

Teachers' understanding of the use of everyday contexts in the teaching of Mathematics at three selected urban junior secondary schools in Windhoek, Namibia

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ABSTRACT

The primary aim of this study was to gain insight into how effectively BETD teachers used everyday contexts to facilitate a meaningful understanding of the Mathematics content by the learners. The study used a qualitative research approach conceptualized within a constructivist framework. Nine Mathematics teachers from three junior secondary schools were purposively selected for the study. The data were collected using questionnaires, and interviews with the teachers. The results revealed varying levels of integration and effectiveness of everyday contexts used by the teachers to facilitate meaningful conceptual understanding of mathematics by the learners.

The findings suggested that preference of procedural mathematical skills over conceptual understanding impeded the effective integration of contextual teaching. The teachers also regarded the use of everyday contexts as time consuming. From this study, it can be concluded that the teachers had a clear understanding of the essence of contextual teaching of Mathematics and its advantages. Nonetheless, several factors seemed to affect their use of everyday contexts in the teaching of Mathematics. There is a need to change the perceptions of the Mathematics teachers toward the use of everyday contexts as a waste of time if teachers are to use everyday experiences in their Mathematics classrooms.

Keywords: *Everyday contexts, Basic Education Teacher Diploma, Mathematics, Contextual teaching and learning, Realistic Mathematics, Namibia*

1. INTRODUCTION

Teacher training for Basic Education was the responsibility of the former Colleges of Education in Namibia until the latter merged with the University of Namibia (UNAM) in 2010. Since 1993, the Colleges of Education have been offering the Basic Education Teacher Diploma (BETD) to train teachers for grades one to ten (Dahlstrom, 1998). The first set of BETD teachers graduated in 1996. Over the years there have been a lot of criticisms leveled against the BETD graduates in terms of their content knowledge and

their ability to teach properly. Among the most persistent criticisms, Dählstrom (1998, p.10) identified the following: the BETD teachers only focus on group work; the BETD teachers have very low content knowledge, especially in Mathematics and Science; the BETD is not training the teachers that we need in Namibian schools. Such criticism is also leveled against the BETD teachers with very limited or no backing of empirical evidence. Given the above, the teacher training process needs to be responsive to such criticisms in order to improve the professional skills and general public image of the BETD graduates, through proper and relevant training and research to understand what the BETD teachers are capable of achieving in teaching Mathematics.

In discussing BETD graduates' quality of teaching, Clegg and Courtney-Clarke (2009) argue that learners in schools are simply taught to develop mathematical routines with little or no understanding of what the routines mean. Routine procedures and rules are taught and learnt as isolated bits of knowledge, not connected to real-life contexts or other topics in Mathematics. Clegg and Courtney-Clarke (2009) further suggest that BETD graduates lack knowledge of how to translate mathematical abstractions into a form that is comprehensible and familiar to the learners in order to enable their learners to relate the Mathematics taught to what they already know. In more concise terms, they argue that the BETD graduates have a limited ability to use relevant everyday contexts to help their learners to understand and relate the content taught to their prior knowledge and experiences.

The Directorate of National Examinations and Assessment (DNEA) (Ministry of Education, 2009) recommended that Mathematics teachers should use Mathematics in practical situations and link it to real-life contexts in order for the learners to gain conceptual understanding of the content taught. The same recommendation was again aptly captured by DNEA (Ministry of Education, 2010, p.159) with the statement "let learners do and touch Mathematics" in order for the teachers to make the content more relevant and practical to the learners. These recommendations were made with the understanding that such teaching will enable the learners to learn Mathematics conceptually and enable them to successfully apply the concepts mastered in unfamiliar problem-solving situations in the grade 10 external examinations.

Considering the teaching skills of Mathematics teachers in Namibia in general, the Report of a National Consultative Process on Improving Mathematics in Namibia noted that teaching methods advocated for Mathematics are not efficient. It argues that the teaching methods: lack application and contextualization; create little 'feel' for numbers; do not allow Mathematics to be visualized; emphasize procedural thinking (rote procedures) and; are inadequate for problem solving (learners cannot apply skills to unfamiliar situations) (Ministry of Basic Education, Sport and Culture) (MBESC, 2002, p.7).

Based on the above discussion, this study was necessitated by a need to investigate concerns raised in several reports of government commissioned studies (MBESC, 2002; Clegg and Courtney-Clarke, 2009; DNEA, 2009; DNEA, 2010) in terms of the use of



contextual teaching and learning of Mathematics in schools. The following research questions were addressed in this study in order to determine the BETD mathematics teachers' use of everyday contexts in the teaching of mathematics in order to enhance its learning in Namibian schools in Windhoek schools:

1. How do BETD Mathematics teachers define and understand the use of everyday contexts?
2. What are the challenges faced by BETD Mathematics teachers in the use of everyday contexts in their Mathematics lessons?

2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

The social constructivist theoretical framework underpinned this study (Vygotsky, 1978; Wheatley, 1991). The concept Contextual teaching and learning (CTL) was used as it integrates philosophies of social constructivism and brain-based learning. In contextual learning, the students' experiences and interests are deemed essential in making connections between academic concepts and real world applications. Therefore, it is important to take these into consideration to ensure learning takes place. The social constructivist aspect of CTL is based on the connections between previous knowledge and collaborative learning 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). Accordingly, a conducive and challenging learning environment might result in enhanced grasp of the taught content.

Social constructivism emphasizes that meanings and understandings grow out of social interactions. Ng and Nguyen (2006) argue that central to the constructivist learning theory is the belief that learners are active in shaping how new knowledge is taken in and shaped and that new understandings emerge progressively as learners develop own views, test those views and re-shape their understandings on the basis of their experiences. Thus, the teacher as a facilitator should possess knowledge of the subject in order to assist his or her learners effectively. However, in this context, the knowledge a teacher needs to possess to teach effectively is always dependent on the interplay of a number of factors, over and above, the understanding of Mathematics content. Shulman (2004) referred to such knowledge as pedagogical content knowledge. According to Shulman (1986), pedagogical content knowledge, "...also includes an understanding of what makes the learning of specific concepts easy or difficult: the conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning (p. 9)".

Shulman (2004) further posits that since there are no single most powerful forms of representation of reality (e.g. analogies, illustrations, examples, explanations and demonstrations) teachers must have various alternative forms of representation of the

content they teach. He further points out that some of “these representations are derived from research whereas others are derived from the wisdom of practice” (p.203).

Cochran, De Ruiter, and King (1993) revised Shulman’s original model of pedagogical content knowledge to be more consistent with a constructivist perspective on teaching and learning. Their revised model was based on an integration of subject matter knowledge, pedagogical knowledge and two other components of teacher knowledge which separate teachers from subject matter experts. One component is teachers’ knowledge of students’ abilities and learning strategies, ages and developmental levels, attitudes, motivations, and prior knowledge. The other component of teacher knowledge that contributes to Pedagogical Content Knowledge (PCK) is the teacher’s understanding of the social, political, cultural and physical environments in which students are asked to learn. The researchers grounded their understanding of the problem investigated in Cochran, De Ruiter, and King’s (1993) perspective of constructivist learning in order to understand the BETD Mathematics teachers’ use of everyday contexts in the mathematics classrooms.

3. DEFINITIONS AND THE NATURE OF CONTEXTUAL TEACHING

Contextual teaching and learning (CTL) has different definitions, each of which is based on different perspectives (Hayes, 1993; Granello, 2000). These different perspectives could include among others: Realistic Mathematics Education (RME), problem-centred and problem-based approaches, critical education, and modeling. Contextual teaching and learning has been defined as a teaching methodology that relates academic concepts to real-world conditions and encourages students to see how what they learn relates to their lives (Putnam, 2000; Williams, 2007). Contextual teaching and learning thus enables learners to connect what they learnt in class to real-life contexts in which the new knowledge and skills can be applied. Mayer (1998) expands that view further by noting that in CTL, learning is attached to the context in which the knowledge is constructed, and knowledge is seen as inseparable from the context and the activities within which it develops. Thus, connecting content with context is important to bring meaning to the learning process.

Thus, contextual teaching and learning creates a classroom environment in which the pre-knowledge, opinions, perspectives and the life experiences of learners are valued in the process of teaching and learning of formal school Mathematics. Conversely, in the traditional Mathematics classroom setting, learners’ out-of-school experiences, opinions and perspectives are seldom integrated in the normal classroom discourse. Therefore, in the Namibian school system which is based on the learner-centred philosophy (Ministry of Education and Culture, 1993), an understanding of how BETD teachers integrate the conceptual and cultural knowledge that students bring with



them to the classroom and how they employ relevant everyday contexts in Mathematics teaching is necessary.

4. FACTORS THAT AFFECT THE USE OF EVERYDAY CONTEXTS

Some Mathematics educators (e.g. Burton, 1996; Davis, 2003; Horsthemke, 2006) do not support the use of everyday contexts in Mathematics instruction. Venkat, Bowie, and Graven (2009) suggest that those who oppose the use of everyday contexts in Mathematics teaching argue that the nature of Mathematics is incommensurate with the nature of everyday considerations, or that teachers are not competent enough to teach Mathematics effectively using everyday contexts. Moreover, several factors affect the use of everyday contexts in Mathematics instruction. The nature of the topic (Makari, 2007; Gainsburg, 2008), the attitudinal orientations of the teachers (Julie, Holtman, & Mbekwa, 2011) and an interdependence of teachers' beliefs, subject content knowledge and pedagogical content knowledge (Bransford, Brown, & Cocking, 2000) have been identified as some of the factors that determine if and how teachers use everyday contexts in their Mathematics lessons.

Literature further suggests that the use of everyday contexts is beneficial in the teaching of Mathematics. The teachers can employ everyday contexts to enhance the following positive benefits; improvement of learner motivation and engagement (Boaler, 1993; Boaler, 1994; Barnes, 2004; Mutemeri & Mugweni, 2005; Ng & Nguyen, 2006; Makari, 2007; Barnes & Venter, 2008; Gainsburg, 2008), enhancement of transfer of learning between Mathematics and its real-life applications (Boaler, 1994) while Stears, Malcolm, and Kowlas (2003, p. 117), indicate that "the use of everyday knowledge in the science classroom increases the levels of engagement of learners."

However, some challenges limit the use of everyday contexts in Mathematics instruction. Sometimes the everyday contexts used by the teacher create a barrier to the understanding of the Mathematics taught if the contexts are unfamiliar to the learners (Boaler, 1993; Ng & Nguyen, 2006; Vithal, 2008). Furthermore, finding relevant culture-sensitive ways to contextualise mathematics content is difficult in heterogeneous classrooms where learners came from different social and cultural backgrounds (Barnes & Venter, 2008). Teachers regard the integration of everyday contexts as time consuming (Ng & Nguyen, 2006; Makari, 2007; Barnes & Venter, 2008; Gainsburg, 2008) and an impediment to their pace of completion of the prescribed curriculum.

5. METHODOLOGY

A qualitative research approach was used. The study was naturalistic because predominantly narrative data, behaviours and opinions were recorded and the greater part of the data collection process occurred in natural classroom settings which were not

researcher-controlled. Nine junior secondary school Mathematics teachers from three schools (A, C, D) in Windhoek comprised the sample. Three BETD Mathematics teachers, one teaching each of the grades 8, 9 and 10 per school were selected in order to cover the entire junior secondary phase per school. The participants were purposively selected based on their BETD qualifications and at least one year teaching experience. The requirement of at least one year teaching experience was needed to exclude novice teachers who might rely on guidance by experienced teachers in the choice of teaching approaches, types of teaching-learning aids and type of assessment to mention but a few.

The data were collected using structured open-ended interviews, observation of classroom teaching and questionnaires. Face-to-face interviews allowed participants to express their opinions on the use of everyday contexts in the teaching of Mathematics and also enabled the researchers to gain insight into the participant's understanding of contextualization of the Mathematics content. Immediately after the interview, a questionnaire was administered to all the nine participants. Questionnaires were used to increase the trustworthiness and consistency of the data collected by using multiple sources of data collection (Boudah, 2011) Furthermore, the questionnaire afforded an opportunity to those participants who could not express themselves effectively orally, to write down their opinions. Inductive data analysis method was used to interpret the data collected. The data were coded and organized into categories. Then the coded categories were combined in order to search for repeating ideas and larger themes connecting the codes and the summary findings were linked to the research questions.

6. RESULTS

6.1 The BETD Mathematics teachers' definition of everyday contexts

Varying definitions of everyday contexts were given by the participants in terms of Mathematics teaching. However, the most frequent views were those of integrating learners' pre-knowledge into Mathematics lessons and using relevant examples from the learners' everyday lives. Two of the definitions given were: *"Using relevant examples that are in learners' everyday lives or real-life situations that we can relate to the content in Mathematics"* (Teacher 3) and *"Use of real-life situations that we can relate to the content in Mathematics or simply applying Mathematics in our daily lives by using practical experiences of the learners in the Mathematics classroom or real-life situations that we can relate to the content in Mathematics"* (Teacher 4). Teacher 8 stated that using everyday contexts referred to *"teaching Mathematics in a practical way."* On further probing, he explained that *"it means to integrate learners' experiences and constant use of media in your teaching"*. From the above quotations, it is clear that the BETD Mathematics teachers in this study "knew" what everyday contexts meant in the teaching of mathematics.



6.2 Challenges faced by BETD teachers in the use of everyday contexts in their Mathematics lessons

This aspect was investigated in terms of challenges the teachers faced in the use of everyday contexts in their Mathematics lessons with respect to: the learners, the nature of Mathematics, the presence of teaching-learning aids and the classroom environment. The nine participants felt that most learners in their classrooms viewed Mathematics as a difficult subject and were not interested in it irrespective of the teaching methods employed and that the use of everyday contexts was no exception. The participants argued that they were de-motivated by the learners' attitudes in the mathematics classroom to use innovative teaching methods including everyday contexts. Some of the views were:

Teacher 2: *"Most learners are conditioned to believe that Mathematics is very difficult and they don't concentrate even if you teach using interesting methods."*

Teacher 4: *"Learners find Mathematics very challenging and it does not help to use everyday contexts."*

The teachers also indicated that the learners did not always understand the contexts used to explain the content. Teacher 8 stated that *"If I use an everyday context, were the learners really exposed to it outside the class and how will I know? It might be something new to them, therefore it's better to teach the content directly from the textbook to be fair to all"* to explain that the learners did not always understand the contexts used to explain the mathematics content. Moreover, some teachers felt that everyday contexts caused only more confusion than facilitate meaningful learning. Teacher 3 stated that, *"my learners cannot solve simple word problems using contexts from their environment, like marbles and sweets, but they can solve the same problem if I remove those things. Therefore everyday contexts can be confusing for the learners."*

All nine BETD Mathematics teachers regarded the utilisation of everyday contexts in Mathematics as time consuming both in preparation and during lesson presentation. This concern was clearly indicated through responses such as; *"using everyday contexts is time consuming!"* (Teacher 5) and subtle ones like *"preparing to teach using everyday contexts can take up the whole afternoon and one is left with no time for marking and other things"* (Teacher 9). Participants also argued that certain topics were too abstract and could not necessarily be aligned to the learners' everyday experiences and hence impeded their use of everyday contexts. Teacher 5 noted that *"some topics are too abstract and you as the teacher just don't know how to relate it to the learners' experiences, for example irrational numbers"*.

Teachers claimed that sometimes the unavailability of teaching-learning aids undermined their ability to teach contextually. Furthermore, the general lack of teaching aids for specific topics that could bring out the practicality, relevance and utility of Mathematics to the learners was also highlighted. Teacher 6 stated that *"the unavailability of relevant*

teaching aids makes teaching and learning difficult". Teacher 9 remarked that *"there are not enough [ready-made] teaching aids available for Mathematics. We cannot improvise graph boards, compasses and computers"*.

Further, all nine participants pointed out that sometimes a topic requires specialized instruments. For example, geometrical construction needs pairs of compasses and dividers, set squares and rulers. However, in the absence of such instruments learners will not fully grasp the essence of the concept. This concern was underscored by Teacher 2 who explained that *"when I am teaching circumference and diameter of a circle and I draw sketches with freehand because the school doesn't have compasses, what I am teaching won't be accurate"*.

All participants felt that overcrowded classrooms affected their ability to contextualise Mathematics content meaningfully. Teacher 9 noted that *"overcrowded classrooms do not allow teachers to use everyday contexts or learner-centred teaching because the classes are too noisy and learners don't concentrate"*. Two more issues concerning the classroom environment identified by the respondents in this study were: *"disciplinary problems and overcrowded classrooms do not allow one to have a learner-centred teaching approach in teaching Mathematics"* (Teacher 5) and *"some classrooms lack desks and chairs and learners stand or sit on the floor an entire period therefore they are not be able to concentrate on Mathematics"* (Teacher 8).

Although overcrowded classrooms were a feature at all three schools (Schools A, B and C) visited, the lack of classroom furniture for learners was very acute at School B only. The participants in this study seemed to associate teaching Mathematics contextually with the provision of a lot of teaching aids. In our view, teaching contextually might lessen dependence on commercially produced teaching aids. In fact, the challenge that the Mathematics teachers might face might be identifying appropriate everyday life experiences that would enhance the teaching of a given Mathematics topic.

7. DISCUSSION

This study aimed at investigating BETD teachers' understanding of everyday contexts as well as factors affecting the teachers' use of everyday context to facilitate a meaningful understanding of the Mathematics content by the learners. All nine BETD Mathematics teachers who took part in this study had a working understanding of the concept of everyday contexts. Their definitions of everyday contexts were relatively consistent with those found in the literature. Their definitions emphasized relating academic content to real-world situations or contexts in which the new knowledge and skills could be applied (Putnam, 2000; Williams 2007). The teachers' views on contextual teaching of Mathematics are within the broad parameters of the constructivist view of learning in line with Johnson's (2002) observation that contextual teaching and learning (CTL)



incorporates social constructivism to employ students' experiences and interests to relate academic concepts and real-world applications.

According to Hayes (1993) and Granello (2000), different definitions of CTL are informed by different perspectives. The data from this study suggest that the teachers' definitions of everyday contexts were consistent with a learner-centred education perspective. The opinion *"I use many different learner-centred teaching methods and the use of everyday contexts is just one of them"* by Teacher 5 attests to the teachers' perceived link of contextual teaching with LCE.

The teachers' view that learners did not always understand the contexts used to explain the content with, could be analysed from two perspectives. First, the teachers might not be able to implement or integrate everyday contexts in their lessons effectively in view of Mayer's (1998) argument that in contextual teaching and learning, learning is attached to the context in which the knowledge is constructed, and knowledge is intertwined with the context and the activities within which it develops. The teachers in this study integrated and used everyday context in the introduction of their lessons. Indeed, our study seems to suggest that situations in the classroom including the topic being taught do limit the use of everyday context. Further, it is clear that "knowing" something does not imply it will be "used" as was the case in this study. The BETD teachers could "accurately" define everyday contexts and gave situations in which these could be used, but did not actually use them in most of their teaching.

Second, teachers expressed the concern that if learners were not familiar with the context used by the teacher, no learning took place and the learners ended up confused as a result of the use of that everyday context. This view is supported by Boaler (1993) and Ng and Nguyen (2006) who argue that learners are sometimes unable to deal with contextualised problems if they are not already familiar with the subject content under consideration. Boaler (1993) further points out that in such a situation the context itself became an additional challenge because learners' lived experiences did not include it. We suggest the use of materials including textbooks that are culturally relevant to the learners.

All nine BETD mathematics teachers felt that topics that were too abstract could not be taught contextually. However, the data collected in this study suggested that the teachers viewed teaching page-by-page from a textbook as a safer and faster alternative to teaching contextually. That approach was regarded safer, since no contexts which could cause confusion were used and it was regarded as faster, because contextual teaching was seen as time consuming. That finding was consistent with Gainsburg's (2008) opinion that most teachers feared that contextual teaching through ill-structured problems could lead to confusion, impede learning and compromise the learning of Mathematics. In our study the BETD mathematics teachers appear to have "become" slaves to the textbook and adhered to it at all cost. A situation that may produces rote learning in the learners.

Unavailability of teaching-learning aids, overcrowded classrooms and associated disciplinary problems were also viewed as factors affecting the use of contextual teaching. However, even when the same teachers taught in classrooms with a reasonable teacher-learner ratio and all learners had access to a chair, a desk and textbook, everyday contexts were not used by the same teacher. Therefore, it's safe to conjecture that the attitudinal orientations of the teachers played a major role in whether or not to use everyday contexts in their teaching. The data from this study seems to suggest a need for in-service training with a focus on contextual teaching of Mathematics. This suggestion appears to imply that the initial teacher training (which was three years) was not sufficient in enabling the BETD mathematics teachers to successfully integrate everyday contexts in their lessons. Alternatively, it highlights a need for refresher courses to assist teachers with creative teaching approaches such as the use of contextual teaching to enhance the teaching and learning of mathematics in Namibian mathematics classrooms.

8. CONCLUSION AND RECOMMENDATIONS

From this study, it can be concluded that the BETD mathematics teachers had some understanding of the essence of contextual teaching of Mathematics and its advantages. Nonetheless, several factors seemed to affect their use of everyday contexts in the teaching of Mathematics. Some of these included; an exaggerated view of their use of everyday contexts in their lesson plans; tended to teach Mathematics procedurally with little conceptual understanding and finally, they viewed the use of everyday contexts as a waste of time, especially since they had large classes. It is recommended that teachers should be encouraged to teach Mathematics relationally which might enable them to see the use of such content in everyday lives. There is a need to change the perceptions of the Mathematics teachers toward the use of everyday contexts as a waste of time if they are to use these everyday experiences in their Mathematics classrooms. It is further recommended that in-service training be given to teachers on how to use problem-based approaches to enhance their use of contextual teaching in their Mathematics classrooms.

9. LIMITATIONS OF THE STUDY

This study was limited to three schools in Windhoek. Therefore, the findings should not be generalized to other schools and should be treated with caution in that regard. However, the findings might be indicative of the current situation in Namibian junior secondary schools concerning contextual teaching of Mathematics by the BETD trained teachers.



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