

*A Needs Analysis for the Implementation of a Complementary
Course in Mathematics Education for Teachers of Mathematics
in Namibia:
A Case Study of the BETD Graduates*

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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 focused specifically on mathematics subject content knowledge and pedagogical content knowledge in the BETD.

This paper reports on a study which investigated the need for a complementary course for mathematics teachers to address the perceived lack of mathematical content and pedagogical knowledge in the Namibian BETD. The study involved five mathematics school teachers, two former 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. And the data was collected by means of two methods namely documents analysis and semi-structured interviews. These methods complemented each other and also provided a degree of cross checking of claims.

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' views. The perceptions and experiences of the selected educators, and information obtained from analyzed documents such as syllabi and course outlines were the main source of data. The findings indicate that despite the training that the four BETD mathematics graduates in this study received, the level of mathematics taught in a complementary course, such as an Advanced Certificate in Education (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.

Introduction

This research reports on a bigger study that conducted 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 such 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 bigger study attempts to explore and illuminate if such a perception is justified and why there is such concern around this issue after 19 years of BETD implementation.

Context of the 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 Bantu Education system segregated people along racial lines whereby Black people received an inferior education, to their White counterparts. It did not embrace the current philosophy of "education for all" [ME], 1993, p.:75). The Namibian government recognized that in order to strengthen mathematics teacher education to meet the national needs for mathematics teachers, three teacher-training programs were to be introduced:

- The Basic Education Teacher Diploma (BETD). This program prepared 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 former Namibian 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, 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.

The student teachers at the four merged colleges of education with the faculty of education at the University of Namibia followed a three-year BETD to be phased out by the end of the year 2012. Candidates were required to follow common foundation studies in their first year and in the third term of their first year, if mathematics or physical science

is chosen; this made 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” (MEC, 1994). Although the documents make this statement, there is a common perception that the in-depth contents of teachers who graduate with BETD do not go beyond grades 5-7. As mathematics education lecturers this is of particular concern to us. This study attempts to investigate whether a feasible solution would have been to introduce a complementary course to address this perceived shortage of content knowledge in mathematics.

Our interest in doing an in-depth analysis into the needs of such a program was triggered by seeing many former BETD graduates not being admitted into the Faculty of Education at the University of Namibia for a bachelor’s degree. One of the researchers, a former BETD and ACE (MathsEd) graduate and a former mathematics lecturer at Rundu College of Education (now University of Namibia: Rundu Campus), observed with concern that mathematics student teachers at former Colleges were taught little mathematics content knowledge. In addition, their exposure to effective teaching methods was inadequate. Thirdly, research carried out by the Southern and Eastern Africa Consortium for Monitoring Education Quality (SACMEQ) in 2000 covering fifteen countries also inspired this study. The research revealed that Namibian learners and their teachers performed poorly in mathematics. As such this study is concerned about the content proficiency of mathematics teachers which was perceived to be poor. Arguably, this was perceived to have adverse impact on the teaching of mathematics and the achievement of learners.

Significance of the study

Although the Basic Education Teacher Diploma Program in Namibia with its emphasis on the learner-centered 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 former Colleges of Education.

This research could thus benefit the four former colleges of education, former BETD graduates and current BETD students, policy makers at National Institute for Educational Development (NIED), the Namibian public at large, and other institutions of higher learning in education. Further it will add value to the successful outcomes in mathematics teaching in Namibia.

Question of the study

The needs analysis focused specifically on the former Rundu College of Education and asked the specific question: Is there a need for developing a complementary course in mathematics education at the former Rundu College of Education for teachers of mathematics in Namibia?

Literature Review

Research carried out in 2000 by the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) in fifteen countries found that Namibian learners and their teachers performed poorly both in reading and in mathematics (Ministry of Basic Education Sports & Culture [MBESC], 2004). The report states, "...in mathematics Namibian learners were bottom. The Namibian teachers were second from the bottom beating only Zanzibar" MBESC, 2004:146".

The Mathematics and Science Teachers Extension Program MASTEP, 2002) and Presidential Commission on Education, Culture and Training 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 learner's prompts the question, what might be the causes? Questions could be leveled at many factors that affect mathematics education in Namibia. Is the mathematics curriculum at fault, is the teacher training of mathematics teachers inadequate, is the infrastructure and support inadequate? This study specifically looked at teacher knowledge and questions the role that the BETD played in the training of mathematics teachers. An effective way of looking at teacher proficiency is through a framework developed by Kilpatrick and his colleagues in 2001 in the United States of America.

According to Kilpatrick, Swafford & Findel (2001) the notion of mathematics proficiency provides a way to think about mathematics learning that encompasses key features of knowing and doing mathematics. Kilpatrick's et al., (2001: 116) framework suggests five interwoven strands of mathematical proficiency:

- *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.

These strands articulate well with what is meant by proficiency in terms of knowledge, skills, abilities and beliefs in and about mathematics. The strands are intertwined and inter-connected. The first two strands are what schools have traditionally emphasized, with many schools only aiming towards procedural fluency.

What we see in most Namibian mathematics classes however, is learners being drilled through steps and procedures that lead to correct solutions without understanding. We need to adopt methodologies and strategies that embrace a more comprehensive approach to teaching mathematics and not simply focus on an exclusively procedural teaching approach. We need to teach proficiently in order to offer opportunities for “wonder and wondering” (Wigley 1992, as cited in Winter, 2001: 209). Kilpatrick et al. (2001) argues for methods that are fluent and flexibly. Against this backdrop this study therefore set out to explore whether, in the context of the former Rundu College of Education, a complementary mathematics education course to enhance the BETD was desirable.

Teacher Training in Namibia

The teacher training in Namibia has undergone major restructuring and transformation since the recommendation 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 in Khorixas, Döbra near Windhoek, Okakarara in Hereroland, Rundu in Kavango, Ongwediva in Ovamboland and Caprivi in Katima Mulilo. These were virtually secondary schools with a teacher training wing (Nujoma, 1991 in Ilukena, 2008:14). The courses that were offered at these campuses were, Lower Primary Teacher Certificate (LPTC) and Primary Teacher Certificate (PTC). Until 1976 (Cohen, 1994) blacks were then trained for the first time in Junior Secondary Teacher Certificate (JSTC). The entry requirement for the LPTC was standard 6, for the PTC it was standard 8 and for the JSTC a candidate was supposed to have a Senior Certificate. These courses were all offered on two year full-time basis only.

In keeping with apartheid policy, two teacher training colleges were established in 1982. The Khomasdal Teacher Training College for the coloureds, Rehoboth Basters and Namas and Windhoek Teacher Training College for whites only (Beukes, Visagie & Kasanda, 2005 in Ilukena, 2008). Before this, Coloureds and White teachers were trained in South African Colleges and Universities. The Coloured trainees entering the three year LPTC required a standard 8, and for PTC a standard 10, while the Secondary Teachers Certificate (STC) offered only at universities required a matriculation exemption. Whites were 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). These requirements were in fact a barrier to black students to deny them access to the qualification since most of them could not get a Senior Certificate.

For the South African government to provide access to higher institutions, the multi-racial Academy for Tertiary Education was established in 1980 in Windhoek and introduced a teacher training program for the first time in 1988 through distance education. This was done through the College for Out of School Training (COST) in Windhoek which had strictly limited space for black students. No loans or scholarships were offered to black students and there was lack of facilities and staffs. This was yet another deliberate strategy to keep the Namibians majority out of tertiary education.

After the abolishment of LPTC, PTC and JSTC, a new program was introduced, namely the Education Certificate Primary (ECP). This two year course required students to take half the matriculation subjects and half of the professional courses (Chaka, 1997; Nyambe, 1996; Mayumbelo, 1996 in Ilukena, 2008:14). Towards the end of South African occupation, two courses were introduced that replaced ECP in 1991 namely the National Education Certificate (NEC) and National Higher Education Certificate (NHEC). The NEC was a three year program that trained primary school teachers while NHEC a two year program that trained junior secondary teachers. The entry requirement for NEC was standard 8. Both programs were subsequently phased out with implementation of the Basic Education Teacher Diploma [BETD].

These changes showed how education in South West Africa (Namibia) was segregated and controlled by those in power. The 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 comparison to their white counterparts. As Ellis (1984:36) pointed out, three-quarters of Namibian teachers had too little education themselves to provide high quality teaching. This led to a situation at independence whereby it was "hard to find a country anywhere in which education (and teacher) standards were lowered for the majority of the population" (Chamberlain, 1990:12).

The new teacher training program (BETD) that phased out NEC and NHEC at post – independence in 1990 was aimed at, as stated in the BETD Broad Curriculum:

developing 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.[MHEVTS], 1998:4).

The curriculum document served to move the teachers and learners from passive roles 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 others' teaching and learning (Howard, 1995: 19).

Furthermore Swarts (1999:6) argues that the BETD program does not necessarily focus on content alone, but also on the professional development of the student-teacher. As a teacher training program content is not taught or acquired for the sake of content, but is utilized as the basis for teaching and acquisition of appropriate methodologies as it strikes a balance between professional insight, skills and subject knowledge rather than emphasizing one to the detriment of the other. Therefore 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 the teaching profession (MHEVTST, 1998).

Research Methodology

The data for the study was collected from the former Rundu College of Education. The study was located in the interpretive paradigm and a case study method was used because it gives an opportunity for one aspect of a problem to be studied in some depth within a limited time scale (Bell, 1993:8). The sample population consisted of five teachers from different schools in the Kavango Region, two former lecturers from the former Rundu College in northern Namibia and an official from the University of Namibia (UNAM). All eight participants were teaching mathematics at various Namibian educational levels.

The data were collected through document analysis and semi-structured interviews. For this study a range of curriculum and syllabus documents we consulted such as the BETD mathematics syllabi for both grade 5-7 and 8 – 10 phases; ACE (Mathematics) syllabus for Rhodes University and B. Ed degree mathematics syllabus for UNAM. These documents assisted in establishing an initial sense of the mathematics content and potential gaps or shortfall in the BETD mathematics syllabus at the former Rundu College of Education. Furthermore, interview guide was the mostly used research tool. The semi-structured interview technique allows one to explore more deeply the perceptions and views of the participants (Cohen & Manion, 1994).

Firstly, interview questions were piloted following the design of a draft interview schedule. The piloting was done using two BETD graduates. These graduates were different from those who participated in the main study. This was necessary to test and check the appropriateness of the questions before the actual case study. Secondly from the four BETD graduates in the study, we 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. They were also asked about their own career expectations. From the ACE graduate, we explored the benefits they reaped from completing an ACE program. Then we went on to explore the broader need for a complementary course with the UNAM lecturer. We further discussed how the complementary course could fit into the UNAM teacher education model. Lastly, with the former College lecturers we analysed

the issue of mathematics content in the 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. 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 we included questions to those being interviewed to seek verification of some of the data. This added credibility to the study.

Furthermore, after each interview with the participants, we re-read the field notes to help clarify our thoughts in preparation for the next interview. Each interview session was followed by immediate transcription and a preliminary analysis of the data. We 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.

Results and Discussion

The findings from the National Institute of Educational Development [NIED] shows that student-teachers display a mixed grasp of content. Due to a lack of subject content, some teachers even tended to end lessons 15 minutes before the end of the allocated 35 or 40 minutes (MEC, 1997;[MHETE], 2000;[Mo], 2005).While according to the document analysis, in the following programs; the BETD, B. Ed and ACE also suggest that there is a large discrepancy in both mathematical content and pedagogical content between the current BETD mathematics syllabus and the UNAM mathematics syllabus, and to a lesser extent the ACE (Mathematics Education) Curriculum from Rhodes University. The University of Namibia B. Ed program in mathematics covers substantially more mathematics content than the BETD and the ACE of Rhodes University. It includes a wider scope and greater coverage of the more theoretical aspects of mathematics that one would expect from such course. The ACE syllabus covers additional mathematics elements, at higher level than that covered in the BETD course. This is not surprising as 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. Furthermore, the level of mathematics of the ACE equipped student teachers to cope with the higher levels of mathematics in the B. Ed mathematics degree.

It also emerged from four (4) out of five (5) participants (teachers) in the research that the BETD mathematics curriculum was of low standard and inadequate to prepare students for the task ahead. The sub minimal mathematics content in the BETD made the three preset graduates to enroll for further studies after BETD. The two pre-sets students enrolled for studies with Rhodes University and Institute of Open Learning (IOL) in Namibia for an ACE mathematics course respectively that specialized in more mathematics content

with a partial focus on methodology, while third pre-set graduates studies enrolled with, a Technician Pretoria in leadership management.

The particular in-set BETD graduate did not further his studies due to lack of an institution that was willing to recognize his prior knowledge in mathematics. While a graduate from Zimbabwean Teacher Training College in 2006 opted to further his studies with IOL. The ACE mathematics course paved a way for one of the BETD graduates to do her Bachelor of Education (Honors) degrees in mathematics as an elective. It is evident that the majority of the teachers in the research opted to further their studies with other institutions rather than the University of Namibia after completing their diplomas in mathematics. They opted for these institutions other than UNAM as it could not recognize their qualifications due to its initial entry admission required of 1992 of a C - symbol or better in mathematics at grade 12 levels. This sentiment was echoed by a UNAM mathematics lecturer that a candidate is expected to have a minimum of C or preferred a B symbol at grade 12, irrespective of whether a person had a BETD diploma or not to be admitted into the Faculty of Education.

Furthermore, the inadequacy in content knowledge in student- teachers was acknowledged by the two former college mathematics lecturers in the research. They said that student teachers struggle with mathematics content covered at secondary level in school. They found it difficult to grasp concepts or build more new concepts due to a poor, proper, strong foundation and background in mathematics at both primary and secondary level. The researchers contend that the teacher training programs cannot be equivalent to the school curriculum. Teachers should not be trained for upper primary mathematics (grade 5-7) and junior secondary level (grade 8-10) using the school curriculum. Because should there be any change in content in the grade 5-10 mathematics curriculum, the BETD graduates will probably find themselves, with insufficient content in mathematics to prepare their learners. In addition, the UNAM official concurred with four teachers and the two former college's lecturers, that the BETD program did not teach much content. Since its inception, it has been "content second class and methodology first class." However, he acknowledged that recently there has been some additional content included but minimal. This minimal content cannot enable one to be able to deliver the best mathematics content to learners.

This is grossly inadequate for the job ahead, as the teacher ought to know more than his/her learners to teach mathematical content knowledge confidently.

From the data above it is evident that there is agreement amongst the participants that there is a need to raise the levels of mathematics content and pedagogic knowledge in mathematics teachers in Namibia. Apart from restructuring the BETD in its entirety, one of the viable solutions to the problem of insufficient subject and pedagogic content knowledge and the lack of exposure to alternative mathematics pedagogies is to develop and offer a complementary course to the BETD 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. The purposes of this continued professional development course 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 would focus on related subject content and pedagogy areas;
- b) encourage the participants to read around 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. It would enable aspiring teachers to register for the .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; and
- 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 modeled 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 [Mo], 2008), 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. The content and skills acquired at ACE (Mathematics Education) would provide the BETD graduates with a legitimate route into other tertiary courses such as the B. Ed (Honours) and Masters in Mathematics Education with any institution of higher learning.

Conclusion and Recommendation

The research findings reported in this study reached several conclusions. One of the main conclusions is that the BETD program has been compromised due its lack of focus on content and 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 the Ministry of Education through NIED with institutions of higher learning. There has been no

collaboration with institutions of higher learning since the inception of BETD in the last 19 years. We therefore recommend that:

- New satellite campuses of the University of Namibia offering Education need to explore joint ventures with either other institutions of higher learning in SADC or with the Department of Mathematics at the University of Namibia to address the issue of lack of mathematical content of the BETD graduates.
- The Faculty of Education at University of Namibia should devise a mechanism to recognize BETD qualifications and give credit to other aspects such as experience and prior knowledge without compromising inadequacy of content if they are allowed to continue in the new B. Ed Lower or Upper Primary program at second year level.
- The Ministry of Education through the Advisory Council for Teacher Education and Training (ACTET) and NIED in collaboration with Namibia National Qualification Authority (NQA), should start evaluating of the BETD program.
- The Ministry of Education in collaboration with any University should implement a complementary course that will specifically address the lack of mathematics content knowledge of the BETD graduates.
- The Ministry of Education ensures that any educational qualification offered by any institution of higher learning in this country must be articulated and accredited within the NQA framework.
- A research in investigating the proficiency of teaching of mathematics at lower primary level should be carried out. We feel it is 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.

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