A STUDY OF THE EXTENT TO WHICH CONTEXTUAL TEACHING AND LEARNING IS APPLIED IN GRADE 11 AND 12 MATHEMATICS CLASSROOMS IN SECONDARY SCHOOLS IN GOBABIS

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BY:

E. K. MAKARI

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Main Supervisor: PROF. C. D. KASANDA

Co-supervisor: DR. D. ZEALAND

APPROVAL PAGE

This research project has been examined and is approved as meeting the required standards for partial fulfillment of the requirements of the Master of Education Degree.

1. _____ _____

   Internal Examiner Date

2. _____ _____

   Internal Examiner Date

3. _____ _____

   Dean, Faculty of Education Date

4. _____ _____

   External Examiner Date

STATEMENT OF ORIGINALITY

I Eben Eser Kakunasemba Makari, declare hereby that this study is a true reflection of my own research, and that this work, or part thereof has not been submitted for a degree in any other institution of higher learning.

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Eben Eser Kakunasemba Makari Date

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DEDICATION

This thesis is dedicated to my baby girl Riyameka Makari. Your presence in my life gave me the extra energy and motivation to complete this study.

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ACRONYMS

BETD	-	Basic Education Teachers Diploma
CTL	-	Contextual Teaching and Learning
MEC	-	Ministry of Education and Culture
MoE	-	Ministry of Education
NIED	-	National Institute for Educational Development
NSSC	-	Namibian Secondary School Certificate
PETROFUND	-	Petroleum Training and Education Fund

ABSTRACT

This study investigated the extent to which Contextual Teaching and Learning (CTL) was applied in grade 11 and 12 mathematics classrooms in secondary schools in the Gobabis area. It also sought to determine the types of contexts used and the underlying pedagogical strategies for the use of contexts as well as the factors that hindered the effective implementation of CTL of mathematics in grade 11 and 12 classrooms in the Gobabis secondary schools.

Answers to the following questions were sought: (i) To what extent is CTL applied in grade 11 and 12 mathematics classrooms in secondary schools in Gobabis? (ii) To what extent does the Namibian Secondary Schools Certificate (NSSC) mathematics curriculum make room for CTL of mathematics? (iii) What types of everyday contexts are used in the NSSC mathematics classrooms in secondary schools in Gobabis? (iv) What are the underlying pedagogical strategies for the use of contexts in NSSC mathematics classrooms? (v) What views do Gobabis secondary school mathematics teachers hold on the use of CTL in mathematics? and (vi) What factors are hindering the effective implementation of CTL of mathematics in the secondary schools in Gobabis?

The population of this study was made up of teachers teaching mathematics at NSSC level in the secondary schools in Gobabis. The sample comprised two mathematics teachers in the two purposefully selected secondary schools in the Gobabis area.

Two types of research instruments were used to collect data from the sample. The two sets of instruments allowed the researcher to have a deep understanding of the use of

CTL in the mathematics classrooms in Gobabis. The instruments used to collect the data were the interview schedules and the observation forms for mathematics lessons. A total of 25 NSSC mathematics lessons taught by the two teachers that were in the sample were observed.

The main findings of this study were as follows:

i. The use of contexts was only entertained to the point that the numerical information needed for substitution in a formula was extracted. Further, on average 1.8 classroom episodes per lesson related to everyday contexts.
ii. The Namibian curriculum did not cover all aspects needed by teachers to fully implement contextual teaching and learning for example assessment techniques such as portfolios and projects are not considered in the final grade 12 results.
iii. Not all contexts in the taxonomy suggested by Mayoh and Knutton (1997) were observed in the mathematics lessons. For example, none of the contextualized episodes referred to the mass media and industry.
iv. Solely teachers used contexts, mainly as a primary strategy for exposition, question and answer and as part of assessment tasks.
v. Teachers viewed the use of contexts as having the potential of demonstrating relevance and the use of mathematics to the learners. The teachers also indicated that the use of CTL had the potential to increase learner performance as it motivates and increases learners' interest and thus increasing classroom participation.
vi. Time constraints and a lack of resources were identified as the major factors hindering the effective implementation of CTL of mathematics by the teachers.

The study concluded that CTL was not fully implemented in the two Gobabis secondary schools because of a lack of resources as well as a lack of knowledge and experience in using CTL on the part of the teachers. Further, the heavy teaching load of the mathematics curriculum (in terms of the amount of content to be covered) limited the extent to which CTL was implemented.

Finally, the findings of this study are consistent with findings of other studies on contextual teaching and learning. This seems to suggest that there is a long way to go before contextual teaching and learning is fully understood and implemented in the secondary schools in the Gobabis area.

CHAPTER ONE

INTRODUCTION

Background

For many students, school mathematics seems completely separated from what they do at home and in the community. They cannot see the point of what they are doing in mathematics in school. They also cannot see the connection between the mathematics they do at school and the mathematics that they do in other places such as the market, kitchen, or in the fields (Portman and Richardson, 1997; #Hara-Gaes, 2005).

It is further, widely believed that mathematics is an abstract subject that is important and yet with no relevance to daily activities. However, Frobisher and Orton (1996) view mathematics as a powerful tool with great relevance to the real world. Further, they suggest that for this to be appreciated by the learners they must have direct experiences of using mathematics in a wide range of contexts throughout the curriculum.

According to Evyatar and Rosenbloom (1981), many distinguished mathematicians and educators have advocated that mathematics be taught in close connection with its applications and be motivated by them. The critics of the reforms in school mathematics curriculum in the 1950's strongly emphasized this view, but produced very little concrete material for school mathematics showing how mathematics can be applied. Up to that time (1950's), the only applications that were treated in school mathematics were

consumers' and shopkeepers' problems (Evyatar and Rosenbloom, 1981). These observations are sadly, still relevant and true descriptors of present-day mathematics instruction.

Teachers that are not creative enough, do little proper preparations and do not use the learners' experiences as the starting point of their teaching, which worsen the above situation. Teachers who also tend to use abstract examples when going about the business of teaching mathematics do not help the learners to see the connection of school mathematics to their everyday lives (Makari, Gervasius and Kasanda, 2006).

While doing teaching observation as an undergraduate student teacher, the researcher heard a teacher introducing the chapter on algebra to grade 11 learners. A group of four learners at the back of the class did not follow the lesson and they were disturbing the effective teaching of the lesson. The teacher then asked the learners why they were misbehaving. One learner replied and said; "*Sir please tell me where in life am I going to use these letters that you are teaching us today? I am tired of doing things that would not help me or that are irrelevant"*. The worst part was that the teacher was unable to give a clear-cut answer to the learners on practical examples of how algebra is used in everyday life.

Mathematics teachers should make contextual teaching and learning (CTL) a part of their instruction. That is, connecting educational theoretical knowledge to community practical

applications (relating classroom content to the 'real' world). In doing this the teachers will succeed in:

- breaking the barriers between home and school learning experiences;
- making the link between the mathematics that is used in the community and the school syllabus;
- showing that the community is a good resource of mathematics; and
- above all, making school mathematics more relevant, meaningful and enjoyable to learners.

Theoretical Framework

CTL is a new instructional approach rapidly being adopted by teachers, particularly math and science teachers, across many nations (Glynn and Scott, 2003). However, for CTL to be considered a legitimate pedagogy to be applied with learners, it must be based on sound educational principles, theories and practices. CTL builds upon bodies of literature that include theories and writings by Dewey, Piaget, Bruner, Vygotsky (quoted by Fosnot, 1996) and others. Thus, it is an extension of past thinking, theories, testing and writings.

Moreover, CTL integrates the philosophies of social constructivism and brain-based learning in a theory of learning that utilizes a student's experiences and interests to make connections between academic concepts and real-world applications (Johnson, 2002; Glynn and Scott, 2003 and Pate, 2003).

The social constructivist aspect of CTL stems from connections between previous knowledge and collaborative environments, whereas the philosophies of brain-based learning state that the brain seeks challenges, patterns, and meanings (Johnson, 2002). In addition, contextual teaching uses meaningful work that involves critical thinking to build on academic concepts and creates self-regulation among learners through creative outlets and nurturing environments (Johnson, 2002).

CTL, like any approach to instruction, is characterized by the use of some learning strategies more than others. When teachers are implementing the CTL approach, they often use the following research-validated strategies or theories, either singly or in combination (Berns and Erickson, 2001: 2):

1. *Effort-based learning/ incremental theory of intelligence* based on the conception that increasing one's efforts results in more ability. This theory opposes the notion that one's aptitude is unchangeable. Striving for learning goals motivates an individual to be engaged in activities with a commitment to learning.
2. *Socialization* based on the understanding that children learn the standards, values and knowledge of society by raising questions and accepting challenges to find solutions that are not immediately apparent, along with explaining concepts, justifying reasoning and seeking information. Indeed, learning is a social process, requiring social and cultural factors to be considered during instructional planning. This social nature of learning also drives the determination of the learning goals.

3. *Situated learning*, which proposes that knowledge and learning are situated in particular physical and social contexts. Thus, a wide range of settings may be used such as the home, the community and the workplace, depending on the purpose of instruction and the intended learning goals.
4. *Distributed learning* based on the conception that knowledge may be viewed as distributed or stretched over the individual, other persons and various artifacts such as physical and symbolic tools and not solely as a property of individuals. Thus, people, as an integral part of the learning process, must share knowledge and tasks.

Working together, these strategies and theories and others serve as underlying principles upon which the CTL conception and process are based. Indeed, the contextual approach recognizes that learning is a complex and multifaceted process that goes far beyond drill-oriented, stimulus-and-response methodologies (Bern and Erickson, 2001).

Statement of the Problem

Many writers and educational researchers such as Dlamini (2007), Cain (2002), Kasanda (2001), Mwakapenda (2001), Campbell and Lubben (2000) are of the opinion that the use of CTL in teaching mathematics has the potential to change various aspects of student learning such as interest in mathematics, critical reflection and active participation. However, as Mwakapenda (2001) noted, this has enormous implications for classroom practice. For example, extensive knowledge and professionalism is required in order to

enable teachers to facilitate the process of making connections between school mathematics and reality. The success of this approach also depends heavily on the culture of the mathematics classroom and teachers' abilities to create pedagogic spaces for negotiation, reflection and critical use of mathematics.

Given the possibilities afforded by the use of everyday experiences in mathematics it was deemed necessary to consider the extent to which CTL is applied and the shortcomings in the use of CTL in mathematics classrooms in Namibia.

Specifically, the purpose of this study was to investigate the extent to which contextual teaching and learning was applied in grade 11 and 12 mathematics classrooms in secondary schools in Gobabis. It also sought to determine the types of everyday contexts used and the underlying pedagogical strategies for the use of contexts as well as the factors hindering the effective implementation of contextual teaching and learning of mathematics in grade 11 and 12 classrooms in the Gobabis secondary schools.

Questions of the Study

The main research questions were:

1. To what extent is contextual teaching and learning applied in grade 11 and 12 mathematics classrooms in secondary schools in Gobabis?

2. To what extent does the Namibian Secondary Schools Certificate (NSSC) mathematics curriculum make room for contextual teaching and learning of mathematics?
3. What types of everyday contexts are used in the NSSC mathematics classrooms in secondary schools in Gobabis?
4. What are the underlying pedagogical strategies for the use of contexts in NSSC mathematics classrooms?
5. What views do Gobabis secondary school mathematics teachers hold on the use of contexts in the teaching and learning of mathematics?
6. What factors are hindering the effective implementation of contextual teaching and learning of mathematics in the secondary schools in Gobabis?

Significance of the Study

It is important that teachers are aware of the different teaching approaches or strategies used to enable them to teach their subjects effectively. Thus, this study on contextual teaching and learning strategies might enable teachers to focus their attention not only on teaching mathematics as an abstract subject but to also relate mathematics to the real life experiences of the learners they teach. In doing this, the learners might view mathematics as a powerful tool with relevance to their world.

For this study, contextual teaching and learning of mathematics should be understood as described by Kasanda (2001). That is, contextual teaching and learning refers to the use

of aspects of the learners' or teachers' environment and /or experiences they are familiar with, to make the otherwise abstract content more concrete (p. 2). Given the fact that, contextual teaching and learning is a relatively new concept in Namibia, this study creates awareness on the part of the teachers and helps them to use everyday contexts to make mathematics relevant to the learners and to enhance the learners' understanding of mathematics.

Furthermore, the fact that not much research has been carried out on contextual teaching of mathematics in Namibia and in Gobabis secondary schools in particular, necessitated this particular study to be undertaken. It is indeed only recently that Kasanda, Lubben, Gaoseb, Kandjeo-Marenga, Kapenda and Campbell (2005) embarked on a study that investigated the role of everyday contexts in learner-centred teaching in science classrooms while this study was undertaken to look at the situation in the mathematics classrooms.

Finally, the findings of this study may serve as a guide to educational planners and mathematics teachers in the Gobabis area about the use of everyday contexts in mathematics classrooms. The findings of the study might also serve as a useful starting point for other researchers towards the ongoing efforts of popularising contextual teaching and learning of mathematics for positive and meaningful achievements of Namibian learners on mathematics tasks.

Limitations of the Study

The ideal population of the study would have been all schools in the Omaheke region, but due to time and financial constraints only secondary schools in Gobabis constituted the population and sample for this study. Thus, the findings of the study are only applicable to the practice at the two secondary schools in Gobabis as opposed to all the secondary schools in the Omaheke region.

Another limitation of this study was the researcher's ability and limited experience in conducting research of this magnitude in general, which may have undermined some aspects of the data analysis and the findings of the study. However, to overcome this limitation the researcher worked in close consultation with the supervisors to ensure that the inexperience in conducting research did not affect the findings of the current study.

Delimitations of the Study

This study was aimed at investigating the extent to which contextual teaching and learning was applied in grade 11 and 12 mathematics classrooms in secondary schools in Gobabis. There are two secondary schools in Gobabis of which one is a public school and the other is a private school. Only mathematics teachers teaching grade 11 and 12 in these two schools in Gobabis were included in the study.

Definition of Terms

Contextual Teaching and Learning: refers to the use of aspects of the learners' or teachers' environment and experiences, they are familiar with, to make the otherwise abstract subject content more concrete (Kasanda, 2001: 2).

Contextual Teaching is teaching that enables learners to reinforce, expand and apply their mathematical knowledge and skills in a variety of in-school and out-of-school settings in order to solve simulated or real-world problems (http://jwilson.coe.uga.edu/CTL/CTL/intro/ctl-is.html).

Contextual Learning occurs when learners apply and experience what is being taught in the mathematics classroom referencing real problems associated with their roles and responsibilities as family members, citizens, learners and workers (http://jwilson.coe.uga.edu/CTL/CTL/intro/ctl-is.html).

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Introduction

In this chapter, literature has been reviewed and discussed under the following headings; introduction, a definition of CTL: why it works, CTL and the curriculum, reasons for the non-use of CTL in mathematics and teachers' views on the use of CTL in mathematics. The point worth noting is that, only a limited number of reports were found on the use of CTL in mathematics classrooms, as a result most of the literature reviewed was based on the use of CTL in science classrooms.

A Definition: Why CTL Works

Teaching and learning normally involve an interaction between several factors within and outside the classroom. These factors may include among others, the teachers, the learners, the content of the curriculum and the community at large.

While the roles of teachers, learners and the curriculum on student achievement are well studied and documented (Harcourt, 1976), the classroom environment and the community at large are often neglected when talking about the teaching and learning of school subjects and hence learner performance is the context (Kasanda, 2001). Because subject

matter especially in mathematics is taught devoid of context, students do not associate the content covered in class to real life experiences.

Contextual teaching and learning represents a concept that involves connecting the content that students are learning with the context in which that content could be used. Connecting content with context is an important part of bringing meaning to the learning process (Kasanda et al., 2005; Johnson, 2002).

For that connection to take place, a variety of teaching approaches may be used. Over the years, literature has emerged based on research and development on how people learn (Wang, Haertel and Walberg, 1990; Mwamwenda, 1996). The following teaching approaches include context as a critical component and are found in literature on teaching and learning:

- problem-based learning;
- collaborative/cooperative learning;
- project-based learning;
- service learning; and
- work-based learning.

Of critical importance is that the above approaches be used at the learner's developmentally-appropriate level of learning, that the environment be established to support self regulated learning, that culturally-relevant pedagogy be applied, that

knowledge about multiple intelligences be considered, and that appropriate authentic assessment be included (Wilson, nd.).

Contextual teaching and learning could be viewed as a good method of teaching and learning because it motivates and increases learners' interest and thus increasing classroom participation (enhancing learner-centred education). Furthermore, it helps the learners make appropriate links between the content and the context(s) thus facilitating learning. However, research into the learning effect of the use of everyday contexts infused in mathematics lessons is limited and inconclusive (Kasanda et al., 2005).

Cain (2002: 224) conducted an evaluation of the Connected Mathematics Project, a program "devoted to developing student knowledge and understanding that is rich in connections to other mathematical concepts and to real world applications". She observed that the average score of the learners that participated in the connected mathematics was 16% higher than the learners that did not participate in the programme. Thus, the results of the learner achievement showed that the program had helped the learners' understanding of mathematical concepts well enough to put them ahead of other learners at the same level.

In studies conducted on how learners move from practical work to formal work by Hughes (1986) and Johnson (1989) cited in Askew and Wiliam (1995), it was observed that while practical work and 'real' contexts can be useful, they need to be chosen carefully, and accompanied by careful dialogue with the learners to establish the extent of

their understanding. Askew and Wiliam further, suggested that the learners' success on concrete tasks should not be taken as an indication of understanding the abstract. Thus, there is need to engage the learners in discussions to assess how the links between practical work and abstract mathematical content are created.

Since problems in everyday life do not come in neat forms, learners whose learning depends on the use of such school-based cues will often be unable to apply their learning to real world situations. For such learners, skills in real-world situations would then require the learning of a new set of ideas, rather than the application of existing ideas. This evidence casts serious doubt on approaches to learning mathematics that are based on the assumption that pupils will be able to easily transfer skills and knowledge learned in one context to others. Therefore many researchers (Sjøberg, 2000; #Hara-Gaes 2005; Mayoh and Knutton, 1997; Marttens and Vass, 1990) suggest that attention needs to be paid to the concept being taught, the activity through which the concept is introduced and the culture of the classroom.

This means that the activities used in classrooms need to mirror the sort of situations to which mathematics is actually applied. The mathematical concepts should arise from the activities rather than being imposed on them and the teaching should emphasise that there is rarely a single right method for solving a problem.

CTL and the Curriculum

Contextual teaching can be viewed as a way of answering the famous question that most learners ask, i.e. Why do we have to know this? That is because contextual teaching helps the learners to become active learners as opposed to being passive. Thus, the learning process or learning in general will be more meaningful to the learners and will help show them how the information fits into the community outside the classroom and how members of the community use the knowledge in their everyday lives. A teacher who uses the contextualised method will not lecture to the students but rather he/she will act as a facilitator of student learning.

In a study on the role of everyday contexts in learner-centred teaching Kasanda et al. (2005) have put forward arguments for the inclusion of everyday contexts in mathematics and science education in two partly overlapping perspectives; that is, their effectiveness for achieving particular learning outcomes and their desirability for an appropriate curriculum. On the use of everyday contexts for improving learning, they noted that research into the learning effect of the use of everyday contexts infused in science and mathematics was limited and inconclusive.

On the use of everyday contexts for curriculum appropriateness Kasanda et al. (2005) note that since independence in 1990, the school curriculum in Namibia has rested on a learner-centred approach. In Government policy documents, a learner-centred approach means that:

i. The starting point is the learner's existing knowledge, skills, interests and understandings, derived from previous experience in and outside school.

ii. The natural curiosity and eagerness of all young people to learn, to investigate and to make sense of a widening world must be nourished and encouraged by challenging and meaningful tasks.

iii. Learners should be empowered to think and take responsibility not only for their own, but also for one another's learning and total development.

iv. Learners should be involved as partners rather than receivers of educational growth (Ministry of Education and Culture, 1993: 30).

The assumptions that go with contextual teaching and learning from Sauer (nd.: 3) will do a good job in describing what contextual teaching and learning entails and the reasons for its inclusion as an instructional method relevant to the Namibian mathematics curriculum. The assumptions include:

- Learners are actively engaged in what they are learning;
- Learners view learning as relevant;
- Learning is related to the real world;
- Learners' diverse life contents and prior experiences are important and valued in learning;
- The learning environment is dynamic and exciting;
- Higher order thinking and problem solving are encouraged;
- Learning occurs in multiple settings and contexts; and
- Knowledge extends beyond the boundaries of conventional classrooms.

Thus, from the Namibian government's description of the learner-centred approach and the assumptions that go with contextual teaching (MEC, 1993; Sauer, nd.), the link and the significance of using CTL in mathematics classrooms to ensure that effective teaching and learning take place in the classrooms can clearly be seen.

According to the Mathematics Syllabi – Ordinary Level published by NIED (2005) the abilities to be assessed in the NSSC Mathematics examinations include amongst others, the ability of learners to recall, apply and interpret mathematical knowledge in the context of everyday situations. Hence, the need for teachers to include contextual teaching and learning to ensure that their learners are able to apply and interpret mathematical knowledge in the context of everyday situations.

Campbell and Lubben (2000) provide arguments for including the learners' everyday experiences in a science curriculum. They are of the opinion that, to explain natural phenomena, examples from the learners' surroundings need to take priority. Contextualisation improves access to knowledge and thus provides equity to disadvantaged groups. In addition, the learners' responses to context-led approaches show that the use of everyday contexts in science (and mathematics) teaching improves learners' enjoyment.

In a study of responses of Swazi students to contextual learning, Lubben, Campbell and Dlamini (1996) also cited in Campbell and Lubben (2000) identified three types of contexts, which increase learners' motivation, interest in science learning and their

participation in classroom activities. They found that positive attitudes were displayed towards lessons, which allowed the learners (i) to work on personally useful application of science, (ii) to own the lesson activities by contributing their expertise and knowledge, and (iii) to discuss contentious issues.

The most frequent argument for CTL, however, has been that it provides relevance to the learning of school science (and mathematics) (Campbell and Lubben, 2000). Mayoh and Knutton (1997) suggest that within the issue of relevance two questions need to be specified: *'relevant to whom?'* and *'relevant to what?'*. This research explored the relevance of CTL of mathematics to the learner. In terms of *'relevance to what?'*, the current research focused on the relevance to everyday life, further education as well as the world of work.

Finally, it is often reported that the learner-centred teaching and learning has not been fully understood and implemented in Namibia (Njabili, 1998). Contextual teaching can be viewed as one method or approach to ensuring the effective implementation of learner centred education.

Reasons for the Non-use of CTL in Mathematics

Even though it makes sense to make use of context in the teaching and learning of mathematics, classroom teachers have problems in using contexts. Fish (1996) cited in

Kasanda (2001) gave some reasons for the non-use of everyday experiences. These include:

- The heavy teaching loads often given to teachers, may limit the teachers in their preparations, teachers may thus 'forget' to include contexts and they may focus on the content to be covered only. This is mainly because CTL requires proper and reflective preparation on the part of the teacher.

- Teacher laziness. The use of context requires the teachers to sit down, prepare and reflect on the lessons. Nevertheless, teachers often do not seem to have time to prepare their lessons. Furthermore, often the more experienced teachers do not see the need for lesson preparation. As a result, they end up using old materials without thinking through them.

- Syllabus anxiety. The need to cover what is mandated in the examinations normally dictates what should be covered in the mathematics classrooms. This limits the use of context as teachers have a limited time. Thus, teachers spend most of their time preparing students for the final examinations; therefore, teaching for understanding is not a priority.

- Mathematics teachers may themselves not be aware of the applications of their content to everyday experiences. There is therefore a need for teacher educators to ensure that they introduce this aspect during the training of student teachers.

- Textbooks used. Kasanda et al. (2005) observed that teachers of science and mathematics at grade 10 level used more contexts compared to teachers at the grade 11 and 12 level. This was attributed to the fact that whereas the grade 10 textbooks and examinations were local (Namibianised), the grade 11 and 12 textbooks and final examinations were international. Thus, the teachers and learners might not have been familiar with the contexts used in textbooks. With the new localised curriculum, it is hoped that more context will be used in classrooms as both the curriculum and the examinations are now localised at grade 11 and 12 levels.

Teachers' Views on the Use of CTL in Mathematics

According to Tsai (2002), over the last two decades, research on teachers' beliefs has received much attention from educators, as the educational paradigm has shifted from behaviourism to constructivism. Constructivists assert that people subsequent actions and thoughts are mainly based on their ideas constructed earlier. Consequently, many educators (An, 2004; Tsai, 2002; Schmidt, McKnight, Cogan, Jakwerth and Houang, 1999) agree that teachers' beliefs may, in some way, affect their instructional practice. Hence, to understand the use of CTL in mathematics better, it is imperative that we investigate the views of teachers on the use of CTL in mathematics classrooms.

As Julie (2006) observed, teachers' beliefs, views and preferred contexts for mathematical literacy is at most an under-researched area. It therefore came as no surprise to the researcher that research into these areas is limited and inconclusive. The researcher therefore reviewed related literature that did not address the issue (mathematics teaching and learning) directly.

In their study of the extent to which mathematics instructional practises in early childhood education in Zimbabwe related to or made use of children's experiences Mutemeri and Mugweni (2005) observed that, while teachers acknowledged that children bring mathematical experiences to school and that teachers should build from their learners' experiences. The teachers did not see the mathematical knowledge children have from outside the school as valid or helpful and feared that it would slow down progress and concept development.

Mutemeri and Mugweni (2005), further observed through lesson observations that children's out-of-school strategies of solving mathematical problems and even their out-of-school experiences did not form part of the teachers' business in helping children learn mathematics. Such beliefs and practices could be some of the reasons why the learners find the learning of mathematics difficult, lose confidence in problem solving and in some cases develop negative beliefs about mathematics. Thus, mathematics learning should start with what the learners experience in everyday life.

It might be safely concluded from the existing research literature that, while the use of everyday contexts in teaching and learning mathematics has the potential to enhance learner performance there is little conclusive evidence to support it. Further, it is also important to be engaged in research geared towards popularising contextual teaching and learning. In so doing, learners that are responsive to the needs of industry may be produced.

CHAPTER THREE

METHODOLOGY

This chapter describes the methodology used to collect the data from the participants in the two Gobabis secondary schools. It describes the research design, the population and sample, the research instruments as well as the procedures used to collect and analyse the data.

Research Design

This study was a qualitative exploratory and descriptive study aimed at determining the extent to which CTL was practiced in secondary schools in Gobabis. The study was exploratory in that it attempted to generate ideas that the teachers had about CTL and it was descriptive as it attempted to describe the practices of CTL in mathematics classrooms in Gobabis (Johnson and Christensen, 2004).

However, quantitative data in the form of frequency tables was also used in summarising and presenting the data. This research design was used because it had the potential of providing the researcher with a lot of information (Fraenkel and Wallen, 1993), thus leading to a better understanding of the mathematics teaching and learning practices in secondary schools in Gobabis.

Population and Sample

The population of this study was made up of two teachers teaching mathematics at NSSC level in the two secondary schools in Gobabis. The sample comprised the two mathematics teachers in the two purposefully selected secondary schools in the Gobabis area.

Research Instruments

Two types of research instruments were used in a converging fashion to collect data from the sample. This allowed the researcher to have a deep understanding of the use of CTL in the mathematics classrooms in Gobabis. The instruments used to collect the data were the interview schedules and the observation forms for mathematics lessons (see Appendices 1 and 2).

Interviews

A face-to-face standardized semi-structured open-ended interview was used to collect data from the two mathematics teachers in the sample. The rationale for the use of a semi-structured interview was based on the view that interviewing enabled the researcher to check the accuracy of the impressions gained through observations (Fraenkel and Wallen, 1993).

The use of a semi-structured interview was further helpful, in that it gave the researcher a chance to find out what was on the minds of the teachers, what they thought and what they felt about CTL. This enabled the researcher to find out from them things that were not directly observed (Fraenkel and Wallen, 1993; Best and Kahn, 1998).

The researcher developed the interview guide. The primary aim of the interview was to get the views that the mathematics teachers in the sample had on the use of CTL of mathematics as well as the factors that hindered them from effectively implementing CTL in their lessons (see Appendix 3). The validity of the interview questions was ensured as expert opinion (from supervisors) was sought, after the development of the interview guide. The reliability of the interview guide was checked during the pilot study. The interviews were recorded using a cassette tape (teachers gave the researcher permission to do so) to save time needed in note taking.

Observations

A non-participant naturalistic observation format was employed in this study, as the researcher visited NSSC mathematics classrooms to observe what was happening in the mathematics classrooms. It was naturalistic in that the observations were carried out in the normal classes where these learners usually took their mathematics lessons (Fraenkel and Wallen, 1993). The researcher sat at the back of the class and simply observed and recorded what happened in the classrooms as events presented themselves or unfolded in class.

Recognising the potential threats of reactivity (i.e. changes in the behaviour of people because they know they are being observed) to both the internal and external validity of this study, the researcher built and maintained rapport with all the research participants which were observed, throughout the observation period (Johnson and Christensen, 2004). In addition, the participants were encouraged from the onset to behave normally or to do things the way they did them normally as they were not to be penalised or reported to anybody. Indeed as the time progressed, the teachers and the learners 'got used' to the researcher and the artificial ways of doing things started to fade away. This was mainly because many lessons were observed, and as a result, reactivity was overcome in the process.

In qualitative observations, observing entails looking at all relevant phenomena critically and taking extensive field notes without specifying in advance exactly, what is to be observed (Johnson and Christensen, 2004). The observation guidelines in Appendices 1 and 2 were not exhaustive of what was observed in the classes. The researcher's intentions were to be guided by the use of lesson plans and related handouts during the observation and analysis processes. However, this was not realised, as teachers were very reluctant to provide the researcher with copies of their lesson plans.

Pilot Study

Two weeks before the actual research took place, the researcher conducted a pilot-study on NSSC mathematics teachers that were not part of the main study. The instruments

were pilot tested on NSSC mathematics teachers at Hochland High School in Windhoek because both secondary schools in Gobabis were taking part in the study. The fact that the true purpose of the study might have leaked out to the teachers of NSSC mathematics, also made it appropriate for the pilot-study to be conducted in Windhoek instead of Gobabis. The researcher followed the procedures for administration that were used in the study.

The rationale for the pilot study was to help the researcher in detecting any problems or shortcomings of the data collecting instruments, enabling the researcher to improve the instruments before the actual study was carried out. The results of the pilot study showed that the instruments were valid for the present study and all the questions in the interview guide elicited responses that the researcher anticipated.

Data Collection Procedure

Permission to conduct the main research was obtained from the Permanent Secretary of in the Ministry of Education, the Omaheke Director of Education, the two Principals and the Mathematics teachers in the participating schools. It should be noted that the Permanent Secretary, Principals and the Director of Education got a detailed explanation of the study. On the other hand, the mathematics teachers were only given a general overview or objective of the study. This was deemed appropriate as giving a detailed report of the study to the mathematics teachers would have compromised the validity and reliability of the study. That is, teachers could have created conditions to please the

researcher while the interest of the research was to study the normal use or application of contextual teaching in the mathematics classroom.

Twenty-five lessons of NSSC mathematics were observed at the two schools that were in the sample using the observation schedule in Appendix 2. The lessons were also tape recorded to help in the identification of contexts used and the pedagogical strategies for the use of the contexts.

Teacher interviews were conducted after the completion of the observation process. This was deemed fit because if the interviews were conducted earlier the teachers might have structured their lessons to impress the researcher, as they would have found out the 'real' purpose of the study.

The data collection process took place from 11 to 22 June, 2007. The research participants were thanked at the end of the data collection period. The 'real' or detailed purpose of the study was also communicated to them then.

Data Analysis

The data, including worksheets (given to the learners during the observed lessons), classroom observation records and the interview transcripts, were scrutinised to identify the extent to which mathematics was contextualised as well as related shortcomings in contextualising their lessons.

The first analysis that was undertaken soon after the data collection period was content analysis. Content analysis is defined by Patton (1990: 381) as "the process of identifying, coding and categorising the primary patterns in the data". This meant the analysis of the content of the interviews, observations and the transcripts.

For analysing teachers' interviews, both case analysis and cross-case analysis were used (Patton, 1990). The fact that a standardised open-ended interview was used also made it easier for both case analysis and cross-case analysis to be undertaken for each question in the interview. This type of analysis enabled the researcher to understand the practises and problems that individual teachers were experiencing in using CTL of mathematics, and furthermore, it enabled the researcher to compare the practises and experiences of teachers in the two schools where the study was conducted.

This chapter looked at the methodology used in this study, in particular the research design, the population, the sample, the instruments, the procedures used to collect and analyse the data were described. In the next chapter, the results of the study are presented.

CHAPTER FOUR

RESULTS

Introduction

In this chapter the results are presented under the following headings, which also addresses the research questions; the use of contexts in mathematics lessons, the types of everyday contexts used in teaching mathematics, pedagogic strategies for using contexts and the teachers' views on the use of CTL in mathematics lessons. However, the characteristics of the research participants are first describe briefly.

Characteristics of the Research Participants

Two teachers took part in this research and are named Teacher A and Teacher B respectively to protect their identities. Teacher A had the Basic Education Teachers Diploma (BETD) obtained from the Windhoek College of Education; he was responsible for mathematics grade 9 to grade 12 at School A, even though he did not have a teaching degree required to teach at grade 11 and 12 levels. He also had 15 years teaching experience of mathematics at both primary and secondary school levels. His class average was 38 learners in grade 11 and grade 12.

Teacher B came from School B and had a Bachelor of Science Degree (Mathematics and Physics) as well as the Higher Education Teaching Diploma; had taught mathematics for

29 years in the two secondary schools in Gobabis and had an average of 20 learners per class in grade 11 and 12.

The Use of Contexts in Mathematics Lessons

Table 1 presents the number of times that the two mathematics teachers and their learners referred to everyday contexts during their lessons. The table indicates that on average 1.8 classroom episodes per lesson related to everyday contexts. Teacher A however had a higher average of 2 episodes per lesson compared to the average of Teacher B of 1.7 episodes per lesson relating to everyday contexts. The table shows that Teacher A had initiated 6 more contexts than Teacher B, the observed difference was however not statistically significant. This is supported by the calculated chi-square (χ^2) value of 0.39 being less than the 3.84 value obtained from the table of critical values for χ^2 at 0.05 level of significance for one degree of freedom.

Table 1 also shows that the learners at both schools did not initiate any episode referring to everyday contexts the teachers initiated all contexts. Contexts in the textbook examples and activities that were referred to during the observed lessons were classified as everyday contexts initiated by the teachers.

Table 1. Frequency of teachers' and learners' references to everyday contexts (N=46)

		Frequency of using everyday context			
Teacher	**Number of lessons observed**	**Teacher initiated**	**Learner initiated**	**Total**	**Average per lesson**
Teacher A	13	26	0	26	2
Teacher B	12	20	0	20	1.7
Total	25	46	0	46	1.8

The Types of Everyday Contexts Used

The taxonomy suggested by Mayoh and Knutton (1997) was used to identify the types of contexts used in the mathematics classrooms. Mayoh and Knutton distinguished 12 categories of contextualised lesson episodes as presented in the first column of Table 2. The remaining columns of table 2 show the frequencies (percentages) in which the various types of everyday contexts used by the two mathematics teachers.

From table 2 it can be observed that none of the contextualised episodes referred to the media and the industry. Further, none of the episodes attempted to develop the skills of the learners for use in everyday life and furthermore, no episode used everyday context for classroom activities.

Table 2. Frequencies of the episodes for different types of everyday contexts (N= 46)

Type of every day context used	Teacher A (n=26) (%)	Teacher B (n=20) (%)	Total frequency of episodes (n=46) (%)
1. Referring to the mass media.	0 (0)	0 (0)	0 (0)
2. Referring to personal experience: telling stories.	2 (8)	0 (0)	2 (4)
3. Referring to common out-of-school experiences.	1 (4)	4 (20)	5 (11)
4. Referring to uncommon out-of-school experiences.	2 (8)	3 (15)	5 (11)
5. Referring to common objects.	2 (8)	2 (10)	4 (9)
6. Referring to images from out-of-school experiences.	1 (4)	0 (0)	1 (2)
7. Referring to everyday knowledge.	3 (12)	1 (5)	4 (9)
8. Referring to everyday words.	8 (31)	6 (30)	14 (30)
9. Using analogies and metaphors based on everyday experiences.	7 (27)	4 (20)	11 (24)
10. Using everyday contexts for classroom activities.	0 (0)	0 (0)	0 (0)
11. Developing skills for use in everyday life.	0 (0)	0 (0)	0 (0)
12. Referring to industry.	0 (0)	0 (0)	0 (0)

Table 2 shows that episodes referring to everyday words had the highest frequency of 14 (30%) followed by the use of analogies and metaphors based of everyday experiences with a frequency of 11 (24%). The contexts referring to common out-of-school experience as well as the uncommon out-of-school experience had the same frequency of 5 (11%). However, Teacher A used a wider range of contexts (classified into 8 categories) as compared to Teacher B (classified into 6 categories). As further illustrations of the types of contexts used, examples of episodes are now provided:

Episodes Referring to Everyday Words

The use of everyday words was noted as the episodes with the highest frequency of use (30%). An example of an episode referring to everyday words was observed in a lesson on simultaneous equations presented by Teacher B.

> Teacher B: Okay, what does the word simultaneous mean to you?
>
> Learners: Same time [chorusing].
>
> Teacher B: What we have done up to now is to solve an equation like this example (simple linear equation, which the teacher solved on the board):
>
> $2x + 4 = 18$
>
> $2x = 14$
>
> $x = 7$
>
> Remember when we are going to solve simultaneous equations you are still going to solve equations in the same way that you have done up to now.

Later in the same lesson the teacher started to teach the methods of solving simultaneous equations, using the substitution method. Then an element of 'code switching' (i.e. the temporal use of a local language to explain concepts that learners are struggling to grasp in the official language) came into play, which again was viewed as an episode referring to everyday words.

> Teacher B: So, I substitute in Afrikaans '*vervang beteken daar is nie weer 'n p nie, daar is eits in sy plek*'. If you substitute then there is no *p* there is something in its place, you are going to replace it.

Further use of episodes referring to every day words came from a lesson on indices were Teacher A pointed to the fact that writing numbers in standard form was the same as writing numbers in scientific notation as used in physical science.

Teacher A: So, those people that are doing physical science …

Learners: All of us [chorusing]

Teacher A: Sometimes if you are talking about huge distances, for example, the distance from the earth to the moon, it is a very long distance so it will be a lot numbers. So to write that in an easy and convenient way we write the numbers in…

Learners: Standard form [chorusing].

Teacher A: When it comes to physical science then we talk about we are writing the numbers in scientific notation.

In a lesson on indices, Teacher A also referred to the 'convenience' of writing numbers in standard form. He claimed, 'it made life easy' instead of writing very long numbers like the distance from the earth to the moon or the diameter of the earth, one could write it in a 'short and convenient form'.

Episodes Referring to Analogies

Just over 20% of the episodes using contextualisation made use of analogies and metaphors based on everyday experiences. An example of an analogy made was an analogy between directed numbers and peoples' names and surnames. The teacher was trying to emphasise the need to write the numbers with their correct signs (directed numbers):

Teacher A: For example, $3x - 4y = 24$ whereby you have to make y the subject of formula. Some of you are writing $4y = -3x + 24$ but, you must write down the number with the sign [referring to the sign of $4y$].

Normally when you write down your name you write also your surname, do also the same with the numbers. Write down what it deserves, it deserves its sign; you also deserve your surname.

So we will have $-4y = -3x + 24$ and therefore $y = \frac{3}{4}x - 6$.

So what is the gradient of the line $3x - 4y = 24$?

Learners : ¾ [chorusing].

Teacher A: What is the y-intercept of $3x - 4y = 24$?

Learners: – 6 [Some learners responded as 6].

Teacher A: People please give the correct surname of the number. So therefore, the answer is...

Learners: – 6 [chorusing].

Further analogies were made between the gradient of the graph and the slope of a mountain, as well as, analogies between an equation and a 'balance' with the two sides 'weighing' the same. The emphasis was on the fact that for the 'balance' to remain 'balanced', whatever is done on the one side of the 'balance' should be done on the other side of the 'balance'.

The analogy between a balance and an equation was observed in lessons presented by both teachers. Teacher B referred to this analogy during a lesson on simultaneous equations, whereas, Teacher A used the same analogy in a lesson on graphs as the learners were required to make y the subject of a formula in order to find the gradient of the straight line represented by the equation $4x + 5y = 20$.

Teacher A: To find the gradient you have to make y the subject of formula. You must know that an equation is the same as a balance. So if this one is a balance [referring to a ruler held horizontally in the hand of the teacher], if you do something this side [one end of ruler] then you must do the same

thing on the other side also [opposite end of ruler]. Or if you put someone who is fat on this side you put also the same fatness on the other side.

That is why in order to make *y* the subject of formula I have to subtract 4*x* from both sides and divide both sides by 5. Since 5 is not a multiple of 4, I will leave that as a fraction. Therefore, I have $y = -\frac{4}{5}x + 4$. What is the gradient in this case?

Learner: $-\frac{4}{5}$.

Teacher A: Correct, because we know that the gradient is the numerical coefficient of *x*. In street language the number that stands next to *x*.

Episodes Referring to Common Out-of-school Experiences

Just over 10% of the episodes of contextualisation made use of common out-of-school experiences of learners. The extract below from the New Namibian Syllabus Mathematics (book 1) by Coulson (2006: 175) is an example that used common out-of-school experiences of learners.

Three notebooks and five pencils cost N$ 30.

One notebook and ten pencils cost N$ 30.

Taking the cost of a notebook to be *n* dollars and the cost of a pencil to be *p* dollars, write down two simultaneous equations in *n* and *p*. Solve the equations and calculate what a notebook costs and what a pencil costs.

The learners were given the above question to solve as part of their class work on solving equations simultaneously by Teacher B. The other episodes classified in this category were also only present in either class work or class tests that the learners wrote, thus, it was not part of the normal teaching and learning but rather part of the questions that the learners had to answer in their revision.

Episodes Referring to Uncommon Out-of-school Experiences

Only 11% of the episodes of contextualisation made use of uncommon out-of-school experiences of learners. Most episodes in this category again came from questions in the textbooks that the learners had to complete or solve as class work. An example of one such question was the question on the amount of information an encyclopaedia holds. The question read as follows:

> A square centimetre of high-resolution photographic film holds 1.5×10^8 bits of information. A large encyclopaedia holds 4×10^{10} bits of information. What area of high-resolution film is needed to hold all the information from the encyclopaedia? Give your answer correct to three significant figures.

Episodes Referring to Common Objects

Just below 10% of the episodes referred to common objects. An example of an episode that related to a common object was observed in a lesson on the calculation of volumes of revolution by Teacher B. In this case a portion of the $y = x^2$ curve was rotated about the y-axis and the resulting image was related to a wine glass (see Figure 1).

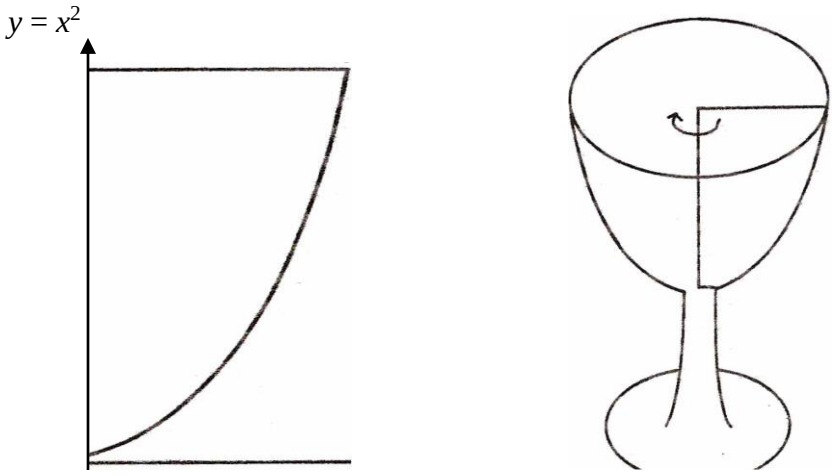

Figure 1. The wine glass (adapted from Rhodes, 1998: 127)

Figure 1 above was one of the images that were referred to in trying to explain how integration could be used to find the volume of revolution about one of the coordinate axes, in this case the y-axis. An example of how this figure was used in the lesson is provided below:

> Teacher B: So if you look at the first sketch [referring to figure 1], there is part of the sketch of the curve $y = x^2$. Can you see that if you to rotate it around the y-axis for one cycle you will get the top part of the glass on the right hand side?
>
> Learners : Yes [chorusing].
>
> Teacher B: Now with that in mind, you should realise that we are not going to work with glass, but we are going to work with solids and not thinking about glass that is open at the top. So we are going to work with solids of revolution and finding the volumes of solids.

In the same lesson, Teacher B had a wine glass, glass cylinders, cones and pyramids to revise the calculation of volumes of these solids, before the use of integrals to calculate the volumes of solids was introduced.

Episodes Referring to Everyday Knowledge

Only 9% of the contextualised episodes were classified as referring to everyday knowledge. According to Mayoh and Knutton (1997), everyday knowledge is common sense or general knowledge, which is shared and used within the everyday domain of experience. This category of episodes referring to everyday knowledge overlaps with that referring to common out-of-school experiences (Kasanda et al., 2005). An example of one such an episode occurred in a lesson on Coordinate Geometry where the learners where expected to find the distance between two points and some learners in the class

found the distance to be negative. Teacher A introduced the fact that distance is not negative by giving an example of travelling between Gobabis and Windhoek.

> Teacher A: When you travel from here to Windhoek you don't say that the distance from here to Windhoek is – 200 Km because distance is always given as a positive.

Episodes Referring to Personal Experience: Telling Stories

Only 4% of the contextualised episodes included a story, with a specific person in the main role. An example of one such an episode occurred in a lesson on simultaneous equations, where Teacher B used a story of an everyday experience both as part of the introduction of simultaneous equations and as a demonstration on how simultaneous equations could be used to solve everyday problems.

> Teacher B: Say for instance I go to the shop to buy fruits, bananas and apples. I buy a few bananas and a few apples. I know that if I look at the pricing list they for instance say a banana cost N$3,00 and an apple cost N$2,00 and in the end I pay N$25,00. I know in total I bought 20 fruits. Now I want to know and calculate how many bananas and how many apples I bought.
>
> Some of you are very good, if I give you an example like that, some of you would be able to come up with how many apples and how many bananas I bought. Nevertheless, algebra is going to help us to do that, by using simultaneous equations.

From here the teacher constructed two equations from the information i.e. $2a + 3b = 25$ and $a + b = 20$ and the equations were solved using the method of equal coefficients and the substitution method.

Episodes Referring to Images from Out-of-school Experience

Only 2% of the contextualised episodes referred to images from out-of-school experiences. It should be noted that the quantification of episodes relating to images from everyday life is difficult because most classroom activities involve some sort of imagery, either mental or visual (Mayoh and Knutton, 1997). The images for the current study where presented as line drawings in textbooks and on the chalkboards by the teachers. Of all images presented, only one had contextual significance and it was an image on the distance of an ant from a spider, which came from an activity in the textbook on coordinate geometry.

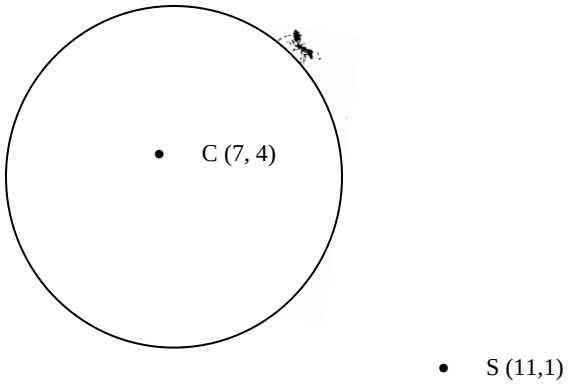

Figure 2. The spider and the ant (adapted from Coulson, 2006: 78)

The above image (figure 2) from the New Namibian Syllabus Mathematics (book 2) by Coulson (2006: 78) was accompanied by the following questions that the learners had to answer.

a. Calculate the distance between the points C (7, 4) and S (11, 1).
b. An ant crawls around the circumference of a circle with centre C, radius 3 cm. What is the ant's greatest distance from a spider at S? (The diagram is not to scale.)

Episodes Referring to Industry

While no episode referring to industry was observed during the lessons, an example of such an application came forth during an interview with Teacher B. Asked about a particular instance when context was used in class, Teacher B responded:

> "For example, when you try to find the maximum volume for instance of producing a tin. This can be a fruit tin and you want to produce it with a certain amount of metal to make sure that you produce the tin that produces the maximum volume and to use as little of the metal to get the volume that you need this is in context with differentiation".

Teacher B's response gave a context relating to industry pointing to the production and packaging of goods and in this particular instance referring to the production of tins, unfortunately this episode was given outside the actual teaching.

Pedagogic Strategies for the Use of Contexts

For the identification of the pedagogic strategies for the use of everyday contexts, the taxonomy used by Kasanda et al. (2005) was used. According to Kasanda et al. (2005), context may be introduced as the initial teaching approach, which they called a primary strategy. However, when the introduction of the context is prompted by the failure of a non-contextualised teaching method (context used as alternative strategy) they called it a secondary strategy.

For the first pedagogic strategy, the use of everyday context as part of exposition, it was observed that 91% of the time exposition was used as a primary strategy, while it was only used 9% of the time as a secondary strategy. An example of the use of everyday context as part of primary exposition is illustrated by the earlier quotation of the episode referring to personal experience: telling stories. This example refers to Teacher B's purchase of bananas and apples which was solved simultaneously by the teacher to demonstrate to the learners how equations can be solved at the same time, to determine the number of apples and bananas that were purchased. Whereas, the use of context as a secondary strategy was exemplified by the episode in Teacher A's class, that involved the use of the analogy between directed numbers and people's surnames, which helped the learners, understand the need of writing numbers with their correct signs.

Secondly, everyday contexts were used as part of a question or answer; this use only reflected the use of everyday context as part of primary question and answer strategy. This use is exemplified by the episode referring to everyday words given earlier where Teacher B wanted to know the meaning of the word simultaneous.

Thirdly, everyday contexts were used as part of primary assessment tasks. The use of contexts as part of assessment was evident in the class work and tests that the learners wrote at both schools during the period of observation. For example, the learners of Teacher B had to answer the following question as part of their class work in their revision of integration and differentiation from a handout given to them by the teacher:

A particle ***p*** travels in a straight line at time ***t*** seconds after starting from point ***O*** on a straight line. The velocity of the particle is ***v*** m/s where $v = t^2(6 - t)$. After a certain time ***p*** came to rest at point ***A*** on the line where it remains (a diagram was given on the board to represent the information see figure 3).

a. Find the positive value of ***t*** at which the acceleration is zero.
b. Find the maximum value of ***v*** during this motion.
c. Find the time taken for the motion from ***O*** to ***A*** and the distance ***OA***.

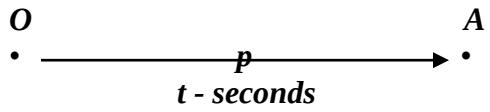

Figure 3. The motion of particle *p*

The learners were given time to solve the question and after that the teacher made corrections with the learners.

Table 3 provides an overview of the frequencies of these two sets of four pedagogic strategies in which everyday contexts were used. The table indicates that 70% of the teaching episodes referring to everyday contexts were used as part of an exposition (Strategies 1a and 1b). The use of context as part of a primary assessment task (Strategies 3a) accounted for 20% of all contexts used. All contexts used as part of assessment tasks formed part of revision tests that the learners wrote and most questions were taken from past exam papers. Just 11% of all contexts used were questions and answers (Strategies 2a and 2b). No contexts were used as part of skills practice development at all.

Table 3. Frequencies of pedagogic strategies used involving everyday contexts (N=46)

Pedagogic strategies	Teacher A (n= 26) (%)	Teacher B (n=20) (%)	Total frequency of episodes (n=46)(%)
Strategy1a. Contexts as part of primary exposition	18 (69)	11 (55)	29 (63)
Strategy1b. Contexts as part of secondary exposition	2 (8)	1 (5)	3 (7)
Strategy 2a. Contexts as part of primary question/answer	2 (8)	3 (15)	5 (11)
Strategy 2b. Contexts as part of secondary question/answer	0 (0)	0 (0)	0 (0)
Strategy 3a. Contexts as part of primary assessment task	4 (15)	5 (25)	9 (20)
Strategy 3b. Contexts as part of secondary assessment task	0 (0)	0 (0)	0 (0)
Strategy 4a. Contexts as part of primary skills practice	0 (0)	0 (0)	0 (0)
Strategy 4b. Contexts as part of secondary skills practice	0 (0)	0 (0)	0 (0)

Teachers' Responses to the Learners' Attempts to Contextualise the Lessons

No instances occurred where the learners tried to contextualise the mathematical content themselves. However, it is worth noting that the teachers responded to learners' questions and comments in an open and welcoming manner. The non-contextualisation of lessons by the learners seems to suggest that the teachers should have done more to engage the learners in their lessons.

Teachers' Views on the Use of CTL

In an attempt to get insight into the views that teachers in the sample held on the use of CTL in mathematics teaching, various questions were posed to them during a face-to-face interview (see Appendix 3). The responses to the interview questions are now summarised as per the questions asked during the interview process.

Teachers' definitions of CTL

At the start of the interview session, the teachers were invited to define or describe contextual teaching and learning. Both teachers defined contextual teaching and learning as "teaching and learning that is aimed at creating meaning and demonstrating relevance of the content being taught".

As Teacher B pointed out '(CTL) … is taking your subject to the real world. Putting that (the subject) in context … (moreover, answering the questions such as) where are we going to use this mathematics in the real world or where is it that we can use it?' Teacher A added that 'during contextual teaching and learning the teacher relates the learning content to the child' and that 'the learning context should be selected according to the age of the learner, the experience or readiness of the child, the ability of the learners and the resources available.'

Teachers' exposure to CTL during their studies

On whether they were exposed to contextual teaching during their studies, both teachers claimed that they were exposed to contextual teaching during their studies especially during microteaching. However, Teacher B was quick to point out that the exposure was very limited and that most aspects of mathematics were rather abstract and hence, not always practical to contextualise. Put in Teacher B's words '… but you also have many parts of mathematics that is not really … (pause) ... that is more working with numbers and working with mathematics and not always going to real life situations'.

Advantages of using CTL according to the teachers

In their responses to the question on the perceived advantages of using CTL in mathematics classrooms, the teachers listed the following as advantages of using CTL:

1. Active participation in learning/motivation of learners
2. Attend to individual differences;
3. Create meaning;
4. Visualisation is enhanced;
5. Diagnose learners' mastery levels;
6. Allows remedial teaching to take place;
7. Knowledge transfer is encouraged;
8. Promote teacher-pupil relationship
9. Focus is on learning and personal development.

The teachers pointed out that the above advantages gave the learners a chance to experience success in mathematics, which in their opinion have the potential of helping the learners to develop positive attitudes and the love for mathematics. The advantages referred to by the teachers were indeed also highlighted in the literature reviewed on CTL of mathematics (Saucer, nd; Berns and Erickson, 2001).

Disadvantages of CTL in mathematics

In terms of the possible disadvantages of using CTL in mathematics, both teachers were convinced that CTL had hardly any disadvantages. Teacher A however, identified group work (as a component of CTL) as a method that (in the opinion of Teacher A) could sometimes be counter productive as 'gifted learners tend to leave the slow learners behind' and that 'during group projects some learners are getting marks they do not deserve' as they let some learners do all the work. The perceived disadvantage of CTL by Teacher A could be overcome through proper planning and monitoring of the work that learners were doing in groups.

Teacher B on the other hand, viewed CTL as a method that requires time. Hence, the opinion that 'if you go too much into CTL of mathematics you might not cover the syllabus; it can take a lot of time'.

The use of CTL by the teachers

On the question of whether they were applying contextual teaching and learning or not both teachers indicated that they indeed were applying CTL in their lessons. However,

Teacher B pointed out that the nature of mathematics and time were the constraints that sometimes prevented the full implementation of CTL in the lessons. In responding to the question, Teacher B said; ‘As far as possible yes I do, but not as much as I would like as time is not enough’.

Teacher A in his response claimed to ‘create a conducive environment inside the classroom for effective teaching and learning by regarding each child as an individual’. He went on to state that in his classroom ‘the existing knowledge of the learners is linked with the new knowledge to make it meaningful’ and that ‘the subject content is also linked with everyday life’.

Problems encountered by the teachers in contextualising their lessons

In responding to this question, only two problems came to the fore, that is, ‘the lack of resources and the time limitations’. A limited resource referred to by Teacher A was a lack of textbooks at the school. Indeed, at School A no learner had a mathematics textbook, whereas, all the learners at School B had their own textbooks of mathematics. In terms of time, both teachers were quick to point out that ‘often the school programme was changed and they lost on the already limited time they have with their learners to teach’. As a way of overcoming the problem of no textbook Teacher A had to ‘make copies of all the activities in the textbook to give to the learners’. This sometimes delayed the teaching process as the ‘photocopying machine was sometimes out of order’.

Teacher recommendations to make CTL a reality in teaching mathematics

According to Teacher A, CTL will only be possible if teachers do proper planning. Teacher A further believed that effective planning will only take place if the teachers are aware of the aim of teaching mathematics at school level which he described as '.. to prepare learners to function effectively by providing a basis to use mathematics in their personal and professional lives'.

Another recommendation made referred to the need to close the gap between the grade 10 mathematics and the grade 11 and 12 mathematics. This was viewed as a hindrance to CTL as teachers were forced to teach prerequisite knowledge to learners from grade 10 before teaching the grade 11 and 12 content and given the already limited time the teachers have, CTL becomes practically impossible to implement.

In summary, the overall impression that emerged from the lesson observations and the comments that the teachers made, was that the teachers valued CTL of mathematics as they saw the potential benefits that can come as a result of using CTL in their mathematics lessons. While the teachers placed high value on CTL, their actual practices in the classrooms did not reflect it much. The main factors hindering the effective implementation of CTL identified by the teachers were the lack of time as they claimed that, a lot of time was needed to fully implement or practice contextual teaching and learning effectively, as well as, the lack of resources such as textbooks in the case of School A.

CHAPTER FIVE

DISCUSSION OF RESULTS

In this chapter, the discussion of the results is presented. The six research questions are discussed, one at a time.

Research Question #1: *To what extent is contextual teaching and learning applied in grade 11 and 12 mathematics classrooms in secondary schools in Gobabis?*

It was observed that an average of 1.8 episodes per lesson referred to everyday experiences of either the learners or the teachers. This observation is less than half the frequency recorded by Mayoh and Knutton (1997) and it is only about a quarter of the frequency recorded by Kasanda et al. (2005) in their studies on the use of CTL in science lessons in the UK and in Namibia respectively. This however, should not be used as an indication that the mathematics teachers were less competent in contextualising their lessons than the science teachers observed in the studies by Kasanda et al. (2005) and Mayoh and Knutton (1997). This is probably because of the nature of mathematics, which sometimes does not allow contextualisation to take place especially at senior secondary school level. The topics observed i.e. Algebra, Coordinate Geometry, Indices, Trigonometry, Polynomials and Graphs might have had a bearing on the extent to contextualisation took place. For example algebra, coordinate geometry trigonometry and graphs were identified by teachers in the study by Akpo (1999) as difficult topics to teach.

As was observed by Kasanda et al. (2005) in a study that investigated the role of everyday contexts in learner-centred teaching in science classrooms, the use of contexts in the present study was only entertained by both teachers to the point that the numerical information needed for substitution in a formula was extracted. From there on, no references were made to the context and even the solutions were stated in abstract terms as evident in the example of the episode referring to personalised experience: telling stories, as the teacher only solved for *a* and *b* without answering the initial question of the number of apples and bananas that were purchased. Thus, as Mayoh and Knutton (1997) pointed out, teachers need to recognise that the mere mention of everyday events may not necessarily be as effective as they assume in improving science (and mathematics) learning.

The fact that the teachers initiated all everyday contexts observed in this study is rather worrisome, especially given the fact that the Namibian school curriculum rests on a learner-centred approach. In the learner-centred approach emphasis is on the needs, interests, and experiences of the child (Kasanda, 2007). Thus, learners ought to be actively involved in the learning process, learning should be related to their lives and experiences, learning should be an empowering and enlightening experience that creates awareness, competencies and attitudes that will enable the learners to take control of their lives (Villet, 2004). This observation therefore seems to suggest that our teachers are not fully implementing learner-centred teaching and learning, an observation also echoed by other researchers (Kasanda et al., 2005; Mpofu, 2002 cited in Kasanda, 2007).

Very often, the lack of resources (such as textbooks) and large classroom sizes are blamed for the non-use of learner centred methodologies (Kasanda, 2006). However, with the current study it came to light that while School A had large numbers of learners in class and no mathematics textbooks for the learners as opposed to School B, where all learners had mathematics textbooks and the numbers of learners per class was significantly smaller than School A. The use of everyday contexts was higher at School A. This can be an indication that a lack of resources and a high teacher-learner ratio is not necessarily 'the major' hindering factor when it comes to the implementation of CTL and learner-centred teaching. However, it may suggest that other factors are at play, which may include the creativity, exposure and commitment of the teacher.

Research Question #2: *To what extent does the Namibian Secondary School Certificate [NSSC] mathematics curriculum make room for contextual teaching and learning of mathematics?*

Analysis of the NSSC Mathematics syllabi, NSSC Mathematics textbooks, NSSC Mathematics specimen question papers and NSSC Mathematics teachers' guides led to the realisation that indeed gaps exist for teachers to explore in order to contextualise their lessons and different activities that they may engage their learners in are provided as well.

Through the analysis of the prescribed NSSC mathematics textbooks it came to light that localised contexts were included in both the examples given in the textbooks as well as the activities and exercises that the learners were expected to complete. This inclusion of contexts in assessment tasks in the standard textbooks should be used by the teachers to cement links between everyday experiences and mathematics (Kasanda et al., 2005).

The Namibian mathematics curriculum calls for the use of learners' everyday experiences (NIED, 2005). However, if the resources in terms of mathematics textbooks, teaching aids, posters, etc. are not available as observed at School A, it may hamper the full use of the learners' experiences. Proponents of such a setting would argue that the lack of resources gives the teachers the freedom to select relevant experiences (Backhouse, Haggarty, Pirie and Stratton, 1992), as experiences of learners and teachers are varied depending on where they find themselves. This is especially true given the fact that predetermined experiences might act as 'outsiders' (Costa, 1995 cited in Kasanda et al., 2005; Backhouse et al., 1992) that is, the everyday contexts will be incompatible with the experiences that the learners and perhaps the teachers are familiar with as the experiences do not come from themselves but from outside. Sometimes the necessary experiences can be provided by other school subjects hence the need for thematic teaching to be implemented if CTL is to be effective.

CTL is a complex method and amongst its methods is service learning and work-based learning. These critical components are not part of the curriculum. For the full implementation of CTL to be realised there is therefore a need for the curriculum to

include a variety of assessment methods and to move away from the high dependence on the final examination results at the grade 12 level.

Research Question #3: *What types of everyday contexts are used in the NSSC mathematics classrooms in secondary schools in Gobabis?*

The Mayoh and Knutton (1997) taxonomy was used to identify the types of contexts used (see, Appendix 1). From the results, it became clear that not all the types of contexts in the taxonomy featured in the lessons observed. This observation could be based on the fact that the taxonomy was developed in the UK and not in Namibia (Kasanda et al., 2005) accordingly the differences in terms of culture, teacher training, availability of resources and access to resources could be responsible for the observed differences and the non-use of some types of contexts in the taxonomy.

A further possible explanation for the observed differences in the results could be the fact that the instrument was developed for use in science classrooms and not necessarily in mathematics classrooms. It is however, also important to note that the nature of the topics observed also had a bearing on the types of contexts used. For instance, if statistics was one of the topics taught or observed it might have been easier for the teachers to refer to media reports on a particular issue say road accidents reported and use it as a statistic to draw and interpret graphs.

It is sad to note that none of the episodes referred to industry especially given the constant criticisms levelled against the Namibian education system by captains of industry (e.g. Pupkewitz (2006) in a local media in an article titled: On The Crisis of Education). The Namibian education system is said to produce incompetent graduates that are not able to perform in industry hence, the need for the teachers to include contexts relating to industry when teaching their subjects. On the other hand, industry should also be prepared to help in terms of providing experts from industry to help the teachers, as well as, providing the tools or equipment needed to properly demonstrate the relevance of the subject matter to aspects of industry. This is especially true given the fact that most, if not all, the teachers in the classroom are not experts of industry nor did they work there to experience the application of mathematics to most aspects of industry. While the experts from industry may not have the knowledge of teaching, they will certainly be helpful especially if they are to work hand-in-hand with qualified mathematics teachers to conduct presentations or demonstrations on particular topics or aspects of mathematics that have been identified.

Research Question #4: *What are the underlying pedagogical strategies for the use of contexts in NSSC mathematics classrooms?*

It is encouraging to note that the two mathematics teachers used CTL almost exclusively as a primary strategy. This may suggest that CTL was not used as an alternative strategy on which teachers had to rely when a non-contextualised method failed. However, it is sad to note that this impressive strategy was only introduced by the teachers and none

came from the learners. This certainly is a sad observation especially given the fact that the Namibian curriculum calls for the use of learners' experiences as a starting point of teaching, thus, in this case contexts seemed to have been super-imposed on to the learners.

It may be argued that there is nothing a teacher can do if the learners themselves are not coming up with the contexts. In such a situation the teacher is left with no other option but to come up with the context by him/her self. While such an argument might be true and relevant, it is the responsibility of the teachers to use methods that would encourage learners to relate what they are learning to their daily experiences. The methods that can be used to achieve this may include group work, projects, and many others, which were not observed during the course of this study. Indeed all lessons observed followed the same routine of; learners come in class, are greeted, homework checked, new lesson begins, teacher does one or two examples (often taking about 20 – 25 minutes), learners do a related question, time up, homework quickly announced (usually just an activity from the book). There was no variation in the teaching routine and methods used. As pointed out earlier contextual teaching and indeed learner-centred teaching are methods that draw upon many teaching methods and not just one method, hence, the need for teachers to vary their teaching methods and homework assignments that they give to the learners.

The implementation of learner-centred teaching and CTL in particular, can be very difficult and require ample time for the teachers to prepare and that the teachers be well

read in their disciplines and should have sound general knowledge as learners might challenge them (Kasanda et al., 2005). If these preconditions are not met, the teachers might give inaccurate information to the learners. A particular incident with Teacher A was a case in point. In the lesson on Coordinate Geometry where the learners where expected to find the distance between two points, where the teacher said distance is never negative when the distance between Gobabis and Windhoek was referred to as a context. Such an example can be easily challenged when distance is considered as a vector, as vectors are defined by their magnitude and direction. Hence, the need for the teachers to know what they are talking about when they are responding to learners' questions or when trying to contextualise their lessons.

Research Question #5: *What views do Gobabis secondary school mathematics teachers hold on the use of contexts in the teaching and learning of mathematics?*

The two mathematics teachers viewed the use of contexts in the teaching of mathematics as a method that would demonstrate the relevance of mathematics to the learners and thereby hopefully improve the performance of learners on mathematics tasks. The teachers also claimed to contextualise their lessons as far as possible. Nonetheless, they claimed that some aspects of senior secondary school mathematics were rather complex and abstract and as a result impossible to contextualise.

During the course of the interviews, it came to the attention of the researcher that the teachers knew that CTL entailed making connections to careers and everyday life.

Therefore, it would seem that for the teachers simply giving an example of how a particular aspect of mathematics was used in everyday life situations would indicate contextualisation. However, CTL goes beyond merely giving examples as it seeks to engage its learners in *performing significant work* (work that has a purpose, matters to others, involves making choices, and results in a product, tangible or intangible) and *using creative and critical higher-order-thinking* (analyse, synthesise, solve problems, make decisions, use logic and evidence) (Johnson, 2002).

While teachers referred to interesting aspects such as the active participation of learners, learners not being empty vessels to be filled, little effort came from the teachers during the lessons observed to engage the learners actively during the lessons. Thus, it can be said that the teachers knew what CTL entailed and the advantages thereof, however, their implementation of CTL needed to be worked on in order to improve their teaching efficiency.

Research Question #6: *What factors are hindering the effective implementation of contextual teaching and learning of mathematics?*

The main factor hindering the effective implementation of CTL of mathematics was the lack of time. The teachers indicated that they could not use CTL as often as they would like because they would not finish their mathematics syllabus within the allocated two-year period. This was not surprising given the amount of content to be covered at this level. This tended to force teachers to resort to a traditional method of instruction that

was evident in the teacher-centred or lecture methods used during the lessons observed. Additional training in 'time management for teachers' might be helpful and should be integrated in pre-service teacher preparation programmes and training in the use of CTL.

Planning and thinking of contexts was an aspect that did not feature well in the lessons. This could be attributed to the fact that the teachers had been long in the profession and might have thought that they 'did not need to prepare as they knew what they were doing' this was evident in their reluctance to provide the researcher with their lesson plans. It should be noted here that Teacher B showed the researcher an example of the 'lesson plan', which comprised just a list of topics or subtopics to be covered for the week that were written on the timetable of the week.

Lack of knowledge due to a lack of information and exposure was also observed, as the teachers were not fully aware of all the components of CTL. This was evident in the description or definitions of CTL, which were rather limited to simply giving examples to the learners as to where the subject matter fits or is used in everyday life or in industry. The full utilisation of CTL includes critical application of the known knowledge to solve the unknown, or to solve community problems and this use was not observed during the lesson observations nor was it mentioned by the teachers during the interviews. This observation is further supported by the lack of evidence during the observed lessons that indicated that no group work, or project work was used which according to Kasanda et al. (2005) would support more advanced types of learner-centred teaching and indeed CTL.

In most lessons observed, the learners showed a marked degree of low interest, low level of involvement and high degree of boredom with their work. Passivity was commonplace, demonstrated by learners who quietly copied down the methods without any apparent desire to challenge, question or think about their work. This lack of initiative and inquisitively on the part of the learners did not help much as they were supposed to do their part by challenging the teachers with relevant questions and thereby motivate the teachers to read and prepare very well before they present lessons.

While the lack of resources such as textbooks was identified as a limiting factor to the effective implementation of CTL of mathematics, the school with the least resources (School A) was observed to have been the one where the highest frequency of contextual episodes were recorded even though the results were not statistically significant. This is supported by the calculated chi-square (χ^2) value of 0.39 being less than the 3.84 value obtained from the table of critical values for χ^2 at 0.05 level of significance for one degree of freedom. This observation seemed to suggest that a lack of resources is not necessarily the major factor hindering contextualisation, but that other factors such as teacher commitment and exposure, topics being taught, had a bearing on the extent to which a teacher contextualised his or her lesson.

From the discussions in this chapter which resulted from the data which were collected at the two schools in the sample it emerged that the findings of the current research are consistent with previous research findings on contextual teaching and learning (such as the studies by Kasanda et al., 2005; Mutemeri and Mugweni, 2005; Glynn and Scott,

2003 and Mwakapenda, 2001). This observation was sad to note as it seemed to suggest that since the findings of the previous studies nothing much was done by stakeholders in mathematics education to overcome the shortcomings that were identified back then and thus, the same problems were still prevalent in the schools were the current study was conducted.

The problems included the underutilisation of learners' experiences in the actual lessons also observed by Kasanda et al. (2005), the inconsistency between the teachers' views of the usefulness of CTL and their actual practice in the classrooms also cited in the study by Mutemeri and Mugweni (2005) and the lack of resources and time constraints as barriers to using CTL cited by Glynn and Scott (2003). There is thus a need for a concerted effort from the government, teacher training institutions and indeed all stakeholders of education to use research results and recommendations that are made in research studies if the Namibian educational practice is to improve.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter presents a summary of the results, conclusion and recommendations emanating from the findings and discussions of this study.

Summary

This study was aimed at investigating the extent to which CTL was applied in grade 11 and 12 mathematics classrooms in secondary schools in the Gobabis area. In addition, this study sought to determine the types of contexts used and the underlying pedagogical strategies for the use of contexts as well as the factors hindering the effective implementation of CTL of mathematics in grade 11 and 12 classrooms in the Gobabis secondary schools.

The following questions were addressed in this study;

1. To what extent is CTL applied in grade 11 and 12 mathematics classrooms in secondary schools in Gobabis?
2. To what extent does the Namibian Secondary Schools Certificate (NSSC) mathematics curriculum make room for CTL of mathematics?
3. What types of everyday contexts are used in the NSSC mathematics classrooms in secondary schools in Gobabis?
4. What are the underlying pedagogical strategies for the use of contexts in NSSC mathematics classrooms?

5. What views do Gobabis secondary school mathematics teachers hold on the use of CTL in mathematics?
6. What factors are hindering the effective implementation of CTL of mathematics in the secondary schools in Gobabis?

Two types of research instruments were used in a converging fashion to collect data from the sample. The sample comprised the two mathematics teachers in the two purposefully selected secondary schools in the Gobabis area. The instruments used to collect the data were the interview schedules and the observation forms for mathematics lessons. Data was analysed using content analysis, case analysis and cross-case analysis. This type of analysis allowed the researcher to have a deep understanding of the use of CTL in the mathematics classrooms in Gobabis.

The key findings of this study were as follows:

1. **The use of everyday contexts was only entertained to the point that the numerical information needed for substitution in a formula was extracted**. However, CTL is a complex method that goes beyond simply giving examples, as it seeks to make educational connections between and amongst disciplines, learners' skills and the real world and making opportunities for the learners to apply their knowledge and skills. Further, only an average of 1.8 classroom episodes per lesson related to everyday contexts (see Table 1). Hence, CTL was not used to its full potential in the observed lessons.

2. **The Namibian mathematics curriculum does not cover all aspects needed by teachers to fully implement contextual teaching and learning**. Further, the mathematics curriculum does not encourage contextualization of content. In order to do so, the use of a variety of assessment forms such as portfolios and projects should be encouraged in addition to the written examination at the end of the grade 12 level.

3. **Not all contexts in the taxonomy suggested by Mayoh and Knutton (1997) were observed in the mathematics lessons**. It was found that none of the contextualized episodes referred to the mass media and industry. Further, none of the episodes attempted to develop the skills of the learners for use in everyday life (see Table 2). However, justifications for the observed results may be due to the fact that the taxonomy might not be relevant for use in developing countries as it was developed based on observations in an industrialized nation and in science. In addition, the nature of the topics observed in mathematics had a bearing on the contexts used.

4. **Contexts were used solely by teachers mainly as a primary strategy for exposition, question and answer and as part of assessment tasks**. While the use of contexts as a primary strategy is plausible, the fact that none of the contexts were initiated by the learners was worrisome, especially given the value that the Namibian curriculum places on the needs, interests and experiences of the

learners as it is based on the learner-centered paradigm (see Table 3). Therefore, the teachers should create a conducive environment in which learners express themselves and refer to their experiences without fear.

5. **The teachers viewed the use of contexts as having the potential of demonstrating the relevance of mathematics to the learners**. The views of the teachers where also reflected in a review of both national and international research on the use of contextual teaching and learning which indicated that the use of CTL have the potential to increase learner performance as it motivates and increases learners' interest and thus increasing classroom participation. Furthermore, CTL helps the learners make appropriate links between the content and the context(s) thus facilitating learning. However, research into the learning effect of CTL in mathematics lessons is limited and inconclusive.

6. **The teachers identified time constraints and a lack of resources as the major factors hindering the effective implementation of CTL in their mathematics lessons**. Both teachers indicated that they had difficulties in making use of CTL due to a lack of time because of the overloaded curriculum, as there was too much content to be covered over the two-year period. Teacher A went on to state that, 'if there were more resources such as textbooks it would be easier to make CTL a reality'.

Since the current study focused on only two schools and two teachers of mathematics, care should be taken in generalising the findings of the current study to the practises of other secondary schools' mathematics teachers. Despite this limitation, it is important to note that the findings might in some ways be representative of the activities taking place in many mathematics classrooms across Namibia.

Conclusion

The present study investigated the extent to which contextual teaching and learning was applied in grade 11 and 12 mathematics classrooms in Gobabis. The study concluded that CTL was not fully implemented because of a lack of resources as well as a lack of knowledge and experience in using CTL on the part of the teachers. Further, the heavy teaching load of the mathematics curriculum limited the extent to which CTL was implemented.

Finally the findings of this study are consistent with findings of other studies on contextual teaching and learning (Kasanda et al., 2005; Mutemeri and Mugweni, 2005; Glynn and Scott, 2003 and Mwakapenda, 2001). This seems to suggest that there is a long way to go before contextual teaching and learning is fully understood and implemented in the mathematics classrooms in the secondary schools in Gobabis.

Recommendations

In view of the findings reported in this study, the following recommendations are made. These are recommendations directed at the mathematics teachers, the Ministry of Education, tertiary teacher training institutions and other stakeholders of mathematics education in Namibia.

1. There should be extensive training of teachers through pre-service and in-service training to ensure that they are updated on the latest teaching and learning techniques and CTL in particular.

2. The Namibian mathematics curriculum should be revised to include more assessment methods such as portfolios and projects. These alternative assessment methods will give the learners and the teachers a chance to solve real world problems or simulated problems by applying mathematical concepts and ideas and in the process engaging in CTL.

3. The implementation of contextual teaching and learning of mathematics should start at earlier grade levels so that cognitive and meta-cognitive learning skills and critical thinking skills of the learners can begin to develop at an early age. In this way, learners will become more proficient, for example, in accessing and using different resources when they are at secondary school and it may thus help the learners to engage in contextual learning, as they will possess the required skills

to do so. Further, the learners will be able to challenge the teachers with relevant questions and to suggest and talk about their own experiences with mathematics beyond the classroom boundaries.

4. The mathematics teachers should use questioning techniques that enhance student learning and the development of problem solving skills and other higher order thinking skills. The questions must be carefully planned to produce the intended level of thinking, responses and actions by the learners. Thus, the teachers should move away from simply using the questions in the textbooks, but they should also make their own relevant contextual questions for the learners to answer.

5. The mathematics teachers should make time to prepare for their lessons thoroughly as it is only through proper lesson preparation that mathematics teachers can fully and effectively implement CTL.

6. The Ministry of Education should make resources available such as textbooks, computers and facilities such as libraries should be established at all the schools as this will enable the teachers as well as the learners to do in-depth research and preparations.

7. Finally, further research with more research participants across Namibia is needed on contextual teaching and learning especially research geared towards exploring the effect of the use of CTL on learner's performance on mathematics tasks.

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APPENDICES

Appendix 1: Descriptors that were used in the classification of the type of context used and the identification of the pedagogic strategies for using the contexts.

1. **Types of Everyday contexts used**

TYPE OF EVERY DAY CONTEXT USED
1. Referring to the mass media.
2. Referring to personal experience: telling stories.
3. Referring to common out of school experience.
4. Referring to uncommon out of school experience.
5. Referring to common objects.
6. Referring to images from out of school experience.
7. Referring to everyday knowledge.
8. Referring to everyday words.
9. Using analogies and metaphors based on everyday experience.
10. Using everyday contexts for classroom activities.
11. Developing skills for use in everyday life.
12. Referring to industry.

2. **Pedagogic strategies for using contexts**

PEDAGOGIC STRATEGIES
Strategy1a. Contexts as part of primary exposition
Strategy1b. Contexts as part of secondary exposition
Strategy 2a. Contexts as part of primary question/answer
Strategy 2b. Contexts as part of secondary question/answer
Strategy 3a. Contexts as part of primary assessment task
Strategy 3b. Contexts as part of secondary assessment task
Strategy 4a. Contexts as part of primary skills practice
Strategy 4b. Contexts as part of secondary skills practice

***Note*:**

1. Primary strategy refers to context introduced as the initial teaching approach.
2. Secondary strategy refers to the use of context as an alternative strategy following the failure of a non-contextualized method to produce desirable results.

Appendix 2: Classroom Observation Schedule

OBSERVATION SCHEDULE:

Name of School: _____ **Name of Teacher**: _____

Date: _____ **Time from** _____ **to** _____

Topic:_____ **Grade**: _____ **No. of learners**: _____

Time	Note full text of teacher-learners questions and answers (for group work: make notes of teacher interactions with groups).	Copy full text from the board (for group work: task provided, attach handout)	Note classroom arrangements, sketch plan

Appendix 3: Interview Guide Used to get Teachers' Views of CTL of Mathematics.

Section A: Personal Information

1. Name of school:_____
2. The grade being taught: _____
3. Teacher's academic qualifications:_____
4. Teaching experience [years]: _____

Section B:

5. What do you understand by contextual teaching and learning?
6. Where you exposed to contextual teaching during your studies?
7. What are the possible advantages of using contextual teaching and learning in mathematics (Is CTL important and why)?
8. What are the possible disadvantages of using contextual teaching and learning in mathematics?
9. Do you apply contextual teaching methods in the teaching of your mathematics lessons (How/ why/ why not)?
10. What are the problems that you are encountering in contextualizing your mathematics lessons (How do you overcome them)?
11. Please provide any possible recommendations that would make CTL of mathematics effective or a reality.

Appendix 4: Request Letter to Conduct the Research to MoE Permanent Secretary

Box 21234
Windhoek
Namibia

22 May 2007

The Permanent Secretary
Ministry of Education
P/Bag 13186
Windhoek
Namibia

Dear Sir

Subject: Request for permission to visit secondary schools in Gobabis

I am a Master of Education student at the University of Namibia. Part of my study is to complete a thesis by conducting research on a specific area of Mathematics Education. My research topic aims at investigating the extent to which contextual teaching and learning (CTL) is applied in grade 11 and 12 mathematics classrooms in secondary schools in Gobabis.

It is important that teachers are aware of the different teaching approaches/strategies used to enable them to teach their subjects effectively. Thus, this study on CTL strategies will enable teachers to focus their attention not only on teaching mathematics as an abstract subject, but to also relate mathematics to the real life experiences of the learners they teach. In doing this, the learners will view mathematics as a powerful tool with relevance to their world. The findings of this study may also serve as a guide to educational planners and mathematics teachers in Gobabis and Namibia at large to include the use of everyday contexts in the mathematics lessons. Finally, the findings of this study will also serve as a useful starting point for other researchers intending to conduct research in the area of CTL in mathematics.

Two types of research instruments will be used in collecting data from the sample. The instruments will include an interview schedule and an observation form for mathematics lessons.

A face-to-face interview will be conducted with all the teachers in the sample. The interview will enable the researcher to check the accuracy of impressions gained through observations. The interview is further helpful, in that it will give the researcher a chance to find out what is on the minds of the teachers, what they think and what they feel about CTL. This will enable the researcher to find out from them the things that cannot be directly observed.

A non-participant naturalistic observation format will be employed in this study. Thus, the researcher will visit NSSC mathematics classrooms to observe what is happening in the mathematics classrooms. The researcher will simply observe and record what happens in the classrooms as events present themselves or unfold in class. Further the lesson plans (as well as all copies of printed handouts, worksheets, or pages from books used during the observed lesson) of the teachers will be used to guide the observation and analysis process.

The schools to be visited are the Wennie Du Plessis Secondary School and The Gobabis Gymnasium.

The envisaged visit to schools is from 11 – 22 June 2007. I would be very grateful if favorable consideration is made at your earliest possible convenience.

Sincerely yours.

E. K. Makari (0812702525)

Appendix 5: Request Letter to Conduct the Research to Principals of Participating Schools

Box 21234
Windhoek
Namibia

23 May 2007

The Principal

Wennie Du Plessis / Gobabis Gymnasium

Dear Sir/Madam

Subject: Request for permission to visit your school

I am a Master of Education student at the University of Namibia. Part of my study is to complete a thesis by conducting research on a specific area of Mathematics Education. My research topic aims at investigating the extent to which contextual teaching and learning (CTL) is applied in grade 11 and 12 mathematics classrooms in secondary schools in Gobabis.

Two types of research instruments will be used in collecting data from the sample. The instruments will include an interview schedule and an observation form for mathematics lessons. A face-to-face interview will be conducted with all the teachers in the sample. A non-participant naturalistic observation format will be employed in this study. Thus, the researcher will visit NSSC mathematics classrooms to observe what is happening in the mathematics classrooms. The researcher will simply observe and record what happens in the classrooms as events present themselves or unfold in class.

Please be assured that the data collected will be treated and used with strict confidentiality and for the intended purpose of the study only. The envisaged visit to your school is from 11 – 22 June 2007. I would be very grateful if favorable consideration is made at your earliest possible convenience.

Sincerely yours.

Mr. E. K. Makari (0812702525)

Appendix 6: Permission Letter to Conduct the Research from MoE Omaheke Regional Office