (Grade 11 and 12) for the development of science, technology and commerce. Therefore, the goal of my research is to investigate the "Mathematics teachers' views and challenges on the implementation of the compulsory Mathematics compulsory", in the Otjozondjupa region.

I kindly request your good office to allow me to use the senior secondary schools in the Otjozondjupa region as my research site for the research project. If granted permission,

the first phase of the research project will involve distributing a questionnaire to 20 randomly selected Grade 11 and 12 Mathematics teachers in the senior secondary schools in the Otjozondjupa region. The second phase of the research project will involve an interview with 10 Mathematics teachers that will be chosen on the basis of the results of the first phase of the research.

The Mathematics teachers will receive full information about the purpose and objectives of the study. Their information will be treated with the utmost confidentiality and anonymity. The teachers' names will not appear on the questionnaires or in the final thesis report. This study will not in any way harm the participants either physically or psychologically.

The findings of this study might be useful to the Ministry of Education in formulating policies with respect to improving the quality of teaching and learning of mathematics in Otjozondjupa region, and the country as a whole.

I look forward to a favourable response from your good office.

Yours Sincerely,

Rauna Angula

Masters Student

University of Namibia

Appendix F: Letter of approval from the Director of Otjozondjupa Region

REPUBLIC OF NAMIBIA
OTJOZONDJUPA
REGIONAL COUNCIL

DIRECTORATE OF EDUCATION

Tel no: 264 67 308000/04
Fax no: 264 67 304871

Private Bag 2618
Otjiwarongo
NAMIBIA

Ref no: 11/4/8

To: Ms. Rauna Angula
P.O.Box 40
Okahandja

PERMISSION TO CONDUCT A RESEARCH STUDY IN OTJOZONDJUPA REGION

Your letter dated 6 August 2014, bears reference. The Director does not have any objection towards your intention.

Therefore permission is hereby granted to you to conduct your research on "Mathematics teachers, views and challenges on the implementation of compulsory Mathematics" in the Otjozondjupa Region. At the end of your research our office would like to share the outcome of your study, your findings and recommendations with us.

Ensure that your activities do not interfere with the normal schools programmes preferably to be done in the afternoon.

We wish you fruitful time during your operations.

Yours sincerely

.....
Ms. Faustina N. Caley
Director

OTJOZONDJUPA REGIONAL COUNCIL
DIRECTORATE OF EDUCATION
12/08/2014
2014 -08- 12
TEL: 067-308000 PRIVATE BAG 2618
FAX: 067-304871 OTJIWARONGO
OTJOZONDJUPA REGION

Appendix G: Teachers' letter of Consent

_____ September 2014

Dear participant

You are invited to participate in a research project aimed at investigating "**Mathematics teachers' views and challenges on the implementation of the compulsory Mathematics curriculum**".

Since 2012, the Ministry of Education has made mathematics a compulsory subject at senior secondary school level (Grade 11 and 12) for the development of science, technology and commerce. Therefore, the goal of my research is to investigate the Mathematics teachers' views and challenges on the implementation of the compulsory Mathematics curriculum, in the Otjozondjupa region. Your input and feedback is therefore crucial to the study.

Your information will be treated with the utmost confidentiality and anonymity, and your name will not appear on the questionnaire or in the final thesis report. Your participation in this research may entail audio-taped interviews. Your participation is voluntarily.

If you are willing to participate in the research, please sign this letter as a declaration of your consent; that you are willing to participate in this study willingly. Any information obtained from the questionnaire and interview will be used solely for the purpose of this research.

Yours Sincerely,

Rauna Angula

CONSENT

I agree to participate in the research entitled **"MATHEMATICS TEACHERS' VIEWS AND CHALLENGES ON THE IMPLEMENTATION OF THE COMPULSORY MATHEMATICS CURRICULUM IN OTJOZONDJUPA REGION, NAMIBIA"** as outlined in the consent letter.

Name: …….

Signature: ……..

Date: ……..

Appendix H: TEACHERS' QUESTIONNAIRE

School code: | | | |

Teacher code: | | | |

MATHEMATICS TEACHERS' VIEWS AND CHALLENGES ON THE IMPLEMENTATION OF THE COMPULSORY MATHEMATICS CURRICULUM IN OTJOZONDJUPA REGION

Dear Mathematics teacher

- In partial fulfilment of the requirements for the completion of the Master of Education (M.Ed.) degree (Mathematics Education) at the University of Namibia, students are required to conduct research about key issues in Education. I should be most grateful if you could kindly spare a few minutes of your time to complete this questionnaire. The study is seeking information on the Mathematics teachers' views and challenges on the implementation of the compulsory mathematics curriculum in the Otjozondjupa educational region. All information given in this study will be treated with the utmost confidentiality and anonymity.
  Thank you for your help.

INSTRUCTIONS

- Please answer all the questions as honestly as possible.

SECTION A: BIOGRAPHICAL INFORMATION

Please mark with an **[X]** in the appropriate box.

1. Indicate whether you are:

Category	Gender	Mark here **[X]**
A	Male	
B	Female	

2. Which one of the following age categories applies to you?

Category	Age group	Mark here **[X]**
A	Under 25	
B	25 – 29	
C	30 – 34	
D	35 – 39	
E	40 – 44	
F	45 – 49	
G	Above 49	

3. Highest teaching qualification:

Category	Qualifications	Mark here **[X]**
A	BETD	
B	BED	
C	MED	
D	Others	

If “others”, please specify._____

4. Years of teaching experience:

Category	Years	Mark here **[X]**
A	0 – 2	
B	3 – 5	
C	6 – 8	
D	9 – 11	
E	12 – 14	
F	15 – 17	
G	18 – 20	
H	Above 20	

5. What is the average number of learners in the classes you teach? (Please, select only one category).

Category	Number of learners	Mark here **[X]**
A	Less than 25 learners	
B	26 – 30	
C	31 – 35	
D	36 – 40	
E	41 – 45	
F	More than 45 learners	

6. Location of your school:

Category	Location	Mark here **[X]**
A	Rural	
B	Urban	

SECTION B: CLOSED-ENDED QUESTIONS

Views of teachers on the implementation of the compulsory Mathematics curriculum

For the following statements, please mark with an **[X]** in the box of your choice.

Statements	Strongly Agree	Agree	Disagree	Strongly Disagree
1. Mathematics is an important subject for the future of all learners.				
2. All learners at senior secondary school level should study Mathematics.				
3. Mathematics is a difficult subject, and it cannot be managed by all the learners at senior secondary school level.				
4. Learners in the Social Science and Commerce fields do not need mathematics.				
5. Mathematics taught in Primary school and Junior secondary school does not prepare learners well for senior secondary school level mathematics.				
6. I think Mathematics is an easy subject for learners to understand.				
7. Not all learners have the necessary capabilities to solve mathematical problems at senior secondary school level.				
8. Senior secondary school level Mathematics is essential to all learners for their Tertiary Education.				

9. Some of the learners do not have an interest in Mathematics as a subject, because they feel that they will not be needing mathematics in their future careers.				
10. Mathematics teachers were not consulted in the decision to make Mathematics compulsory at senior secondary school level.				
11. Mathematics teachers were adequately prepared to teach compulsory Mathematics at the senior secondary school level.				

2. Teacher motivation in the teaching of compulsory Mathematics

For the following statements, please mark with an **[X]** in the appropriate box of your choice.

Statements	Strongly Agree	Agree	Disagree	Strongly Disagree
12. The school management gave support and assistance to Mathematics teachers during the implementation process of the compulsory Mathematics curriculum at senior secondary school level.				
13. Workshops were conducted for Mathematics teachers to address the implementation of the compulsory Mathematics curriculum at senior secondary school level.				
14. Mathematics teachers gave their input on the implementation of the compulsory Mathematics curriculum at senior secondary school level.				
15. Mathematics teachers received support and assistance in the implementation process from the Mathematics Advisory Teachers in the region.				
16. Mathematics Advisory teachers did not visit my school often enough to monitor the implementation process of the compulsory Mathematics				

curriculum.				
17. There was co-operation and communication between policy-makers and curriculum implementers (Mathematics teachers) about the decision to make Mathematics compulsory at senior secondary school level.				
18. Mathematics teachers implemented the curriculum on their own without the necessary support, encouragement and assistance from the school management.				
19. Mathematics teachers implemented the curriculum on their own without the necessary support, encouragement and assistance from the Mathematics Advisory teachers				
20. Mathematics teachers implemented the curriculum on their own without the necessary support, encouragement and assistance from the inspectors in the region.				
21. Parents showed support, assistance and encouragement to the learners and teachers by attending parents' and teachers' meetings to discuss the introduction of compulsory Mathematics at the senior secondary school level.				
22. There was no monitoring of teachers and learners in the implementation of the compulsory Mathematics curriculum by the school management.				
23. There was no monitoring of teacher and learners in the implementation process from the Mathematics Advisory teachers.				

3. Challenges experienced by teachers in the teaching of compulsory Mathematics.

For the following statements, mark with an **[X]** in the appropriate box of your choice.

Statements	Strongly Agree	Agree	Disagree	Strongly Disagree
24. The policy-makers focus on the policy formulation and not how it will be implemented.				
25. The teachers were not well prepared for the change in order to successfully implement the compulsory Mathematics curriculum reform.				
26. There are no textbooks for all the learners at senior secondary school level to successfully implement the compulsory mathematics curriculum.				
27. There is lack of furniture in the Mathematics classrooms due to a large number of learners taking mathematics now.				
28. Classrooms are now too crowded for Mathematics teachers to provide individual learner assistance in the classroom.				
29. Mathematics teachers feel overwhelmed with work due to an increase in the number of learners.				
30. Mathematics teachers at senior secondary school level have been relieved from teaching other classes to enable them to concentrate on the implementation of the compulsory Mathematics curriculum at senior secondary school level.				
31. Time allocated for Mathematics lessons on the time-table is not enough to cover the syllabus in time.				
32. There are both fast and slow learners in one class which makes coverage of the Mathematics curriculum difficult.				
33. Compensatory (remedial) teaching for Mathematics is not possible given the large number of learners now taking Mathematics at senior				

secondary school level.				
34. Many learners take Mathematics at the Core level because it is easier.				
35. Many learners find extended Mathematics more difficult to obtain a better grade at senior secondary school level.				

SECTION C: OPEN-ENDED QUESTIONS

4. **Possible solutions to ameliorate the challenges faced in teaching compulsory Mathematics at SSL**

(a) Please suggest possible solutions to ameliorate the challenges stated in the implementation of the compulsory Mathematics curriculum at SSL.

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(b) What other challenges do you foresee in the implementation of the compulsory Mathematics curriculum at the SSL?

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THANK YOU FOR YOUR HELP

Appendix G: TEACHERS' INTERVIEW GUIDE

MATHEMATICS TEACHERS' VIEWS AND CHALLENGES ON THE IMPLEMENTATION OF THE COMPULSORY MATHEMATICS CURRICULUM IN OTJOZONDJUPA REGION

A. Views of teachers on the implementation of the compulsory Mathematics curriculum

1. Do you think all learners at senior secondary school level should study Mathematics? Give reasons to support your answer.
2. Do you think Mathematics is a difficult subject, and it cannot be managed by all the learners at senior secondary school level? Give reasons.
3. Do you agree with the statement? "Some of the learners do not have an interest in Mathematics as a subject, because they feel that they will not need Mathematics in their future careers". Support your answer with a reason.
4. Were you as a Mathematics teacher consulted in the decision-making process to make Mathematics compulsory at senior secondary school? Give reasons to support your answer.
5. Were you as a Mathematics teacher adequately prepared to teach compulsory Mathematics at the senior secondary school level? Provide reasons for your answer.

B. Teacher motivation in the teaching of compulsory Mathematics

1. "The school management, advisory teachers and inspectors gave support and assistance to Mathematics teachers during the implementation process of the compulsory Mathematics curriculum at senior secondary school level". Do you agree with the above statement? Give reasons for your answer.
2. Were there any workshops conducted for Mathematics teachers to address the implementation of the compulsory Mathematics curriculum at senior secondary school level?

3. Was there any co-operation and communication between policy-makers and curriculum implementers about the decision to make Mathematics compulsory at senior secondary school level? Support your answer.
4. Was there any monitoring of teachers and learners in the implementation of the compulsory Mathematics curriculum by the school management and Mathematics advisory teachers?

C. Challenges experienced by teachers in the teaching of compulsory Mathematics

1. Do you think policy-makers focus mostly on the formulation of policies and not how to implement policies? Give reasons.
2. Were you well prepared for the change in order to successfully implement the compulsory Mathematics curriculum reform? Give reasons for your answer.
3. "There is a lack of resources (e.g. textbooks, furniture etc.) for all the learners at senior secondary school level to successfully implement the compulsory Mathematics curriculum." Do you agree with the statement? Give reasons to support your answer.
4. Do you feel overwhelmed with work due to an increase in the number of learners? Give reasons to support your answer.
5. Do you agree with the statement? "Classrooms are now too crowded for Mathematics teachers to provide individual learner assistance in the classroom". Provide reasons for your answer.
6. "There are both fast and slow learners in one class which makes coverage of the Mathematics curriculum difficult". Do you agree with the statement? Give reasons to support your answer.

Thank you for your participation.