PROBLEMS ENCOUNTERED BY EDUCATORS REGARDING THE IMPLEMENTATION OF THE NATIONAL CURRICULUM STATEMENT IN MATHEMATICS

BY

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Submitted to the Faculty of Humanities in fulfillment of the requirements for the degree of

MAGISTER TECHNOLOGIAE: EDUCATION

In the
School of Teacher Education
at the
Central University of Technology
Free State

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Date Submitted:

ACKNOWLEDGEMENTS

I wish to express my sincere gratitude and appreciation to the following people who contributed to the completion of this research project:

My supervisor, Dr Junqueira K. E, for her relentless patience, constructive criticism, academic guidance, suggestions, enthusiasm, dedication, comments and sacrifices made, which greatly inspired and motivated me to complete this study. Her research expertise gave me confidence that this research will come together eventually.

Mrs Mosala M. A, my wife and self-appointed 'mentor' for her motivation, advice and support.

Mr Phori J, friend, colleague and self-appointed co-supervisor for his assistance in completing this research project.

My sons, Elton and Tebogo for always showing a keen interest in my career.

Mr Sello F.R, in the Directorate: Quality Assurance (DoE) for granting me the permission to undertake research in the Motheo-district schools.

Ms Bihi J, who really took trouble in typing and compiling this thesis.

All secondary school educators in the Motheo-district, Free State, who openly and honestly participated in this study.

Mr Monyane S.T, my colleague and friend who, in different ways, assisted and motivated me in making this study a reality.

Mr Selesho J. M, the programme head for the Postgraduate Studies at the School of Teacher Education, CUT, who motivated and assisted me during the period of my study.

Lastly, I would like to thank God for giving me the strength and opportunity to complete this study.

DECLARATION

I hereby declare that the dissertation “Problems encountered by educators regarding the implementation of the National Curriculum statement in Mathematics” is my own original work both in conception and execution and that all the sources I have used or quoted have been indicated and acknowledged by means of complete reference. This work complies with the code of Academic Integrity, as well as other relevant policies, procedures, rules and regulations at the Central University of Technology, Free State and has not been submitted before to any institution by myself or any other person in fulfillment (or partial fulfillment) of the requirements for the attainment of any qualification.

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ABSTRACT

This study examines the problems encountered by educators regarding the implementation of the National Curriculum Statement in mathematics in grades 10-12. The first aim of the study was to provide solutions to problems regarding training experienced by FET mathematics educators. The second aim was to identify problem areas in the NCS that frustrate mathematics educators teaching in the FET band and to identify areas that appeal to these educators. The third aim was to provide guidelines to assist educators with lesson planning in mathematics in the FET band. The fourth aim was to provide guidelines for appropriate assessment in mathematics in the FET band. The fifth aim was to provide guidelines for the effective integration of OBE in the teaching of mathematics in the FET band. The field work was executed by administering a questionnaire to a randomly selected sample of fifty two educators teaching in the FET band. Interviews were semi-structured, flexible and yielded additional information to that of the questionnaire. The questions of the interview were directly related to the objectives of the study and followed a given sequence that was adhered to in each interview process. The researcher arranged to interview one educator from each of the 15 randomly selected schools in the Motheo-district, but only 10 educators responded positively in the interview process, other educators could not avail themselves on that day.

The researcher analysed the responses according to the respondent's personal particulars. Descriptive analysis of the sample data for section B of the questionnaire were then done, using respondent counting, percentages and the average for the responses of each statement.

This study revealed that educators differ in terms of the problems that they encountered in implementing the NCS in mathematics. The findings from this study pointed out problems such as educators receiving inadequate training on implementing the NCS in mathematics. It was also revealed that educators had

not been visited by the departmental officials in their schools for monitoring the implementation of the NCS in mathematics. The last finding showed that teaching and learning support material arrived late during 2008 and that there was a large shortage of such material.

The result of the study provides invaluable baseline information with regard to the problems encountered by the educators in the implementation of the NCS in mathematics. On the basis of the findings of this study, a number of recommendations for the implementation of curriculum change in mathematics on FET level are given in Chapter 5.

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LIST OF ACRONYMS

ABET	Adult Basic Education and training
ABETA	Adult Basic Education and training Act
ANC	African National Congress
C2005	Curriculum 2005
CDPCU	Communication Directorate and Provincial Communication Units
CEM	Council of Education Ministers
DoE	Department of Education
EEA	Employment of Educators Act
FET	Further Education and Training
GET	General Education and Training
HEDCOM	Heads of Education Departments and Committees
HSRC	Human Sciences Research Council
NCS	National Curriculum Statement
NEPA	National Education Policy Act
NEPI	National Education Policy Initiative
NIS	National Implementation Strategy
NQF	National Qualifications Framework
OBE	Outcomes-Based Education
RDP	Reconstruction and Development Programme

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A LETTER OF PERMISSION TO CONDUCT RESEARCH

CHAPTER ONE

GENERAL ORIENTATION TO THE STUDY

1.1 INTRODUCTION

This research was initiated as a result of the transformation that took place in mathematics education in South Africa over the past 10 years and the launch of the National Curriculum Statement (NCS) in January 2004. Globally, education systems are changing constantly. According to Rambuda & Fraser (2004: 10), one such change was the shift from a philosophy that focused mainly on the transmission of information to one based on a constructivist approach to teaching and learning. In South Africa this shift was evident in the outcomes-based education (OBE) that was introduced two years after the country's first democratic elections in 1994.

The introduction of this new curriculum replaced the traditional pedagogical style of rote learning with more learner-centred pedagogical approaches and engendered critical thought. Mason (1999: 137) argued that OBE in South Africa aimed at addressing the legacy of apartheid by promoting the development of skills to prepare all learners for participation in an increasingly competitive global economy. The process of curriculum change that was taking place in South Africa gained further momentum with the phasing in of the National Curriculum Statement for the Further Education and Training band, in the year 2006.

The NCS attempted to provide more structure and support to teachers than Curriculum 2005. The critical factor in successfully translating Curriculum 2005 into practice was to ensure that the three pillars of curriculum transformation were in place and in alignment. These pillars are curriculum development, teacher development and the development, selection and supply of learning materials. As the implementation of Curriculum 2005 began, there were apparently no clear strategies to put these pillars in place in any province (Jansen, J. and Christie, P. 1999: 231).

The promulgation in October 1997 by the then national Minister of Education, Prof Kader Asmal, of the new curriculum for the General Education and Training (GET) band implied that Curriculum 2005 was then national policy and that all state schools in South Africa were obliged to implement it. The national department determined norms and standards for Curriculum 2005. The original idea behind Curriculum 2005 was that the critical and specific outcomes would be developed at a national level to ensure basic norms and standards for the new policy of the new curriculum. The outcomes would then inform the three key pillars or the essential components of the curriculum, namely:

- Curriculum development, including learning programmes and progress maps or some framework for assessment.
- Learning materials based on illustrative learning programmes.
- Teacher training that would assist teachers to translate all of the above into practice.

The implementation of Curriculum 2005 was not successful, however, and in 2006 it was replaced by the RNCS for grades R-9. While the Revised National Curriculum Statement (RNCS) was an improvement on its forerunner, it still had weaknesses. One of the central aims of the RNCS was to clearly articulate the assessment standards per grade against which learners were to be assessed. The RNCS streamlined and strengthened Curriculum 2005. It was part of the process of transforming education and training to realize the aims of our democratic society and of the constitution.

A committee was appointed by the then Minister of Education Prof Kader Asmal, in 2000 to review the structure and design of Curriculum 2005, teacher orientation, training and development, learning support materials, provincial support to teachers in schools and the implementation of time-frames.

The review committee recommended that the curriculum needed to be strengthened by streamlining its design features, simplifying its language, aligning curriculum and assessment, and improving teacher orientation and training, learner support materials

and provincial support. RNCS would deal with the curriculum requirements at various levels and phases and give a clear description of the kind of learner expected at the end of the General Education and Training (GET) band in terms of knowledge, skills, values and attitudes. The Revised NCS was developed towards these goals.

Curriculum 2005 had eight curriculum design features, namely critical and developmental outcomes, specific outcomes, range statements, assessment criteria, performance indicators, phase organizers, programme organizers and expected levels of performance. The RNCS had three curriculum design features, namely critical and development outcomes, learning outcomes and Assessment Standards.

An improvement of the NCS was that teachers were provided with guidelines with respect to the context and content through which the learning outcomes could be achieved by means of the Assessment Standards (ASs). According to the NCS Grades 10-12 (DoE 2003A: 7) assessment standards are "criteria that collectively provide evidence of what a learner should know and demonstrate at a specific grade. They embodied the knowledge, skills and values per grade required to achieve the learning outcomes".

Mathematics education in South Africa is arguably a tradition of defining narrow behavioural objectives derived from the content that mathematics teachers are expected to teach. So how are 'outcomes' different from objectives? Even if the policy intends a 'transformational' OBE that moves away from a 'traditional' OBE, how will it counter the teaching of mathematical techniques and procedures in ways that teachers have been doing all along?

It was against this background that an alternative scenario to that envisaged by the national Department of Education seemed inevitable: that OBE was implemented in 1998 in most provinces, regardless of the calls of teachers for more time and training. Teachers would determine whether the new curriculum (NCS) succeeded or not. The success of the new curriculum (NCS) depended on the training and support that

teachers received, as well as their ability to mobilise and manage the resources around them to implement the NCS. The policy issue was that change in the NCS would have teacher involvement and development as an integral part thereof.

The fundamental objective of this research was therefore the need to determine and highlight the problems and challenges that Mangaung educators experienced in the implementation of the NCS in mathematics for grades 10-12.

1.2. PROBLEM STATEMENT AND RESEARCH QUESTIONS

South Africa has embarked on a radical transformation of education and training from national right through to district and school level. One of the most challenging aspects of this transformation was the introduction of Curriculum 2005 (C2005) which was coupled with OBE in official documents and discourses (Chrisholm, 2001). Educators, as those who would need to make the transformation a success, were understandably asking questions about OBE: What it was; where it came from; and what its track record was with respect to success or failure?

Contemporary curriculum changes posed a number of problems to the educators. Pivotal to the problem was the implementation of the NCS in the FET curriculum band. Observable problems included, inter–alia, understanding the critical outcomes and teaching mathematics in the FET band in such a way that the critical outcomes were reached by the end of grade 12.

The seven critical outcomes are:

- Learners will identify and solve problems and make decisions using critical and creative thinking.
- Learners will work effectively with others as members of a team, group, organisation and community.

- Learners will organise and manage themselves and their activities responsibly and effectively.
- Learners will collect, analyse, organise and critically evaluate information.
- Learners will communicate effectively using visual, symbolic and/or language skills in various modes.
- Learners will use science and technology effectively and critically, showing responsibility towards the environment and the health of others.
- Learners will demonstrate an understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation. (RSA, DoE, 2003a: 15 National Curriculum Statement. Grade 10-12. Pretoria.

Educators were furthermore responsible for creating opportunities through the teaching of mathematics to advance the developmental outcomes in FET mathematics.

The five developmental outcomes are:

- The learner must be aware of the importance of reflecting on and exploring a wide variety of strategies, to learn more effectively.
- The learner must be made aware of the importance of being culturally and aesthetically sensitive across a range of social contexts.
- The learner must be made aware of the importance of participating as a responsible citizen, in local, national and global communities.
- The learner must be made aware of the importance of exploring education and career opportunities.
- The learner must be made aware of the importance of developing entrepreneurial opportunities (RSA, DoE, 2003a: 15 National Curriculum Statement. Grade 10-12. Pretoria.

The above mentioned critical and developmental outcomes were quoted from Govender, Boshoff and Oliphant (2006: IV).

A new approach to the implementation of the NCS was the introduction and use of rubrics for use in mathematics assessment in the FET band. "These rubrics can be self-assessment rubrics, peer-assessment rubrics, group assessment rubrics or rubrics designed to help the teacher assess whatever is being looked for. A rubric is a set of criteria that will be applied in the learning process" (Govender et al, 2006: viii). Many educators had never used a rubric before, but were only accustomed to tests and examinations. In a self-assessment rubric, the learners look at criteria and assess the individual. It motivates the learners to do their best. In group assessment rubrics the whole group assesses the performance of each individual or the group's participation as a whole. Its use encourages the learners to try and reach consensus when completing group-assessment rubrics.

Having highlighted the nature and content of the research problems, the following questions were formulated:

1. What are the solutions to problems regarding the training of FET mathematics educators?
2. What are the problem areas in the NCS that frustrate mathematics educators teaching in the FET band and which areas appeal to these educators?
3. What guidelines exist to assist educators with respect to lesson planning in mathematics in the FET band?
4. What guidelines exist to assist educators for appropriate assessment in mathematics in the FET band?
5. What guidelines exist for the effective integration of OBE in the teaching of mathematics in the FET band?

1.3. THE AIM AND OBJECTIVES OF THE STUDY

The main aim of the study was to determine the problems encountered by FET educators regarding the implementation of the NCS in mathematics for grades 10-12.

The following objectives were formulated from the above-mentioned aim:

- To provide solutions to problems regarding training experienced by FET mathematics educators.
- To identify problem areas in the NCS that frustrate mathematics educators teaching in the FET band and to identify areas that appeal to these educators.
- To provide guidelines to assist educators with lesson planning in mathematics in the FET band.
- To provide guidelines for appropriate assessment in mathematics in the FET band.
- To provide guidelines for the effective integration of OBE in the teaching of mathematics in the FET band.

1.4. RATIONALE FOR THE STUDY

The purpose of this study was to highlight the wide range of problems and difficulties Mangaung educators experienced with the implementation of the NCS, in the teaching of Mathematics in the FET band. Recommendations regarding the support and development of educators, the development of support materials and the pace and scope of the implementation of the NCS, were then made.

Outcomes-based education (OBE) formed the foundation for Curriculum 2005 when it was developed in 1998. It strived to enable all learners to reach their maximum learning potential by setting learning outcomes that had to be achieved by the end of the educational process. OBE encourages a learner-centred and activity-based approach to education (Department of Education: National Curriculum Statement Grade 10-12).

The Revised National Curriculum Statement for the GET band in mathematics built its learning outcomes on the critical and development outcomes that were inspired by the constitution and development through a democratic process. As schools nationwide continued their efforts to improve the implementation of the NCS, some reformers suggested that what was needed was a fundamental rethinking of the function and structure of education. OBE was one model for restructuring what was being examined nationwide. (McKernan, J.1993: 343).

The National Curriculum Statement for the FET band sought to promote human rights, inclusivity and environmental and social justice. All newly-developed subject statements were infused with the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa. In particular, the National Curriculum Statement Grades 10-12 is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors (Department of Education, NCS grades 10-12).

OBE was first introduced in South Africa in 1994 after apartheid education failed learners in many different ways. Examples include traditional educational practices that centred only on “inputs”; students who were exposed to a segment of the curriculum over a specified time; grades that were assigned regardless of whether all students mastered the material; and the implementation of a teacher-centred type of learning and teaching style (Christie, 1997). The following reasons were given as motivation for the introduction of OBE in schools in South Africa:

- To develop an authentic national system of education and training;
- To afford equal opportunity of access and outcomes in education and training to all citizens in terms of race, class, gender and ethnicity;
- To provide a qualitative system in terms of relevance, learner-centredness, critical thinking, economic growth and development, social responsibility, integration and ubuntu (National Department of Education, 1997);

- Rapid changes in the world. Schools could not teach what was contained in books because the information became outdated very quickly. It was believed that the best knowledge to have was that which helped the learner to think and solve problems (National Department of Education, 1997);
- South Africa does not exist in isolation. It is part of a global community and has to compete with other countries on different levels. Learners in South Africa need to develop the skills to be involved in this global competition (Curriculum 2005, p.10).

The implications of a growing global community, technological inventions and organisational shifts in the world of work, are self-evident. In the first instance, South Africa is a global partner. In a period when national autonomy was being replaced by international interdependence and economic co-operation as predominant global trends, it was unthinkable that South Africa could be isolated and at the same time hope for a competitive economy. A growing economy is not only dependent on healthy domestic policies, but also on international co-operation, business allies, higher productivity and quality products for the export market which are able to compete with the best in the world. As considered earlier, South Africa would have to react quickly to technological developments in order to ensure good standards of living for its inhabitants.

In order to be competitive, South Africa would have to invest in a corps of workers according to the requirements of the so-called high performance work organisations described previously. This country needs workers who are familiar with the latest technological developments, who have resolve to keep on learning, who can solve problems, are creative, can communicate well, have a healthy work ethic, can participate in managerial processes and decision making, can work well in a team and can be utilised flexibly.

These factors bring traditional education sharply into focus. The question was whether the traditional education system could live up to these expectations (Spady and Marshall, 1994). According to Spady and Marshall (1994: 1), probably the most well-

known authors on the subject, outcomes-based education was nothing new. It had always been with us. We are outcomes-based when we teach a child to cross a road safely. We go to great lengths to teach the skill correctly to the child and insist that he or she practices it until we are convinced that he or she does it safely. Most jobs are outcomes-based. When a product is manufactured, we know exactly what the outcome should be beforehand.

Although Spady and others believed that the concept outcomes-based was nothing new and had been with us since time immemorial, it was going to change South African education drastically. Classroom teaching, assessment of achievement, learner-advancement, the placement of learners and learning support material were heading for fundamental change. Brady (1996: 13) reported as follows concerning this approach: "it places enormous demands on teachers to further individualise instruction, plan remediation and enrichment, administer diagnostic assessment and keep extensive records… Outcomes-based education will flounder if there is not appropriate high quality staff development and the provision of sufficient support…"

Coinciding with renewal in classroom management, school management had to be adjusted radically. "To make OBE successful, schools needed to be substantially reorganised" (Dlugosh; Walter; Anderson & Simmons, 1995). Consequently, the role of the parent in education also had to change. The successful implementation of OBE depended on informed and motivated communities. For this reason, teachers, parents and educational managers had to be familiarised with all facets of this approach. Knowledge was vital.

Taking the aforementioned into consideration, the rationale for my study was to understand the position of OBE and the role it plays in the problems encountered by FET educators teaching mathematics in the FET band. Such an understanding would then assist in the formulation of recommendations regarding the presentation, assessment and planning of events regarding the subject mathematics at FET level.

1.5. RESEARCH DESIGN AND DATA COLLECTION METHODS

The research design involves a set of decisions regarding what topic is to be studied, amongst what population, with what research methods and for what purpose (Leedy & Ormrod, 2001: 149). Research design is the process of narrowing or focusing your perspective for the purpose of a particular study (Cohen and Holliday, 1996).

In this research a qualitative approach was used. Qualitative researchers recognize phenomena that occur in natural settings, that is, in the "real world". "Secondly, qualitative research involves studying phenomena in all their complexity. Qualitative researchers recognise that the issues they are studying have many dimensions and layers, and so they try to portray the issue in its multifaceted form" (Leedy & Ormrod, 2001:147). Such researchers attempt to remain neutral, objective and apart from the reality that they study. "They try to create a research environment devoid of extraneous influences and attempts to have them operate equally among groups so that they can isolate key causes, ensure reliability and validity, and strengthen the productive capability of the phenomena that is being studied" (Marshall, P: 1988: 51).

The researcher collected data that would allow him to identify the challenges and problems in the implementation of the NCS in the teaching and learning of FET mathematics, in the Motheo District. The data consisted of information collected by using interviews, a questionnaire and other relevant material such as official documents from the National Department of Education and Training. The data gave the researcher insight into the nature of the problems and challenges in the implementation of the NCS in teaching mathematics. The researcher did not identify cause-and-effect relationships as quantitative research is needed to answer such questions.

An open-ended questionnaire was used. It is a powerful tool which consists of a series of questions, statements or items. These were presented to the respondents who were asked to answer, respond to or comment on them in a way that they thought best. There was a clear structure, sequence and focus to the questionnaire, but the format

remained open-ended, enabling the respondents to respond freely (Cohen & Manion, 2000: 248). The questionnaire was distributed to 60 mathematics educators in the Motheo district. The sample of the population who answered the questionnaire consisted of 4 grade 10-12 mathematics educators per school. According to research ethics, participants cannot be coerced into completing a questionnaire. The respondents might be strongly encouraged, but the decision whether to become involved and when to withdraw from the research is entirely theirs. Questionnaire respondents are not passive data providers for researchers; they are subjects, not objects of research (Sapsford, R and Jupp.V, 2006: 98-107).

Interviews were semi-structured, flexible and yielded additional information to that of the questionnaire. One educator from each of the 15 randomly selected schools in the Motheo district was expected to participate in this interview process. The researcher realized that only 10 educators from those 15 schools positively participated in the interview process. Other educators did not.

The survey method was used. Surveys gather data at a particular point in time with the intention of describing the nature of existing conditions, or identifying standards against which existing conditions can be compared, or determining the relationships that exist between specific events. The universal purpose behind this research was to identify the challenges and problems in the implementation of the NCS in the teaching and learning of mathematics at secondary schools in the Motheo district. This research is therefore of a descriptive nature. At each school where the researcher left the questionnaires, the researcher strongly pleaded with the principal to persuade FET mathematics educators to complete the questionnaire as it was for the benefit of the subject, the learners and the educators. A period of a week was given to the concerned respondents to complete the questionnaire. Thereafter the researcher personally went to the different schools to collect the completed questionnaires.

1.6. LIMITATIONS OF THE STUDY

For the purpose of the study, the research was confined to 15 schools in the Motheo District, namely: Moemedi Secondary School, Lereko High School, Ikaelelo Secondary School, Navalsig High School, Dr Block High School, Atlehang Senior Secondary School, Kaelang Senior Secondary School, Albert Moroka Secondary School, Moroka High School, Goronyane High School, Qibing High School, Dewetsdorp High School, R.T. Mokgopa School, Lenyora La Thuto Secondary School and Setjaba se Maketse Secondary School.

It would have been appropriate to investigate the problems encountered by educators regarding the implementation of the NCS in mathematics in all the districts of the Free State Province. However, time, resources, finance and logistics made it impossible. For this reason, the investigation was limited to the Motheo district. This area has as many high schools as most of the districts in the Free State Province. Furthermore, it is assumed that the situation in the Motheo district is similar to what prevails in other areas of the province. The findings made from this study may therefore be believed to show similarities to corresponding studies in other districts of the Free State Province.

1.7. VALIDITY AND RELIABILITY

Validity refers to the truth, the correctness and the strength of a statement. A valid argument is sound, well-grounded, justifiable, strong and convincing (Kvole, 2007: 122-123). In this study validity was ascertained by the researcher by examining the sources of invalidity. Verification was built into the entire research process with continual checks on the credibility, plausibility and trustworthiness of the findings.

The attempt to build out invalidity is essential if the researcher is to be able to have confidence in the elements of the research plan, data acquisition, data processing analysis, interpretation and its ensuing judgement (Sapsford and Jupp, 2006: 25b).

In this research, the following statements were used in order to ensure that the investigation is valid:

- Choosing an appropriate time scale

The researcher personally submitted five questionnaires to each school and explained to the principals that the questionnaires would be collected after eight days. This was to ensure that the educators had a reasonable period of time to complete the questionnaires.

- Ensuring that there are adequate resources for the required research to be undertaken

The researcher ensured that the following resources were available for the research to be undertaken: a vehicle for taking the questionnaires to the schools and also for interviews; writing materials, computers for typing, a memory stick for storage of the research chapters, a typist, articles and books for references.

- Selecting an appropriate methodology for answering the research questions

The researcher chose qualitative research as the method. Such researchers attempt to remain neutral, objective and apart from the reality that they study.

- Selecting appropriate instrumentation for gathering the type of data required

A questionnaire and interviews were used to collect the data. A questionnaire is a powerful tool which consists of a series of questions, statements or items. Interviews were semi-structured, flexible and yielded additional information to that of the questionnaire.

- Using an appropriate sample

The sample of the population consisted of 15 schools in the Motheo district. The researcher left five questionnaires at each school and requested the principals to select one educator from each school for an interview which lasted ±10 minutes.

Reliability pertains to the consistency and trustworthiness of research findings; it is often treated in relation to the issue of whether a finding is reproducible at other times and by other researchers (Kvole, 2007: 122-123). For research to be reliable it must demonstrate that if it were to be carried out on a similar group of respondents, in a similar context, then similar results would be found. In this study, the researcher found the research to be reliable because similar groups of respondents from different schools in the Motheo district were involved and similar results were obtained.

1.8. OUTLINE OF THE DISSERTATION

CHAPTER 1: General orientation to the study

Chapter 1 provides an introduction to the study by outlining its purpose and rationale and by presenting the research questions.

CHAPTER 2: Literature review

It provides the theoretical framework within which the research is conducted as well as a systematic, critical, and integrated discussion of related research findings.

CHAPTER 3: Methodology

Chapter 3 contains a description of the research design and method. It includes a discussion of the population and sample, data collection methods and data analysis.

CHAPTER 4: Research Findings

This is the chapter in which the findings of my empirical research are presented. It also contains an analysis, interpretation and discussion of the findings.

CHAPTER 5: Conclusions and Recommendations

This chapter provides conclusions and recommendations for the use of the research findings. It furthermore mentions the weaknesses and gaps or constraints in the research.

1.9. CONCEPT CLARIFICATION

A clarification of important concepts, as encountered in this dissertation, is provided in the following paragraphs:

Outcomes-based Education

In OBE the outcome, that is, what learners will be able to do, know and value as a result of their learning experience, is central. This is different from considering what educators will teach as a starting point. By starting with the outcomes, educators think about learning as a whole: what knowledge and skills need to be learned, and what values and attitudes will lead to the achievement of the outcome?

Curriculum 2005

The introduction of this new curriculum replaced the traditional pedagogical style of rote learning with more learner-centred pedagogical approaches and engendered critical thought. Curriculum 2005 was introduced in order to strengthen outcomes-based

education (OBE) that was introduced two years after the country's first democratic elections in 1994.

Revised National Curriculum Statement

The Revised National Curriculum Statement (RNCS) uses simple language to provide clarity about what learners should achieve by the end of each grade from Grade R-9. It forms the basis for all planned school activities to help develop the learners. This includes what happens inside and outside the classroom. The Revised National Curriculum Statement is not a new curriculum but a streamlined and strengthened version of Curriculum 2005, which was introduced in our schools in 1998.

National Curriculum Statement

The National Curriculum Statement (NCS) for the Further Education and Training band was phased in, in the year 2006. The NCS attempted to provide more structure and support to teachers than Curriculum 2005.

Teachers' Portfolios

A teacher's portfolio is a compilation of all the tasks used for school-based assessment. It contains a collection of all the assessment tasks, the annual programme of assessment and learning area record sheets. A teacher's portfolio enables you to monitor your progress and to plan for the next step in the learning experience.

1.10. SUMMARY

This thesis aims to report on an investigation into the problems encountered by educators regarding the implementation of the National Curriculum Statement in mathematics. Five research questions were formulated with the purpose of constructing guidelines for ensuring the successful implementation of the National Curriculum

Statement in mathematics. Limitations of the study as well as aspects regarding validity and reliability were touched on in this general orientation to the study.

The following chapter reviews the literature on the stated research questions and it provides theoretical perspectives on the techniques to be used in the implementation of the National Curriculum Statement in mathematics in the FET band.

CHAPTER TWO

LITERATURE REVIEW

2.1. INTRODUCTION

The new South African FET school curriculum provides opportunities for educators and researchers to see mathematics as a discipline that has connections: it has links within itself and other disciplines. An important purpose of mathematics in the FET band is the establishment of proper connections between mathematics as a discipline and the application of mathematics in real-world contexts. Mathematical modeling provides learners with the means to analyse and describe their world mathematically, and so allows learners to deepen their understanding of mathematics while adding to their mathematical tools for solving real-world problems.

The new FET school curriculum allows for the development of teaching strategies that help educators and teacher educators see teaching in a new perspective. The vision in the new curriculum also helps us to conceptualise assessment in ways that recognise that all learners can do, and succeed in, mathematics.

Chapter two seeks to provide an argument that the new mathematics curriculum presents an opportunity for understanding curriculum itself. The researcher addresses the question: what is our current understanding of the FET mathematics curriculum that is presently being implemented in South Africa? There have been recent attempts to understand the context (Cross, Mungadi & Ravhani, 2002) and practice (Craven, 2004; Naidoo & Parker, 2005) of curriculum and its implementation in South Africa. Although the concept of connections lies at the heart of key deliberations concerned with new mathematical curricula (Foargasz et.al, 1996), none of these discussions have made connections an object of exploration and understanding. The launching of Outcomes Based Education (OBE), which is an outcomes-oriented curriculum model or approach, together with Curriculum 2005 (C2005), which was implemented in different grades in 1997, was greeted with mixed feelings in the education sector. The feelings included excitement, anger, trepidation, outrage and caution (Ramroop, 2004:1). While some

people saw it as a definite move towards redress and equality in education, others saw it as a way to drop the existing standards of education. But with pressure on the new democratic government to address the plight of education coupled with global politics and economics, OBE and C2005 were to become the key strategies for educational change and reform in South Africa.

The curriculum developers in South Africa believed that this new curriculum had the potential to address the needs of society in the 21st century. Unfortunately, in South Africa the implementation was fraught with problems and negativity that seriously hampered the realization of the new education system based on quality and democracy. Ramroop (2004:1) asks the questions: why is the implementation of the new curriculum so fraught with problems? What is missing in this process that hampers the development of schools? Could it be the case of many gaps that exist between the policy makers and the practitioners? What are the readiness and skills levels of educators on the ground to be able to implement the change? De Clerq (1997: 139) states that, although this approach has the potential to restructure and realign a poor and ineffective system, the way it is conceptualized and introduced may jeorpardise its ability to address and redress the real problems and causes of the existing system.

2.2. BACKGROUND TO CURRICULUM TRANSFORMATION IN SOUTH AFRICA

The National Curriculum framework document (Department of Education, 1996) was the first major curriculum statement of a democratic South Africa. It was informed by principles derived from the White Paper on Education and Training (Department of Education, 1995a), the South African Qualifications Act (NO 58 of 1995) (DoE, 1995) and the National Education Policy Act (No 27 of 1996) (DoE, 1996). The White Paper emphasized the need for major changes in education and training in South Africa in order to normalize and transform teaching and learning in South Africa.

The National Curriculum framework which focused on lifelong learning, also stressed the need for a shift from the traditional aims-and-objectives-approach to outcomes-based education. It promoted a vision of: ‘A prosperous, truly united, democratic,

internationally competitive country, with literature, creative and critical citizens leading productive, self-fulfilled lives in a country free of violence, discrimination and prejudice' (DoE, 2002: 3).

According to Jansen (1999: 3), the historiography of OBE in South Africa is itself a matter of controversy. However, it is important to recognize the significance of 1990 as the critical turning point in the curriculum debates in South Africa. Until that time South African education was characterized by a uniform and predictable curriculum policy environment. The apartheid government managed a centralized curriculum policy system, which was described as racist, Euro-centered, sexist, authoritarian, prescriptive, unchanging, context blind and discriminatory (DoE, 2002, RNCS Grade R-9).

The National Education Co-ordination Committee (NECC), itself a nominal alliance of progressive education and labour stakeholders, initiated the National Education Policy Investigation (NEPI) to develop education 'policy options' for the broad democratic movement, in effect the African National Congress and its allies. One of the key research groups in the NECC was the curriculum group which produced important foundational documents upon which much of the existing curriculum policy is based (NEPI, 1993). What the NEPI did was to provide a broad framework for thinking about democratic education policy after apartheid. This framework emphasized non-racism, democracy, equality and redress as the platform for post-apartheid education policy (Jansen, 1999: 4).

The first democratic national elections of 1994 saw the establishment of a single national education system. The Ministry of Education produced a White Paper on Education and Training in 1995 which presented the proposal for OBE. In October 1997 the National Curriculum Statement for Grades R-9 was published in the Government Notice NO. 1445 and an assessment policy in the General Education and Training Band was introduced in 1998. The intention was that the new Outcomes-Based Curriculum would be phased in, in 1998 and completed by the year 2005. Hence it was called Curriculum 2005 (DoE, 2002).

The changes that had to be made for C2005 were vast and courageous, and as with any such complex process, constant review is necessary and a Ministerial Committee was appointed in 2000 to review the progress and effectiveness of the new curriculum (DoE, 2002). The Review Committee recommended that the C2005 be streamlined and that it be modified to make it more accessible to educators.

2.3. THE BACKGROUND TO AND CONTEXT OF CURRICULUM REFORM IN SOUTH AFRICA

Jansen (1998) and Chisholm (2005) note that curriculum revision in South Africa has proceeded in three main waves. The first involved cleansing of syllabi from racist language and controversial and outdated content. This process also aimed to lay a foundation for a single national core syllabus with curriculum decisions made in a participatory and representative manner. The second wave included the launch of curriculum 2005 (C2005) in March 1997. C2005 was driven by the principles of outcomes-based-education (OBE) used in countries such as Australia, Canada and parts of the United States of America. C2005 also mirrored the constitutional emphasis on equity and human rights. It was seen as important for its content to be non-authoritarian and to be shaped in a participatory manner (Fiske and Ladd, 2004). OBE thus formed the foundation of the revised South African curriculum. The origins and nature of OBE have been traced by various authors. Fiske and Ladd (2004) simply describe it as an instructional method in which curriculum planners define the general knowledge, skills, and values that learners should acquire. It thus differs from the traditional instruction in which curriculum planners define specific kinds of knowledge and skills that are to be transferred from teacher to learner, leaving teachers to enjoy somewhat less freedom of operation (Fiske and Ladd, 2004).

Due to challenges experienced in the implementation of C2005 in classrooms, the then Minister of Education, Professor Kader Asmal, appointed a task team led by Professor Chrisholm to review C2005 in the year 2000. The Review Committee recommended that the curriculum be strengthened by streamlining its design features, simplifying its language, aligning curriculum and assessment, and improving teacher orientation and

training, learner support materials and provincial support (DoE, 2000). This process marked the start of the third wave of curriculum reform.

Based on the team's recommendation, C2005 was revised, leading to the launch of the Revised National Curriculum Statement (RNCS) in 2002. The RNCS is therefore not a new curriculum, but rather builds on the vision and values of the South African Constitution and C2005. According to the RNCS (2002:4), it keeps intact the principles, purposes and thrust of C2005 and affirms the commitment to OBE. The philosophy of OBE, which is an achievement-oriented, activity-based and learner-centred education process, remains the foundation of the curriculum (DoE, 2000).

This section of the literature review contributes to research question five, which states: what guidelines exist in the FET band for the effective integration of OBE in the teaching of mathematics?

2.4. REVIEW OF THE IMPLEMENTATION OF THE NATIONAL CURRICULUM STATEMENT (NCS)

The NCS (Grades 10-12) was introduced in 2002 after the panel which was appointed by the Minister of Basic Education. The curriculum laid a foundation for the achievement of the goals. Stipulated by the constitution which states that everyone has the right to further education which the state, through reasonable measures, must make progressively available and accessible. The NCS stipulated Learning Outcomes and Assessment Standards and spelt out the key principles and values that underpin the curriculum.

In July 2009 the Minister of Basic Education, Minister Motshekga, appointed a panel of experts to investigate the nature of the challenges and problems experienced in the implementation of the National Curriculum Statement (NCS) and to develop a set of recommendations designed to improve the implementation of the NCS.

The Minister's brief was in response to comments of stakeholders such as teachers, parents, teacher unions, school management and academics, over several years, on

the implementation of the NCS. While there has been positive support for the new curriculum, there has also been considerable criticism of various aspects of its implementation, manifesting in teacher overload, confusion and stress and widespread learner underperformance in international and local assessments. Whilst several major interventions have been made over time to address some of the challenges of implementing the curriculum, these changes had not had the desired effect (DoE, 2000).

The panel identified key areas for investigation based on the major complaints and challenges encountered since 2002, when the NCS was introduced for the first time. The key areas were identified as: curriculum policy and guideline documents; transition between grades and phases; assessment; learning and teaching support materials (LTSM) and teacher support and training for curriculum implementation.

The panel focused specifically on the development and purpose, dissemination and support, use and availability, adequacy, clarity, accessibility and load with regard to policy and guideline documents, for the NCS. Regarding transition between grades and phases, questions were posed on whether teachers and stakeholders thought there were problems and if so, where these problems occurred specifically.

Assessment has been an area receiving much criticism. The panel questioned what the problems were with the assessment policies. Learning and teaching support material (LTSM) and teacher support were two other critical areas that were brought to the panel's attention. The methods employed by the panel in collecting comments, evidence and data included document reviews, interviews, and hearings with teachers from all nine provinces. Across the nine provinces, the teachers were extremely clear about their views on the curriculum and its implementation. There was also remarkable consensus across different provinces and amongst teachers and unions about what the problems were. The panel experienced an overwhelming sense of the overall commitment of teachers across the country to try and improve learner performance, and this was very reassuring (DoE (1995a), White Paper on Education and Training).

An important finding of the review panel was that there was no clear, widely communicated plan for the implementation and support for the NCS. Teachers and

parents complained that they had no vision of the bigger picture in terms of what education and curriculum set out to do and achieve. Coupled with poor learner performance in local and international tests, this had led to pockets of distrust in the education system.

Recommendations by the task team for the review of the implementation of the NCS included the following: A coherent, clear, simple five year plan to improve teaching and learning across the schooling system needed to be developed and adhered to. Offering support to teachers and the improvement of learner performance must be its central themes. Mechanisms to monitor the implementation of the plan through regular external monitoring to assess whether it has the desired effect on learner and teacher performance, needed to be built into the plan. There was a plethora of policies, guidelines at all levels of the education system. Exacerbating the situation was the reality that teachers, as well as some DoE staff, had not made the shift from C2005 to the revised NCS. This had resulted in widespread confusion about the status of curriculum and assessment policies.

A further recommendation by the task team for the review of the implementation of the NCS read as follows: Develop one curriculum and assessment policy document for every learning area and subject that will support all teachers and help address the complexities and confusion created by curriculum and assessment policy vagueness and lack of specification. Subject advisors did not have sufficient knowledge and skills to offer teachers the support they required to improve learner performance. Subject advisors resorted to developing tools to help interpret policies and guidelines that contributed to the confusion and proliferation of documents and paperwork. The panel recommended that the roles of the subject advisors be clarified nationally. The exact nature of in-classroom and school support should be specified for the provision of teachers.

Teachers across the country complained about numerous administration requirements and duplication of work. The administrative burden around assessment and planning appeared to impact negatively on teaching and contact time. Another recommendation

by the task team for the review of the implementation of the NCS was to reduce teachers' workload particularly with regard to administrative requirements and planning, which would allow more time for teaching.

Assessment has been a challenge for teachers ever since the inception of C2005, when an unnecessarily complicated approach to assessment was introduced. Further complicating the situation in the GET phase, a new assessment policy was never developed to support the NCS. As a result, teachers and parents were confused about several aspects of assessment, from progression requirements to performance descriptors. The recommendation by the task team for the review of the implementation of the NCS was to simplify and streamline assessment requirements and improve the quality and status of assessments by making the GET and FET phases consistent. Conduct regular national systematic assessments in Grade 3 to 6, and replace the Common Tasks of Assessment (CTA) with the annual National Testing for all Grade 9 learners in Mathematics.

The proper and comprehensive use of textbooks was discouraged and undermined by C2005. Teachers were encouraged to produce their own materials (DoE: 2002, RNCS). Yet, both local and international research has shown that the textbook is the most effective tool to ensure consistency, coverage, appropriate pacing and better quality instruction in implementing a curriculum. Other LTSM related complaints were that some provinces had not provided sufficient textbooks for learners. Some provincially developed catalogues contained LTSM of dubious quality. The recommendation by the task team for the review of the implementation of the NCS was that the quality assurance of catalogue development for textbooks and other LTSM needed to be centralised at national level. The useful role and benefits of textbooks needed to be communicated at the highest level. Each learner from Grade 4 to Grade 12 should have a textbook for each learning area or subject.

Teachers complained that most higher education institutions that were training teachers did not cover the NCS thoroughly enough and that many newly trained teachers were not competent to teach the curriculum. It was almost unanimous, across all provinces, that any further training needed to be subject specific. Support staff such as the school

management, subject advisors and district staff also needed to be trained and have clarity on their roles and responsibilities.

2.5. NEW CURRICULUM REFORM

It is indisputable that teachers are key to the success of curriculum reform (Smith and Desimone, 2003; Spillane and Callahan, 2000). Their knowledge, beliefs, and perceptions play a fundamental role in understanding the reforms (Blignaut, 2007; Haney et al., 2002). Thus it would be irrational and naïve to expect teachers to easily or without any objections accept educational reforms.

Literature on new educational or curriculum reforms currently abounds in the educational field (Beasly, 2000; Rogan and Grayson, 2003). These reforms aim to bring changes in the educational system and in the classroom teaching and learning process. In South Africa, as in other countries, educational reforms are intended to redress past racial inequalities as well as combat current skills shortages in areas like mathematics, science and technology.

Some reforms have been triggered by the evaluation results of the Trends in International Mathematics and Science Study (TISMSS). Other reforms result from a lack of satisfaction with students' performance (within a country). Curriculum reform may also be introduced with the goal of producing scientifically literate citizens capable of competing nationally and internationally. Evidently, developing and launching a new curriculum does not guarantee that challenges and problems will be overcome (Gritlin and Margonis, 1995). A range of factors, including teachers' understanding and acceptance of the new curriculum, are likely to impact on implementation. In South Africa, for example, Jansen (1998) and Chrisholm (2005) note that since democracy in 1994, there have been a series of educational changes, all intended to redress past educational injustices. However, contrary to expectations, these have not been universally welcomed (Lessing and De Witt, 2007).

As Rogan and Grayson (2003) point out, whilst policy documents contain visionary and educationally sound ideas, implementing these often proves to be slower and more

difficult than anticipated. In their view, much work on implementation issues need to be done in South Africa if the promises of the new curriculum are to make an impact in schools. In order to address such challenges, the DoE in South Africa launched programmes to help teachers understand the curriculum and change teaching practices. However, limited changes have been seen, and this raises the question as to what the difficulties actually are.

2.6. SUPPORT FOR CURRICULUM IMPLEMENTATION: TRAINING PROGRAMMES FOR FET MATHEMATICS TEACHERS

In this section the purpose of in-service education and training in mathematics education is discussed. In-service education and training (INSET) in mathematics education is aimed at developing mathematics teachers so as to improve their teaching. It also contributes to the teacher's content knowledge, attitude and techniques of training. The training programmes are used as a platform for teachers to understand policies, principles and procedures of the teaching profession. INSET therefore has a key role in developing the skills and capabilities of teachers (NEPIR: 1993).

Currently, in South Africa one often hears the words transformation, change, reform, development and growth. INSET is a professional development programme that is all about transformation, change and reform in the education system. INSET programmes are organized in the form of workshops. These workshops are meant to develop teachers so as to improve their classroom practice. Changes in classroom practices may be attributed to many factors, namely, the introduction of technology in education, changes in curriculum, reform in instructional methods and new assessment practices and techniques (Adler et al, 2002:160). Along with LTSM and especially textbooks, effective teacher training is crucial to the successful implementation of the curriculum.

Submissions from the review team of the panel appointed by the Minister of Basic Education, Ms Motshekga, reported that many newly qualified teachers have deficiencies in respect of their subject knowledge and methodologies. It would appear that newly qualified teachers have not been adequately prepared in respect of appropriate methodologies. A more general observation is that new teachers (as well as more experienced teachers) are not confident with assessment. If new entrants to

the profession are equipped with the necessary knowledge and skills with regard to the curriculum, then the need for ongoing training would be reduced over time.

2.6.1. Targeted Training

Training of teachers for both C2005 and the NCS was shown to be too superficial and too generic. It is increasingly clear from our history of curriculum training that a one-size-fits-all approach is not effective. There was a strong call in the hearings from the review team of the panel appointed by the Minister of Basic Education, Ms Motshekga for subject content training and for subject-specific training. Not only has training been superficial and too generic, it has also been decontextualised and unsupported (DoE (1995): South African Qualification Act. There is a need to ensure that all training is contextualized in terms of actual needs, and then followed up through classroom-based monitoring and support.

The task-team for the Review of the Implementation of the NCS proposed that subject advisors should monitor and support in ongoing cycles as follows: pre-training classroom observation to identify actual needs; needs-driven training, based on insights gained through observation, which focuses on both official curriculum requirements and the challenges/weaknesses and needs of teachers; post-classroom monitoring, quality assurance, support and mentorship, which in turn should inform future training needs in ongoing cycles.

Broad categories of teachers should be identified and targeted for training (based on their specific needs). Some of these areas include training and supporting teachers who are not sufficiently competent to teach in English where their own mother tongue is not English; training in subject disciplinary content; training in the use of textbooks. Research has shown that all these aspects represent major barriers to improved learner performance (DoE (1995): SAQA NO 58).

2.6.2. Training of all curriculum stakeholders

One of the problems with prior training initiatives for C2005 and the NCS reforms was that many of the departmental officials (trainers) themselves had a relatively poor

understanding of OBE and provided teachers with superficial information. In addition, they often contradicted the policies, which resulted in confusion and uncertainty among teachers.

It also emerged in the hearings from the review team of the panel appointed by Minister Motshekga that there is confusion amongst district officials, including subject advisors, provincial officials and principals about understanding their role in relation to implementing the curriculum. It is important, therefore, that all of these stakeholders receive targeted training in any future revisions of the curriculum. This should include clarity on roles, document and policy status, and what aspects of previous curricula are no longer applicable. The quality and delivery of the training needs to be very carefully planned and of a high standard (DoE, (2000): South African Curriculum for the 21st century).

2.6.3. Training for effective time use

Research has shown that one of the crucial obstacles to effective teaching and learning is the loss of teaching time (Chisholm et al, 2005). All training therefore needs to focus on preparing teachers, both in terms of what they teach but also their professional orientation, to teach for a given number of hours a day. In this way, curriculum coverage and improved learning outcomes are likely to be supported.

The Task Team for Review of the implementation of the NCS proposed the following recommendations: in-service teacher training should be targeted to where it is most needed; training needs to be subject-specific; principals, HOD's, District and provincial support staff need in-depth training on roles, curriculum content and assessment requirements to be able to support teachers effectively; subject advisors should be trained to work as supportive, training and development oriented advisors, who offer in-class support as well as training and development to teachers and all training, in all contexts, must be underpinned by the principle that teachers should be actually teaching for the minimum number of hours a day, every day as specified in policy.

According to Botha (2000), other factors that contribute negatively to the successful implementation of the NCS in mathematics education, are inadequate teacher salaries,

the low professional status of teachers in South African society, and teachers resigning to take up better paid and less stressful jobs. Teachers' workloads are also a barrier to effective in-service education and training. Most teachers are unwilling to participate in training programmes because of their workload (DoE, (2000): South African Curriculum for the 21st century).

The aforementioned literature underpins the first and second research questions, namely: What are the solutions to problems regarding the training of FET mathematics educators? What are the problem areas in the NCS that frustrate mathematics educators teaching in the FET band and which areas appeal to these educators?

2.7. ASSESSMENT OF MATHEMATICS IN GRADES 10-12

Assessment in mathematics should focus on collecting reliable information regarding learners' mathematical growth and competence. Assessment includes informal assessment, formal internal assessment and external assessment. Informal or daily assessment informs the teacher about how learners are progressing towards achieving assessment standards with the purpose of enhancing teaching and learning. Formal internal assessment tools should provide the teacher with a means of differentiating between learners on a given scale. External assessment occurs in the Grade 12 National Senior Certificate examinations (SAG: Mathematics, January; 2007: 7).

The learning outcomes (LO) and Assessment Standards (AS) of the mathematics National Curriculum Statement have been divided into core assessment standards and optional assessment standards. The core assessment standards are examined by means of two compulsory papers: Paper one (LO1 and LO2) and Paper two (LO3 and LO4). The optional assessment standards are examined by means of Paper three. Paper three is optional to all learners in Grade 12 from 2008. It is anticipated that those assessment standards identified as optional will with time become compulsory.

Daily or informal assessment is used by teachers to make decisions about teaching and to determine how learners are progressing towards achieving the learning outcomes (SAG: Mathematics, January; 2007: 7). Learner performance in such tasks is not formally recorded. The purpose of daily assessment is to evaluate the performance of

individuals and the class on a certain part of the mathematics curriculum. Therefore, assessment tools used should tell the teacher about the strengths and weaknesses of individual learners and the class so that he or she can determine who needs more help and what kind of help is required.

The programme of assessment for mathematics in Grades 10 and 11 comprises of eight tasks which are internally assessed (school-based assessment). As indicated in Table1, the seven tasks completed during the school year make up 25% of the total mark for mathematics, while the end-of year examination makes up the remaining 75%. Assessment should be ongoing and spread across the school year.

Table 1 illustrates the forms of assessment and the weighting that should be used to compile learners' promotion mark. Table 1 also suggests when the assessment tasks should be given.

Table 1: Example of a Programme of Assessment for Grades 10 and 11

(SAG: Mathematics, January; 2007: 8)

	GRADE 10		GRADE 11	
	TASKS	**WEIGHT (%)**	**TASKS**	**WEIGHT (%)**
Term 1	Test Investigation	10	Test Investigation	10
Term 2	Investigation Examination	10 30	Investigation Examination	10 30
Term 3	Project Test	20	Project Test	20
Term 4	Assignment	10	Assignment	10
Porgramme of Assessment mark		100		100
Programme of assessment mark (as % of promotion mark)		25%		25%
End-of-year examinations		75%		75%
Promotion mark		100%		100%

In Grade 12, assessment consists of two components: an internal programme of assessment which makes up 25% of the national senior certificate mark for mathematics and an external examination which makes up the remaining 75%. The programme of assessment for mathematics in Grade 12 consists of seven tasks which are internally assessed. The external examination is externally set and moderated.

Examinations in Grade 10 and 11 should, where possible, have a distribution of marks similar to that of Grade 12, indicated in Table 2 and Table 3. Grade 10 and 11 examinations should also include problem-solving questions in preparation for such questions in the National Senior Certificate Mathematics examinations at the end of grade 12.

Table 2: Suggested number of examination papers in Grades 10 and 11

	GRADE 10	GRADE 11
TERM 2	Paper 1: 2 hours (100 marks)	Paper 1: 2 hours (100 marks) Paper 2: 2 hours (100 marks) Paper 3: discretion of school
TERM 4	Paper 1: 2 hours (100 marks) Paper 2: 2 hours (100 marks) Paper 3: minimum of 1 hour if offered (50 marks at least)	Paper 1: 3 hours (150 marks) Paper 2: 3 hours (150 marks) Paper 3: 2 hours if offered (100 marks)

(SAG: Mathematics, January; 2007: 10)

Table 3: Suggested distribution of marks for Grade 12 question papers

PAPER 1		PAPER 2		OPTIONAL PAPER	
Bookwork: max of 6 marks		**Bookwork: O marks**		**Bookwork: max of 15 marks**	
LO1: Patterns and sequences	±30	LO3: Coordinate geometry	±40	LO1: Recursive sequences	±5
LO1: Annuities and finance	±15	LO3: Transformation	±25	LO3: Geometry	±40
LO2: Functions and graphs (see note below)	±35	LO3: Trigonometry (see note below)	±60	LO4: Descriptive statistics and interpretation	±20
LO2: Algebra and equations	±20	LO3: Data handling	±25	LO4: Probability	±20
LO2: Calculus	±35			LO4: Bivariate data	±15
LO2: Linear programming	±15				
Total	**150**	**Total**	**150**	**Total**	**100**

(SAG: Mathematics, January; 2007)

The National Senior Certification process includes a formal external assessment at the end of Grade 12. The formal external assessment assesses the Assessment Standards for Grades 11 and 12. The assessment will consist of two compulsory papers (Paper 1 and Paper 2) and one optional paper (Paper 3). The structure, time allocation and marks of the Grade 12 National Mathematics examinations are illustrated in Table 4.

Table 4: Summary of the National Senior Certificate external Grade 12 assessment

EXAM PAPER	LEARNING OUTCOMES	TIME ALLOCATION	TOTAL MARKS
Paper 1	LO1 and LO2	3 hours	150 marks
Paper 2	LO3 and LO4	3 hours	150 marks
Paper 3	LO3 and LO4	2 hours	100 marks

(SAG: Mathematics, January; 2007)

A learner must achieve a minimum of 30% (level 2): Elementary achievement in mathematics for promotion at the end of Grade 10 and 11 and for certification at the end of Grade 12. Moderation of internal assessment tasks will take place at schools in Grades 10, 11 and 12.

The information mentioned in this section underpins the following research questions of research question number three which states: What guidelines exist to assist educators with respect to lesson planning in mathematics in the FET band? And also research question number four, which states: What are the guidelines for appropriate assessment in mathematics in the FET band?

2.8. SUMMARY

This dissertation aims to report on an investigation into the problems encountered by educators regarding the implementation of the NCS in mathematics in the FET band. Chapter two seeks to provide an argument that the new mathematics curriculum presents an opportunity for understanding curriculum itself. The researcher addresses the question: what is our current understanding of the FET mathematics curriculum that is presently being implemented in South Africa.

The chapter discussed the background to curriculum transformation in South Africa. The launching of Outcomes-based Education (OBE), which is an outcomes-oriented curriculum model or approach together with Curriculum 2005 (C2005), which is the time-frame for implementing the new curriculum in different grades in 1997, were

discussed. The chapter also discussed the review of the implementation of the NCS. In this section, the Report of the Task Team for the Review of the Implementation of the NCS was clearly discussed.

The literature in Chapter two also gave ideas on new curriculum reform. In South Africa, as in other countries, educational reforms are intended to redress racial inequalities as well as combat current skills shortages in areas like mathematics, science and technology. Other items discussed in Chapter two were the support for curriculum implementation under which training programmes for FET mathematics educators were explained in conjunction with the recommendations proposed by the Task Team for the implementation of the NCS. Lastly, the chapter identified and discussed the assessment of mathematics in Grade 10-12.

In the following chapter a detailed research design and methodology will be provided.

CHAPTER THREE

METHODOLOGY

3.1. INTRODUCTION

Literature reviewed in Chapter two revealed that educators need to understand the design elements of the NCS in order to implement it successfully in Mathematics education in the FET band (refer to section 2.3 p26). In this chapter, the research design and the methodology used in this study are explained. Specifically, the research problem, the purpose and objective of the study, the research questions, the research strategy and techniques, the data collection methods and instruments, the procedures that were followed, as well as data analysis, are explained in detail. Ethical issues are also considered.

3.2. RESEARCH PROBLEM AND MOTIVATION FOR THE STUDY

South Africa has embarked on a radical transformation of education and training from national right through to school district level. One of the most challenging aspects of this transformation was the introduction of Curriculum 2005 which was coupled with OBE in official documents and discourse (Chisholm, 2001).

Contemporary curriculum changes posed a number of problems to the educators. Pivotal to the problem was the implementation of the NCS in the FET curriculum band. This study was done in order to emphasise the transformation that took place in mathematics in South Africa over the past 10 years and the launch of the NCS in January 2004, and to identify the problems that were encountered in mathematics with the implementation of this new curriculum.

3.3. PURPOSE AND OBJECTIVES OF THE STUDY

The purpose of this study was to highlight the wide range of difficulties that Mangaung educators experienced in the implementation of the NCS, in the teaching of mathematics in the FET band, and will be brought to the attention of the Free State DoE for possible intervention.

The following objectives were formulated from the above mentioned purpose:

- To provide solutions to problems regarding training experienced by FET mathematics educators.
- To identify problem areas in the NCS that frustrate mathematics educators teaching in the FET band and to identify areas that appeal to these educators.
- To provide guidelines to assist educators with lesson planning in mathematics in the FET band.
- To provide guidelines for appropriate assessment in mathematics in the FET band.
- To provide guidelines for the effective integration of OBE in the teaching of mathematics in the FET band.

3.4. RESEARCH QUESTIONS

The following research questions were addressed in the study:

1. What are the solutions to problems regarding the training of FET mathematics educators?
2. What are the problem areas in the NCS that frustrate mathematics educators teaching in the FET band and which areas appeal to these educators?
3. What guidelines exist to assist educators with respect to lesson planning in mathematics in the FET band ?

4. What guidelines exist to assist educators for appropriate assessment in mathematics in the FET band exist to assist educators?
5. What guidelines exist for the effective integration of OBE in the teaching of mathematics in the FET band?

The above-mentioned research questions are answered in chapter four of this dissertation.

3.5. RESEARCH STRATEGY AND TECHNIQUES

In this research a combined quantitative and qualitative approach was used. The reasons for using both approaches were that the data in this research consisted of information retrieved by using questionnaires and interviews. The use of questionnaires rendered quantitative data while the interviews rendered qualitative data.

The researcher used random sampling. A list of FET band schools in the Motheo district was obtained by the researcher at the district office. Thereafter the researcher selected 15 schools randomly from the list. The sampling was executed in May 2009. A sample is a group of subjects or persons selected from the target population. The sample has the same characteristics as the target population and is trusted to provide the relevant data, as it would be obtained from the whole population (De Vos, 2002:145).

The fundamental method of probability sampling is simple random sampling. Random sampling means that every element in the population of interest has an equal and independent chance of being chosen. Here the word independent means that the selection of any one element in no way influences the selection of any other (Sapsford & Jupp, 2006:31). Simple does not mean that random sampling is easier to carry out than other methods, but that steps are taken to ensure that nothing influences the selection each time a choice is made, other than chance.

Educators teaching mathematics in grades 10, 11 and 12 of the Further Education and Training band in the Motheo district, were the respondents in this study. These

respondents were drawn from schools in the Motheo district. The regions where the study was conducted included Mangaung, Botshabelo, Thaba-Nchu, Wepener and Dewetsdorp. There were four randomly selected schools from each region. Therefore, the total number of schools was 15.

3.5.1. Ethical issues

All people involved with research, the research community, funding agencies, government and the public, share certain common concerns. These concerns raise several general considerations which must always be addressed. The specific considerations and acceptable standards for ethical research are that risks to participants are minimised by research procedures that do not unnecessarily expose them to risks, that the rights and the welfare of participants are adequately protected, that the risks to participants are outweighed by the anticipated benefits of the research, that informed consent has been obtained and appropriately documented (Cohen & Manion, 2003: 106).

The most fundamental principle for ethical acceptability is that of informed consent, meaning the involved participants must be informed of the nature and purpose of the research, its risks and benefits, and must consent to participate without coercion. All the above mentioned ethical issues were discussed with the participants by the researcher.

3.6. DATA COLLECTION METHODS AND INSTRUMENTS

Five major techniques or methods for gathering qualitative data are used in different types of research, namely; tests, questionnaires, interviews, observations, and unobtrusive measures. Once the purpose and constraints of this research project were clear, the researcher chose a questionnaire and interviews to fit the research design applicable to this study.

A semi-structured questionnaire was used. It is a powerful tool which consists of a series of questions, statements or items. Questionnaires were presented to the

respondents who were asked to answer, respond to or comment on them in a way that they thought best. There was a clear structure, sequence and focus to the questionnaire, but the format remained open-ended, enabling the respondents to respond freely (Cohen & Manion, 2000: 248).

According to research ethics, participants cannot be coerced into completing a questionnaire. The respondents might be strongly encouraged, but the decision whether to become involved and when to withdraw from the research is entirely theirs. Questionnaire respondents are not passive data providers for researchers; they are subjects not objects of research (Sapsford, R and Jupp, V. 2006: 98-107).

An advantage of using a questionnaire is that it is relatively economical, has the same questions for all subjects, can ensure anonymity, and contains questions written for a specific purpose. Questionnaires are easy to score and provide time for subjects to think about responses. Disadvantages or weaknesses of questionnaires include the slow response rate of mailed questionnaires, the inability of the researcher to probe and clarify, scoring open-ended items, faking and social desirability, a restriction to subjects who cannot read and write and biased or ambiguous items (Sapsford, R and Jupp, V. 2006: 108).

3.6.1. The layout of the questionnaire

The appearance of the questionnaire is vitally important. In this research, the questionnaire looked easy, attractive and interesting rather than complicated, unclear, forbidding and boring. A compressed layout is uninviting and it clutters everything together. A larger questionnaire with plenty of space for questions and answers is more encouraging to respondents. Verma & Mallick (1999: 120) also suggest the use of high quality paper if funding permits.

Clarity of wording and simplicity of design are essential. In this research clear instructions were given to guide respondents, because complicated instructions and

complex procedures intimidate respondents. The researcher ensured that short, clear instructions accompanied each section of the questionnaire.

The researcher realized that it was important to include assurances of confidentiality, anonymity, and non-traceability in the questionnaire.

Finally, a brief note at the very end of the questionnaire (a) asked respondents to check that no answer had been inadvertently missed out; (b) solicited an early return of the completed schedule; (c) thanked respondents for their participation and co-operation, and offered to send a short abstract of the major findings when the analysis was completed.

3.6.2. Construction of the questionnaire

It takes time and effort to design a questionnaire and the researcher should realise that the questionnaire will possibly be re-drafted a number of times before finalisation. When designing a questionnaire many people make the mistake of making it too long, uninteresting and not relevant (Cook, 2005:42). Useful tips in designing a questionnaire include (Henning, E. 2004: 76):

- Ensure that the questionnaire is easy to complete.
- Make the layout of the questionnaire attractive and appealing to the eye.
- Use plain English so that the wording is clear to all.
- Explain the benefits of completing the questionnaire in the introduction and say why you want to hear the respondent's views.
- Reassure the respondent that the responses will be treated in confidence.

The questionnaire was designed to determine the problems encountered by FET educators in the Motheo district with regard to the implementation of the NCS in mathematics teaching and learning. In order to obtain the information needed for the purpose of this study, the questionnaire was divided into three sections, namely, Section A, Section B and Section C.

Section A consisted of questions that provide the biographical information of the respondents such as gender, age, teaching experience, qualification and rank. Section B of the questionnaire consisted of the National Curriculum Statement Scale (NCSS). Section C consisted of two items: a scale with questions on identifying problem areas that frustrate educators in mathematics teaching in the FET band and a scale with questions on identifying areas that appeal to educators in the teaching of Mathematics in the FET band.

3.6.3. Categories of the rating scales and scoring thereof

With regard to Section B of the research instrument, a rating scale with four response alternatives was used: namely, Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). According to Mayring, (2002:78) a rating is a measured judgement of some sort. When we rate people, we make a judgement about their behaviour or something they have produced.

Rating scales are often similar to attitude scales in form, with words and numbers placed in continuum (from lowest to highest). A commonly used attitude scale in this research is the Likert scale – named after its inventor, R. Likert. A Likert scale is an attitude or personality scale where respondents are invited to express their degree of agreement or disagreement with a proposition (Sapsford and Jupp: 120-121).

3.6.4. The structure of the items in the questionnaire

As indicated earlier, the questionnaire consisted of three sections. Section A, with items 1,2,3,4 and 5 required biographical information. This information was used in relation to objectives number two, three and four of the study which intended to identify whether biographical factors have any influence on FET mathematics educators and the problems they encountered with regard to the implementation of the NCS in mathematics education.

In Section B there were 20 items. These items of the questionnaire were designed to determine the respondents' reaction with regard to the problems encountered as FET educators in implementing the NCS in mathematics education. It therefore focused on the aim of the study. Section C of the questionnaire consisted of interview questions, which further aimed at establishing the problems encountered by the FET mathematics educators with regard to the implementation of the NCS in the teaching of mathematics.

3.6.5. Covering letters

The purpose of the covering letter is to indicate the aim of the research, to convey to respondents its importance, to assure them of confidentiality, and to encourage their replies (Cohen, et al., 2003: 128). The covering letter in this research provided a title to the research, introduced the researcher, his name, address, organisation, contact telephone, together with an invitation to feel free to contact the researcher for further clarification or details.

The researcher also indicated the purpose, importance and benefits of the research. Professional backing was indicated and permission for the research was explained. The researcher explained that the questionnaires would be collected after a period of two weeks and he thanked the respondents in advance for their co-operation.

3.6.6. The interview

Interviews were semi-structured, flexible and yielded additional information to that of the questionnaire. One educator from each of the 15 schools in the Motheo district participated in this interview schedules. Interview schedules and questionnaires are basically the same kind of instrument – a set of questions to be answered by the subjects of the study.

There are some important differences in how interviews and questionnaires are administered. Interviews are conducted orally, and the answers to the questions are recorded by the researcher. The major steps in constructing an interview are the same as in preparing a questionnaire – justification, defining objectives, writing questions,

deciding general and item format and pretesting. The difference is that the interview involves direct interaction between individuals which has both advantages and disadvantages as compared to questionnaires.

The interview technique is flexible and adaptable. It can be used with many different problems and types of persons, such as those who are illiterate or too young to read and write. Responses can be probed, followed up, clarified, and elaborated on to achieve specific accurate responses. The interviewer can clarify any questions that are obscure to expand on answers that are particularly important or revealing.

The primary disadvantages of the interview are its potential for subjectivity and bias, its higher cost and time-consuming nature, and lack of anonymity. Furthermore, the presence of the researcher may inhibit respondents from saying what they really think.

3.6.7. Preparing the interview

An interview schedule was drawn up by the researcher. The schedule listed all the questions that were to be asked and the interviewer was given space to write answers. The questions of the interview were directly related to the objectives of the study and followed a given sequence that was adhered to in each interview process. Appropriate probing questions helped the researcher to better understand the participant's answers.

The questions are usually in one of three forms: structured, semi-structured, or unstructured. Structured questions are followed by a set of choices, and the respondent selects one of the choices as the answer. Semi-structured questions have no choices from which the respondent selects an answer. Rather, the question is phrased to allow for individual responses. It is an open-ended question but is fairly specific. Unstructured questions allow the interviewer great latitude in asking broad questions in whatever order seems appropriate (Henning, E. 2004: 128).

In qualitative educational studies most interviews use a combination of structured and semi-structured questions. This provides a high degree of objectivity and uniformity, yet

allows for probing and clarification. In this research the form of the interview questions was semi-structured.

3.6.8. Validity of the instrument

Validity is the extent to which the research conclusions can plausibly be taken to represent a state of affairs in the wider world. Validity refers to whether a questionnaire is measuring what it intends to (Sapsford and Jupp, 2006: 23). Validity has two parts, namely, does the instrument actually measure the concept in question, and is the concept measured accurately (De Vos, 2000: 121). The type of validity used for this study is content validity. Content validity refers to expert opinions concerning whether the scale items represent the proposed domains or concepts the questionnaire is intended to measure. The drawing of correct conclusions based on the data obtained from an assessment will ensure the researcher that what he did, is valid.

3.6.9. Reliability of the instrument

According to Kvole S (2007: 122-124), reliability pertains to the consistency and trustworthiness of research findings; it is often treated in relation to the issue of whether a finding is reproducible at other times and by other researchers. Reliability refers to the repeatability, stability or internal consistency of a questionnaire. Internal consistency refers to the degree to which the results from various items comprising the measurement, are in harmony. The answers to the questions of the questionnaire and the interviews will be tested. The scores would probably not be identical, but they should be close.

3.6.10. Coding and scoring methods

Scoring and coding are processes where the raw data obtained from the questionnaire is converted to a quantitative form for analysis and display purposes. According to Larson and Forber (2003:37), coding and scoring are processes whereby the responses

on a questionnaire are classified into meaningful categories and converted into numbers which are suitable for the analysis of data by a computer.

In this study the respondents were requested to make a cross through SA, A, D or SD in section B thereby describing the statement which suits their experience with regard to the problems encountered in implementing the NCS in Mathematics education best. In section C, interview questions were forwarded to HODs of Mathematics. The purpose of these interview questions was to determine how these HODs manage educators with regard to the successful implementation of the NCS in Mathematics education.

The thirty statements in Section B were assigned codes or values as follows:

- 4 to strongly agree
- 3 to agree
- 2 to disagree
- 1 to strongly disagree

The codes mentioned above were used for positively worded statements. The codes for negatively worded statements are:

- 1 to strongly agree
- 2 to agree
- 3 to disagree
- 4 to strongly disagree

This is a usual procedure. Typically the highest number is assigned to the most positive response and the lowest number to the most negative response, McHugh (2003:37).

3.7. DATA ANALYSIS

According to Larson and Farber (2002:85), descriptive statistics refers to statistical methods used to describe data where no hypotheses are being tested nor inferences drawn about a wider population. Descriptive statistics assist with understanding how

the data is distributed across the possible range of values. These statistics also assist with the process of organizing and summarizing data.

The researcher analysed the responses according to the respondent's personal particulars (section A of the questionnaire). Descriptive analysis of the sample data for section B of the questionnaire was then done, using respondent counting, percentages and the average (mean) for the responses of each statement. Respondent counting involves counting the number of respondents who marked SA, A, D or SD. Respondent counting provides a summary of the tabulated frequency for which each category is marked, therefore, frequency data can be converted to percentages, indicating the number of respondents who marked a particular category in relation to the total number of respondents.

By averaging group scores on a set of items, you are reducing or summarizing the data in order to make it easier to work with and interpret. When the mean or average for the responses to each item is converted to the nominal categories, it gives an indication of the group's response to a particular statement. In this study it means that when the mean or average for the responses to each item are converted to SA, A, D or SD, it gives an indication of the educators' responses to a particular statement. Electronic data processing was used in this study.

3.8. LIMITATIONS OF THE STUDY

For the purpose of the study, the research was confined to 15 schools in the Motheo District. Out of 15 schools, 7 were situated in the Mangaung area, which is an urban area. Most parents living in this area are literate and employed. Eight of the remaining schools were situated in a rural area, which was poverty-stricken and most parents were illiterate and unemployed.

It would have been appropriate to investigate the problems encountered by educators regarding the implementation of the NCS in mathematics in all the districts of the Free State Province. However, time, resources, finance and logistics made it impossible. For

these reasons, the investigation was limited to the Motheo district. This area has as many high schools as most of the districts in the Free State Province. Furthermore, it is assumed that the situation in the Motheo district is similar to what prevails in other areas of the province. The findings made from this study may therefore be believed to be similar to that which can be found in other districts of the Free State Province.

3.9. SUMMARY

The study was done in order to emphasise the transformation that took place in mathematics in South Africa over the past ten years with the launch of the NCS in January 2004. The purpose was to highlight the wide range of and difficulties that Mangaung educators experienced in the implementation of the NCS, in the teaching of mathematics in the FET band.

In this chapter, the procedures followed in conducting the research were discussed. This included a discussion of the research design, a discussion of the research problem, a motivation for the study, the purpose and objectives of the study, the research questions, research strategy and techniques, the data collection methods, namely, questionnaires and interviews and the procedures used for analyzing the data. In Chapter four, the empirical research is reflected, and an analysis and interpretation of the data obtained by means of the empirical research will be discussed.

CHAPTER FOUR

RESEARCH FINDINGS

4.1. INTRODUCTION

In Chapter three a detailed account of the research design and methodology was given. In this chapter the analysis and interpretation of the data are discussed. Descriptive statistics were used to summarise educators' responses to the statements in Section A and B of the questionnaire and the interview questions in Section C.

4.2. ADMINISTRATION OF THE RESEARCH INSTRUMENT

Descriptive statistics summarize the general nature of the data obtained, for instance, how certain measured characteristics appear to be "on average", how much variability exists among different pieces of data, how closely two or more characteristics are interrelated, and so on (Rowntree; 2003: 30-31). Research instruments are means by which the researcher gathers information relevant to his/her research problems. Research instruments range from equipment in a science laboratory to questionnaires and interview schedules, administered to people in various facets of life.

The distribution of subjects according to biographical variables in Table 4.1, is presented with the following headings: gender, age, teaching experience in years and qualification. Under "qualification" the acronym REQV is used, which is the acronym for Relative Education Qualification Value. The questionnaire was administered to 60 FET mathematics educators. The researcher received 52 questionnaires, hence the analysis of the research was done on 52 questionnaires.

Table 4.1. Distribution of subjects according to biographical variables (N=52)

Gender	Male	Female
	31	21

Age	25 or younger	26-35	36-45	46-55	56 or Older
	3	23	16	7	3

Teaching experience in years	0-5yrs	6-10 yrs	11-15yrs	16-20yrs	21 or more
	21	11	7	5	8

Qualification	REQV 10 (Matric or Below)	REQV 11 (M+1)	REQV 12 (M+2)	REQV 13 (M+3)	REQV 14 (M+4)	REQV 15 (M+5)
	0	0	1	15	29	7

According to Table 4.1, there were more males than females. Most respondents were between the ages 26 and 35. In referring to years in teaching experience, the researcher realized that there were more respondents in bracket 0-5 years. Lastly, Table 4.1 indicated that more participants in the research fell in the qualification rank of REQV 14 (M+4).

4.3. RESULTS OF THE STUDY

In the following subsections a descriptive analysis of the data, interview questions and findings from the interviews will be provided.

4.3.1. Descriptive analysis of data obtained from the questionnaire

Table 4.2 and Table 4.3 contain the frequency distribution of responses to items 1-20 from the questionnaire. Statements by the respondents are classified as positive or negative within the following response categories: strongly agree (SA), agree (A), disagree (D) and strongly disagree (SD). Typically the highest number is assigned to the most positive response and the lowest number to the most negative response (S.Cook, 2005: 43).

Table 4.2 contained positively worded statements and Table 4.3 contained negatively worded statements. Table 4.2 was assigned values as follows: 4 to strongly agree, 3 to agree, 2 to disagree and 1 to strongly disagree. The items in question were statements 1, 2, 3, 4, 5, 6, 8, 9, 10 and 11. In Table 4.3 the scoring was reversed as follows: 4 to strongly disagree, 3 to disagree, 2 to agree, 1 to strongly agree. The items in question were statements 7, 12, 13, 14, 15, 16, 17, 18, 19 and 20. Thereafter frequencies, percentages and means were determined. The means were obtained by finding the sum of the percentages of the responses and dividing it by the number of responses. Percentages are indicated in parentheses. For further details on the analysis of data in this study refer to Chapter 3, section 3.6.

Table 4.2. Frequency distribution of responses for positively worded statements.

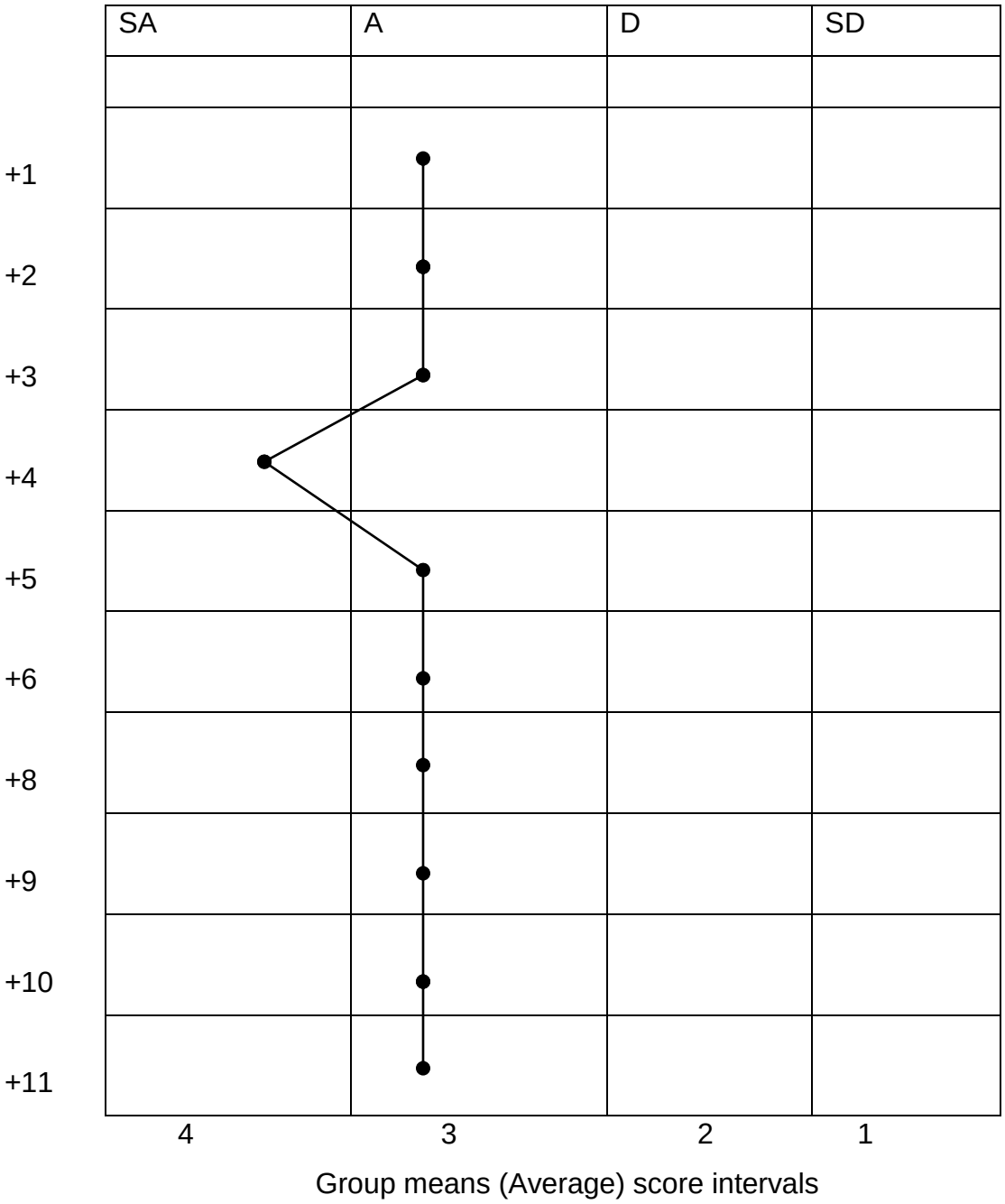
(+) Positively worded items (scoring 4, 3, 2, and 1)

Statement No	Response Category				
	SA (4)	A (3)	D (2)	SD (1)	Mean
1	5(9,6%)	22(42,3%)	18(34,6%)	7(13,5%)	2,48
2	5(9,6%)	35(67,3%)	10(19,2%)	2(3,8%)	2,83
3	4(7,7%)	24(46,2%)	22(42,3%)	2(3,8%)	2,58
4	25(48,1%)	20(38,5%)	5(9,6%)	2(3,8%)	3,31
5	6(11,5%)	21(40,4%)	18(34,6%)	7(13,5%)	2,50
6	4(7,7%)	22(42,3%)	18(34,6%)	8(15,4%)	2,42
8	6(11,5%)	29(55,8%)	16(30,7%)	1(1,9%)	2,77
9	4(7,7%)	39(75%)	8(15,4%)	1(1,9%)	2,88
10	5(9,6%)	22(42,3%)	22(42,3%)	3(5,8%)	2,56
11	7(13,5%)	36(69,2%)	8(15,4%)	1(1,9%)	2,94

Table 4.3 Frequency distribution of responses for negatively worded statements

(-) Negatively worded items (scoring 1, 2, 3, and 4)

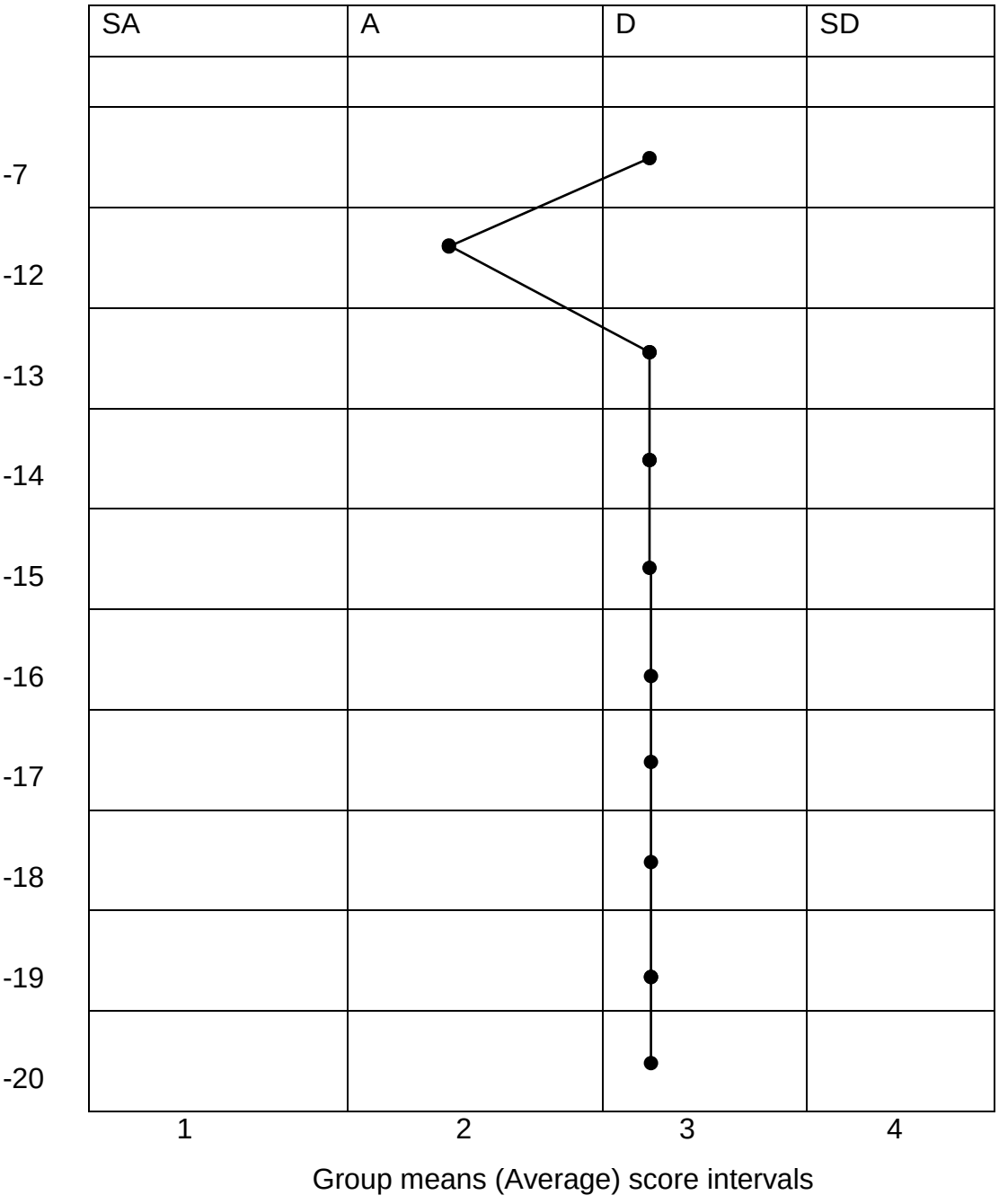
Statement No	Response Category				
	SA (1)	A (2)	D (3)	SD (4)	Mean
7	6(11,5%)	18(34,6%)	22(42,3%)	6(11,5%)	2,54
12	6(11,5%)	25(48,1%)	18(34,6%)	3(5,8%)	2,35
13	3(5,8%)	17(32,7%)	26(50%)	6(11,5%)	2,67
14	1(1,9%)	10(19,2%)	36(72%)	5(9,6%)	2,87
15	4(7,7%)	15(28,8%)	29(55,8%)	4(7,7%)	2,63
16	3(5,8%)	10(19,2%)	32(61,5%)	7(13,5%)	2,83
17	4(7,7%)	12(23,1%)	31(59,6%)	5(9,6%)	2,17
18	4(7,7%)	20(38,5%)	26(50%)	2(3,8%)	2,60
19	4(7,7%)	20(38,5%)	26(50%)	2(3,8%)	2,60
20	4(7,7%)	14(26,9%)	28(53,8%)	6(11,5%)	2,69



Graph 1: Graphic representation of responses to positively worded statements

The graphic representation indicates that educators agreed with nine positively worded statements, namely 1,2,3,5,6,8,9,10 and 11. In statement 4, educators agreed strongly

that they found the material for implementing the NCS in mathematics supplied by the DoE, useful.



Graph 2: Graphic representation of responses to negatively worded statements

The graphic representation shows that educators disagreed with nine of the ten negatively worded statements, namely, 7,13,14,15,16,17,18,19 and 20. The only statement that they agreed with is number 12, namely, that it took them long to feel confident in implementing the NCS in mathematics. This means that educators still need support in certain areas in order to be able to implement the NCS in mathematics successfully.

Table 4.2 and Table 4.3 summarize the following information pertaining to FET educators in Mangaung with regard to the problems encountered with the implementation of the NCS in mathematics.

Statement 1: I found the timeframes for implementing the NCS in mathematics to be realistic.

This statement is worded positively. Table 4.2 reveals that 5 (9,6%) of the educators strongly agreed and 22 (42,3%) educators agreed that the timeframes for implementing the NCS in mathematics were realistic. Only 18 (34,6%) disagreed and 7 (13,5%) strongly disagreed. The mean score is 2,48. When converted back to the nominal categories of the scale it falls within the “A” category (see Graph 1). Therefore, on average the educators agreed that the timeframe for implementing the NCS in mathematics was realistic.

Statement 2: I have received support from departmental officials to assist me in the implementation of the NCS in mathematics.

This is a positively worded statement. Table 4.2 shows that 5 (9,6%) of the educators strongly agreed and 35 (67,3%) agreed that they received support from the departmental officials through attending workshops in order to assist them in the implementation of the NCS in mathematics. 10 (19,2%) disagreed and only 2 (3,8%) strongly disagreed. The mean score is 2,83 and when converted back to the nominal categories of the scale it falls within the “A” category (see Graph 1). Therefore, on

average the educators agreed that they received sufficient support from departmental officials through attending workshops to assist them to implement the NCS in mathematics.

Statement 3: I received adequate training in order to pilot the curriculum on implementing the NCS in Mathematics teaching.

This is a positively worded statement. Table 4.2 reveals that 4 (7,7%) of the educators strongly agreed and 24 (46,2%) agreed that they received adequate training in order to pilot the curriculum on implementing the NCS in mathematics teaching. 22 (42,3%) disagreed and only 2 (3,8%) strongly disagreed. The mean score of 2,58 falls within the "A" category (see Graph 1). On average, educators in the sample therefore agreed that they received adequate training in implementing the NCS in mathematics teaching.

Statement 4: I find material for implementing the NCS in mathematics, supplied by the Department of Education, to be useful.

This is a positively worded statement. Table 4.2 shows that 25 (48,1%) of the educators strongly agreed and 20 (38,5%) of the educators agreed that they found the material for implementing the NCS in Mathematics supplied by the Department of Education useful. 5 (9,6%) disagreed and only 2 (3,8%) strongly disagreed. The mean score of 3,31 falls within the "SA" category (see Graph 1). On average, educators strongly agreed that they found material for implementing the NCS in mathematics, useful.

Statement 5: I have been visited by departmental officials in my school for monitoring the implementation of the NCS in mathematics.

This is a positively worded statement. Table 4.2 indicates that 6 (11,5%) of the educators strongly agreed and 21 (40,4%) agreed that they were visited by departmental officials in their schools for monitoring the implementation of the NCS in

Mathematics. 18 (34,6%) disagreed and 7 (13,5%) strongly disagreed. The mean score of 2,50 falls within the “A” category (see Graph 1). On average, educators agreed that departmental officials visited them at their schools for monitoring the implementation of the NCS in Mathematics.

Statement 6: I received teaching and learning support material to implement the NCS in mathematics teaching.

This is a positively worded statement. Table 4.2 illustrates that 4 (7,7%) of the educators strongly agreed and 22 (42,3%) agreed that they received teaching and learning support material to implement the NCS in Mathematics teaching. 18 (34,6%) disagreed and only 8 (15,4%) strongly disagreed. The mean score of 2,42 falls within the “A” category (see Graph 1). On average, educators agreed that they received teaching and learning support material to implement the NCS in mathematics teaching.

Statement 7: I am not satisfied with the quality of teaching and learning support material for implementing the NCS in mathematics in my school.

This is a negatively worded statement. According to Table 4.3, 6 (11,5%) of the educators strongly agreed and 18 (34,6%) agreed that they were not satisfied with the quality of the teaching and learning support material that they received for implementing the NCS in Mathematics at their schools. 22 (42,3%) disagreed and 6 (11,5%) strongly disagreed. The mean score of 2,54 falls within the “D” category (see Graph 2). On average, educators disagreed that they are not satisfied with the quality of the teaching and learning support material for implementing the NCS in mathematics in their schools. It can therefore be deduced that educators were satisfied with the quality of teaching and learning support material.

Statement 8: The NCS is helpful in assessing my learners' performance in mathematics.

This is a positively worded statement. Table 4.2 shows that 6 (11,5%) of the educators strongly agreed and 29 (55,8%) agreed that the NCS was helpful in assessing their learners' performance in mathematics. 16 (30,7%) disagreed and only 1 (1,9%) strongly disagreed. The mean score of 2,77 falls within the "A" category (see Graph 1). On average, educators thus agreed that the NCS is helpful in assessing their learners' performance in mathematics.

Statement 9: The NCS is helpful in planning my learning programme in mathematics.

This is a positively worded statement. Table 4.2 shows that 4 (7,7%) of the educators strongly agreed and 39 (75%) agreed that the NCS is helpful in planning their learning programme. Only 1 (1,9%) strongly disagreed. The mean score of 2,88 falls within the "A" category (see Graph 1). On average, educators agreed that the NCS is helpful in planning their learning programmes in Mathematics.

Statement 10: I find the simplified terminology of the NCS in mathematics easily understandable.

It is a positively worded statement. Table 4.2 illustrates that 5 (9,6%) of the educators strongly agreed and 22 (42,3%) agreed that they found the simplified terminology of the NCS in Mathematics easily understandable. 22 (42,3%) disagreed and only 3 (5,8%) strongly disagreed. The mean score of 2,56 falls within the "A" category (see Graph 1). On average, educators agreed that they found the simplified terminology of the NCS in mathematics easily understandable.

Statement 11: I use the NCS in Mathematics in my day-to-day teaching.

This is a positively worded statement. Table 4.2 reveals that 7 (13,5%) of the educators strongly agreed and 36 (69,2%) agreed that they use the NCS in Mathematics in their day-to-day teaching. 8 (15,4%) disagreed and only 1 (1,9%) strongly disagreed. The mean score of 2,94 falls within the "A" category (see Graph 1). On average, educators agreed that they use the NCS in Mathematics in their day-to-day teaching.

Statement 12: It took me long to feel confident to implement the NCS in mathematics.

This is a negatively worded statement. Table 4.3 reveals that 6 (11,5%) of the educators strongly agreed and 25 (48,1%) agreed that it took them long to feel confident to implement the NCS in Mathematics. 18 (34,6%) disagreed and only 3 (5,8%) strongly disagreed. The mean score of 2,35 falls within the "A" category (see Graph 2). On average, educators therefore agreed that it took them long to feel confident to implement the NCS in mathematics.

Statement 13: The NCS has a negative impact on my record keeping of learners' performance.

This is a negatively worded statement. Table 4.3 indicates that 3 (5,8%) of the educators strongly agreed and 17 (32,7%) agreed that the NCS has a negative impact on their record keeping of learners' performance. 26 (50%) disagreed and 6 (11,5%) strongly disagreed. The mean score of 2,67 falls within the "D" category (see Graph 2). On average, educators disagreed that the NCS has a negative impact on their record keeping of learners' performance. The NCS therefore has a positive impact on the record keeping of learners' performances by the teacher.

Statement 14: The NCS has a negative impact on my assessment of learners' performances in mathematics.

It is a negatively worded statement. Table 4.3 reveals that only 1 (1,9%) strongly agreed and 10 (19,2%) agreed that the NCS has a negative impact on their assessment of learners' performances in mathematics. 36 (72%) disagreed and 5 (9,6%) strongly disagreed. The mean score of 2,87 falls within the "D" category (see Graph 2). On average, educators disagreed that the NCS has a negative impact on their assessment of learners' performances in mathematics. The NCS therefore has a positive impact on the assessment of learners' performances in mathematics by the teacher.

Statement 15: The NCS has a negative impact on my lesson planning in mathematics.

It is a negatively worded statement. Table 4.3 shows that 4 (7,7%) of the educators strongly agreed and 15 (28,8%) agreed that the NCS has a negative impact on their lesson planning in mathematics. 29 (55,8%) disagreed and 4 (7,7%) strongly disagreed. The mean score of 2,63 falls within the "D" category (see graph 2). On average, educators disagreed that the NCS has a negative impact on their lesson planning in mathematics. The NCS therefore has a positive impact on the lesson planning of teachers

Statement 16: The NCS has a negative impact on my teaching methodology in mathematics.

This is a negatively worded statement. According to Table 4.3 3 (5,8%) of the educators strongly agreed and 10 (19,2%) agreed that the NCS has a negative impact on their teaching methodology in mathematics. 32 (61,5%) disagreed and 7 (13,5%) strongly disagreed. The mean score of 2,83 falls within the "D" category (see Graph 2). On average, educators disagreed that the NCS has a negative impact on their teaching methodology in mathematics. Therefore, it can be said that the NCS has a positive impact on the teachers' teaching methodology in mathematics.

Statement 17: I have difficulty using the learning outcomes in implementing the NCS in mathematics.

This is a negatively worded statement. Table 4.3 reveals that 4 (7,7%) educators strongly agreed and 12 (23,1%) agreed that they have difficulty using the learning outcomes in implementing the NCS in mathematics. 31 (59,6%) disagreed and 5(9,6%) strongly disagreed. The mean score of 2,71 falls within the "D" category (see Graph 2). On average, educators disagreed that they have difficulty using the learning outcomes in implementing the NCS in mathematics. Educators could therefore easily use the learning outcomes in teaching mathematics according to the NCS.

Statement 18: I have difficulty using assessment standards in my implementation of the NCS in mathematics.

It is a negatively worded statement. Table 4.3 illustrates that 4 (7,7%) of the educators strongly agreed and 20 (38,5%) agreed that they have difficulty using assessment standards in their implementation of the NCS in mathematics. 26 (50%) disagreed and 2 (3,8%) strongly disagreed. The mean score of 2,60 falls within the "D" category (see graph 2). On average, educators disagreed that they have difficulty using assessment standards in their implementation of the NCS in mathematics. The assessment standards were therefore seen as user-friendly by the educators.

Statement 19: I have difficulty integrating knowledge and skills from different learning areas when I implement the NCS in mathematics

This is a negatively worded statement. According to Table 4.3, 4 (7,7%) of the educators strongly agreed and 20 (38,5%) agreed that they have difficulty integrating knowledge and skills from different leaning areas when they implement the NCS in mathematics. 26 (50%) disagreed and 2 (3,8%) strongly disagreed. The mean score of 2,60 falls within the "D" category (see Graph 2). On average, educators disagreed that

they have difficulty integrating knowledge and skills from different learning areas when they implement the NCS in mathematics. Knowledge and skills from different learning areas can therefore integrated easily into mathematics according to the educators.

Statement 20: I have difficulty differentiating between learning outcomes and assessment standards in the NCS for mathematics

This is a negatively worded statement. Table 4.3 reveals that 4 (7,7%) of the educators strongly agreed and 14 (26,9%) agreed that they have difficulty differentiating between leaning outcomes and assessment standards in the NCS for mathematics. 28 (53,8%) disagreed and 6 (11,5%) strongly disagreed. The mean score of 2,69 falls within the "D" category (see Graph 2). Therefore on average, educators disagreed that they find difficulties in differentiating between learning outcomes and assessment standards in the NCS for mathematics. Educators therefore find it easy to differentiate between learning outcomes and assessment standards.

4.3.2. Interview questions

Interviews were conducted in which 15 mathematics teachers participated, one mathematics teacher per school. The aim of the interviews was to determine the problems and challenges encountered by FET mathematics educators in the Mangaung area with regard to the NCS implementation. The interviews were conducted orally, and the answers to the questions were recorded by the researcher directly onto paper. The interviews were semi-structured hence all interviewees were asked the same questions.

In interview questions 1-7, the ten participants or respondents were grouped according to their views and answers. Respondents, whom their views and answers were precisely the same, were grouped together.

Interview question 1: What is your general view with regard to the NCS in mathematics teaching?

Respondents 1,5,8: The NCS in mathematics teaching is challenging, especially learning outcomes three and four.

Respondents 2,3,4,6,7: The NCS involves huge challenging tasks that needs (some years).

Respondents 8,9,10: The NCS is a dynamic curriculum which assists learners in developing skills, values, attitudes and knowledge in their learning.

Respondents 4: The learning support materials are inadequate in our schools.
The NCS is a relevant approach but the time frame for the implementation of the NCS in mathematics is little.

The researchers' conclusions from the respondents of question 1, are that the NCS is a dynamic and challenging curriculum, but that the time for preparing mathematics educators was not adequate. LTSM at schools was furthermore inadequate for educators to implement the NCS successfully.

Interview question 2: What are the advantages or merits of the NCS in mathematics teaching?

Respondents 1,2,9,10: Learners deal with mathematical concepts in real context and they make sense to them. The NCS develops learners' reasoning capacity, by assisting learners with problem solving techniques.

Respondents 3,5,8: Clear guidelines and policies for applying assessment standards and learning outcomes are forwarded to educators.

Respondents 4,6,7: The NCS brings mathematics into real life situations. The learning content of mathematics in the NCS is not divided into higher grade and standard grade sections. This enables learners to prove their abilities equally in mathematics.

From the respondents' answers the researcher is able to deduce that clear guidelines and policies for applying assessment standards and learning were forwarded to educators and that the NCS places mathematics in a real-life context for the learners.

Interview question 3: Mention any disadvantage(s) of the NCS in the teaching of mathematics.

Respondent 1, 4, 7, 9, 10: Learners in the FET band do not have the basics of mathematics taught in the GET band. Hence, most learners are not yet ready for the new curriculum which is introduced in the teaching and learning of mathematics.

Respondent 2, 3, 5, 6, 8: The NCS in the teaching of mathematics needs abundant support from parents, educators and DoE officials; it lacks that support. More time is needed for the implementation of the NCS in mathematics because of the educators who are inadequately trained. Certain terminology used in the NCS is not clarified.

The researcher deduced from the answers given by the respondents that the readiness of the learners was not considered when the NCS was introduced.

Interview question 4: Which problems do the educators encounter with regard to the implementation of the NCS in mathematics?

Respondent 3,5,8,9: Too much work in one academic year. Shortage of teaching material, resources such as computers, as well as the shortage of textbooks are still barriers to the implementation of the NCS in mathematics.

Respondent 1,6,7: Educators encounter problems with regard to planning of their learning outcomes. Application of the learning outcomes and assessment standards are not yet clear to the educators.

Respondent 2,4,10: The learning content of the NCS in mathematics is too broad. More workshops are needed during the course of the academic year, in order to train educators adequately. Large numbers of learners or overcrowded classes hamper the smooth running of teaching and learning in the implementation of the NCS in mathematics.

Conclusions made by the researcher from the respondents' answers suggest that a shortage of LTSM, inadequate time for training of educators, lesson planning and unclear learning outcomes and assessment standards, hampered the smooth implementation of the NCS in mathematics teaching.

Interview question 5: What is your opinion regarding the assessment standards for mathematics in the NCS?

Respondent 1, 3, 5, 8, 9, 10: Assessment standards (AS's) are appropriate and develop learners' insight. The number of assessment standards, tasks and pieces of writing, regarding the continuous assessment of the learners, are insufficient.

Respondent 2,4,6,7: Assessment standards are confusing and not understandable. Educators need extensive training with regard to the implementation of the assessment standards.

Conclusions made by the researcher from the respondents' answers suggested that the number of assessment tasks given to learners was insufficient and that the educators need more training with regard to the implementation of the assessment standards.

Interview question 6: What is your view on educator training in the NCS for mathematics?

Respondent 3,6,7,9,10: The DoE should conduct workshops regularly during the academic year, for the purpose of training educators adequately. The departmental officials should visit the schools regularly, in order to assist the educators in the implementation of the NCS in mathematics learning and teaching.

Respondent 1,2,4,5,8: During the training sessions of the educators by the departmental officials, emphasis should be placed on the implementation of learning outcomes and assessment standards in the mathematics class. The departmental officials who conduct these workshops for educators must be knowledgeable and skilful with regard to the NCS.

Answers given by the respondents indicate that adequate time was not given to educators for training in the implementation of the NCS. Regular workshops were not given to educators and follow-up was not done by the departmental officials after training.

Interview question 7: What are your views in respect to the use of terminology in the NCS in the teaching of mathematics?

Respondent 1,5,7,8,9: The terminology used in the learning of mathematics in the NCS is confusing and difficult to understand.

Respondent 2,4,6: There is a glossary at the back of the prescribed textbooks. This assists learners to understand the difficult terminology used in the learning content of mathematics.

The researcher concluded from the respondents' answers that the terminology is confusing and difficult to understand.

4.3.3. Findings from the interviews

The findings revealed that educators differ in terms of the problems that they encountered in implementing the NCS in the teaching of mathematics in the FET band. 6 out of the 10 educators who were interviewed reported a positive attitude compared to those who reported a negative attitude (4 out of 10) with regard to the problems encountered with the implementation of the NCS in the teaching of mathematics at secondary schools.

The implication of these findings is that although there are still problems here and there the majority of the educators are comfortable with implementing the NCS in the teaching of mathematics at FET schools.

A possible reason for the positive attitude of the majority of educators in implementing the NCS in the teaching of mathematics at FET schools may be that Curriculum 2005 has been streamlined and strengthened in the form of the Revised National Curriculum Statement.

4.3.4. Answers to the research questions

In answering the five research questions, the researcher arrived at the following conclusions:

From Table 4.2, which revealed the information pertaining to FET educators in Mangaung with regard to the problems encountered with the implementation of the NCS in mathematics, statement 3 in the questionnaire clearly indicated that, on average, educators in the sample agreed that they received adequate training in implementing the NCS in mathematics training. The abovementioned information answered research question 1 which asked the following question: what are the solutions to problems regarding the training of FET mathematics educators?

In Table 4.2, it is revealed from statements 1,2,4,5,6,7 and 10 that educators agreed that the timeframe for implementing the NCS in mathematics was, on average, realistic; that educators received support from the departmental officials through attending workshops in order to assist them in the implementation of the NCS in mathematics; that the material received from DoE was useful for implementing NCS in the teaching of mathematics; that departmental officials visited their schools to monitor the implementation of the NCS; that educators found the simplified terminology of the NCS in mathematics easily understandable. These statements mentioned above answered research question 2: what are the problem areas in the NCS that frustrate mathematics educators teaching in the FET band and which areas appeal to those educators?

Deductions made from statements 9, 11, 15, 17 and 20, indicated that, on average, educators agreed that the NCS is helpful in planning the learning programme in mathematics; that educators agreed that they use the NCS in mathematics in their day-to-day teaching. On average, educators also agreed that the NCS has a positive impact on the teachers' lesson planning. Educators could easily use the learning outcomes in teaching mathematics according to the NCS and lastly it was discovered that educators, on average, find it easy to differentiate between learning outcomes and assessment

standards. These statements mentioned above answered research question 3 which stated: what guidelines exist to assist educators with respect to lesson planning in mathematics in the FET band?

In Table 4.2, statement 8 explained that on average, educators agreed that the NCS is helpful in assessing their learners' performance in mathematics. Furthermore, statements 13 and 14 respectively indicated that the NCS has a positive impact on the record keeping of learners' performances by the teacher and that the NCS therefore has a positive impact on the assessment of learners' performance in mathematics by the teacher. Lastly, it was revealed from statement 18 that the assessment standards were seen as user-friendly by the educators. The four statements mentioned above answered research question 4: what guidelines exist to assist educators for appropriate assessment in mathematics in the FET band? According to the information obtained from statements 12, 16 and 19, it was revealed that, on average, educators agreed that it took them long to feel confident to implement the NCS in mathematics, that the NCS has a positive impact on the teachers' teaching methodology in mathematics and lastly that knowledge and skills from different learning areas can be intergrated easily into mathematics according to the educators. These statements answered research question 5: What guidelines exist for the effective integration of OBE in the teaching of mathematics in the FET band?

4.3.5. Summary

In Chapter four the findings of this study were analysed and presented. All the results that were obtained from doing the fieldwork were clearly presented and discussed by the researcher. The researcher summarized the responses to the interview questions and made conclusions. The researcher explicitly answered the five research questions by making references from the questionnaire statements and the responses of the interviewees. Lastly, the research results were analysed and interpreted by the researcher.

In the last chapter (Chapter 5), the rationale, conclusions regarding the research questions, recommendations and a summary of the study will be presented.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. INTRODUCTION

The main purpose of this study was to investigate the problems encountered by educators regarding the implementation of the National Curriculum Statement in mathematics. This investigation was relevant considering, for example, the reported high failure rate in Mathematics in South Africa. The researcher hoped that this investigation would provide a better understanding of what is happening regarding the problems encountered by educators in the implementation of the National Curriculum Statement in Mathematics. This knowledge should provide baseline information about the implementation of the NCS in Mathematics to facilitate improvements in the quality of Mathematics outputs. The researcher felt that such improvements could contribute to endeavours aimed at alleviating the problems currently experienced in Mathematics classrooms in this country.

In this chapter pertinent findings, as well as recommendations based on these findings, are presented. Also included are limitations identified in this study.

5.2. RATIONALE

The research was designed to study the problems encountered by educators regarding the implementation of the NCS in Mathematics. To understand these problems, the following research questions were formulated:

- What are the solutions to problems regarding the training of FET Mathematics educators?

- What are the problem areas in the NCS that frustrate Mathematics educators teaching in the FET band and which areas appeal to these educators?
- What guidelines exist to assist educators with respect to lesson planning in Mathematics in the FET band?
- What guidelines exist to assist educators for appropriate assessment in Mathematics in the FET band ?
- What guidelines exist for the effective integration of OBE in the teaching of Mathematics in the FET band?

The main aim of the study is to determine the problems encountered by educators regarding the implementation of the NCS in Mathematics.

The following specific objectives were formulated:

- To provide solutions to problems regarding training experienced by FET Mathematics educators.
- To identify problem areas in the NCS that frustrate Mathematics educators teaching in the FET band and to identify areas that appeal to these educators.
- To provide guidelines to assist educators with lesson planning in Mathematics in the FET band.
- To provide guidelines for appropriate assessment in Mathematics in the FET band.
- To provide guidelines for the effective integration of OBE in the teaching of Mathematics in the FET band.

A questionnaire and interviews were used as research instruments for collecting data. The instruments were administered to a randomly selected sample of 52 respondents. Descriptive statistics was used to analyze the data. Respondent counting, percentages as well as means (averages) were used for the descriptive analysis in the item by item analysis of the data.

5.3. CONCLUSIONS

According to the results of the study discussed in Chapter 4, the following features of the National Curriculum Statement in the implementation of Mathematics require attention:

There is support and development from departmental officials to assist educators with the implementation of the NCS in Mathematics. The obstacle which makes the implementation of the NCS in Mathematics problematic, however, is that the support and development is not an ongoing process (refer to section 4, Table 4.2 and Table 4.3, statement 2).

Educators did receive initial training in order to pilot the curriculum with respect to the implementation of the NCS in Mathematics teaching. One of the problems which hampered the smooth implementation of the NCS in Mathematics, however, was the inadequate follow-up training workshops from the side of the DoE (refer section 4 Table4.2 and Table 4.3, statement 18).

Although most educators received some form of training, the training was generally insufficient and inappropriate. This had a negative impact on the level of confidence of the educators. Dissatisfaction with short 2 to 3-day training workshops without follow-up support was a general feature.

Allocations of learning support materials was in general inadequate. Schools received materials too late and therefore some schools had to delay the implementation of the NCS in Mathematics. Educators were given insufficient time to purchase materials and therefore made hasty choices of materials which now prove to be problematic.

The number of assessment standard tasks were not sufficient for the implementation of the NCS in mathematics. Educators disagreed that the NCS has a negative impact on their lesson planning in Mathematics (refer to section 4, Table 4.2 statement 15). Most

educators disagreed that the assessment standards were seen as user-friendly (refer to section 4, Table 4.2, statement 18). Lastly, educators find it easy to differentiate between learning outcomes and assessment standards, but most educators had difficulty in integrating knowledge and skills from different learning areas (refer to section 4, Table 4.2 and Table 4.3, statement 18).

5.4. RECOMMENDATIONS

The main purpose of the study was to investigate problems encountered by educators regarding the implementation of the National Curriculum Statement in Mathematics at FET level. Based on the findings of this study, a number of recommendations that are essential to robust implementation of curriculum change in Mathematics, can be made.

Recommendations are accordingly made for improvement with respect to:

1. District-level support;
2. Training, orientation and development of educators;
3. Learning support materials (LSM's);
4. Regular monitoring and review;
5. The pace and scope of implementation.

These recommendations are as follows:

With respect to district-level support, the study recommends that the implementation of the NCS in Mathematics requires support and monitoring. A plan should be in place to provide on-going support to educators. This should be provided by the departmental officials in the form of in-service training and provision of materials for teaching and learning mathematics. Monitoring and support go hand-in-hand in the sense that it is through monitoring that one can identify areas which need support and development. Support and monitoring of the implementation of the NCS in Mathematics is a task that has not been adequately undertaken. This indicates a need for reorganization,

reinforcement of personnel (because there is a shortage of personnel from the side of the Department of Education), and the provision of necessary resources at provincial and district level.

Regarding the second recommendation, the study suggests that the support and monitoring stage should be followed by the training of educators for piloting the FET Mathematics curriculum. To pilot means to test on a small scale how something will work. Workshops should be designed by the departmental officials for professional development of educators on the topics, consistent with the thrust and vision of the Mathematics curriculum. Professional development involves all those activities which may assist educators in the implementation of the NCS in Mathematics. The pilot study should follow immediately after the training of educators for this purpose. Piloting is a key stage in the process of Mathematical curriculum development.

The dynamics of putting the curriculum for mathematics into action with educators and learners itself constitutes a complex process and sequence of events. The selection of schools to take part in the pilot study is also complex, as there should be a representative sample of educators and school environments from across the Motheo District. The schools to take part in the pilot study should come from different sections of the Motheo district's population (i.e. rural, semi urban and farms). The pilot study will help determine how well learners have achieved the learning outcomes or expectations set out in the NCS for Mathematics.

If any changes should be made to the implementation of the NCS in Mathematics, an evaluation plan should be in place to assess the success or the failure of the pilot project. The implementation of the NCS in Mathematics should at least be piloted to schools for the duration of one-and-half years to determine its effectiveness. A pilot study also assesses needs and pre-empts problems which may arise.

With respect to learning support material, the researcher recommends that, after the implementation of the NCS in Mathematics has been piloted, the next step should be to

adequately supply learning support material to schools as it is essential to the effective running of an educational system.

A prerequisite for the successful use of learning support material is a strong alignment between the NCS framework, teacher development and the development and supply of learning support materials. A report should be commissioned annually on the degree to which this alignment has been achieved. The central role played by textbooks in addition to other learning support materials affecting the change in the implementation of the NCS in Mathematics should be recognized and affirmed and a requisite investment in those resources should be made.

The DoE should produce a clear NCS framework in Mathematics for writers and publishers to follow so that textbooks are produced and evaluated in line with this statement. The NCS should be made available to publishers at least a year before textbook orders are due to be placed.

Educators need to be trained in the evaluation, selection and use of textbooks in the context of the NCS framework. To ensure the quality of the NCS support materials in mathematics, responsibility for developing these materials should shift to dedicated units or institutes as described in the White Paper of Education and Training.

Training of all educators should follow the stage of supplying adequate LSMs. The professional development of educators is vital to the implementation of the NCS in Mathematics. It is therefore imperative for educators to receive adequate training to prepare them for the implementation of the NCS in Mathematics.

With respect to regular monitoring and review, together with the pace and scope of implementation, the study recommends that special codes of Motheo district should be identified, selected and trained. The subject advisors should also be included in this process of training. These teams could work collaborately with NGOs. This could serve

to avoid the problems inherent in the cascade model of training educators for the implementation of the NCS in mathematics and to ensure quality and uniformity.

Motheo district core teams should be provided with intensive and regular training in assessment, record keeping, promotions, and team teaching, developing supplementary materials and policy interpretation, particularly in the subject Mathematics. The teams should be deployed to work directly with school clusters providing on-site support to educators and to serve as mentors. All trainers should be accredited through an appropriate process.

Lead teachers could be trained to provide on-site support and development. This could be done by identifying one Mathematics educator from every school in the Motheo-District to participate in a three month intensive accredited course at a university with replacement educators provided. Such a course should focus on learning outcomes and deepening content knowledge in Mathematics, sharpening understanding and use of assessment in Mathematics and using textbooks.

The following limitations of this study are outlined for directing future studies as it is clear that more research is needed:

The sample of this study was drawn from educators of the Motheo-district in the Free State province only; therefore it is not representative of the entire population of educators of the Free State province. Further studies need to be conducted in other districts of the province, to confirm the findings.

Only public schools were the target population in this study. Further research, focusing on private schools is needed. The sample of this study was drawn from FET band educators only. There is a need for a study with GET and Intermediate Phases school educators.

The sample of the study consisted of 52 Mathematics educators only. More research, with a bigger sample, preferably a nation-wide study, is essential so that the results can be generalized nationally with greater confidence.

In spite of the limitations mentioned above, this study has achieved its objective of studying the problems encountered by educators regarding the implementation of the NCS in Mathematics. The researcher in this study recommends another study based on the implementation of the CAPS document as from 2012.

5.5. SUMMARY

The aim of this study was to investigate the problems encountered by educators in the implementation of the NCS in Mathematics in the FET band. This study revealed that educators differ in terms of the problems that they encountered in implementing the NCS in Mathematics. The findings from this study pointed to problems such as educators receiving inadequate training in implementing the NCS in Mathematics. It was also revealed from these findings that educators have not been visited by the department officials in their schools for monitoring the implementation of the NCS in Mathematics. Educators also reported about the late arrival of the teaching and learning support material and the shortage of such material. The result of the present study provides invaluable baseline information with regard to problems encountered by the educators in the implementation of the NCS in Mathematics.

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APPENDIX A

LETTER OF APPROVAL OF TITLE

Central University of Technology, Free State

CENTRAL UNIVERSITY OF TECHNOLOGY, FREE STATE
SENTRALE UNIVERSITEIT VIR TEGNOLOGIE, VRYSTAAT
YUNIVESITHI E BOHAREBONG YA THEKNOLOGIA, FREISTATA

EXAMINATION SECTION

2008-01-28

Mr OL Mosala
11152 Swanepoel Street
BLOEMANDA
9309

Dear Mr Mosala

M.Ed : APPROVAL OF THE TITLE OF A PROPOSED RESEARCH PROJECT:

TITLE: "A critical study of the problems encountered by Further Education and Training (FET) educators in Mangaung with regard to the implementation of the National Curriculum Statement (NCS) in Mathematics."

It is my pleasure to inform you that the Central Research Committee of the CUT approved the above project title on 2007-05-24.

Kind regards.

A VAN ROOYEN
HEAD: EXAMINATION ADMINISTRATION
/Research1 Goedkeuring van titel

Copies to: Dr SRS Litheko (Director: School of Teacher Education)
Prof LOK Lategan (Dean: Research and Development)
Mr J Kabamba (Director: Library and Information Centre)

APPENDIX B

REGISTRATION OF RESEARCH PROJECT

education

2008 - 05 - 23

Mr OL MOSALA
P.O.Box 23238
Kagisanong
9349

Dear Mr Mosala

REGISTRATION OF RESEARCH PROJECT

1. This letter is in reply to your application for the registration of your research project.
2. Research topic: **Factors and problems encountered by educators in the implementation of National Curriculum Statement in the teaching of Mathematics.**
3. Your research project has been registered with the Free State Education Department.
4. Approval is granted under the following conditions -
   - 4.1 Educators and officials participate voluntarily in the project.
   - 4.2 The names of all schools and participants involved remain confidential.
   - 4.3 The questionnaires are completed and the interviews are conducted outside normal tuition time.
   - 4.4 This letter is shown to all participating persons.
   - 4.5 A bound copy of the report and a summary on a computer disc on the study is donated to the Free State Department of Education.
   - 4.6 Findings and recommendations are presented to relevant officials in the Department.
5. The costs relating to all the conditions mentioned above are your own responsibility.
6. You are requested to confirm acceptance of the above conditions in writing to:

   The Head: Education, for attention: DIRECTOR : QUALITY ASSURANCE
   Room 401, Sytsma Building, Private Bag X20565, BLOEMFONTEIN, 9321

We wish you every success with your research.

Yours sincerely

PP
DIRECTOR : QUALITY ASSURANCE

Directorate: Quality Assurance, Private Bag X20565, Bloemfontein, 9300
Sytsma Centre, 61 Markgraaf Street, Bloemfontein
Tel: 051 404 8750 / Fax: 051 447 7318 E-mail: quality@edu.fs.gov.za

APPENDIX C

APPLICATION TO CONDUCT RESEARCH

Central University of Technology, Free State

CENTRAL UNIVERSITY OF TECHNOLOGY, FREE STATE
SENTRALE UNIVERSITEIT VIR TEGNOLOGIE, VRYSTAAT
YUNIVESITHI YEBUNJINI YA THEKNOLOJI, FREISTATA

FACULTY OF MANAGEMENT SCIENCES
School of Teacher Education

HOD/Superintendent general

Free State Education
Bloemfontein
9300

Sir/Madam

Application to conduct research in schools in Mangaung (Motheo District)
(By Mr. LO Mosala student Number: 20145233)

I here in beg to apply to conduct academic research in the schools attached to the Motheo district for the academic year 2007/08

I am currently registered MED(Education Management) student at the abovementioned institution of higher learning in Bloemfontein. The programme requires that I research on the following topic, the topic is:

A CRITICAL STUDY OF THE PROBLEMS ENCOUNTERING BY FET EDUCATORS IN MOTHEO DISTRICT WITH REGARD TO THE IMPLEMENTATION OF THE NCS IN MATHEMATICS EDUCATION

The essence behind the topic is to gather and analyse the views of educators in respect of implementation of RNCS in the Mangaung

The study intends to suggest guidelines to assist educators in both the understanding and the implementation of RNCS as per departmental requirements

I trust that this request of significance in the interest of education will indeed receive your unparallel attention and consideration

Thanking you in advance

Yours Faithfully

LO MOSALA (MED Student Number 20145233)

Signature.....

School Of Teacher Education
FACULTY OF MANAGEMENT SCIENCE
24 OCT 2007
CENTRAL UNIVERSITY OF TECHNOLOGY FREE STATE
PRIVATE BAG X20539, BLOEMFONTEIN 9300

Date.....

Supervisor: Dr. Jacquiera KI
Signature.....

Date 24/10/2007

HOD/Superintendent general
Free State Education

APPENDIX D

QUESTIONNAIRE

QUESTIONNAIRE

1. This questionnaire is on a critical study of the problems encountered by FET Educators in Mangaung (Motheo District) with regard to the implementation of the NCS in Mathematics teaching.
2. You are kindly requested to respond to all the items in this questionnaire.
3. The instructions on how to respond to each item accompany the questionnaire.
4. Information gathered will be treated as highly confidential; therefore do not write your name or the name of the school on this questionnaire.

Your cooperation will be highly appreciated.

Thank you

……

O. L. MOSALA

Faculty of Management Sciences
Central University of Technology, Free State
Private Bag X20539
BLOEMFONTEIN
9300

SECTION A

Please make a cross(X) in the appropriate box.

1. Gender

1	2
Male	Female

2. Age in years

1	2	3	4	5
25 or younger	26-35	36-45	45-55	56 or older

3. Teaching experience

1	2	3	4	5
0-5 yrs	6-10 yrs	11-15 yrs	16-20 yrs	More than 20 yrs

4. Highest Qualification

1	REQV 10 (Matric or below)
2	REQV 11 (M+1)
3	REQV 12 (M+2)
4	REQV 13 (M+3)
5	REQV 14 (M+4)
6	REQV 15 (M+5) or above

SECTION B

National Curriculum Statement Scale (NCSS)

Below are statements concerning your view of the problems encountered by FET educators with regard to the implementation of the NCS in Mathematics teaching.

SA = Strongly Agree A = Agree

D = Disagree SD = Strongly Disagree

1.	I found the timeframes for implementing the NCS in mathematics to be realistic.	SA	A	D	SD
		1	2	3	4
2.	I have received support on the implementation of the NCS in mathematics from the departmental official by Attending cluster meetings and workshops.	SA	A	D	SD
		1	2	3	4
3.	I received adequate training for teaching learning Outcomes on the implementation of the NCS in Mathematics.	SA	A	D	SD
		1	2	3	4
4.	I need further professional development on how to Adapt to the change in the new curriculum in order to Implement the NCS in mathematics.	SA	A	D	SD
		1	2	3	4
5.	I have taken steps to upgrade myself on the implementation of the NCS in mathematics.	SA	A	D	SD
		1	2	3	4
6.	I received teaching and learning support material to Implement the NCS in mathematics teaching.	SA	A	D	SD
		1	2	3	4
7.	I am not satisfied with the quality of the teaching and Learning support material for implementing the NCS in mathematics in my school.	SA	A	D	SD
		1	2	3	4
8.	The NCS is helpful in assessing my learners' performance in mathematics.	SA	A	D	SD
		1	2	3	4

9.	The NCS is helpful in planning my learning programme in mathematics.	SA	A	D	SD
		1	2	3	4
10.	I find the simplified terminology of the NCS in Mathematics easily understandable.	SA	A	D	SD
		1	2	3	4
11.	I use the NCS in mathematics in my day-to-day Teaching.	SA	A	D	SD
		1	2	3	4
12.	It took me long to feel confident to implement the NCS in mathematics.	SA	A	D	SD
		1	2	3	4
13.	The NCS has a negative impact on my record Keeping of learners' performance.	SA	A	D	SD
		1	2	3	4
14.	The NCS has a negative impact on my assessment on learners' performance in mathematics.	SA	A	D	SD
		1	2	3	4
15.	The NCS has a negative impact on my lesson Planning in mathematics.	SA	A	D	SD
		1	2	3	4
16.	The NCS has a negative impact on my teaching Methodology in mathematics.	SA	A	D	SD
		1	2	3	4
17.	I have difficulty using the learning outcomes in Implementing the NCS in mathematics.	SA	A	D	SD
		1	2	3	4
18.	I have difficulty in using assessment standards in my Implementation of the NCS in mathematics.	SA	A	D	SD
		1	2	3	4
19.	I have difficulty integrating knowledge and skills from	SA	A	D	SD
	Different learning areas when I implement the NCS in mathematics.	1	2	3	4
20.	I have difficulty differentiating between learning outcomes and assessment standards in the NCS for mathematics.	SA	A	D	SD
		1	2	3	4

SECTION C

INTERVIEW QUESTIONS

1. What is your general view with regard to the NCS in mathematics teaching?
2. What are the advantages or merits of the NCS in mathematics teaching?
3. Mention any disadvantages(s) of the NCS in mathematics teaching?
4. What are the challenges experienced by educators in implementing the NCS in mathematics?
5. What is your opinion regarding standards in the NCS for mathematics?
6. What is your view on educators training in the NCS for mathematics?
7. Briefly discuss the impact of the NCS strategic method with respect to “empowering educators for teaching mathematics”.
8. Discuss the content of the policies of the NCS in short with regard to the teaching of mathematics in the FET band.
9. Give short notes on your views on the guidelines forwarded to educators regarding the implementation of the NCS in mathematics teaching.