

**A NEEDS ANALYSIS FOR THE IMPLEMENTATION OF A
COMPLEMENTARY COURSE IN MATHEMATICS EDUCATION FOR
TEACHERS OF MATHEMATICS IN NAMIBIA.
A CASE STUDY.**

A thesis submitted in partial fulfilment of the requirements for the degree of

MASTER OF EDUCATION

(Mathematics Education)

RHODES UNIVERSITY

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DECEMBER 2008

ABSTRACT

After the introduction of the Basic Education Teacher Diploma (BETD) in Namibia, a number of studies were conducted on how teachers, lecturers, stakeholders and the Namibian public perceived the BETD program and its implementation. However, very few studies focussed specifically on mathematics subject content knowledge and pedagogical content knowledge in the BETD.

The purpose of this study was to investigate the need for a complementary course in mathematics education to address the lack of mathematical content and pedagogical knowledge in the Namibian BETD. The study involved five mathematics school teachers, two mathematics college lecturers in the Kavango educational region and a professor of mathematics education at the University of Namibia. These participants were purposefully selected because of their knowledge and experiences with various aspects of the BETD program. The motivation for conducting this study was to gain a better understanding of some of the issues that have been raised about the BETD program, particularly the perceived inadequacy of mathematical subject content and methodology since the inception of the program.

The study adopts a qualitative approach in reporting participants' reflections. The views of the focal educators and documents such as syllabi and course outlines were the main source of data. The findings indicate that despite the training that the three BETD mathematics graduates in this study received, the level of mathematics taught in a complementary course, such as an ACE, would clearly better equip mathematics teachers to teach proficiently and facilitate access to institutions of higher learning such as universities.

The results of the study revealed that there was a need for the implementation of a complementary course to the BETD in mathematics education for teachers of mathematics in Namibia. This study also provided valuable insights into what such a course could look like.

ACKNOWLEDGEMENTS

I would like to acknowledge the following people who contributed towards my submission of this research project:

My participants whose willingness to share their first hand experiences with me made this project possible.

My supervisor Professor Marc Schäfer for his time, commitment, patience and guidance throughout this study. He was truly an inspiration to me.

Mr Robert Kraft, for working closely with my supervisor and assisting me where necessary, and Judy Cornwell for facilitating the final, referencing, proofreading and editing this research.

The Rundu College of Education, lecturing, my students and non-lecturing staff for contributing one way or another in this final draft.

My editors Mr Sirinji Reuben, Ms Anna Resele, Mr Henry Kapalu, Mr Chiweshe, Mr and Mrs Kerosi, for willingly reading through some of my drafts.

Mr and Mrs Sichombe, Mr Kaonde Misika, Mr Horst, T. Mokaleng, Mrs Jennety Situnda, Dr Andrew Clegg, Dr Mary Bennett, Mr Shifafure Manfred, Mr Kanyetu Joseph, Ms Utete Christina, Mr John S Kamwi, Mr John K Nyambe, Mr Edgar Sichombe, Mr Sangaya Ilukena, Ms Lungowe Ilukena, Mr Benard N Mabengano, Mr Nicol-Wilson and Professor C. D. Kasanda for materials they contributed.

I am indebted to the Rundu College Staff Development Committee for selecting my name for financial support to the Ministry of Education. And indeed to the Ministry of Education via the Secretariat of the Advisory Council for Teacher Education and Training for their financial support during my two years of studies.

I would also like to thank the Rundu College of Education's Administrative staff for their material support in the creation of this project. I would also like to convey a particular special thanks to Mr Johannes Shigwedha, Mr Shivute John, Mr Hausiku Sevelinus and Mrs Muhembo Alba for their enthusiastic and patient library service.

I owe a special appreciation to my wife Doreen Mpule Mabengano-ILUKENA and my son Ilukena Alpha ILUKENA for their unyielding support and patience throughout two long years of study. Above all, I thank God the Almighty for giving me courage and wisdom, may His name be glorified.

DECLARATION

The work contained in this research was completed by Alex Mbonabi Ilukena, at Rhodes University during 2007 and 2008. It is my own work written in my own words. Where I have drawn on the words or ideas of others, these have been acknowledged using the reference practices according to the Rhodes University Education Department Guide to Referencing.

Signed: *Alex Mbonabi Ilukena.*

Date: 19 December 2008

ACRONYMS USED IN THIS STUDY

BETD	Basic Education Teachers' Diploma
INSET	In Service Training
LCE	Learner Centred Education
MBE	Ministry of Basic Education
MBEC	Ministry of Basic Education and Culture
MBESC	Ministry of Basic Education, Sports and Culture
ME	Ministry of Education
MEC	Ministry of Education and Culture
MHEST	Ministry of Higher Education Science and Technology
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Education Quality
NPC	National Planning Commission
NIED	National Institute for Educational Development
LPTC	Lower Primary Teacher Certificate
PTC	Primary Teacher Certificate
JSTC	Junior Secondary Teacher Certificate
ECP	Education Certificate Primary
NEC	National Education Certificate
NHEC	National Higher Education Certificate
SBS	School Based Studies
STC	Secondary Teacher Certificate
PPTD	Pre-Primary Teacher Diploma
JPTD	Junior Primary Teacher Diploma
SPTED	Senior Primary Teacher Education Diploma

LP	Lower Primary
UP	Upper Primary
JS	Junior Secondary
UNIN	United Nation Institute for Namibia
NANMC	Namibia Annual National Mathematics Congress
INSTANT	In-service Training Assistance to Namibian Teachers
NGO's	Non-governmental Organisations
IBIS (WUS)	World University Service
BES	Basic Education Support Project
IFESH	Foundation for Education and Self Help Project
PQA	Programs for Quality Assurance.
EMP	Ekondopeko (Strengthening) Mathematics Project
MHEVTST	Ministry of Higher Education, Vocational, Training, Science and Technology
MHETEC	Ministry of Higher Education, Training and Employment Creation
UNAM	University of Namibia
IOL	Institute for Open Learning
H/IGCSE	Higher and International General Certificate for Secondary Education
TRC's	Teacher Resource Centre
B. Ed	Bachelor of Education degree
B. Ed (Honours)	Bachelor of Education Honours degree
ACE (MathsEd)	Advanced Certificate in Education (Mathematics education)
ACE	Advanced Certificate in Education
CPD	Continued Professional Development
COST	College for Out of School Training
SWAPO	South West Africa People Organisation

NMI	Namibia Mathematics Institute
SAQAF	South African Qualification Authority Framework
UNAMCES	University of Namibia Centre for External Studies
MASTEP	Mathematics and Science Teacher Extension Program
PGDE	Postgraduate Diploma in Education
NNQA	Namibia National Qualification Authority
PCK	Pedagogical Content Knowledge
CK	Curricular Knowledge
LPTs	Lower Primary Teachers
NMT	Namibian Mathematics Teachers
FDE(MathEd)	Further Diploma in Education Mathematics Education
HED	Higher Education Diploma
NNQF	Namibia National Qualification Framework

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CHAPTER 1

1.1 INTRODUCTION

This chapter introduces my study on a needs analysis for the implementation of a complementary course in mathematics education for teachers of mathematics in Namibia. The study interrogates selected participants' perceptions and experiences with various aspects of the Basic Education Teacher Diploma (BETD) program in order to establish whether a need for a complementary course exists. The purpose of the course would be to address the perceived shortage of mathematical content knowledge and pedagogical knowledge in the BETD program. This small-scale study attempts to explore and illuminate if such a perception is justified and why there is such concern around this issue after 15 years of BETD implementation.

This chapter provides a broad overview of the study. The first section provides some background to the investigated phenomenon. The second section briefly introduces the research methodology and the research sites. Section three focuses on the research questions, followed by possible limitations and the significance of the study. Finally, section five frames the structure of the whole thesis.

1.2 THE CONTEXT OF STUDY

Education systems throughout the world have undergone major restructuring and transformation, and Namibia is no exception. The teacher-training program that Namibia inherited from the South African apartheid regime was inadequate and did not address the needs of an independent Namibia. The system known as Bantu Education segregated people along racial lines whereby Black people received a different quality education. It did not support the current philosophy of "education for all" (Namibia. Ministry of Education and Culture [MEC], 1993:75).

Education under the apartheid ideology left much to be desired. The Namibian government recognised that if it was to strengthen teacher education it needed to introduce programs with a new orientation. The new Namibian government needed to bring about changes. Four goals of education were thus articulated: access, equity, quality and democracy (Namibia. MEC, 1993:20). A decision was made to promote teaching in schools using a learner-centred approach (Namibia. MEC, 1993). In order to meet the national needs for mathematics teachers, three teacher-training programs were introduced:

- The Basic Education Teacher Diploma (BETD). This program prepares teachers for grades 1-10, through a three year course on a full time (or four years part-time) basis. The program is offered by the four Colleges of Education and Teacher Resource Centers respectively
- A technical and vocational education instructor qualification program which prepares teachers for instruction in pre-vocational skills. This is offered by the Polytechnic of Namibia
- A senior secondary school teacher qualification, a Bachelor of Education (B. Ed) degree, offered by the University of Namibia

Three of the four Colleges of Education are situated in the densely populated North East, North and the Caprivi regions. The fourth is located in Windhoek. Student teachers at the four Teacher's Colleges follow a three year BETD program. During the three years of study, candidates are generally required to follow common foundation studies in the first year with mathematics and integrated natural science. In the third term of their first year, students are expected to select a subject area of specialisation related to the chosen phase of Basic Education (grades 1-7, 5-10). If mathematics or physical science is chosen, this takes up 50 % of the study time until they complete their studies. This is to enable the “teachers to know and understand their teaching subjects thoroughly” (Namibia. MEC, 1994). Even though the documents make this statement, there is a common perception that the “in-depth content knowledge” of teachers who graduate with the BETD does not go beyond grades 5-7 (Namibia. MEC, 1994). As a mathematics education lecturer this is of particular concern to me. This study attempts to investigate whether a feasible solution would be to introduce a

complementary course to address this perceived shortage of content knowledge in mathematics.

My interest in doing an in-depth analysis into the needs of such a program was triggered by seeing many former BETD graduates not being accepted into the Faculty of Education at the University of Namibia. Secondly, as a former BETD and Advanced Certificate in Education ACE (MathsEd) graduate and now a mathematics lecturer at the Rundu Teacher Education College, I have observed with concern that prospective mathematics teachers at Colleges are taught little mathematics content knowledge. In addition, their exposure to effective teaching methods is inadequate. This situation is compounded by many College students choosing specialist fields other than mathematics. As the Presidential Commission on Education stated, many teachers feel inadequate in mathematics education and are unable to give children the skills that are needed to succeed in upper primary and at secondary levels (Namibia. MEC, 1999; Clegg, 2008).

Recent research carried out by the Southern and Eastern Africa Consortium for Monitoring Education Quality (SACMEQ) in fifteen countries inspired my study. The research revealed that Namibian learners and their teachers performed poorly in mathematics. As a mathematics educator in Namibia I am concerned that the content proficiency of mathematics teachers is poor. It has an adverse impact on the teaching of mathematics and the achievement of learners.

1.3 RESEARCH QUESTION.

The goal of this research is to do a needs analysis for the implementation of a complementary course to the BETD in mathematics education for teachers of mathematics in Namibia. In order to achieve this, I ask the specific question: Is there a need for developing a complementary course in mathematics education at Rundu College of Education for teachers of mathematics in Namibia?

1.4 RESEACH METHODOLOGY

This research is qualitative in nature and is located in the interpretive paradigm or orientation. A case study method was used in this study in order to facilitate an in-depth research approach. Two research tools were employed namely, semi-structured interviews and document analysis. These two tools complemented each other and also provided a degree of cross checking of evidence. The data from semi-structured interviews were coded and used for analysis.

1.5 THE RESEARCH SITES

This research was conducted at the Rundu College of Education, at five schools in the Kavango region, and at the University of Namibia. The Kavango region is one of the 13 political regions of Namibia as seen on figure 1.1 and its main town is Rundu. It shares international borders with Angola, Zambia and Botswana (Stols, 1993). Refer to figure 1.1.



Figure 1.1 Map of the regions of Namibia. (Sue Abraham (2006). Graphics Services Unit, Rhodes University, Grahamstown).

The Kavango region is situated to the north east of the capital city of Windhoek. It encompasses 48 463 square kilometers (Namibia. National Planning Commission, [NPC], 2004)

The Kavango region has nine constituencies. This research study was conducted in the four constituencies Mashare, Rundu Rural East, Rundu Urban and Rundu Rural West.

The five participating schools were: Katumwa Combined school in Mashare constituency, Tjangano Senior Secondary school in Rundu Rural West, Namakau Senior Secondary School, Muhinda Primary school, and Mabengano Senior

Secondary School which are situated in Rundu urban constituency respectively. All the names of the schools are pseudonyms.

The Kavango region is an educational region with 329 schools, one national teacher training college, one nursing training college and a vocational training centre. There are 13 senior secondary schools; 1 junior secondary school, 51 combined schools; 169 Junior primary schools; 95 Senior Primary (Namibia. Ministry of Education [ME], 2008a). In 2008 there were 2 343 teachers in Kavango region of which 1 308 are male and 1 055 females.

1.6 LIMITATIONS AND CONSTRAINTS

One limitation of the study was the short time span of six months (between May to October 2008) to collect data at the research sites. This was due to an increased workload at the College where I work. A second limitation was that some participants were not comfortable with the idea of tape-recording the interviews. Thirdly, the times and venues selected by the teachers were not always conducive to conducting an interview. For example some sites were noisy with many disturbances; in one case, interviews were conducted on a Saturday. Lastly, some of interviewees were not available on the agreed upon dates and I had to re-schedule other appointments for some of the interviews. The postponements delayed me in collecting the data for analysis.

1.7 SIGNIFICANCE OF THE STUDY

Although the Basic Education Teacher Diploma Program in Namibia with its emphasis on the learner-centred approach was implemented in 1993, very little research has been conducted on the content knowledge and pedagogical knowledge in mathematics at any of the four teachers training colleges.

This research could thus benefit teacher training colleges, policy makers at National Institute for Educational Development (NIED) and other similar teacher education organisations. Further it will add value to the successful outcomes in mathematics teaching in Namibia.

1.8 OVERVIEW OF THE THESIS

This section provides an outline of the thesis. It consists of the introduction plus five chapters.

Chapter one is the introductory chapter. It briefly describes the context of the research, the research methodology, the research sites, the research goals and significance of study. This chapter concludes with a brief overview of each chapter.

Chapter two provides a brief background of literature pertinent to the educational reform process in Namibia and to the main issues of this research study.

Chapter three describes the research design, and methodology I employed. The chapter further outlines the sampling procedures and how I used the relevant data collection tools to investigate my particular case.

Chapter Four analyses the data collected using appropriate categories and patterns. The chapter aims at responding to the research goal.

Chapter five is the concluding chapter. The chapter provides a summary of the findings, recommendations, and it proposes avenues for future research. It ends with a brief personal reflection on the research process.

CHAPTER 2

LITERATURE REVIEW

The varying perception which societies, policy makers and teacher-educators have of teachers is an influential factor on how teachers are prepared and how their professional development is promoted (Calderhead & Shorrock, 1997; Organisation for Economic Cooperation and Development (OECD), 1990).

2.1 INTRODUCTION

This chapter critically analyses and reviews literature that shapes, informs and provides the foundation framework for the study. My argument in this research is that, if we have to teach for proficiency then we need effective professional development programs that value both subject content knowledge and pedagogical knowledge. My interest in this study is to investigate the need for the implementation of an advanced course in mathematics education for teachers of mathematics in Namibia.

As my study is located within the educational reform milieu of Namibia, I begin by giving a brief overview of teacher professional development. This is followed by a discussion on teacher-education in Namibia, mathematics education in the Namibian context, what makes an effective teacher of mathematics, and the need for a bridging course. Before concluding I reflect on the Advanced Certificate in Education (Mathematics education) ACE course offered by Rhodes University in Namibia.

2.2 TEACHER PROFESSIONAL DEVELOPMENT

2.2.1. What is teacher professional development?

Professional development, in a broad sense, refers to the development of a person in his or her professional role (Villegas-Reimers, 2003). More specifically, “teacher development is the professional growth a teacher achieves as a result of

gaining increased experience and examining his or her teaching systematically” (Glatthorn, 1995:41). According to Ganser (2000) professional development includes formal experiences (such as attending workshops and professional meetings, mentoring, etc,) and informal experiences such as reading professional publications, watching television documentaries related to an academic discipline, to mention but a few.

2.2. 2 Importance of professional development for teachers and learning

Professional development provides teachers with opportunities to deepen their understanding of academic disciplines and pedagogical principles, and to gain the necessary knowledge to integrate rapidly into changing educational technologies (Ganser, 2000). There is evidence that pre-service and in-service teachers are eager to learn the ropes of the teaching profession from teachers who have the experience (Mudavanhu, 2006). Some educational researchers in examining the deficiencies in professional development efforts have stressed measures of quantity (i.e not enough hours of professional development). But recent research indicates that substantive pedagogical change requires extended professional development over time (Supovitz & Turner, 2000) and this is what is envisaged with the proposed complementary qualification to the BETD program.

Therefore, in order to create excellent programs of professional development, it is necessary to build on empirical knowledge based on different forms of professional development that links both teachers’ and learners’ learning outcomes. An inquiry-oriented approach to teaching and learning linked to pedagogical practices such as constructivism (Von Glasersfeld, 1989) and project-based learning (Blumenfeld, Soloway, Max, Karajcik, Guzdial & Palimesar, 1991) are such professional development approaches that challenge the existing capabilities of teachers. The two approaches are widely recognised because they involve, for example, change in classroom management strategies, and the organisation of knowledge and assessment. There is little doubt that an inquiry-oriented approach deepens and broadens teachers’ subject knowledge more than traditional rote learning.

Research conducted by Garet, Porter, Desimone, Birman and Yoon (2001) found that effective professional development can improve teaching and students' outcomes. Professional development should be about changes in the knowledge, beliefs and attitudes of the teacher that should lead to the acquisition of new skills, new concepts, and new processes related to teaching. Richardson (1996) argues that the chief objective of professional development should be to foster a change in teachers' learning, because these components of teachers' cognition show a strong correlation to teachers' classroom practices.

2.3 TEACHER EDUCATION IN NAMIBIA

2.3.1 Traditional education

Education in Namibia started long before colonization. According to Mwamwenda (2004:400) traditional African communities educated their young ones about their cultures and skills. In 'old Namibian societies' the purpose of education was a preparation for adulthood. It was not the responsibility of a specialist labour force called teachers, principals, co-ordinators, consultants, or "supervisors" (Auala, 1989). Rather, it was the responsibility of all parents to teach, correct, or even punish any child who did something wrong. The roles and skills of adult society were learnt through poetry, riddles, proverbs, storytelling, memory tests, racing, wrestling, demonstrations, as well as through traditional songs, dance and games (Ellis, 1984; Ndilula, 1988; Mwamwenda, 2004). In addition, there are various activities children practiced to learn traditional skills. For example, they did carpentry, made drums, built houses, and weaved mats and baskets. This traditional education involves a life-long process where individuals pass through different learning processes of their lives. It aims at transmitting the people's cultural heritage, beliefs, behaviour patterns, attitudes, values and skills from one generation to another.

Recent ethnomathematics research has shown that there is a wide variety of mathematical ideas found in traditional cultures (Vithal, n.d.). These ideas are found in traditional number systems, languages, gestures and symbolism, games, riddles and puzzles; geometry is found within the spaces, shapes, patterns,

symmetry of their art and architecture. The two board games that are common in various parts of the world are two-row and the four-row versions (Zaslavsky, 1999). Players must outwit their opponents in addition, subtraction, division and multiplication. Other games are Kudota, and Ondota played in Namibia which involve multiples, counting and addition.

In the mathematics content in the current BETD, students are taught to expose learners to familiar contexts in class. It not only makes the content relevant to the learner's interest, but also connects geometry content in the class with learner's cultures (Schäfer & Dabula, 2002).

2.3.2 Missionary education

The arrival of colonialists and missionaries brought changes in the Namibian education system. They introduced a modern and formal type of education that required a different system and infra-structure. This replaced and downgraded earlier indigenous forms of instruction and socialisation (Ndilula, 1988). Missionaries were the first people in Namibia to establish schools. The first school was established at Warmbad in 1805 and another in Betanie in 1813. According to O'Callaghan (1977:95) in 1910 the Catholics opened a mission school in Kavango and in about 1920, the Seventh-Day Adventists set up a school in East Caprivi. Schooling was an afternoon activity aimed at evangelism, basic literacy and numeracy, and some training for the church and or practical skills (Amukugo, 1993; Roger, 1997; Mbamba, 1981; Ndilula, 1988). However, as adults acquired basic knowledge in reading, writing and numeracy from their schooling, the missionaries started giving them some very basic teacher training so that they could gradually take over instruction in the church. Schooling was intended mostly for the general Namibian people. The European settlers however did not show much interest in their children receiving formal education in schools because they relied on private tutors or governesses at home (Roger, 1997).

Schools were built with local materials and by the local people under the supervision of missionaries. The sustainability of teachers forced missionaries to establish teacher training centres. The Rhenish Mission Society opened the first

teacher training centre at Otjimbingwe in 1860 and Augustineum teacher training at Okahandja in 1906. The central regions St Joseph's at Döbra was opened in 1925. In the northern part of Namibia, teacher training was established by the Finnish Mission Society at Oniipa in 1910, Okahao in 1948, Oshigambo in 1952 and later at Ongwediva in 1979 (Amukugo, 1993; Roger, 1997; Ndilula, 1988; Auala, 1989; Cohen, 1994). The majority of teachers trained at these centres were black Namibians. The descendants of European settlers and new settlers mostly went to Germany or South Africa for their teacher training.

2.3.3 The colonisers

German colonial education was based on the foundation laid by missionaries. It opened up education for the white Namibian, but did not try to change the pattern of the existing missionary education among the African population (Auala, 1989). The Germans had set up two education systems, one for whites and one for Africans (Blacks and Coloureds). The African education system was aimed at religious development and prepared them for semi-skilled employment while white schools reproduced the European system (Katzao, 1999:26). The educational services for whites expanded, and "...school attendance for all whites was made compulsory". Contrary to this "...African education never progressed beyond simple literacy, and Bible study" during the German colonial era (Amukugo, 1993:45). School subjects taught to African boys included German, arithmetic, carpentry and brick-making, while African girls were taught domestic science. These subjects in the curriculum were geared towards creating a labour force for the growing settler population.

2.3.4 Education under South Africa control.

South West Africa (Namibia) was placed under South Africa military rule in 1915 after the defeat of the German forces in World War I. When South Africa took over the administration of Namibia, they abolished the German education system and replaced it with a system formulated under the Education Act (Act 49 of 1919), used in the Cape Province. In terms of the second Educational Act (Proclamation no 55 of 1921), all educational services were placed under the

South African government and a department of education was entrusted with implementing government policies (Auala, 1988; Amukugo, 1993; Katzao, 1999). In terms of this proclamation the management and supervision of African schools was left in the hands of missionaries on condition that, if they accepted government financial grants, they would also conform to the government regulation regarding the establishment, recognition, control, supervision, syllabuses and classification of schools, the employment of teachers, and conditions of services and inspection.

In 1923, a conference on African education was held in Windhoek by the South African government and most of the missionary societies in Namibia with the exception of the Finnish from Ovamboland. The aim of this conference was to ensure the implementation of the Education Act (of 1921) in terms of the structure, content and medium of instruction. According to Tobias (1981) the only major change to the syllabus was that Afrikaans was given a prominent place in the entire school system. In terms of subject content, no significant changes were made to the German and Missionary education systems implemented before. At the same conference the discussion also focussed on training of black teachers. This was necessitated by the closing of the Rhenish Mission's at Okahandja in 1901 that used to train black teachers. It was reopened with the help of state assistance after the conference in 1923.

In 1948, the Nationalist Party in South Africa came to power, and introduced a policy of separate development, known as "apartheid". By 1949, it appointed a commission of "Native" Education under the chairmanship of Dr. W.W.M Eisselen to investigate the existing system of education for black Africans. The commission reported its findings in 1951 and recommended the introduction of Bantu Education. Its recommendation formed the basis for the African system that was practised in the Republic of South Africa to be used in South West Africa (Namibia) after the adoption of the Bantu Education Act, No. 47 of 1953. Bantu Education was designed and introduced in South African by Dr. H. Verwoerd (former Minister of Native Affairs), who spelled out its objectives as follows:

When I have control of Native Education I will reform it so that Natives will be taught from childhood to realise that equality with Europeans is not for them. People who believe in equality are not desirable teachers for the Natives. Education must train and teach people in accordance with their opportunities in life, in accordance to the sphere in which they live.
(Amukugo, 1993:57).

Its underlying philosophy is encapsulated by Wellington (1967:391) in stating that ... “white settlers require native servants; they can only ensure a continuous supply by seeing to it that the servants are kept in a decided state of educational inferiority. To educate them...(would) inculcate such mischievous and intolerable ideas as democracy, the brotherhood of man, human freedom and the like”.

Indeed, the introduction of Bantu Education in Namibia in the 1960s created failures for the under-resourced majority and successes for the privileged minority. This education system provided Africans with basic literacy in the mother tongue and a working knowledge of English and Afrikaans in order to facilitate communication with the white elite who needed larger numbers of literate black workers for the booming industrial economy in South Africa. Education stressed the value of tribal life and rural skills rather than academic subjects. ‘The curriculum de-emphasised progressive values and skills, such as self-reliance, initiative...’(Tjitendero, 1976:45). From 1978 until independence in 1990, an interim government under control of an Administrator-General was put in power. Under this administration, education was provided by a second-tier authority in line with the apartheid policy of segregation of people. This saw the emergence of eleven authorities charged with the responsibility of implementing the Bantu Education System in Namibia. Under the Bantu system the teaching of mathematics and science was only for the privileged (Clegg, 1989; O’Sullivan, 2003).

It was recommended at the conference in 1923 on African education, to train black teachers in South West Africa (Namibia). By 1970, blacks had access to seven teacher training institutions, namely Augustineum in Windhoek, Cornelius Goreseb at Khorixas, Döbra near Windhoek, Okakarara in Hereroland, Rundu in Kavango, Ongwediva in Ovamboland, and Caprivi at Katima Mulilo. These were virtually all secondary schools with a teacher training ‘wing (Cohen, 1994; Nujoma, 1991; Craig, Kraft & du Plessis, 1998). By 1982, there were nine centres

offering teacher training on a full-time basis. The seven teacher training institutions were for blacks as mentioned above, while the Khomasdal Teacher Training College was for the coloureds, Rehoboth Basters and Namas, and Windhoek Teacher Training College, for whites only (Salia-Bao, 1991; Beukes, Visagie & Kasanda, 2005). Before this, Coloureds and White teachers were trained in South African's Colleges and Universities. The South African Universities continued training Coloureds and White Namibian teachers for senior secondary levels.

In keeping with apartheid policy, Windhoek and Khomasdal Colleges awarded three and four-year diplomas, while the northern colleges continued offering only two-year primary teacher courses. The courses that were offered to blacks were, Lower Primary Teacher Certificate (LPTC) and Primary Teacher Certificate (PTC), until 1976 (O'Callaghan, 1977; Cohen, 1994). But in 1977 blacks were trained for the first time in Junior Secondary Teacher Certificate (JSTC). The entry requirement for the LPTC was standard 6, for the PTC Junior Secondary Certificate the entrance requirement was a standard 8, and for the JSTC a candidate was supposed to have a Senior Certificate. The entry requirement for the Diploma in education was a Senior Certificate, which was in effect a barrier to black students to deny them access to the qualification, since most could not get a Senior Certificate.

After the abolishment of LPTC, PTC and JSTC, a new program was introduced, viz. the Education Certificate Primary (ECP). It was a two year course and students were required to take half the matriculation subjects and half of the professional courses (Chaka, 1997; Mayumbelo, 1996). Towards the end of South African occupation two courses were introduced that replaced ECP namely the National Education Certificate (NEC) and National Higher Education Certificate (NHEC). NEC was a two year course that trained primary school teachers while NHEC trained junior secondary teachers (Nyambe, 1996; Dahlstrom, 1995; Cohen, 1994; Shinyemba, 1999). The entrance requirement for NEC was standard 8. Both programs were subsequently phased out with the phasing in of the BETD.

Whites and coloureds training for the same level of education had different entry requirements (Dahlstrom, 1995). Coloured trainees entering the three year LPTC, required a standard 8, for PTC they required a standard 10, while the Secondary Teachers Certificate (STC) offered only at university-level required a matriculation exemption. Whites required standard 10 for all the teaching courses. In addition to what was offered to blacks and coloureds the whites also had a three year Pre-Primary Teachers Diploma (PPTD).

The above shows how education for Namibians in South West African (Namibia) was segregated and controlled by those in power. Disparities such as lack of sufficient secondary schools, loans, scholarships, access to higher institutions, and other forms of support resulted in blacks and coloureds being poorly trained in relation to their white counterparts. This affected their ability to provide high quality teaching and led to low performance in their schools. As Ellis (1984:36) pointed out, three-quarters of Namibian teachers had too little education themselves to provide high quality teaching.

Meanwhile, in order for the South African government to provide access to higher institutions, the multi-racial Academy for Tertiary Education was established in 1980 in Windhoek. The establishment of an Academy resulted into a number of factors. Firstly the government was faced with the embarrassment that a larger number of Namibians outside the country were receiving more university, tertiary education and skills as compared to those inside the country. Secondly it served as a counter-move to the United Nations Institute for Namibia (UNIN) in Zambia that enrolled learners who fled Namibia during the mid-1970s. Thirdly the government wanted to defuse international criticism of its policies in Namibia, making it to appear that it was moving towards greater self-sufficiency in certain spheres. Lastly it was confronting the crisis in Namibian human resource output, by boosting the number of blacks and coloureds in higher jobs in government and commerce.

With the establishment of an Academy, black and coloured students quickly outnumbered White students. The academy offered continuing education to Namibians whose formal schooling had been interrupted and upgraded

qualifications for Namibian teachers especially in 1985 when a new Academy Act No. 9 of 1985 was promulgated which gave the Academy more autonomy in the development and certification of some of the programs (Cohen, 1994; Phiri, 2005). By 1988, teacher training was offered by the Academy via distance education through the College for Out of School Training (COST) in Windhoek. A strict limiting of space for black students, lack of facilities and staff at the Academy was simply part of a deliberate strategy to keep the Namibians majority out of tertiary education. This led to a situation at independence whereby it was “hard to find a country anywhere in which education (and teacher) standards were lower for the majority of the population” (Chamberlain, 1990:12).

2.3.5 Liberation Struggle

During the liberation struggle in the 1970s and 1980s the South West Africa Peoples Organisation (SWAPO) took several initiatives in exile to educate teachers for its schools and to prepare for independence (Geingob, 1988; Shinyemba, 1999). The establishment of the United Nations Institute for Namibia (UNIN) in Lusaka (Zambia) in 1976 accelerated attention to higher education, including teacher training. Many students were sent for their teacher training to other countries such as Cuba, Eastern Europe, Britain and Sierra Leone. In Angola at Kwanza Zul, the in-service teacher training project for example was supported by the University of Umea in Sweden. Many Namibians pursued their education outside the country and were exposed to diverse ideas and practices in education as well as politics. Educational ideas and programs developed during the liberation struggle as SWAPO paved a way for independence and brought the abolishment of disparities in teacher training (Angula & Lewis, 1997).

2.3.6 Post-Independence (1990).

On independence in 1990, the newly elected SWAPO government’s first task was the unification of the fragmented system of education inherited from the previous apartheid system. The Namibian government needed a teacher education system with a unified, common, national and balanced program that would fully prepare teachers to face and meet challenges of reforming and staffing the education

system in the transforming years to come. The Ministry of Basic Education and Culture developed a new teacher training program, the Basic Education Teacher Diploma (BETD) that replaced the Bantu Education program. The main aim of the program as stated in the BETD Broad Curriculum is:

To develop the professional expertise and competence which will enable the teacher to optimize the new basic education for the learners and to be fully involved in promoting change in educational reform in Namibia.

(Namibia. Ministry of Higher Education, Vocational, Training, Science & Technology, [MHEVTST], 1998).

The document served to move the teachers and learners from a passive role as receivers, transmitters and implementers to a new active role of spearheading change. To prepare teachers for the new role, new approaches were based on democratic pedagogy, a methodology that promoted learning for all through understanding. This approach would serve to empower teachers to develop themselves by taking responsibility for their own as well as other's teaching and learning (Howard, 1995: 19). The BETD as a radical reorientation of the former Namibian teachers' educational system would institute new pedagogical strategies aimed at developing "independent thinking and problem solving strategies" (Callewaert & Kallos, 1992; Namibia. MEC, 1994). The new program would also enable student teachers to learn to analyse and synthesise, to image and explore, to criticise and create, to understand and use (Callewaert & Kallos, 1992; Namibia. MEC, 1993; Namibia. MHEVTST, 1998; Nyambe, 2001). Furthermore, the BETD would produce teachers who meet the demands and rise to the challenges of the reformed basic education system in Namibia (Swarts, 1999; Namibia. MHEVTST, 1998). By 1992, the BETD was introduced in four Namibian teacher's colleges. The first group of 420 students were received at all four colleges of teacher education in February, 1993. Of this number 19 students were for Rundu College of Education. The entrance requirements were an acceptable level of maturity and suitability for the study, Grade 12 education with IGCSE passes, or the equivalent (grade 10), and teaching experiences or other work experiences (Namibia. MEC, 1994).

2.3.7 In-service teacher training

Before independence, in-service teacher training was offered by various ethnic education authorities, either through their own resources or those of the department of National Education. Training courses were organised through classroom visits, or as a result of requests from teachers as expressed at the end of a course. The only form of in-service training available to teachers in the country before independence usually consisted of workshops (refresher courses) or short-term courses that offered teachers new information on a particular aspect of their work (Cohen, 1994; Ottevanger, Macfarlane & Clegg, 2005). Teachers improved their academic qualification through correspondence and various in-service courses organised by non-governmental organisation such as the Council of Churches in Namibia and the Rössing Foundation (Cohen, 1994).

After independence, teaching was to be based on constructivist rather than transmission oriented principles. Teachers are perceived as active learners (co-learners), scaffolders, mentors, engaged in the concrete tasks of teaching, assessment, observation and reflection (Lieberman, 1994; King & Newmann, 2000). At workshops or seminars teachers relate their prior knowledge to new experiences (Cohen, 1990; Ganser, 2000; Lieberman, 1994). They become reflective practitioners; they enter the profession with a certain knowledge base, and acquire new knowledge and experiences based on that prior knowledge. They reflect on it during classroom teaching. In so doing, the role of professional development is to aid teachers in building new pedagogical theories and practices and thus develop their expertise in the field.

Some of the in-service professional developments were conducted in the form of collaborative processes where teachers not only interacted among themselves, but also between administrators, parents and other community members (Grace, 1999). An example of collaborative processes is the Namibia Annual National Mathematics Congress (NANMC) where lecturers from teacher education colleges in Namibia, Polytechnic and University of Namibia, and experts in the field of mathematics from other countries and other stakeholders in education share experiences and present papers on the status of mathematics in Namibia and

the world. Other interventions are held using a cascade or cluster mode of training (Fullan, 1991).

Since independence, in-service training has been in the hands of the Ministry of Education and Culture and an ever-increasing number of non-governmental organisations (NGOs). The significant steps were taken by NGO's such as the In-Service Training Assistance to Namibian Teachers (INSTANT), IBIS-World University Service (WUS), Basic Education Support Project (BES 3), Foundation for Education and Self Help project (IFESH) with assistance of Ministry of Education via Program for Quality Assurance (PQA) and NIED with regional advisory teachers. The idea for the support was to introduce teachers to the idea of a learner-centred approach, to enable teachers to prepare their own teaching resources and to train teachers for effective lesson preparation. These lessons were aimed at bringing about improvement in mathematics and science but the system continues producing a large proportion of learners who are essentially innumerate (Clegg, 2007). Urgent action is therefore needed to bring about dramatic attainment of Vision 2030.

The Ekondopeko (Strengthening) Mathematics Project (EMP) was established in 2004 with a help of the Namibian Mathematics Institute (NMI). The EMP in Rundu is for practicing mathematics teachers of grade 10 to teach extended mathematics in grade 10. The project trains almost 30 facilitators and seeks to provide confidence in the teaching of those teachers as well as establish a forum for sharing ideas and solving mathematical problems. Teachers in this project are engaged in a wide range of new challenges. For example, on how to avoiding implementing out physical punishment to learners by creating a collaborative classroom climate, promoting analytical thinking, encouraging good citizenship and gender-fair attitudes, and dealing with HIV / AIDs-related issues and how to incorporate ICT into their work. Teachers are also expected to engage with parents and the local community to build collaborative relationships with them.

2.3.8 The philosophy of education in Namibia since Independence.

The philosophy of education in Namibia reflects that of the nations' constitution of "equity, justice, democratic participation and respect for human dignity" (Namibia. MEC, 1993:32). Quality in teacher education in Namibia should be assessed in the light of these values and principles. These values are supported in Article 20 of the constitution and are further articulated and explained in the policy of 'Education for All'. The Namibian government abolished the past apartheid education offered under colonial rule hence, issues of access, equity, quality and democracy became essential for the reconstruction of the education system.

The Bantu education system was characterized by teacher centred instruction (Nujoma, 1991). This approach was inefficient, encouraged meaningless memorisation and focused on rote learning at the expense of other cognitive skills and conceptual understanding (Namibia. MEC, 1993). The idea of learning was redefined, with the focus on how and why learners construct learning. The new curriculum in Namibia represents a shift from a teacher-centred way of teaching and learning to a more interactive approach. The approach is more learner-centred and teaching is now described as the tool through which meaning is reconstructed, where the learners interpret what they see and hear on the basis of what they already know (Brodie, 2000). Learner-centred education directly supports the national goals of equity and democracy. McCombs and Whisler (in Henson, 2003: 4), define learner-centred education as:

... the perspective that couples a focus on individual learners (their heredity, experiences, perspectives, backgrounds, talents, interests, capacities and needs) with a focus on learning (the best available knowledge about learning and how it occurs and about teaching practices that are most effective in promoting the highest levels of motivation, learning, and achievement for all learners).

The quotation focuses on the knowledge of learners, how learning best occurs as well as teaching practices that bring about effective learning (Namibia. MEC, 1993). Learner-centred education is informed by constructivism as opposed to behaviourism, which was essentially interpreted as a reductionist approach to

teaching and learning (Sichombe 2007; van Harmelen, 1999a). Constructivism is a theory about knowledge and learning; it describes both what “knowing” is and how one “comes to know” (Bodner, 1986). It places emphasis on learners as constructors of knowledge. The knowledge constructed is not deposited in the mind of learners. Rather, as van Harmelen (1999b) noted, learners make meaning of existing constructs through the process of construction, deconstruction and reconstruction. From a constructivist view, learners are not regarded as empty vessels as was the case in the previous dispensation; they instead bring their experiences to the learning situation, which Vygotsky (1978) called spontaneous knowledge. This knowledge serves as prior knowledge and needs to be systematised at school.

Students learn best when they are actively involved in the learning process (Namibia. Ministry of Basic Education, Sport and Culture [MBESC], 1996). The role of the teacher in a learner-centred teaching environment changes from that of an “expert of what is known, to that of a facilitator, mediator, scaffolder, co-learner whose task is “to design experiences that give an opportunity to learners to develop their own understanding” (Hinchey, 1998; van Harmelen, 2004).

Current theories and new approaches to the teaching of mathematics are very compatible with features of learner-centred and constructivist philosophies. In mathematics, the new focus is on ways in which learners represent and connect aspects of mathematical knowledge, and the way they understand mathematical ideas and use them in problem solving and justify their thinking, because learning with understanding is more powerful than simply memorizing (Kilpatrick, Swafford, & Findell, 2001). Current theories of learning mathematics argue that learning takes place through reasoning (Jina & Brodie, 2008). Teachers and learners can stimulate reasoning through questions and through the way they interact. Questions and answers are arguably the main way through which teachers and learners communicate (Sullivan & Clarke, 1991).

2.4. MATHEMATICS TEACHER EDUCATION IN NAMIBIA.

The teaching and learning of mathematics and science subjects in Namibia prior to independence was boring and uninspiring (Clegg, 1989; Hoey, 1989; Turner, 1990). As Cuuington (1989) observed, the training of teachers in Namibia did not engender creativity in the student-teachers; it reinforced the chalk and talk strategy instead.

The majority of schools in northern Namibia did not offer science and mathematics subjects to learners. This was due to the implicit assumptions that these subjects were inherently difficult for blacks (Clegg, 1989). The high failure rates among the few blacks taking these subjects appeared to confirm this. Nevertheless, this view was just the way the colonialist kept blacks in an inferior position so that they only became clerks and messengers (Namibia. MEC, 1993). According to Kasanda (2005:110) a mixture of passive and active discouragement of blacks to take mathematics and science subjects up to matriculation level contributed to the unpopularity of science and mathematics education in the country.

In order to address the lack of access to mathematics and science subjects in the past, the Namibian government after independence assigned the highest priority to the study of science and mathematics education. This resulted in the establishment of Presidents Endowment Fund Bursary Scheme and two ministries of Education; The Ministry of Higher Education, Vocational Training, Science and Technology (MHEVTST), and the Ministry of Higher Education Science and Technology (MHEST). The two subjects became compulsory from primary to the end of junior secondary education for all Namibians. It showed the commitment of the government to encourage the study of these subjects to those who were denied the chance in the past.

2. 4.1 Modes of Study for Mathematics Teachers.

The significant lack of mathematics teachers in Namibia at independence inspired the establishment of two modes of teacher education namely, Pre-service and In-service training programs.

2.4.1.1 Pre-service mode.

The preparation of mathematics teachers in Namibia currently takes place at two levels. These are through the four teachers training colleges and the University of Namibia (UNAM).

a) Teachers Training Colleges of Education.

The duration of the teacher preparation programs at the four teachers' training colleges is three years. Upon completion, graduates are expected to teach in the basic education program which is up to grade 10. During the three years of study candidates are generally required to follow common foundation studies in the first year (which phased out last year, 2007) with mathematics and integrated natural science being compulsory. In the third term of the first year, students were expected to select a subject area of specialisation related to the chosen phase of Basic Education (grades 1-7, 5-10).

b) The University of Namibia.

The University of Namibia prepares teachers for the senior grades namely grade 11 and 12 in all school subjects. There was a policy directive in 1992 from the Ministry of Education and Culture that colleges were to prepare teachers for primary and junior secondary levels through BETD (Phiri, 2005:96). Because of this, the faculty of Education phased out all diplomas related to Primary Education. The focus for the University of Namibia is to prepare teachers for Senior Secondary Education who would teach Higher and International General Certificate for Secondary Education (H/IGCSE) at the senior secondary school level. It offers courses both on a full and part time basis.

2.4.1.2 In-service mode

Mathematics teachers are prepared through the Teacher's Resources Centres (TRC), the University of Namibia (UNAM), Rhodes University, and Institute for Open Learning (IOL). This mode of study targets practicing teachers.

a) Teachers Resource Centres (TRCs).

The TRCs offers BETD-inset programs on a four year part-time basis. The BETD-Inset program is a unified general preparation for unqualified and partly qualified teachers in Basic Education. It provides opportunities for teachers to specialise in their fields in relation to phases of schooling and subject areas. It aims at providing teachers with mastering of the teaching and learning conditions in Namibian schools, through school-based activities as well as becoming reflective practitioners through teaching practice. The accredited 4 year's part-time course was found in 1994 by the Ministry of Education. The BETD-Inset program is offered at TRCs variously stationed at Ongwediva College of Education, Rundu, Khorixas, Keetmanshoop, Katima Mulilo and Windhoek (Namibia. Ministry Education [ME], 2007a: 2).

b) Rhodes University.

Rhodes University offers educational courses on a two-year part-time basis. Students attend lectures during school holidays or in the course of the week. Rhodes University offers mathematical courses such as Advanced Certificate in Education (Mathematics Education), B. Ed (Honours) with Mathematics Education as an Elective course and Masters in Mathematics Education. The ACE (MathsEd) was phased out in 2005 due to the lack of the state subsidy for ACE (MathsEd) graduates. For the ACE (MathsEd), BETD mathematics graduates prior knowledge was recognised unlike at University of Namibia (UNAM). The ACE (MathsEd) provided access to students to study mathematics

education at level 6 and level 7 respectively on the South African qualification authority framework (SAQAF).

c) Institute for Open Learning (IOL).

The Institute for Open Learning (IOL) is an accredited distance education institution, which offers students opportunities to study in various fields such as education. Educational courses offered by IOL are Junior Primary Teacher Diploma (JPTD), Senior Primary Teacher Education Diploma (SPTED), Advanced Certificate in Education (ACE) and B. Ed (Honours) degrees. The IOL is the only institution that recognises teachers with qualifications such as the Lower Primary Teacher Certificate (LPTC), the Primary Teacher Certificate (PTC) or the Education Certificate Primary (ECP). In addition to the qualifications they obtained during apartheid, teachers intending to enrol with IOL should be in possession of grade 12 with teaching experience or grade 10 (or equivalents). The duration of study for a Junior Primary Teacher Diploma (JPTD) and Senior Primary Teacher Education Diploma (SPTED) is three years, while the ACE (Advanced Certificate in Education) requires a maximum study period of two years. Mathematics Education is offered in the first year only at JPTD and is compulsory for the duration of study for SPTED and ACE while no mathematics education is offered at B. Ed (Honours).

2.4.2 General Structure of the Teacher Training Program in Namibia.

In order to meet the national needs for mathematics teachers, three teacher-training programs were introduced after independence:

2.4.2.1 The structure of Basic Education Teacher Diploma (BETD) Program.

This program is structured into major and minor specialisation options. Since its inception the BETD program levels of specialisation has changed with the changing demands of the basic education. The current program is divided into three phases, reflecting the three phases of basic education in the schools. Students choose to specialise in major studies at the Lower Primary (Grades 1-4),

Upper Primary (Grades 5-7) or Junior Secondary (Grades 8-10), while they all take their minor study option at upper primary level. It is structured as follows:

a) BETD at Colleges of Education.

The BETD program is structured over a 3 year period, equally divided into 3 terms each year. The following core subjects are taken by all student teachers: Education Theory and Practice; Arts in Culture; Human Movement Education; English Communication Skills; Integrated Media and Technology Education. Mathematics is offered as a major course with specialisation in either upper or junior secondary education. Within each speciality area the subject content knowledge and the pedagogy are presented in an integrated manner. Each college has its own study options and combinations because not all colleges offer all subjects, in all the phases.

b) BETD at INSET program.

The normal study time for the Inset program is four years. An advanced placement is obtained in terms of experiential learning and qualifications already obtained. The program consists of 12 modules, equally divided into 4 years, three modules per year. Running across the four years are the three core subjects: Education Theory and Practice; English Communication Skills and School Based Activities.

2.4.2.2. The University of Namibia (UNAM).

UNAM is accommodated at the main campus in Windhoek, at the three regional campuses (Northern campus and two campuses offering agriculture only) and at eight regional centres. It has seven faculties including the Faculty of Education. The Faculty of Education offers Diplomas [such as Post Graduate Diploma in Education and a number of other specialised diplomas], Degrees in Bachelor of Education, Masters and PhD. In terms of mathematics education there are three programs whereby teachers can obtain qualifications in mathematics instruction. These programs are:

The Bachelor of Education (B. Ed) degree is the only educational course offered fulltime or through distance at the University of Namibia. It is normally four years full time and six or more years through distance. The B. Ed aimed for individuals who wish to teach at secondary school level. According to the University of Namibia. Centre for External Studies. [UNAM.CES], 2008: 112) the admission requirements into the Bachelor of Education (B. Ed) are:

- A minimum of an upper credit BETD diploma certificate with subject passes obtained at the level of a 'B' grade or better.
- A minimum of three years of teaching experiences after successfully completing the BETD.
- Students should have obtained at least a C symbol in IGCSE or equivalent qualification for mathematics.
- BETD students who want to enrol for B. Ed (Mathematics and Science specialism) should have at least majored at mathematics in the diploma.
- The subject combinations for mathematics and Science specialism are: Biology and Mathematics or Mathematics and English or Mathematics and Physical Science.

(UNAM.CES, 2008: 112).

These requirements put the BETD graduates at par with a school leaving certificate (IGCSE). UNAM does not recognise any prior learning in the BETD. It further requires BETD graduates to be exceptionally good as UNAM is not prepared to accept a lower grade than B (or Credit). Those BETD holders who fall below this condition will never sit in UNAM classrooms (Nyambe, 2001).

The Mathematics and Science Teacher Extension Program (MASTEP), is aimed to train junior school teachers to effectively teach at the IGCSE (now Namibia Senior Secondary Certificate) to prepare learners for school leaving examination (Beukes et al., 2005; UNAM.CES, 2008). The MASTEP is a one-year program offered for two years through distance education. A BETD mathematics graduate and teaching mathematics at Junior Secondary School is allowed to register for: IGCSE subject content, IGCSE teaching methods, Communication skills in English. The content is the very IGCSE syllabus the participants are expected to teach upon graduation. In my view this is grossly inadequate because the teacher ought to know more than the learners. Should there be any change in content in

the grade 11 or 12 curriculum the MASTEP graduates will probably find themselves with insufficient content in mathematics to prepare those learners.

Another course offered by UNAM since 2003 is the Postgraduate Diploma in Education (PGDE). The PGDE is aimed at providing students with a first degree and appropriate school subjects that are recognised by the Namibia National Qualification Authority (NNQA) the opportunity to become teachers. A prospective mathematics teacher typically registers for the following subjects, history of education, educational management, philosophy of education, teaching methods of mathematics and a teaching practice.

2.5 WHAT MAKES AN EFFECTIVE TEACHER OF MATHEMATICS?

The debate of what teachers should know has been going on since, at least, the arrival of public education in the 19th century (Shulman, 1986). Modern research has revealed that to bring about effective learning in classrooms mathematics teachers need a deep understanding of subject content, pedagogical content knowledge, curriculum knowledge, classroom experience and knowledge of teaching materials and how to deliver them (Brown, 2003; Ball, Hill & Rowan, 2005; Ball & Bass, 2000; Kilpatrick et al., 2001).

Teachers are unlikely to provide an adequate explanation of concepts which they do not understand themselves (Kilpatrick et al, 2001). If teachers are to help learners to develop concepts, they themselves should have a thorough understanding of key concepts and the pedagogy of concepts (Sichombe, 2007). But knowledge of the conceptual structure of the topic is also necessary for the teacher to properly understand the concepts.

Knowledge of a concept alone is not enough; teachers need to understand ways of representing the concept to learners. This view has been supported by Shulman and Wilson (1987) who argue that teachers need both subject matter knowledge and pedagogical content knowledge. Teachers should have a clear understanding of how conceptual development is achieved as well as an understanding of how various strategies and resources contribute to the acquisition of conceptual

understanding (van Harmelen, 1999a: 6). It is only teachers with conceptual understanding who will be able to engage their learners in productive conversation about multiple ways to solve mathematical problems. Teachers with a weak conceptual knowledge of mathematics tend to only demonstrate procedures to learners and then give them repetitive opportunities to practice the procedures (Kilpatrick et al., 2001).

The starting point at each stage of a learning process should be the acknowledgement of learners' existing knowledge (prior knowledge), skills, interests and understanding (Namibia. MBESC, 1996; Moll, Gultig, Bradbury & Winkler, 2001; Henson, 2003). Teachers need to connect to their learners' prior knowledge and experience. Moll et al., (2001) argue that if we really want learners to "gain real understanding as quickly and accurately as possible", we should build on the experiences of the learners. They note that if the concept is very far from the experience, the teacher must bridge the gap in some way so as to lead them to it.

"One who understands should be able to describe, explain and apply concepts" (Perkins, 1993: 45). What one learns in activities or tasks should be internalised. Teachers need to assist learners to be in a position to transfer knowledge and skills from one sector to another. For example from the informal (outside school) to the formal (within the school) education sector and vice versa. In particular learners should see the connection between classroom mathematics and outside mathematics. For example Carraher, Schliemann & Carraher (1988), found out that children in Brazilian street markets could solve practical problems involving arithmetic operations. By contrast, they could not solve the same problems using pen and paper in school. This is also illustrated by Onwu (1992), who was informed by a case of a child struggling with addition and subtraction in school but that child was able to give change unerringly when selling groundnuts in the street.

Mathematics in school should be set in a practical and familiar context that will motivate the learners and make mathematics content meaningful. This concurs with Tuckey (1992) when she said that mature concept learning should involve

the harmonious intertwining of formal and informal learning. In other words teachers should “teach for transfer” as Perkins (1993) puts it. Kilpatrick et al., argue that learners are able to present reasoning ability when three conditions are met: “They have sufficient knowledge base, the task is understandable and motivating, and the context is familiar and motivating” (2001:130). Tasks given to learners in lessons should be cognitively demanding so that learners build on their knowledge base as they work through tasks. Learners should be able to justify and explain their ideas in whole class interaction. In general, the teacher’s questions and interaction patterns should promote reasoning. Teachers should initiate higher order questions for learners to reason and communicate their ideas.

2.6 THE NEED FOR A BRIDGING COURSE.

The need for a bridging course was triggered firstly by seeing many former BETD graduates not gaining access into the Faculty of Education at the University of Namibia. Secondly the content proficiency of mathematics teachers in Namibia is poor (Namibia. MEC, 1999). Lastly little content in mathematics is taught at BETD (Namibia. Mathematics and Science Teachers Extension Program [MASTEP], 2002; Alausa, 2000; Kandjeo-Marenga, Kapenda, !Gaoseb, Kasanda, Lubben & Campbell, 2005; Namibia. Ministry of Education and Culture [MEC], 1997).

2.6.1. Content Knowledge.

The BETD program has attracted many international admirers and received applause in international conferences such as the 1997 CAR conference in the UK, the 10th WCCES in Cape Town, and the 45th ICET World Assembly in Windhoek (Nyambe, 2001). The BETD has been applauded as a good example of teacher education in developing nations (Craig, et al., 1998). The BETD program is credited with the success of enhancing student learning in their own context. Despite the international applause, the BETD program has come under criticism from certain quarters of the Namibian society and the University of Namibia for teaching very little “academic content” and producing graduates who have little grounding in the subject content (Namibia. MASTEP, 2002; Kandjeo-Marenga et

al., 2005). UNAM acknowledges the BETD's strength when it comes to methodology and intensive exposure to classroom experience. Its major criticism of the program is that it lacks "sufficient" academic content in various subject areas. This criticism levelled against the BETD for offering little content by UNAM has two sides to it. According to Nyambe (2001:77) UNAM courses are purely traditional content-based degree programs, while the BETD program does not necessarily focus on content alone, but also on the professional development of the student-teacher. As Swarts (1999) rightly argued:

"The public has been misinformed about the BETD particularly on the issue of 'content' and assessment. This misinformation stems partly from the fact that what constitutes the substance and content of a professional teacher education programme differs from what constitutes the substance and content of a secondary course or an academic degree. It seems to be overlooked by the various critics, including teacher educators, student teachers and lectures at the University, that BETD is neither a continuation of senior secondary education nor is it a degree course. It is a teacher education programme and therefore content is not taught or acquired for the sake of content, but is utilised as the basis for teaching and acquisition of appropriate methodologies ...the BETD therefore strikes a balance between professional insight, skills and subject knowledge rather than emphasising one to the detriment of the other" (p.6).

The quotation acknowledges that BETD is neither a degree nor a continuity of senior secondary education. Then BETD is uniquely a teacher education program. The foundation courses in the first year of the BETD were meant to consolidate content knowledge from high school as well as introduce student teachers to theoretical and practical aspects of teaching profession (Craig et al., 1998; Namibia. MHEVTST, 1998). This shows that there is evidence of content knowledge in the BETD. It can also be argued that the perception that there is less content in the BETD is based on the traditionalist approach whereby teacher education is believed to fill prospective teachers with so-called academic content knowledge, so that by the time a student teacher exits the program he or she should have acquired, a bulk of the content knowledge that can be deposited in, or be transmitted to learners (Hinchey, 1998; Nyambe, 2001). The content areas covered in three years at BETD should enable entry into the Bachelor of Education degree at a certain point.

Another counter argument for content taught at BETD is summarised by Shilamba & Dahlstrom (1999), as follows:

There was deliberate attempt to keep the four education colleges independent of the university to break way from the traditional pattern in which the colleges are seen as “minors” to the university, and teacher education is perceived as an academic affair on academic knowledge and hegemony (p.117)

The break away of the four teacher training colleges from the “Academy For Tertiary Education”, the predecessor of University of Namibia (UNAM), in my view was a problematic move by the Faculty of Education of UNAM. The move was initiated by the Ministry of Education. The teacher training colleges were to prepare teachers for the primary education system while the UNAM was to prepare teachers for senior secondary schools (Phiri, 2005). The initiative was also necessitated by the Academy ideological inclinations associated with apartheid regime, meaningless memorisation, more content taught at expense of methodology and other structures that did not address a need for independent Namibia (Nyambe, 2001; Namibia: MEC, 1993; Ottevanger et al., 2005).

The arguments of those advocating for content taught at BETD should be carefully weighed against realities. Firstly according to Beukes et al., (2005) most of the Lower Primary Teachers (LPTs) have little mathematical knowledge; as many have failed mathematics throughout their school career. In addition mathematics was not a requirement for becoming a Lower Primary Teacher until 2007 (Namibia. Ministry of Education [ME], 2007b). But due to a lack of mathematics teachers in Namibia rural areas, school principles recruit the LPTs graduates to teach outside their subject area and grade level specialisation. This was observed by Craig et al., (1998:43) that student teachers trained in lower primary (Grade 1-4) were assigned to teach grade 10 mathematics, because she or he was the only higher trained teacher and only diploma holder at that school. I do agree with the above authors, for example among the 30 student teachers admitted at Rundu College of Education this academic year, 2008 in the Lower Primary Department, only two have a D symbol, seven have E symbols at grade 12 while the remaining twenty-one have no mathematics at either grade 10 or grade 12. Schools still recruit BETD graduates outside their area of specialisation.

These teachers will struggle to teach mathematical content knowledge confidently (Brainer, Cruickshank & Metcalf, 1995; Kasanda, 2005) because it is only primary teachers with well equipped mathematics knowledge who are able to explain mathematics to their learners (Driscoll, 2007; Skemp, 1989; Kilpatrick et al. 2001). Unless the foundation of learners is secured, it will be extremely difficult to build their mathematical and scientific success at upper primary and secondary level.

My second argument is as a former BETD and ACE (MEd) graduate and now a Mathematics Lecturer at Rundu Teacher Training College, I have observed with concern that prospective mathematics teachers at Colleges are taught little content. The limited grasp and poor delivery of the subject content by student teachers was identified by the moderation process in mathematics. Moderators reported that student-teachers displayed a mixed grasp of content and that due to lack of subject content some students tended to end lessons 15 minutes before the end of the allocated 35 or 40 minutes (Namibia. Ministry of Higher Education, Training and Employment Creation [MHETEC], 2000; Namibia. Ministry of Education [ME], 2005a). Although the moderation reports acknowledge some grasp of the content the grasped content does not seem adequate for the task (Kasanda, 2005:115). I concur with Kasanda (2005). The reality is that the mathematics curriculum taught at BETD level is only equivalent to the school curriculum. I argue that we cannot train teachers for Upper Primary Mathematics (grade 5-7) or Junior Secondary level (grade 8-10) using only the school curriculum. Upon completion of their studies teachers are expected to teach either grades 1-7 or grade 5-10, yet their in-depth content knowledge is only required of grade 5-7 or grade 8-10 level. The BETD graduates are expected to provide the backbone in popularising and delivering meaningful science and mathematics education at the primary and junior secondary levels. They should be exposed to a higher level of science and mathematics content.

2.6.2. The content proficiency of mathematics teachers.

What is the research to date on the content proficiency of Namibian mathematics teachers? Research carried out in 2000 by the Southern and Eastern Africa

Consortium for Monitoring Educational Quality (SACMEQ) in fifteen countries found, Namibian learners and their teachers performed poorly both in reading and in mathematics (Namibia. Ministry of Basic Education Sports & Culture [MBESC], 2004).

In mathematics Namibian learners were bottom. The Namibian teachers were second from the bottom beating only Zanzibar teachers (Namibia. MBESC, 2004:146).

The Mathematics and Science Teachers Extension Programme (Namibia. MASTEP, 2002) and Presidential Commission on Education, Culture and Training (Namibia. MEC, 1999) also revealed limited knowledge of teachers in mathematics content in Namibian schools.

This is not a healthy situation. The overall low average scores for Namibian Grade 6 mathematics teachers and their learners begs the question as to what might be the causes? Is it the mathematics curriculum, or the training of mathematics teachers or other causes? This study will be exploring some of the possible causes. But these results also beg the question as to what the literature might suggest be done to remedy the situation? The following section examines some aspects of the latter.

2. 6. 3. Models of teaching mathematics

One well known and internationally respected view of effective teaching of mathematics and accompanying teacher characteristics is the Teaching for Mathematical Proficiency framework of Kilpatrick et al.,

According to Kilpatrick et al. (2001) mathematics proficiency provides a way to think about mathematics learning that encompasses the key features of knowing and doing mathematics. It also implies expertise in handling mathematical ideas. Learners who are mathematically proficient should be able to use the five strands of mathematical proficiency in an integrated manner, so that each strand reinforces the others. The five strands of mathematical proficiency are:

- Conceptual understanding – comprehension of mathematics concepts, operations, and relations;
- Procedural fluency – skills in carrying out procedures flexibly, accurately, efficiently, and appropriately;
- Strategic competence – ability to formulate, represent, and solve mathematical problems
- Adaptive reasoning – capacity for logical thought, reflection, explanation, and justification;
- Productive disposition – habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy.

(Kilpatrick et al., 2001: 116).

These strands constitute the knowledge, skills, abilities and beliefs that all mathematics learners should be able to master. They are intertwined in the development of proficiency in mathematics. The first two strands are what schools have traditionally emphasised, with many schools only aiming towards procedural fluency. Brodie (2000) also stresses that teachers give learners opportunities to reason. This is done when teachers stimulate learners into thinking and justifying conjectures.

What we see in most Namibian mathematics classes is learners being drilled through steps and procedures that lead to correct solutions without understanding. steps need not be devised which smooth the path to solution, indeed such small steps may not result in learning at all, instead measures should be devised to offer opportunities for wonder and wondering (Wigley 1992, as cited in Winter, 2001: 209). However, Kilpatrick et al. (2001) argue that conceptual understanding and procedural fluency are tightly connected, in that the learners will only use methods fluently and flexibly if they understand them.

It is only teachers with higher mathematics content knowledge who can set higher-level mathematics tasks that engage learners in procedures with connection to understanding of concepts (Stein, Grover & Henningsen, 1996; Harod, 2000). For Namibian mathematics teachers (NMT) to be successful, they need more content knowledge (subject matter knowledge) referred to as the knowledge of the subject the teacher need to teach for understanding (Shulman, 1986; Ball et al., 2005; Davis & Krajcik, 2005; Namibia. Ministry Education

[ME], 2005b; Ramatlapana, 2008)). But also they need to develop pedagogical content knowledge (PCK) and curricular knowledge (CK). The PCK includes knowledge of mathematics-specific strategies and various ways to represent content, and learners' thinking about mathematics, while CK is an array of instructional materials, reinforcement devices and teaching media (Shulman, 1986). As teachers change in their horizons of understanding rather than through sudden leaps of insight (Lewin, 2000). Therefore NMT need to access 80% of the teacher preparation time on subject content as international research show and the remaining representing pedagogy (Shulman, 1986).

Some argue that students learn best when working in pairs or small groups to achieve shared learning goals (Barkley, Cross & Major 2005). There is evidence of learning in groups as a social process in which learning is interactive and based on explanation, negotiation, sharing and evaluation (Clements & Battista, 1990). When learners are given opportunities to discuss, evaluate and mutually agree on ideas in pairs or small groups, teachers will be able to hear and see expressions of learners' mathematical ideas and these learners will be able to respond in appropriate ways (Jina & Brodie, 2008).

It is generally accepted that good teaching leads to successful learning outcomes. It is also recognised that good teachers contribute substantially towards good education systems thereby contributing towards the achievement of national goals (Swarts, 2008). As teaching is a complex activity (Ramatlapana, 2008) teachers need continuous professional development. Research on training has shown that with appropriate conditions, training has the potential to significantly change teachers' beliefs, knowledge, behaviour, and the performance of their learners (Ramathapana, 2008; Kennedy, 1999).

Bringing together the threads from the literatures we see that surveys of mathematics proficiency of Namibian teachers points to a need to raise levels of mathematics content and pedagogy. The literature also points to ways forward in terms of raising the proficiency levels of teachers. Now, because I'm interested in supporting mathematics teachers in their endeavours to improve their content knowledge and pedagogical content knowledge, I am keen to examine potential

solutions to this problem. One of the viable solutions to the problem of insufficient subject content knowledge and the lack of exposure to alternative mathematics pedagogies is to develop and offer a complementary course in mathematics for practicing teachers. This could be done through a program of continued professional development (CPD) to bring about necessary fundamental changes in the learning environments of classrooms. This would result in better learner engagement and therefore improved enthusiasm for mathematics (Braund, Ragbir-Boy & Bennett, 2008). The purposes of this continued professional development (CPD) would be to;

- a) increase the possibility of practicing teachers obtaining promotion and furthering their professional knowledge of teaching and learning by embarking on a certificate course delivered by their local institution. The course will focus on related subject content and pedagogy areas.
- b) encourage the participants to read round the literature in the field and to carry out some action research in the classroom.
- c) bridge the gap between BETD (Basic Education Teacher Diploma) and B. Ed (Bachelor of Education) degree offered by the University of Namibia. This has led the BETD teachers to seek admission into tertiary institutions in South Africa. It would enable aspiring teachers to register for the B. Ed qualification at other Universities.
- d) bridge the gap left by Rhodes University when it stopped offering an ACE (Advanced Certificate in Education) in mathematics in Namibia in 2005.
- e) Fill the gap of lack of content among Namibia mathematics teachers.

This complementary course's main aims will be for mathematics teachers to acquire more subject content and to improve their mathematics pedagogy and also to enhance their access to institutions of higher learning in education.

The two year part-time complementary course investigated in this study could possibly be modelled after the Rhodes Advanced Certificate in Education (ACE) in Mathematics. This bridging course would be converted to a B.Ed degree at NQF level 7 (Namibia. Ministry of Education [ME], 2008b), as it would be used for retraining purposes only and for qualified teachers to continue in that same

specialism in a qualification at NQF level 8 until level 10. This program would be of great value to Teacher Training Colleges, former BETD graduates, National Institute for Educational Development (NIED), the Namibian public at large, and other institutions of higher learning in education.

2.7. A BROAD OVERVIEW OF THE ACE (MATHEMATICS EDUCATION) OFFERED BY RHODES UNIVERSITY IN NAMIBIA FROM 2000-2005.

Mathematics education and science education have been identified as critical areas for reform in Namibian Schools. There was and still exists a larger number of under-qualified teachers who lack both the subject knowledge and appropriate teaching skills. The Advanced Certificate in Education ACE (MathsEd) formerly known as Further Diploma in Education Mathematics Education FDE (MathsEd) was introduced in 2000 in Namibia. The two-year part-time course in mathematics was converted to a B. Ed degree at NQF level 6 (South Africa. Department of Education [DE], 2000; Van der Horst & McDonald, 1997). It also qualified students to continue in the same specialism at SANQF level 7 (Rhodes University, 2006:1).

The ACE (MathEd) offered in Namibia addressed the shortcoming of a larger number of under-qualified teachers as a result of the significant educational inequalities that existed within the schooling systems. The ACE (MathEd) also alleviated the deficiency of little content in the BETD by exposing BETD mathematics graduates to high level of mathematics. Students were exposed to topics like algebra, calculus, trigonometry, geometry, sequences and series, permutations and combinations, probability, and technology in mathematics (Rhodes University, 2006). Students were also exposed to theoretical understanding and professional practice in mathematics education with emphasis on constructivism (Rhodes University, 2002). The content and skills acquired at ACE (MathEd) provided the BETD graduates with a legitimate route into other tertiary course such as B. Ed (Honours) and Masters in Mathematics Education with Rhodes University.

As strongly as I personally feel about the need for a complementary course for BETD mathematics teachers in the context of professional development as argued above, it is important to consult other stakeholders in the field. This study therefore aims to shed light on what a range of stakeholders feel about the possible implementation of such a course. This study is essentially a needs analysis for such a course and involves the following key players: five mathematics schools teachers, two mathematics college lecturers and a professor of mathematics education at the University of Namibia.

2.8. CONCLUSION.

In this chapter I critically analysed and reviewed literature that shapes, informs and provides the foundation and framework for my study. As my study is located within the educational reform milieu of Namibia, I began by giving a brief overview of teacher-education in Namibia. Then followed a discussion on teacher professional development, mathematics education in the Namibian context, what makes an effective teacher of mathematics, and the need for a bridging course. I also reflected on the Mathematics course offered by Rhodes University in Namibia from 2000-2005. My argument in this chapter is the advocacy for a complementary course that would fill the gap of poor mathematics content in Namibian mathematics teachers.

In this study I investigate the needs for the implementation of a complementary course in mathematics education for teachers of mathematics in Namibia by engaging with a host of stakeholders.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter documents the research design and methodology followed in the study. This chapter is structured as follows.

- Research goal
- Research Design
- Sampling
- Data collection methods
- Piloting
- Validity
- Managing data
- Data analysis

3.2 RESEARCH GOAL

The goal of this research is to assess the need for developing a complementary course in mathematics education for teachers of mathematics in Namibia.

3.3 RESEARCH DESIGN

3.3.1 Introduction

A research design is a plan for conducting a study that provides the researcher with a detailed approach that is suitable to address the research goals. De Vos, Strydom, Fouche, and Delpont (2005) define such a plan as a logical strategy for gathering evidence about knowledge desired. Yin (2003) argues that the research

design deals with four problems: what questions to study, what data is relevant, what data to collect and how to analyse the results.

The overall purpose of honest research is to advance knowledge. It is my hope that my research will add new knowledge in the field of mathematics education. The credibility and power of the research will be strongly influenced by the quality of the research design.

3.3.2 Research orientation

My research is located within the interpretive paradigm or orientation using a qualitative approach. The interpretive approach tries to “understand and interpret daily occurrences and social structures as well as the meaning people give to the phenomena” (Cantrell cited in Mrazek, 1993:83). I have chosen this paradigm because it offers the opportunity to engage with in-depth descriptions and understanding of actions and events (Babbie & Mouton, 2001).

The research task of this project is complex and multilayered. There are nuances and clear inferences, but also space for reading between the lines. For example the examination of the needs, feasibility and character of a possible complementary program in mathematics involves examination not only of the perceived mathematics competencies of selected groups, their expectations but also their perceptions of the future. Hence numerous managerial players within the education system needed to be involved. I felt that the interpretative paradigm using qualitative approaches lended itself to this multi-layered research project.

3.3.3 Methods

A case study method was used. A case study allows the researcher to concentrate on specific instances or situations and attempt to identify the various interactive processes at work. A case study gives an opportunity for one aspect of a problem to be studied in some depth within a limited time scale (Bell, 1993: 8). According to Allison, O’Sullivan, Owen, Rothwell, Rice and Saunders (1996:20) a case study is an “in-depth study of particular events, circumstances or situations which

offer the prospect of revealing understanding of a kind which might escape broader surveys”.

My case focuses on the perception, experience and hopes of eight participants within an institutional context of an evolving teacher education system in Namibia. The participants are insiders, outsiders and former program participants of different mathematics teacher programs.

3.4 SAMPLING

My sample population consists of five teachers from different schools in the Kavango Region, Namibia, two lecturers from Rundu College in northern Namibia and an official from the University of Namibia (UNAM). All eight participants are presently teaching mathematics at various Namibian educational levels.

Sampling of the participants in the study was guided by purposive sampling procedures. Cohen, Manion and Morrison (2000) refer to this sampling procedure as “convenience sampling”. I chose the nearest individuals who were easily accessible to me as respondents. The educational profile of the eight participants is reflected in table 3.1.

Table 3.1: Educational levels of the eight participants.

Participants names	Qualifications	Institution obtained	Year Studied	Present work place
Jameson (<i>BETD graduate</i>)	BETD, B. Tec, BEd (H)	Rundu College of Education Technikon Pretoria SA Potchesfstroom SA	1994	Katumwa C. School
Gibson (<i>BETD graduate</i>)	BETD, HED	Rundu College of Education Institute for Open Learning	1999	Muhinda P.S
Nzila (<i>BETD Graduate</i>)	BETD, FDE (Math), B.Ed (H).	Rundu College of Education Rhodes University	1995 2000 2002	Tjangano S.S.S.

<i>and ACE)</i>				
Kennedy (<i>NEC graduate</i>)	NEC, Dip in Education, MASTEP, BETD	Rundu College of Education Port Elizabeth University University of Namibia Via Rundu Teacher Resource Centre	1992 1996 2000 2004	Namakau S. S.S.
Mukanwa (<i>Zimbabwe graduate</i>)	Dip in Education.	Beleveral Technical Teachers' College	2003	Mabengano S.S.S.
Namasiku Sansuvu (<i>Maths lecturer</i>)	HED, B.Ed (H)	University of Namibia Rhodes University	2004	Rundu College
Namuchana (<i>Maths lecturer</i>)	PhD	England	1999	Rundu College
(<i>UNAM Official</i>)	PhD	U.S. A	1985	University of Namibia

The BETD mathematics graduates as a target group for the study were selected mainly because of their knowledge and experiences with various aspects of the BETD program. An insight into the BETD program is central to the study in order to establish if there is a mathematics content gap in the program. Further, the expectations and views of BETD graduates for any further mathematics training is also central to the design of the study.

The inclusion of the two mathematics lecturers from the Rundu College was in part to provide a cross check on the BETD graduates' assessment of the program and to establish the current profile of the program. The ACE graduate was selected for her experience and perspective of a South African ACE program. The UNAM official was selected to cast light on the entry gap between the BETD and the B. Ed degree offered by UNAM. Similarly the graduate from the University of Zimbabwe was included to get the perspective on the links between the Zimbabwe Teacher Training Colleges and the University of Zimbabwe.

For ethical and assurances of confidentiality reasons all participants were given pseudonyms.

3.5 DATA COLLECTION METHODS

I used two data collection methods: semi-structured interviews and document analysis. The two data collection methods complemented each other and also provided a degree of cross checking of claims. For example, following a review of the documents I included questions to those being interviewed to seek verification of some of the data. This added credibility to my study.

3.5.1 Interviews

I used mostly interviews as my research tool in my case study. Cohen, Manion and Morrison (2000) define “an interview as a two-person conversation initiated by the interviewer for the purpose of obtaining systematic descriptions, or explanations.” The semi-structured interview technique allows one to explore more deeply the perceptions and views of the participants (Cohen & Manion, 1994). As a skillful interviewer, Bell (1993:91) suggests that one needs to follow up ideas, probe responses and investigate motives and feelings of participants.

From the BETD graduates now teaching in schools I explored how they felt about the BETD program, whether it prepared them adequately for teaching of mathematics, and their views on the need for further mathematics training. I also asked them about their own career expectations. From the ACE graduate, I explored the benefits they reaped from completing an ACE program. Then I went on to explore the broader need for a complementary course with the UNAM lecturer. I further discussed how the complementary course could fit into the UNAM teacher education model. Lastly, with the College lecturers I analysed the issue of mathematics content in curricula. Other issues were also explored with the participants, such as factors that inspired them to take up teaching mathematics, challenges faced by mathematics teachers and issues of access to institutions of higher learning.

3.5.2 Document analysis

According to Gillham (2000:21), records are “things that go back in time but provide a useful longitudinal fix on the present situation”. I consulted a range of curriculum and syllabus documents: the BETD mathematics syllabus for grade 5-7; ACE (Mathematics) syllabus for Rhodes University and B. Ed degree mathematics syllabus for UNAM. These documents assisted me in establishing an initial sense of the mathematics content and potential gaps or shortfall in the BETD mathematics syllabus at Rundu College of Education.

3.6 PILOTING

Following the design of a draft interview schedule, I piloted the interview questions. The piloting was done using two BETD graduates. These were different from the BETD graduates participating in the main study. This was necessary to test and check the appropriateness of my questions before the actual case study. At this stage corrections and additions could still be made. Seidman (1998:32) points that researchers try out their proposals in a pilot venture by interviewing a small number of participants. Not unexpectedly some changes to the questions were made following the pilot.

3.7.1 VALIDITY

Validity refers to the accuracy or truthfulness of a measurement (Walonick, 1993). It addresses the question: ‘Can I believe the data and the findings?’ To reduce the threats to validity I employed the following strategies:

- I used interviews and document analysis for cross checking of claims.
- I recorded accurately by using electronic recordings.
- I made use of member checking, I took back the interview transcripts to participants for verification and validation.

3.7.2 MANAGING DATA

Managing the data efficiently was a vital element for the success of the research. According to Patton (2002:440) “data generated by qualitative methods are voluminous”. The data to be managed covered a number of curriculum and syllabus documents, eight interviews with tapes and transcriptions and research notes. Furthermore in the drafting of the thesis the many drafts of chapters and supervisor feedback texts needed to be managed.

The data collected from interviews was labelled with dates, places and interviewee in order to make retrieval manageable. These were all organised into file folders, index cards and computer files. Once my case record for each participant was sorted into a comprehensible package, I began the data analysis process.

3.8 DATA ANALYSIS

According to Merriam (2001:178), data analysis is a complex process that involves “moving back and forth between concrete bits of data and abstract concepts, between deductive and inductive reasoning, between description and interpretation”. This study involved the collection of data from interviews and documents. The data analysis was an on-going process throughout the entire study.

After each interview with my participants, I reread my field notes to help clarify my thoughts and prepared myself for the next interview. Each interview session was followed by immediate transcription and a preliminary analysis of the data. I then analysed the data by looking for similarities and differences, for groupings, patterns and specific items that spoke about mathematics content knowledge (or the lack thereof) and the need for further teaching education in mathematics. After identifying these themes I then used them to frame my narrative.

3.9 CONCLUSION

In this chapter, I outlined my research design. I discussed the rationale for the selection of the orientation, the sample and choice of research tools used to collect data. I also reported on my pilot, issues of validity and my approach to the management of the data and data analysis.

CHAPTER 4

DATA ANALYSIS AND DISCUSSION

4.1 INTRODUCTION

This chapter presents the data generated through semi-structured interviews and document analysis, the analysis of the data, the findings and a discussion of the findings.

The overall structuring of the analysis was guided by the imperatives of the research question, viz. ‘Is there a need for developing a complementary course in mathematics education at Rundu College of Education for teachers of mathematics in Namibia? The question had initially shaped the kind of information, the sources and categories of information to be collected and explored. The structure for data collection would also provide a broad framework for analysis of the evidence that would shape the answer to the question.

The detailed analysis of the data then consisted of first identifying patterns from the data and then collapsing them into categories. The approach was one where “most (of the) categories and patterns emerged from data, rather than being imposed on the data prior to data collection” (McMillan & Schumacher, 2001: 461) but at all times keeping in mind seeking to prioritise evidence relating the research question.

The framework for analysis is thus as follows:

- The profile of my participants and their institutions.
 - a) Teachers and their schools
 - b) Lecturers and College
 - c) Professor and University
- Factors which inspired my participants to teach mathematics.
 - a) Teachers
 - b) Lecturers

- General challenges encountered by teachers of mathematics in the teaching of mathematics.
 - a) Teachers
 - b) Lecturers
 - c) Professor
- The BETD mathematical content knowledge and pedagogy.
- Access into institutions of higher learning after the BETD.
 - a) Views of teachers
 - b) Views of college lecturers
- Role of professional development.
 - a) Participants' own views and experiences of professional development.
 - b) The role of professional development in mathematics education.
- The need for a complementary course in mathematics education.
- Document analysis of syllabuses:
 - o the BETD mathematics syllabus for grade 5-7, 2006;
 - o the Rhodes University ACE mathematics syllabus 2000- 2003;
 - o the UNAM B. Ed degree mathematics syllabus 2008;

4.2 THE PROFILE OF MY PARTICIPANTS AND THEIR INSTITUTIONS.

This section provides a profile and contextual analysis of the eight participants and their institutions I worked with in my study. Their educational profile and teaching experience is relevant to the study as they are being asked to report experiences with and express views and opinions on the mathematics content, relevance, quality etc of different elements of the curriculum, the training and development needs of mathematics teacher graduates from the BETD program. For the sake of confidentiality, anonymity and privacy, each participant is given a pseudonym.

a) Teachers and their schools

The first teacher is Jameson, a teacher at Katumwa Combined School. This is an urban school on the outskirts of Rundu town. It has no library. Jameson has taught for almost 11 years and is a holder of a B. Ed (Honours) degree, B. Tech degree, a

BETD diploma and a grade 12 certificate. In his BETD he specialised in mathematics while in the B. Ed (Honours) and B. Tech degree he specialised in management. He is a graduate of Rundu College of Education and Potchefstroom University respectively. While at the college he did the foundation block before the specialisation. He was a member of Ekondopeko Mathematics Project in Kavango region.

The second teacher is Gibson, a teacher at Muhinda Primary school. This is an urban school, situated in Rundu town. The school has a library and is well equipped with mathematical teaching media. This year is his 7th year of teaching at this school. He was a qualified BETD teacher until 2007 when he graduated with a Higher Education Diploma (H.E.D) specialising in mathematics education grade 11 to 12 with Institute for Open Learning. At the college he did the foundation block before the specialisation.

The third teacher is Kennedy at Dr Namakau Senior Secondary School. This is also an urban school, situated in Rundu town. He is a head of department for mathematics and integrated natural sciences. He obtained a National Education Certificate (NEC) in 1994; Diploma in Education 5-7 in 1998; MASTEP diploma in 2002, and completed his BETD in-service in 2006. In all these qualifications he specialised in mathematics education to enable him to teach from grades 5-12. Kennedy obtained his qualifications at the Rundu College of Education, the University of Port Elizabeth, University of Namibia and from the Rundu Teachers Resource Centre (RTRC) via the National Institution of Education Development (NIED).

The fourth teacher is Nzila at Tjangano Senior Secondary School. This is a semi-urban school on the outskirts of Rundu town. It has no library and is still under construction. Nzila has been teaching at this school for 3 years now. She has taught mathematics to grades 9 and 10 since 2006. She is a qualified mathematics teacher, a holder of a BETD diploma in 1998 from Rundu College of Education, and also an ACE Mathematics in 2002, and a B. Ed honours in 2005 from Rhodes University. At the College she did the foundation block before her specialisation. In all her qualifications she specialised in mathematics.

The fifth teacher is Mukanwa teaching at Mabengano Senior Secondary School. He is teaching mathematics from grades 8 to grade 10. He has taught mathematics at this school for two years now. He attended the BETD courses for a term at Rundu College of Education, before he was awarded a scholarship to study in Zimbabwe. He is a holder of a Diploma in Education from the University of Zimbabwe associate college, Belvedere Technical Teacher's College. He obtained his qualification in 2006, specialising in mathematics as a double major. He is a member of Ekondopeko Mathematics Project in Kavango region and enrolled with IOL specializing in mathematics.

b) College lecturers and their college

The first lecturer, Namasiku Sansuvu, started her primary education in exile and came back in Namibia in 1989. She obtained her H.E.D in mathematics and science at UNAM. She is also a holder of a B. Ed Honours degree and is currently studying for a master's degree in mathematics education. She first taught at her former mission school, Mufaya Mwemba Higher School before transferring to a government school, Kahundu Secondary School. She taught at this school for two years and was then promoted to head of department at Kamwaka combined school for three years. She transferred to another secondary school as head of department for two years before being appointed as a lecturer at Rundu College of Education in November, 2007. She has 9 years teaching experience at the school level. Currently she offers mathematics and science to the second year college students.

The second lecturer is Namuchana, a PhD holder from England. Her doctoral study was based on the use of language strategies to help in the teaching of mathematics to primary school teachers. She is a primary school teacher and joined Rundu College of education in January 2007. She teaches second years student's mathematics majoring and minoring in grades 5 to 7.

c) University Professor

This official is an associate Professor at the University of Namibia mathematics department and interested in teacher education as areas of research. He has taught for 30 years.

4.3 FACTORS WHICH INSPIRED THE PARTICIPANTS TO TEACH MATHEMATICS.

In any profession there are key elements that define what it means to be a professional, starting with the ethical pledge that members of professions often make to the welfare of all of their clients (Bransford, Darling-Hammond & LePage 2005:6). Teaching is no exception. The central part of being a professional teacher is a commitment to help all learners to succeed. Those who made such commitments to help learners succeed have demonstrated that it is indeed possible to do so, even in areas like mathematics where inequalities are longstanding. Choosing such a career is a challenging, exciting, and perhaps a threatening task for most today (Morales, 1994). Cotton (2001: 23) gives three typical reasons. Thus for some they choose to become mathematics teachers, “because they were inspired by their own teachers of mathematics, some because they enjoyed mathematics and wished to share their enjoyment with others, while some because they believed that education in general and mathematics education in particular is the only route through which we can create a more socially just society”.

The participants were asked what motivated them to become mathematics teachers. Below are some the extracts from the transcribed interviews.

a) Teachers

Jameson said he became a mathematics teacher because he wanted to contribute to the development of education in Namibia. As “...we inherited... a bad thing from the former colonial people who happened to occupy our country” (line, 22). Referring to the type of education that was present before independence. But another strong motivation factor was that he loved mathematics while a learner at school (line, 42). This encouraged him to take mathematics at the college level

were he become a good maths student in his first year - the Foundation Block. This paved the way for him to be selected for the mathematics specialisation option for grade 5 to 10 in his second year. Mathematics was easy for him and he decided to teach it to learners.

The second teacher, Gibson was also motivated by two main factors. Firstly he too was motivated by his mathematics teachers at school and when he graduated he wanted to also become a maths teacher but also he wanted to improve on his teachers teaching approaches and methodology (line, 377). Secondly he said “...all and all just after my grade 10. I did very well in mathematics and science” (line, 308). Thus for him an experience of success in mathematics and science motivated him to do mathematics and science at a higher level. His good examination results helped to pave his way to study mathematics and integrated sciences at the grades 11 and 12 as well as at tertiary levels (line, 310).

The third teacher Kennedy was inspired by two mathematics teachers. The first teacher was his grade 5 teacher in a small village (line, 553) whom he remembers saying in mathematics classes “...who is going to do ...and who is going to get that one right” (line, 555). This was the way his primary mathematics teacher checked, monitored, assessed, motivated and even developed conceptual understanding in his learners. His second mathematics teacher was a pastor and a mathematician at a secondary school. This teacher used encouragement and motivational words such as *keep it up* and *well done* that my participant still has the interest of the subject today (line, 559).

The fourth teacher Nzila had never thought of becoming a teacher in life (line, 741&747). However after failing to secure money and a bursary to study at UNAM she decided to go to a teachers’ college (line, 743). Financial constraints had primarily led her to the teaching profession. Although she felt that she had become a mathematics teacher because of the appeal and challenge: “... *mathematics is a ...a (more) challenging subject*” (line, 746). Teaching was not however her first priority.

The fifth teacher Mukanwa said he was firstly motivated and inspired by his foreign mathematics teachers' words "*remember in Namibia, you don't have...I mean quality mathematics teachers, we are helping you*" (line, 1083). These inspiration and motivational words encouraged him to become a mathematics teacher in Namibia (line, 1085). Now that most expatriates have returned back to their own countries, he is teaching mathematics replacing one of the many vacated positions left by them. His second motivation was that "*...because in my school I did science*" (line, 1040). This helped him to further his studies in mathematics and science related subjects.

b) College Lecturers

The first lecturer, Namasiku Sansuvu, said that initially her first priority was to become a medical doctor. She was however discouraged by the type of job doctors do and decided to rather become a teacher of mathematics. She stated that mathematics is a subject that many learners in Namibia "*struggle with*" (line, 1279). She reminisced how her classmates struggled in the mathematics class. This motivated her to teach mathematics in an understandable way to learners to help "*...her nation*" (line, 1281). The idea was to reduce high failure rates in mathematics at the grade 10 level, so that more learners can opt for mathematics at the senior secondary school grades 11 and 12 (line, 1285).

The second lecturer Namuchana is not a mathematician (line, 1413). She teaches mathematics, she says, because teaching is in her and she likes giving other people what she knows and tries to make it interesting for them to reach some conceptual understanding. She likes to help student teachers to help learners understand the mathematics they are doing (line, 1415).

The responses above revealed that my participants became mathematics teachers for a range of reasons. A frequent theme was to help build the community by improving learners' results so that these leaders of tomorrow are well educated. Some mentioned some intrinsic reasons, such as loving teaching and working with learners, as underlying their decisions for becoming teachers. Two females, one teacher and a lecturer said teaching was not their first choice of career. However, it is encouraging that despite the fact that teaching was not their first priority, they

now really like the profession and feel committed to assisting their communities as teachers.

4.4 GENERAL CHALLENGES ENCOUNTERED BY TEACHERS OF MATHEMATICS IN THE TEACHING OF MATHEMATICS.

Teachers serve as mediators between teaching materials and the learners and translate educational policies into classroom practices. In doing these, they motivate, encourage, guide, plan, assess learning, and even challenge tomorrow's leaders (Oyedeji, 1998). Teachers are one of the final mediators and shapers of curriculum as it is presented to students in the classroom. It is for this reason that what they do in their classrooms is of such great interest. Their perspectives on their readiness for the classroom, and their views and experiences of its challenges need to be included in any analysis of the curriculum for teacher training and development.

One of the areas of focus of the interviews was on the teachers' experiences and opinions on the challenges in teaching mathematics. The section below reports these findings.

a) Teachers

The first teacher Jameson said he received training on how to “*facilitate, lead and guide learners what to do, not to do for them*” (line, 63) in that way learners are at the centre of learning. They do activities individually or in groups. Any difficulties encountered during activities, the teacher serves as scaffolding for learners to reach conceptual understanding (line, 65). Although he learnt content and appropriate teaching methods, his problem is to inspire learners from grade 7 and grade 8 with poor mathematical background (line, 35). When these learners realise that in grade 11 there is a choice of subjects they develop a negative attitude towards mathematics perceiving it to be a difficult subject (line, 37).

Gibson, the upper primary teacher for grades 5-7 echoed similar sentiments that some learners still believe that mathematics is difficult. It is like “*we are escorting them to grade 10 for them to leave mathematics*” (line, 303; 402). This indicates that teachers at lower grades are familiar with negative feelings that learners have about mathematical experiences. Although there is a feeling among learners of mathematics being difficult he motivates and encourages them by telling them that mathematics is a subject like any other (line, 305). Alternatively, to ease learner’s burden, he uses different teaching strategies (line, 396). For example some of the activities given to learners are related to their daily life experiences (line, 370).

Kennedy echoed Jameson’s sentiments of learners having a poor mathematics background “*...you get a grade 8 learner still struggling with multiples*” (line, 544; 584; 691). This indicates that learners are not taught proper mathematics at the lower grades. He said the problem is not with the learners but with “*... teachers ...(who) were not prepared up to the level*” (line, 694). Due to this, he felt that the colleges select and recruit students not meeting the desired mathematical requirements.

Nzila concurs with the other three teachers above on issues of learners resisting the mathematics subject (line, 756). But she sees that as a motivator for her to think of how to convince learners to understand mathematics (line, 758). Her biggest challenges are mathematics topics like “*... negative numbers or imaginary numbers*” (line, 790). The interviewee felt that although she had enough subject content and teaching methods, she still found it a challenge to teach learners on topics that fall outside the learners’ experience, such as where the temperature doesn’t go below freezing point like in the Kavango region (line, 800). It does not happen in learner’s daily life although they are encouraged to watch television and listen to the Radio, see and hear about temperature changes in other parts of the country, and other countries. There still remains a real challenge to teach topics where the teacher cannot find concrete examples to give to learners (line, 802).

Mukanwa concurred with the sentiments of other four teachers that learners perceive mathematics as a very difficult subject (line, 1036). But, the most critical part is to change their minds that mathematics is an easy and enjoyable subject (line, 1037). It takes time to do that, he concluded.

b) Lecturers

Namisiku Sansuvu said her challenge is student teachers “...*not having adequate content*” knowledge (line, 1290; 1294). The student teachers, she said, spend more time on easy topics that are supposed to be covered in a week (line, 1292). They also struggle with questions on new teaching methodology (line, 1294), as they are not receptive to new teaching approaches. They still want, she said, to teach the way they were taught in schools (line, 1295). They even struggle with the mathematics covered at the school levels. But she admitted that “*I don’t know how far they went with their mathematics*” (line, 1307). The content covered in schools is lower than the content covered at college (1308). This makes it more difficult for them to cope up with college work.

Namuchana said the main challenge is that student teachers went through a system where understanding wasn’t emphasized as it was supposed to be (line, 1421). They like to take short cuts or use formulae. They do not mind if they don’t reach conceptual understanding as long they have used the right formula and got the calculation right (line, 1425). They are stuck to the way they were taught. She further said that they do not appreciate difficulties some of the learners find in understanding mathematics. For student teachers to appreciate difficulties learners encounter in learning of mathematics emphasis should be on understanding, which is crucial in learner-centred education.

c) The University Professor

The university professor mentioned the following as challenges. Firstly students’ background: most of the students have a C symbol (line, 1552). This makes it difficult for students to grasp concepts or build more concepts when being taught. Secondly is the language issue as a means of communication: some students

cannot communicate in English (1553). As he said unless they grasp English as means of communication they won't be able to understand and work out the mathematics question problems or respond positively to the questions asked (1555).

Three main issues emerge from the above interviews. The first is the issue of inadequate preparation for conceptual understanding from primary via secondary school to tertiary institutions. This impacts the mathematics competences of future teachers of mathematics. Most participants said that most student teachers lack adequate conceptual understanding of mathematics when they enter the colleges or higher education. If student teachers have difficulty in grasping what is taught, they won't be able to develop a deep understanding in their learners. Secondly, the participants highlighted the problem of learners entering a high grade with a very poor foundation in mathematics from the earlier grades. Thirdly, the participants highlighted, what they saw as a widespread perception among school going children that mathematics was especially difficult. This acted as an inhibitor to motivation and also encouraged learners to drop mathematics as soon as they could.

Clearly these issues need attention and action on a number of fronts. Thus for example: Weaknesses in the delivery of the mathematics curriculum through the grades was underlined by a number of participants. They indicated that foundations were not being properly laid in each grade and being built-up across educational levels. Namely that what is learnt at the lower primary level should served as prior knowledge for upper primary and junior secondary school and the ladder continues until the tertiary level. The further evidence from my participant responses is that they did not know what had been taught in the previous phase or grade underlines further a worrying lack of an integrated view of mathematics teaching across the grades. The shortcomings at lower primary phase are inevitably extended into junior secondary phase, the senior secondary phase, then tertiary education. As a result the achievements in mathematics particularly the content which is weak at primary school correlates with weaknesses at institutions of higher learning. There seems to be a vicious cycle.

Concerning the motivation of learners to study mathematics and their view that it is too difficult, the literature suggests one line of action that has been effective is when teachers introduce learners to expressive forms of writing such as journals stories and similar free forms of writing that bring realities into the classroom situations. This broadens the kind of learning experiences that learners encounter and open up mathematics to those who feel excluded by the over-emphasising abstract symbolism (Morgan, 2001). Research has shown that such types of expressive forms of writing in the mathematics classroom encourages learners to be creative and sceptical without being subjected to excessive assessment (Stempien & Borasi, 1985; Tobias, 1989; Powell & López, 1989).

In addition the literature indicates the role that the use of resources or teaching media of various kinds can play to assist learners to understand mathematical ideas and underlying principles of numerical calculations (Delaney, 2001:123) The emphasis should be more on practical activities. It is also argued that some topics in mathematics can be taught without visual, manipulative or concrete materials of some kind (Askew, 1998; Edwards, 1998; Thompson; 1999).

4.5 THE BETD MATHEMATICS CONTENT KNOWLEDGE AND PEDAGOGY.

There have been a number of news and other reports showing a concern among sections of the Namibian public over the performance of their schools, and also expressions of some dissatisfaction with the performance of colleges of education graduates (Nyambe, 2001; Philander, 2006; Sichombe, 2007; Clegg, 2007). The concern is in part about curricular content and methods of knowledge transfer to student teachers.

As this study seeks to cast more light on the specific matter of the mathematics curriculum of the Colleges, the participants were specifically asked to share their interpretation and perspectives of the BETD mathematics curriculum.

The participant's view on the mathematics curriculum of the colleges and its adequacy in preparing them for teaching is examined in the section below.

a) Teachers

Jameson who was in the second (1994) intake of the BETD program said that in his BETD studies they covered many topics such as quadratic equation, simultaneous equations, application to calculus, integration, vectors, matrices and complex numbers (line, 60).

He said *"I had the information, the whole content that I could use to teach learners or even learners in higher grades"* (line, 90). He stressed that the mathematics work covered in his BETD was not limited to grade the 10 school level. In his view the content taught at BETD is adequate for teaching in schools as the college lecturers, in his experience, teach beyond the BETD curriculum (line, 92; 98), even though the BETD curriculum only requires them to teach up to grade 10 levels.

He expressed some frustration with the public criticism of the mathematics teaching by BETD graduates and said that those who say so *"... be invited to see what's happening in the classroom situations..."* (lines, 108-113). He was of the view that if the public are not happy with the content covered at BETD, then the colleges of education should collaborate with other institutions or the University of Namibia to fix the problem (line, 108; 112; 117).

Mukanwa a student, who attended one term of the BETD program in 2003 and then left for Zimbabwe, said the content done at the BETD level is of lower standard (line, 1114). But the mathematics curriculum he covered in Zimbabwe was at a higher content level compared to what is done in Namibia (line, 1055). In his training in Zimbabwe he covered higher content materials on topics such as integration, differentiation and drawing the graph for polynomials which BETD grades 5 – 7 does not cover (line, 1249).

Gibson said that they covered little mathematical subject knowledge content at BETD. He argued that “...*the content (should not) has to based ... on the syllabi for grades 5-7*” as this content has already been covered by students teachers when they were at school (line, 346). He said he acquired more mathematical subject content when enrolled for HIGCSE with IOL (line, 330; 333). He was trained higher mathematical subject content on topics like common fractions and differentiation (line, 323).

Nzila intake of 1995 said “*We did not have much time to do more of the mathematics content*” in the BETD course (line, 822; 820 & 853). The content at the college covers “*grade 1 up to grade 10*”. She felt she needed more mathematics content after BETD so she enrolled for the ACE mathematics course with Rhodes University, and specialised in pure mathematics with a partial focus on methodology (line, 824-827; 864 & 874). This course paved the way for her to do a B. Ed honours degree which was based more on problem solving (line, 828). She further said the issue of inadequate content has its roots in the schools. Learners completing grade 12 now, had to do a bridging course before being admitted to the Bachelor of Science degree at UNAM (line, 933). She further said this has led some schools to introduce a Form 6 to cater for this deficiency in content knowledge in learners before they enrol at institutions of higher learning (line, 935).

Kennedy who was trained before independence through a NEC program at Rundu College of Education said “*the content covered was not detailed and not at a higher level*” (line, 598). He said he covered more content knowledge when he was enrolled with the University of Port Elizabeth and with UNAM (line, 601). The content covered at these two institutions led to his exemption on mathematical content knowledge when he enrolled for the BETD-insert program (line, 600).

b) College Lecturers

Namasiku Sansuvu said that when the students arrive at the College they do not have adequate content knowledge. Speaking of their content knowledge he said, “...*I can say it is low*” (line, 1304). They even struggle with mathematical knowledge content they covered when at school. In her view, the BETD curriculum is just like secondary school mathematics apart from a few aspects of calculus (line, 1306). Although the college curriculum is based on the school curriculum she acknowledged that lecturers teach extra content to prepare students to teach “*the subject at grade 11 and 12*” as some of our student teachers end up teaching these two grades after completing BETD (line, 1327). So while explaining that some BETD lecturers teach higher grade mathematics content she still feels it is not enough: “*We prepare them for that but it is not enough*” (line, 1332). She felt that the college graduates are more prepared on methodology (line, 1356), than in mathematics content. She said this had emerged from her own interviews with former BETD graduates from Rundu College of Education (line, 1361). They indicated that they lacked mathematical content knowledge when they left the college that’s why they went on to further their studies (line, 1364).

Namachana said what is notable is that there are gaps in the understanding of student teachers (line, 1447). The emphasis should be on filling up the gaps. She stressed that this was necessary so that student teachers can understand the mathematics they are teaching and engage learner’s in mathematics activities. She suggested that extra mathematical content be given to BETD grades 5 to 7 graduates who currently have only 7 periods of mathematics per week (line, 1488) while the grades 8 to 10 have 14 periods of mathematics per week. Extra time is needed so that they can adequately lay a solid foundation in both content and methodology (1490).

c) University Professor

The UNAM Official said that the “*BETD does not teach much content*” (1566; 1573; 1578) since the programs inception it has been, “*content second class and methodology first class*” (line, 1574). The emphasis he stressed is on the methodology rather than the content they are going to teach. He acknowledged

that recently there are some indications of some additional content being included into a BETD program but to a “*very minimal extent*” (line, 1578). This minimal content cannot enable one to be able to deliver the best mathematics content to learners (line, 1576). In his view, teachers should clearly know more than what they teach because learners sometimes ask teachers questions beyond what the teacher is teaching. If you then cannot respond because you do not know your content, you are in trouble, and you can lose respect from your learners (line, 1589).

The main issue that emerged from seven participants out of eight is that BETD mathematics curriculum is of lower standard and inadequacy to prepare students for the task ahead. As there is strong message of too little mathematics content knowledge covered in the BETD program. This was confirmed by some of the literature.

The literature reviewed earlier states that student teachers need both the subject content knowledge and teaching methods to be effective teachers. It stresses that teachers need subject matter competence to be able to pose the right questions to learners or to be able to respond to questions from learners and to use multiples approaches to solve problems. Good content knowledge is also essential for a teacher in order to detect errors or mistakes learners make and prepare to address the sources of errors in ways that result in learning.

4.6 ACCESS INTO INSTITUTIONS OF HIGHER LEARNING AFTER BETD.

Generally, secondary school education is regarded as a stepping-stone to socially and financially valued jobs and entry into universities. ‘Access’ is in fact one of the four guiding principles of the MBESC in Namibia and equitable access is even highlighted in the MHEVSTT in 1999. The black majority population in Namibia, who were denied tertiary education, now have access to institutions of higher learning. And most universities and colleges have opened their doors to educationally disadvantaged students to both those with necessary qualifications and those without sufficient papers qualifications to qualify directly for admission

(Nyambe, 1996; Namibia. MEC, 1993). The emphasis is to eliminate overt and less visible patterns of discrimination in higher education and to redress persisting consequences of societal inequalities.

The number of entrants to higher education has increased and the growth has been particularly rapid since independence. The number of students in first years at Rundu College of Education increased by 68.3 percent between 1993/1995 and by 50 percent between 1995/2008. This increase of BETD candidates into colleges also reflected more entrants from different educational backgrounds, featuring more female entrants and candidates from ethnic minorities.

The focus of this section is on exploring the experiences of participants in furthering their studies in mathematics.

a) Teachers Views.

Jameson completed his BETD in 1996. He wanted to further his studies after the BETD with UNAM (line, 1706). At the time there appeared to be some uncertainty how long one could need to study to complete a B. Ed degree at UNAM but then they were informed that the duration was 4 years to do a B. Ed degree (line, 1708). He waited hoping that UNAM might relax both the duration and entry requirements (line, 1709). This did not happen so in 1998 he decided to enrol with Technikon Pretoria (line, 1710) doing a course in leadership and management. This is how he changed his field of study from mathematics education to leadership and management (line, 1716). But he says that he is willing to further his studies in mathematics if an opportunity should arise (line, 1720).

Gibson a teacher at Muhinda Primary school of the 7th BETD intake obtained his BETD diploma in 2001. He enrolled with IOL in 2002. He argued that the UNAM B. Ed degree which requires 4 years (line, 1762), is too long to get a B. Ed. But by enrolling with IOL in their two year course (H.E.D) when complete and added to his 3 year BETD diploma, then when converted both qualification will be equivalent to a B. Ed undergraduate degree at UNAM (line, 1764, 1769).

Nzila is a holder of a BETD diploma in 1998, from Rundu College of Education. Her complaint is that UNAM does not exempt the BETD graduates for any time or courses and they have to spend the full 4 years to get a degree, the same as is required of a high school graduate with only a grade 12 (line, 979). This prompted her to further studies via an ACE mathematics, followed by a B. Ed honours degree with Rhodes University, in 2000 and 2005 respectively.

The fourth BETD holder is Kennedy of Dr Namakau Senior Secondary School. A holder of an NEC in 1999, a Diploma in Education in 1998, MASTEP in 2002 and lastly an In-service BETD diploma in 2006. He obtained these qualifications with Rundu College of Education, the University of Port Elizabeth, and the University of Namibia and from Rundu Teachers Resource Centre (RTRC) via the National Institution of Education Development (NIED). He is wondering with which institution to further his studies (line, 1661). UNAM offers a B. Ed degree for 4 years (line, 1674) which he feels is too long (line, 1687; 1694). He wants to further his studies with any institution that will recognise his earlier qualification and also meet the requirements of Namibia National Qualification Authority (NNQA) (line, 1662; 1675).

Mukanwa said he furthered his qualification with IOL Namibia because it is linked to South African Universities (line, 1810). In his view the education system there is more advanced than in Namibian (1826). He gave an example of his friend who is studying with Cape University after spending two years with UNAM in a Bachelor of Science but was told to start from scratch. He had opted for Higher Education Diploma (HED) with IOL via correspondence to avoid doing a 4 year B. Ed degree with UNAM. Because the two years of the HED when added to his diploma from Zimbabwe, according to Namibia National Qualification Framework (NNQAF), is equivalent to the B. Ed degree (line, 1833).

a) Views of lecturers on issues of access to UNAM by BETD mathematics graduates.

Namasiku Sansuvu said the problems affecting access to UNAM for BETD graduates lies with the policies that are in place. Policy makes it difficult for UNAM to accept BETD graduates. The BETD is not recognized as an entry qualification by UNAM. This may change after the current consultations to revise the BETD curriculum and teacher reform (line, 1380).

Namuchana argued for getting credit in the B. Ed degree for courses done at the BETD level. For example, she said that when majoring in grades 5 to 7, primary education in the BETD program (1479), the students at the College have done a lot of theory and practice in Education Theory and Practice (ETP). So if they then do a B. Ed in the Theory of Education at UNAM for primary school children they ought to be given credits for all the ETP work done at the college level (1484).

b) The Professor's views on issues of access to UNAM by BETD mathematics graduates.

Firstly, he is of the view that there is little mathematics content taught in the BETD (line, 1566). He argues that although “*some (more) content is being... included now*” but only to a very minimal extent (line, 1578). This is not sufficient mathematics required to exempt BTED mathematics graduates from the mathematics courses at the university (line, 1580). Secondly, the BETD program prepares lower primary, upper primary and junior secondary teachers, while UNAM prepares teachers for the senior secondary (line, 1596). And when they happen to enrol with UNAM, they should be prepared to move from their previous phase levels of study to the senior secondary level. This requires them to learn from scratch as it is a “*different ball game*” (1600). Thirdly, they are required to have a C symbol in matric mathematics, irrespective of whether they have BETD diploma or not, to be admitted into the faculty. He would actually prefer a B symbol; “*I think specifically B*” will be most welcome (line, 1551).

So, he argued, that for BETD mathematics graduates to gain access to the university these obstacles need to be addressed. He suggested ideas such as “*we give them what they call bridging courses*” but he felt that this involves extra expense and extra time to complete (1607). Or alternatively, he suggested exploring collaborative working between the colleges and the university to lift up the mathematics content of the BETD students (line, 1621).

The UNAM still maintains the requirement for a C symbol or better in their grade 12 mathematics as the entry requirement for mathematics graduates from colleges. It is also evident from the interviews that the BETD program admits students with lower symbols from grade 12 which in itself has consequences for subsequent admission to the university. With respect to exemptions of courses done at the colleges UNAM argues that the level or degree of mathematics content covered in the BETD does not match their courses so this makes it difficult for UNAM to exempt them from some of the mathematics courses it offers.

4.7 ROLE OF PROFESSIONAL DEVELOPMENT.

Teachers need both support and supervision throughout their careers. Mulkeen, Chapman, DeJaeghere & Leu (2007) say that it is naïve to assume that teachers can go through a pre-service program and then perform well for the remainder of their career without further professional development. They need further professional development with adequate training to meet the needs of teaching both at the primary and secondary levels. The study participants interviewed had this to say on their experiences with and the importance and benefits of professional development for mathematics teachers.

a) Participants own experiences with professional development

Jameson participated in professional development activities such as BETD inset workshops on how to tutor BETD-inset science teachers; he also attended a workshop on how to train learners on leadership and a workshop on training his fellow teachers in the marking of external examinations. (lines, 199-206).

Gibson said “*I only attended two workshops*” (line, 450). The first workshop was on development of the topic tasks and continuous assessment work sheets. The second workshop was on implementation of the new syllabi for grades 5 to 7. He said since these two workshops there have been no more organised workshops for upper primary mathematics teachers (line, 452).

Nzila associated professional development with cluster meetings (line, 909). In clusters they meet and discuss issues related to the teaching of mathematics, the syllabi and textbooks to be used that academic year (911). They also discuss how to mark external examinations and coach learners on how to tackle questions during tests and final examinations (line, 914).

Mukanwa said professional development is a simple key which will enable “*us to develop our knowledge...(and) to be updated*” with more current information (line, 1166). He associated professional development with the Ekondopeko Mathematics project he usually attends.

Namasiku Sansuvu said professional development consists of further courses apart from the workshops she attended at school (line, 1338). The workshops and further courses studied helped her with more content knowledge and skills to prepare student teachers to teach mathematics better (line, 1341).

Namuchana said “I suppose primarily the most important (experience of professional development) is my doctoral study, which was in the use of language strategies to help in the teaching of mathematics to primary school children” (line, 1437).

b) Participants views on professional development in mathematics education.

Jameson said professional development in mathematics is important because one gets more knowledge and new ideas. Education is “*...continuous...*” (lines, 210; 219; 224). There are always new changes coming in so you need to be updated through professional development. The new changes might be in the form of changes in the syllabus and new topics. He stressed that teachers need to embrace

new knowledge and changes on how to teach new topics. He further said that maybe there are discoveries about short cut ways on how to teach calculus and other methods on how to teach other topics (line, 224).

Gibson said that today the world is new; everything in it is changing on a daily basis. Teachers need to be developed, guided and informed about new changes, and also on how to teach mathematics so as to make learning easier for learners (line, 458).

Nzila echoed the other participant's sentiment that "*...the world is changing, every now and then*" (line, 919). Teachers need to be updated on the latest developments in teaching of mathematics so as to meet the needs of the people, the needs of the country, the needs of economy and international needs on education (line, 922).

Mukanwa said professional development helps teachers to prepare lessons and conduct remedial teaching (1174).

In summary, the participants related the concept of professional development with workshops, further studies or cluster meetings they attended. In their view professional development is of vital importance in a teacher's knowledge acquisition, developing their teaching skills and mostly to be kept up-to-date on current changes in the teaching and learning of mathematics.

4.8 THE NEED FOR A COMPLEMENTARY COURSE IN MATHEMATIC EDUCATION

The proposed complementary course being examined in this study is aimed at the practicing mathematics teachers needs to enhance aspects of their mathematics and teaching proficiency.

The participants have stated that they believe there is a need for enhanced mathematics training for BETD graduate teachers already working as teachers. In commenting on the nature of the enhanced mathematics they place a greater

emphasis on a need to enhance the mathematics content knowledge of the BETD graduate teachers rather than enhancing their methodology knowledge.

The participants' views on the issue of a complementary course are examined below.

a) Teachers

Jameson would like to see a complementary course more or less the same as the Ekondopeko Mathematics Project in the Kavango region, where teachers meet together to discuss how to tackle difficult and challenging topics (line, 242). The course would have more mathematical activities (line, 243) aimed at giving students more content on different mathematical topics (line, 251). The content knowledge gained in the course would enable teachers to be confident when answering learners' questions. Furthermore, the course would enable students to share their own experiences with others and between students and their lecturers (line, 254). He is willing to attend such a complementary course if enrolled (line, 263). He said there is a possibility of other teachers' attending because some still lack subject content knowledge and they need new content and other changes coming (line, 272).

Gibson suggested doing some feasibility studies before establishing such a course, by comparing mathematics content taught at institutions such as Rundu Vocational Training Centre, University of Namibia and the Polytechnic of Namibia with that of the College (line, 485). This will give a clear picture on what type of complementary course to implement. He is willing to attend such a course because "... *right now when we talk about Kavango as a whole we don't have enough mathematicians*" (line, 494). He felt that this course could also be of vital importance to help train mathematical experts in developing books and syllabi based on learners' different cultures (line, 497).

Kennedy said he would like to attend such a course and would like to see the course introduce teachers to teaching at a higher level (line, 678; 680) and that those who complete the course have an easier entry point at any university (line,

679). Because these teachers would be more skilled in mathematics (line, 703) a refresher course that focuses on the latest development in mathematics teaching (line, 704) should take place regularly. He further said the course would serve as a motivational factor to local teachers, principals and inspectors if enrolled at Rundu College of Education because it would then be local and nearby and thus it will be less costly (line, 711). He is willing to attend and foresees other teachers enrolling if it was rolled out.

Nzila would like to also see a complementary course that is focussed more on content knowledge for mathematics teachers who had not yet upgraded their qualifications in mathematics (line, 939). There are teachers in the field who really need this help (line, 992). The complementary course before it is rolled should be linked to one of the universities, at least in Namibia (line, 978), so that the students can then further their studies with that university without a problem so as to avoid the current situation where BETD graduates cannot gain access into UNAM. (line, 980). She will not attend such a course because she had now got enough from Rhodes University (line, 985). But she foresees a possibility of other teachers attending the course (line, 993).

Mukanwa wants to see a complimentary course that caters for both qualified and unqualified teachers like those offered by the Institute of Opening Learning (line, 1190). His preference is for a course based more on methodology (line, 1191; 1208), because *“different authors have got different opinions and views on how mathematics must be taught”* (line, 1210). The idea of such a course is for teachers to acquire new ideas on how to teach mathematics. He would also like to see the course linked to the Faculty of Education at any university to avoid *“...other contradictions by saying this one says (to) us...we were taught this, the other one says (to) us we were taught that...”* The idea would be to have a continuous curriculum. This would mean that when you have completed your course you can be given exemptions on most aspects covered in the course (line 1248) because it is a branch of that university. For example like in Zimbabwe teacher training colleges are associate branches of the University of Zimbabwe (line, 1239). If one completes the program at a teacher training college you can either study fulltime or part time and be awarded a degree (line, 1245). He is also

willing to attend and envisions other mathematics teachers attending to enrich their knowledge and develop the nation (line, 1222).

b) College Lecturers

Namasiku Sansuvu said the complementary course should consist of both content knowledge and teaching methodology. But a bigger portion should be allocated to the content while a smaller portion to the teaching methods (1359). The purpose is for upgrading not only their content knowledge but also their pedagogical knowledge (line, 1357).

While Namuchana said that because colleges train for different levels (grades 5 to 7 and grades 8 to 10) (line, 1513), then two B. Ed degrees should be offered one for grades 5 to 7 and other for grades 8 to 10 (line, 1514). She further suggested that “*What they need then is... (a) mathematics degree with more content*” not a B. Ed offered by UNAM (line, 1517). They need a bridging course that will pave the way to a B. Ed honours (line, 1539).

c) University Professor

He said the BETD mathematics graduates need a bridging course (line, 1606) -a course that can improve both their content and methodology (line, 1611; 1613). He said they deserve a B. Ed Basic Education or B. Ed Primary degree (line, 1612) - that would be best for them (line, 1613).

4.9 COMPARISON OF SYLLABUSES

An analysis of the mathematics syllabuses (See Table 4.9.1 below) of the BETD mathematics for grades 5-7 program (Namibia. Ministry of Education [ME], 2006), the earlier Rhodes ACE in Mathematics program (which was an upgrade program for in-service mathematics teachers with teaching diplomas such as the BETD) (Rhodes University, 2002: 5) and the UNAM B.ED (UNAM.CES, 2008: 119) in Mathematics confirms that there is a reasonably large gap in both level and areas of work covered between the current BETD mathematics syllabus and the UNAM syllabus, and to a lesser

extend the ACE curriculum. It also reveals the not surprising result that the ACE syllabus covers additional mathematics elements, some at a higher level than that covered in the BETD. The comparison below seems also to partially support the claim by the UNAM teaching staff interviewed in the study that the current BETD mathematics syllabus does not cover much of what is covered in the UNAM B. Ed Mathematics syllabus, or it covers it at a lower level and thus there is the difficulty of recognizing for credit to a UNAM degree the BETD courses taken.

Table 4. 9.1 Comparison of Mathematics topics covered by the BETD, the Rhodes ACE and UNAM B. Ed Mathematics courses

Level→	BETD Grades Syllabi College (Mathematics)	ACE (Mathematics Education, Secondary) Rhodes University	B.E degree (UNAM Mathematics)
Themes and Topic	Number concepts: Fractions, Decimals, Percentages, Measurement & Mensuration, Commercial arithmetic, Geometry, Algebra, Rate, ratio & Proportion Statistics, Transformation Geomet Trigonometry a) Define three trigonometrical ratio (Sine, Cosine and Tangent). b) Solve problems using the sine and cosine rules for any triangle c) Use the formula of area of a triangle = $\frac{1}{2} ab \sin C$ to solve problems. & Pythagorean theorem,	Mathematics Part I Algebraic Relationships, Algebraic Topics, Functions & their graphs, Differentiation I Mathematics Part II Trigonometry a) Functions and graphs b) Identities Differentiation II, Integration, Co-ordinate Geometry Geometries, Tesselations, Sequences and Series, Geometries, Permutations and Combination Classroom Research	Year 1 Mathematics IA Statistics IA Foundation Maths Year 2 Calculus I & II Analytic Geometry & Complex Numbers, Elementary linear Algebra Year 3 Real analytic I & II Linear Algebra I Year 4 Linear algebra II Statistics for Educato

Thus examination of the syllabuses of these three programs reveals the following:

1) Not surprisingly the ACE (Mathematics education) course has content not covered by the BETD course and some is covered at a higher level. It is not surprising given that the ACE is intended to upgrade mathematics content of teachers who had not previously done a mathematics degree but have a teacher's diploma such as the BETD.

2) The UNAM B. Ed degree in Mathematics also covers substantially more mathematics content than the BETD and the ACE in Mathematics. It includes a wider scope and greater coverage of the more theoretical aspects of mathematics one would expect from such a degree.

Thus for example Table 4.9.1 above indicates that number concepts in the BETD are not part of the ACE (Mathematics Education) course. But complex numbers are discussed at a B. Ed level. Algebra is taught in all programs. Trigonometry is only taught at BETD and ACE. At ACE, trigonometry constitutes functions and graphs and identities unlike at BETD where it involves only the three trigonometrical ratios (Sine, Cosine and Tangent).

3) The table also gives some support to the claim by the UNAM university staff that the current standard of the BETD mathematics curriculum or alternatively the subject matter covered is sufficiently different from its B. Ed degree in Mathematics. UNAM can thus not grant credits for work done in the BETD. However the level of mathematics of the ACE would clearly better equip students to then cope with the higher levels of mathematics in the B. Ed Mathematics degree.

The shortfalls in the BETD content when compared to the UNAM Mathematics degree appear (Table 4.9.1) to be in topics such as: differentiation I & II, integration, permutation and combination, absolute values to mention but few. It is clear that the ACE (Mathematics Education) was developed to expose students to a higher level of mathematics to alleviate the deficiency of little content in the BETD.

4.10 CONCLUSION

In this chapter I discussed the data collected from interviews and document analysis of the syllabuses. The data discussed from the interviews was based on the experiences and perceptions of my participants.

Participants identified a need for ongoing professional development in mathematics education that supports teachers throughout their careers. The participants more specifically said there was a need for a complementary course for mathematics teachers. This course would be desirable so as to enhance the teacher's teaching proficiency and thereby improve student mathematics performance in the schools. The BETD graduate teachers believed they and other BETD mathematics teachers would be highly motivated to attend such a course.

They also argued that the complementary mathematics course be one which is designed as part of an educational continuum that is linked to a university and which is recognized as enhancing admission options to further university programs. A number of participants had argued that the UNAM ought to recognize some of the coursework done by BETD graduates for admission purposes, but the university staff felt that there this was not appropriate at this stage, given the standard or coverage of the BETD mathematics curriculum when compared to that of the first year of the B. Ed in Mathematics. However the university staff also supported the idea of a bridging course as one of the actions to seek to address the access issue.

Examination of the syllabuses of the BETD mathematics course for grade 5 – 7, the Rhodes ACE in Mathematics and the UNAM B. Ed in Mathematics revealed the not surprising result that both the ACE and the B. Ed present more mathematics content and at a higher level than does the BETD. It also seems to support the argument by the UNAM teaching staff interviewed that the current

BETD mathematics syllabus does not cover much of what is covered in the UNAM B. Ed Mathematics syllabus or it covers it at a lower level. This reinforces the difficulty of recognizing a BETD course towards a UNAM degree. The analysis found that a course such as the ACE (Mathematics education) would be an appropriate bridging course to the B. Ed Mathematics degree.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS.

5.1 INTRODUCTION

This chapter documents the conclusion, recommendations and some limitations of the study. The framework of this chapter follows the pattern:

- Summary of findings
- Potential value of the study
- Limitations
- Conclusion implications and Recommendations
- A brief personal reflection about the research process
- Conclusion

5.2 SUMMARY OF FINDINGS

The design of the BETD program started in 1992 and rolled out in 1993 to replace NEC, NHEC and ECP pre-service programs. The BETD has been a major official strategy for educational development in post-apartheid Namibia. It emphasised a move from apartheid “elite-centred education” to “education for all” (Namibia. MEC, 1993). The BETD is currently the only program that produces teachers to teach at basic levels.

It becomes apparent in this study that BETD mathematics graduates find it difficult to teach meaningful mathematics at both primary and junior secondary levels. The content proficiency of these graduated teachers (and their learners) is poor.

This study also has revealed that some schools recruit BETD graduates outside their area of specialisation. This is despite the fact that only primary teachers with

well equipped mathematical knowledge are able to adequately explain mathematics to their learners.

From recent international surveys it is apparent that Namibian mathematics teachers and learners do not compete at regional and international levels with other countries.

This study however also established that despite their poor proficiency in mathematics content many BETD graduates have good skills and knowledge of teaching. The BETD program, with its main emphasis and focus on methodology equipped the graduates with good and appropriate teaching skills. It is a pity that the original intention of striking a balance between content knowledge and teaching methodology has not been met by the BETD program.

This study revealed that the many of the participants upgraded their qualifications. For example, the three former pre- service BETD graduates plus the researcher have furthered their studies within two years after BETD program. They have furthered their qualifications with institutions such as Institute Open Learning (IOL), Rhodes University or Technikon Pretoria other than UNAM after BETD. Of the three former pre-service BETD participants who had furthered their qualifications two furthered in mathematics education and one in leadership management respectively. The question now arises how many teachers in schools are teaching mathematics without furthering their qualifications in mathematics after completing their BETD? There are still many BETD mathematics graduates who have no access to institutions of higher learning to further their studies and upgrade their mathematics skills. The way the BETD program is structured at present is an incomplete stepping stone to becoming an effective mathematics teacher.

Not only does this study show that there is a need for a complementary course (such as the ACE) to upgrade the mathematics knowledge of BETD graduates, it also shows that such a qualification is needed for BETD graduates to gain access to tertiary institutions such as UNAM and other universities.

A further argument that strengthens the call for a complementary course is the general need in the country for skilled mathematics teachers. This course would not only address the needs of BETD graduates *per se*, but it would also provide mathematics upgrading for other teachers.

There is a shortage of mathematics teachers. Of the 329 schools in Kavango (313 are primary schools; 13 are senior secondary schools with only 1 junior secondary school) many do not have suitably qualified mathematics teachers. In order for Namibia to compete on a regional and international level it needs to equip these schools with qualified mathematics teachers.

This study shows that all the stakeholders and the Namibia public are concerned about the high failure rate in school mathematics both at primary and secondary level. For the Namibian mathematics teachers to stay competitive in the global society they need an in-service educational development and training development program that is dedicated to raising the quality of education and the teacher change (O' Sullivan, 2003; Craig et al., 1998) – hence the need for a complementary course in mathematics education.

The introduction of a complementary course to the BETD is a viable solution to the deficiencies that exist in Mathematics education in Namibia. It should form part of a continuous professional development strategy that will improve mathematics teacher's qualifications and pave a way for them to further their studies with any institution of higher learning. In this way it would raise the proficiency levels of mathematics teachers to bring about necessary fundamental changes in Namibian classrooms.

5.3 POTENTIAL VALUE OF THE STUDY

One of the most important attributes which makes this study unique and significant is its precedence as one of the first research initiatives to systematically and critically study and investigate the post-independence BETD within a framework of developing a complementary course to the BETD for mathematics teachers in Namibia.

More importantly, the study was conducted at a crucial time when the BETD is under national review within a broader consultancy for teacher education reform. The study may thus be seen as a significant response to the call for teacher education research initiatives that benefit various parties which include Teacher Training Colleges, former BETD mathematics graduates, practicing mathematics teachers, policy makers, National Institute for Educational Development (NIED), the Namibian public at large, and other institutions of higher learning in education.

The study also contributes to relevant theory and practice in Namibia teacher education and teaching as it focuses on content knowledge and teaching methodology in the area of mathematics.

5. 4 LIMITATION OF THE STUDY

This research is small in scope since it is a half thesis in Mathematics Education study. Consequently it has some limitations that need to be highlighted:

- Because of the small size of the sample and purposive sampling procedure, I cannot make any general inferences.
- As stated, already there are both in- service and pre-service programs to the BETD. This study was delimited to the pre-service program at Rundu College of Education only. I have chosen this college as my research site because of my personal involvement at the college as a lecturer for mathematics. Furthermore it was chosen due its easy accessibility, taking into account the financial and geographical constrains involved in the study regarding travelling and accommodation.
- All the interviewees had heavy workloads and it was thus difficult at times to conduct interviews according to my negotiated schedule. This sometimes resulted in rushed interviews.
- I used only two research tools for triangulations to cross-check the data. Because some of my participants were not articulate in English,

it would have been better if I used questionnaires as some participants would have preferred responding in writing as opposed to talking.

- Due to time constraints, I was not able to ask all my questions and hence I was not able to explore issues to their fullest extent.

5.5 AREA FOR FUTURE STUDIES

Being small-scale, this research does not allow for much generalisation, but creates the opportunities and direction for further research on a larger-scale. The possibilities for further research that becomes evident in this study is to investigate the proficiency of teaching of mathematics at lower primary level. I feel it crucial as it would further illuminate the issue of a lack of conceptual understanding among learners and teachers. It would also be beneficial to undertake research to establish the impact of deployment of BETD graduates in schools.

5.6 CONCLUSION IMPLICATIONS AND RECOMMENDATIONS

From research findings reported in this study, several conclusions were reached. One of the main conclusions is that the BETD program has been compromised due its lack of focus on content mathematical knowledge. This has led to inadequate training in content of mathematics teachers. The problem is further compounded by a lack of adequate professional assistance or support after the BETD training. All of this has led to poorly qualified teachers. This study also points to a lack of commitment and cooperation by colleges with institutions of higher learning. I therefore recommend that:

- Colleges need to explore joint ventures with institutions of higher learning to address the issue of lack of mathematical content in the BETD.
- The Ministry of Education via the Advisory Council for Teacher Education and Training (ACTET) in collaboration with NIED pitch mathematical content of the BETD at a higher level than at present – possibly to the first year university degree level.

- The Ministry of Education, in collaboration with Namibia National Qualification Authority (NNQA), starts evaluating BETD programs with a view to recognising them as entry qualifications into UNAM.
- The Ministry of Education, in collaboration with any university, to roll out a complementary course that will specifically address the lack of mathematics content knowledge of BETD graduates.
- The Ministry of Education ensure that any educational qualification rolled out by the Colleges of Education and UNAM articulate with each other.
- The Faculty of Education at University of Namibia should devise mechanism to recognise BETD qualifications and give credit to experience and prior knowledge.

5.7 A BRIEF PERSONAL REFLECTION ABOUT THE RESEARCH PROCESS.

I have learnt a number of things in doing this research. I have learnt that mathematics teachers need continuous professional development after completing their studies, so that they are informed and updated with current information on teaching and learning of mathematics. The research process helped me to become a more skilful researcher after proposing a research topic; selecting the participants and probing them on their future plans and preferences about the needs, feasibility and character of a possible complementary course in mathematics after BETD. The reviewing and selecting of suitable literature and documents for analysis pertaining to the research topic, as well as selecting an appropriate interpretive paradigm or orientation to allocate the study and also choosing the right methodology for the purpose of triangulation have, altogether, empowered me to become an aspiring researcher.

This study has acquainted me with pressing issues and challenges surrounding the implementation of the BETD program at Colleges of Education especially in the field of mathematics education pertaining to past issues, current issues and on the way forward. I have learnt that professional development provides a deeper understanding of how teachers and learners can perform better in mathematics.

5.8 CONCLUSION

This qualitative study was situated in the interpretive paradigm or orientation. The two research tools used in this study, namely, semi-structured interviews, and document analysis, helped to conduct a needs analysis for the implementation of a complementary course to the BETD in mathematics education for teachers of mathematics in Namibia. The conclusion is that there is a need for such a course. As the existing BETD curriculum is saturated, the complementary course (similar to an ACE course) will assist in providing mathematical content knowledge to existing teachers with a BETD qualification. It will also inspire a critical re-look at the current BETD curriculum.

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Appendix 1

Interviews questions to the teachers

1. Tell me about yourself? Where do you teach? What do you teach?
2. Why did you choose teaching as a professional?
3. Do you enjoy being a mathematics teacher? Elaborate?
4. Describe some of the challenges that face you, as a mathematics teacher?
5. How did you come to be a mathematics teacher?
6. Where did you train as a mathematics teacher?
7. Tell me a little more about your training?
8. Describe the mathematics content that you were taught in your training?
9. In your opinion, were you taught sufficient mathematics content? Elaborate?
10. In your own opinion, how much 'more' mathematics should be taught at the college?
11. If I told you in my opinion, not enough mathematics content is taught at BETD level. Would you agree or disagree with me? Elaborate?
12. If you agree that there is not enough mathematics content in the BETD, how can this be rectified?
13.
 - i) What is the difference between Learner centred and Teacher centred?
 - ii) Which one do you find appropriate in the teaching of mathematics? Why?
 - iii) What teaching strategies do you use when teaching mathematics?
14. Describe some of the activities that you develop for the learners to sense the importance of mathematics?
15. Is the mathematics you were taught the same mathematics you are teaching now?
16. What assistance do you get from the Advisory Teacher/s, HOD, Principal, Inspector and the circuit based centre?
17. a
 - i) Describe some of the professional development activities that you participated in?
 - ii) Do you think professional development is important in the teaching of mathematics? Motivate your reasons?
 - iii) Do you think that within your teaching practice of mathematics, more professional development is required? Why do you say so?
18. What kind of in-service professional development courses for mathematics teachers would like to see?
19. If you were in charge of all the mathematics teaching at Rundu College of Education, what would you do?
20. If Rundu College of Education started a course to upgrade mathematics content and pedagogy, would you attend it? Would other mathematics teachers also attend this upgrading mathematics content and pedagogy? Why? Would other mathematics teachers also attend?

Stimulated recall interviews questions

21. What were the requirements for BETD program when you were enrolled?
22. Do you think you were well equipped with the teaching content and methodology during BETD? Elaborate
23. What courses did you do after BETD program?
24. What were the requirements for these courses?
25. What hindered you from furthering your studies with the University of Namibia after completing BETD?
26. What do are reasons for learners not been innumerate?
27. What should be done to help learners to be numerate?

Appendix 2

Interviews questions to lecturers

1. Tell me about yourself? Where do you teach? What do you teach?
2. Why did you choose teaching as a profession? Elaborate?
3. Why did you choose to teach mathematics? Elaborate?
4. Describe some challenges that face you as a lecturer for mathematics?
5. Do you think that the mathematics you teach is the BETD is sufficient to equip your students to be proficient teachers of mathematics? Elaborate?
6. Is there a gap between the mathematics being taught at BETD and the mathematics required for a classroom teaching today? Elaborate?
7. Do you think there is a need for additional mathematics for the practicing BETD mathematics teachers? Elaborate?
8. What do you think are reasons for BETD mathematics graduates not give credits in mathematics content when they wish to enroll for a B. Ed degree at UNAM?
9. What should be done to current BETD graduates to assist them in gaining access to the Faculty of Education at UNAM?
10. Describe some of the professional development activities that you have participated in?
11. What kind of in-service professional development courses for BETD mathematics graduates teachers would you like to see? Elaborate?
12. Is there a need for professional development in mathematics content and pedagogy after BETD?
13. Which is more content or methodology at BETD? Elaborate?
14. How could colleges of education and other institutions of higher learning collaborate in addressing the issue of mathematics content in the BETD? What is the solution?

Appendix 3

Interviews questions to UNAM Official

1. Tell me about yourself? Where do you teach? What do you teach at which level?
2. Why did you choose teaching as profession? Elaborate
3. Why did you choose to teach mathematics? Elaborate
4. Describe some challenges that face you as a lecturer for mathematics?
5. What do you think are the reasons for BETD mathematics graduates not given credits in mathematics when they wish to enrol for a B. Ed degree at UNAM?
6. What are your comments about the BETD mathematics course? Please elaborate specifically on the mathematics content of that course?
7. How much content do you think should be taught at BETD?
8. In what way should this content be taught?
9. What should be done to current BETD graduates to assist them in gaining access to the Faculty of Education at UNAM?
10. Do you think that a bridging course in mathematics content for BETD graduate would be useful? Please elaborate
11. Is there a need for such a course
12. How would UNAM and Colleges of Education collaborate in addressing the issue of mathematics content in the BETD?
13. What is the solution?

Appendix 4

LETTER TO TEACHERS/LECTURERS

P. O. Box 1575
Rundu
April 2008

To: Mr/Mrs/Dr/Prof
Institution
Rundu

Permission to interview you

I am a part time student with Rhodes University, Grahamstown, in the Republic of South Africa, (Student number: 600I0001). I am enrolled for a Master of Education Degree (Mathematics Education). I am required to carry out a research. The research involves interviewing and documenting teachers reaps from courses they have attended.

The purposed of this letter is to request for your permission to interview you and you are assured of anonymity in the final research report, and the transcript shall be returned to you to proofread, edit and make some final comments.

I have attached a consent form that you should sign if you grant me permission. Should you have any questions or concerns about this request, contact me at cell: 08129966463/Tel at work 265300/265336Tel at home: 256024

If you grant me permission, please sign the attached consent form

Yours in Education

Mr Alex .M. Ilukena.

Appendix 5

LETTER TO PRINCIPALS /RECTOR

P. O. Box 1575
Rundu
April 2008

To: The principal/Rector
Institution
Rundu

Request for a research site

I am a part time student with Rhodes University, Grahamstown, in the Republic of South Africa, (Student number: 600I0001). I am enrolled for a Master of Education Degree (Mathematics Education). I am required to carry out a research. The research involves interviewing and documenting teachers reaps from courses they attended.

I have conducted Mr/Ms/ Dr/ Prof..... and she/he allowed me interview her/him. The institution/school and Mr/Ms/ Dr/ Prof are assured of anonymity in the final research report, and the transcript shall be returned to him to proofread, edit and make some final comments.

The purpose of this letter is to request your permission to allow me to interview the teacher mentioned. Should you have any questions or concerns about this request, contact me at cell: 08129966463/Tel at work 265300/Tel at home: 256024

I would be most grateful if you grant me permission.

Yours in Education

Mr Alex .M. Ilukena.

Appendix 6

CONSENT FORM

Mr Alex .M. Ilukena is hereby granted permission to interview me and thereafter, a stimulated recall interview will be conducted. I am aware that the interview will be recorded, and that transcripts will be made of the interview and that extracts from these may be used in the final report. I have also been assured of anonymity and that of the school.

Signed_____ Date_____

