FORMATIVE ASSESSMENT IN GRADE 8 MATHEMATICS:

TEACHERS' PERCEPTIONS AND IMPLEMENTATION

by

NGWENYA THEMBAYENA KHOSI

Student No. 208528863

A dissertation submitted in partial fulfillment of the requirements for the Master of Education degree in the School of Educational Studies

Faculty of Education, University of KwaZulu Natal

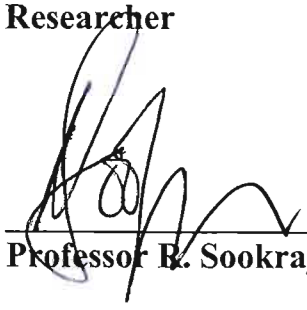
Supervisor: Professor Reshma Sookrajh

December 2009

DECLARATION

I **Ngwenya Thembayena Khosi** (Student Number 208528863) do hereby declare that this dissertation, which is submitted to the University of KwaZulu-Natal for the degree of Master of Education, has not been previously submitted by me for a degree at any other university, and that all sources I have used or quoted have been indicated and acknowledged by means of a complete reference.

Ngwenya Thembayena Khosi
Researcher



Professor R. Sookrajh

ACKNOWLEDGEMENTS

I wish to express my deepest gratitude to the Lord for giving me the strength to undertake this task.

I would also like to express my gratitude to the following persons:

My supervisor, Professor Reshma Sookrajh, for her guidance and devotion, her kindness and patience, which enabled me to complete this study; the principal of the School for granting me permission to interview four educators on his staff, as well as the educators themselves for their patience and cooperation; and my family, especially my husband and my children for their love and support, without which it would have been difficult to complete this undertaking.

ABSTRACT

The constitution of Republic of South Africa (Act 108 of 1996) provides the basis for curriculum transformation and assessment for development in South Africa. The curriculum aims to develop the full potential of each learner as a citizen of a democratic South Africa. Formative assessment is seen as an assessment that can develop the standard of education in South Africa. Muller (2004) asserts that the C2005 policy document and assessment policy for General Education and Training make much of the need to shift from this "authoritarian" approach, to assessment which is formative, standard-based and continuous. Therefore, formative assessment is important in the process of teaching and learning.

This study explores teachers' knowledge of formative assessment and how they translate it into practice within a context of Mathematics. It examines the nature of assessment techniques used by educators at the school and explore its relationship with practice. Furthermore, it aims to determine whether the educators are willing to adapt formative assessment practice to meet the changing demands of South African school education as prescribed by the New Curriculum Statement (NCS) in grade 8.

Data collection and observations for the study were conducted at a high school in Hammarsdale, KwaZulu-Natal, South Africa. Four teachers were interviewed to determine their perception of formative assessment. Two of the four teachers were selected on basis of the interviews for further data collection. These two were observed when conducting lessons. At least two lessons for each teacher were observed. The nature of the task that the two teachers designed for formative purpose and the feedback they gave to learners were analyzed.

The findings from this study suggest that teachers do not reject or resist change in practicing formative assessment, but they have not been properly assisted to replace the old practices with new ones. The teachers therefore, interpret formative assessment according to their own accumulated understanding, which differ from teacher to teacher. Thus, the study recommends that if the change in assessment practice is to be "efficient", it must be accommodated by "appropriate" professional development of teachers.

TABLE OF CONTENTS

FIGURES

Chapter 1 - Context, Objectives and Overview

1.1 Introduction

Assessment is essential in the process of teaching and learning. Shepard (2000) points out that assessment is at the heart of teaching as it provides a necessary condition for judging success or failure of teaching and learning. It is a continuously planned process of gathering information on learner performance. According to Sieborger and Macintosh (1998) the purpose of educational assessment is to improve teaching and learning because assessment is an integral part of the education process, and is strongly bound up with the curriculum. Black (1998, p.13) identifies three purposes of assessment; he states that "assessment is concerned respectively with the support of learning, with reporting the achievement of the individual learner and with satisfying demands for educational accountability". The introduction of Outcomes-based Education (OBE) in post apartheid South Africa (i.e. since 1994) has brought about many changes in assessment, especially in Mathematics. The purpose of this study is to explore teachers' perceptions of formative assessment in Mathematics grade 8. Furthermore, the study will explore how Mathematics teachers in grade 8 translate their perceptions into practice within a context of Mathematics since formative assessment is a key concept in criterion-referenced assessment in Mathematics. The focus is to examine the nature of assessment techniques used by Mathematics educators at a South African school and explore its relationship with practice. Further, it aims to determine whether the Mathematics educators are willing to adapt formative assessment practice to meet the changing demands of South African school education as prescribed by the New Curriculum Statement (NCS) in grade 8.

1.2 Assessment in Mathematics

Assessment in Mathematics has a long history just like other assessments. According to Niss (1993) it was based on a behaviorist approach where discrete facts and skills were tested, where ranking was the primary goal. Actually, assessment in Mathematics was used for grading, ranking and credentialing. For the 21st century it is a challenge as the world is changing globally and economically, the current tends argues for alternative vision for today's assessment in Mathematics (Kilpatrick, 1993). Furthermore, Kilpatrick asserted that Mathematics educators were also concerned and were willing to produce an assessment

practice that did more than measure a person's mind.

This view was a shift from summative assessment – that is, where learners are assessed to determine an overall measure of achievement, to the more supportive role of formative assessment, where learner's achievement results in action plans for both teacher and learners in the pursuit of further learning. According to Dikgomo, Sutner and Roman (1997) there were multiples of assessment approaches that could be used to improve teaching and learning. Some Mathematics educators were actually using them. For example, some Mathematics educators used the cognitive approach which they called an investigative approach – lessons built around Mathematical investigations or problems. Mathematics educators, who used this approach, said that their learners remembered and understood Mathematics better, because they worked actively to construct their own mathematical rules and problem solving strategies. Furthermore, they highlighted that some used questioning, discussion, posing interesting questions, creating their own questions, role play, project, research, peer interaction and reporting back to the class.

According to Joffe (1993) assessment should reflect the curriculum, and Mathematics educators should necessitate a rethink of how it is assessed and for what purpose. Therefore the new curriculum argues that teachers should design tasks that reflect real-life situations for formative purposes. The need for a change in assessment is not change for change's sake – Joffe (1993) asserted that it was necessary in order to establish whether learners were being educated appropriately to equip them for the changing needs of society and workplace. Therefore, teachers are encouraged to use formative assessment in Mathematics. Formative assessment is a core part of OBE teaching and learning. It monitors and supports the process of learning, and is used to inform teachers and learners about a learner's progress so as to improve learning. The information should be of a kind that will enable the learner to grow through constructive feedback, to encourage and motivate learners. For example a teacher might listen to a learner discussing the sum or explaining how she came to the answer so as to know how to help her improve or to encourage her.[1] Furthermore, formative assessment is seen as a self-reflective process that intends to promote student attainment. Educators need to concentrate on how learners plan, make decisions and solve problems, rather than whether

[1] http://en.wikipedia.org/wiki/formativeassessment

they can regurgitate chunks of content that have been fed to them in a styled form (Joffe, 1993). This requires that educators evaluate learners thought processes, as well as their knowledge of facts. This can be done in many ways but the purpose should be formative. The use of formative assessment can be effective and many stakeholders feel that Mathematics should be relevant to learners. The concept of relevance according to Tema (1995) refers to the need to match the curriculum with the learners' lived experience and their personal characteristics such as age, intellectual abilities, interest, temperament and aspiration. She further indicates that the relevance of content is said to have a variety of psychological benefits such as developing, motivating and interest. It also allows for the anchoring of new concepts to learner's existing knowledge and this can only be done through using formative assessment in the process of teaching and learning, and this could allow the learners to learn meaningfully by relating new knowledge to prior knowledge. Furthermore, Tema (1995) says it allows for the characteristics of the learner to be used to his/her advantage in the learning situation.

The South African government established public accountability by shifting its approach to assessment from norm-referenced to criterion-referenced assessment (henceforth CRA) and by setting a system of common norms and standards across different education practices (Shalem and Steinberg, 2001). The shift to CRA was probably the most innovative move in Outcomes-based Education because in CRA learners are assessed according to an explicit and agreed upon set of criteria. The purpose of these changes was to gear up the education system in South Africa, and these changes led to curriculum transformation, and actually the education system has experienced a total transformation.

Curriculum reform followed a number of clear steps. For example, the emphasis on different assessments which included formative assessment showed that education system was taking education to a higher level for the purpose of developing equity, skills and for globalization. "The first step immediately after the 1994 elections was the ironing out of variations in the curriculum used by different education department. The second step – presented as emergency intervention while the new curriculum was being developed – purged the existing curriculum (syllabi) of racially offensive, sexist and outdated content"(Chisholm, 2003). Furthermore, in 1995, according to Brodie (2000) the National Education Department set in motion a curriculum development process which has a stated intention to transform education and training in South Africa. She states that the key concepts and principles informing the

curriculum development process and curriculum design were set out and these included: stakeholder's involvement in the process of OBE, learner centeredness, relevance and the role of assessment in curriculum. The third wave of reform according to Harley and Wedekind 2004, p.197) "shifted the focus away from contention to assessment with the introduction of continuous assessment (CASS) in schools

Moreover, the Constitution of the Republic of South Africa (Act 108 of 1996) provides the basis for curriculum transformation and assessment for development in South Africa. The curriculum aims to develop the full potential of each learner as a citizen of a democratic South Africa and different assessments such as formative assessment, baseline assessment and summative assessment were introduced to meet the standard of education. Therefore, teachers must take into account the schemas or experience of learners when planning their classroom assessment tasks. Bennet and Dunne (1994) demonstrate that to take schemas adequately into account necessitates a clear understanding of what they are, that is, it requires the teacher to take on the role of diagnostician. The Revised National Curriculum Statement (RNCS) emphasizes assessment, and each learning area statement includes a detailed section on assessment. An Outcomes-based framework uses assessment methods that are able to accommodate divergent contextual factors (Department of Education, 2002). Further, according to the Department of Education (2002), the Outcomes-Based Education forms the foundation of the curriculum in South Africa. Formative assessment is linked to it in a sense that its purpose is to enhance the learners' progress, and strives to enable all learners to achieve their maximum ability through monitoring and supporting the process of learning and teaching. Formative assessment is seen as an assessment that can develop the standard of education in South Africa; Muller (2004) and other scholars like Chisholm (2003), Kahn (2006), Sieborger and Macintosh (1998) contend that the C2005 policy document and assessment policy for General Education and Training make much of the need to shift from this "authoritarian" approach, to assessment which is formative, standard-based and continuous.

In the period since 1998, Muller (2004) indicates that the Department of Education has taken steps to prescribe exactly what the continuous assessment should consist of in each learning area in the senior phase of the GET (grade 7-9) and in each subject examined for the senior certificate; formative assessment is essential in this process. The emphasis is that assessments should provide an indication of the learner's achievement in the most effective and efficient

manner and it should help learners to make judgments about their own performance, set goals for progress and provoke further learning and formative assessment is the best assessment that can address these issues. Therefore, all educators are expected to be the key contributors to transformation of education in South Africa.

Furthermore, the assessment policy indicates that each assessment should have a purpose, for example, the purpose of formative assessment according to Malan (1997) is to give some feedback to learners and educators about learning progress, or the lack thereof. Gardner (2006) refers to formative assessment as an assessment for learning, its purpose is to monitor and support the process of learning and teaching, and it is used to inform learners and teachers about learners' progress so as to improve teaching and learning. Therefore, formative assessment is important in the process of teaching and learning and it is a key concept in CRA. It is a form of assessment that assesses learner progress during the learning process in order to feedback that will strengthen learning. The word formative according to Singh (2004) is used to identify assessment that promotes learning by using evidence about how far learners have gone. Moreover, the continuing need to develop the potential of classroom assessment to support learning has recently been stressed by number of researchers in the field (Assessment Reform Group, 1999). Formative assessment could be used as a classroom assessment and it can develop and support learning because its purpose is to enhance the learning process. Formative assessment strives to enable all learners to achieve their maximum ability through monitoring and supporting the process of learning and teaching (Department of Education, 2002). According to Shepard (2000) this kind of assessment (formative assessment) can be used as part of instruction to support and enhance learners developmentally and to give feedback into the teaching and learning; it integrates learning and assessment.

The Assessment Policy for General Education and Training (DoE, 2002) argues that assessment should provide an indication of learner achievement in a most effective and efficient manner, ensure that learners integrate and apply knowledge and skills, and to assist in the process of learner assessment. The Revised National Curriculum Statement outlines the learning outcomes and their associated assessment standards in Mathematics. Mathematics has five learning outcomes, viz. 1. Number, operation and relationships 2. Patterns, functions and algebra 3. Space and shape (geometry) 4. Measurement 5. Data handling, which are useful when designing tasks for formative purposes. In terms of

assessment procedures, outcome-based education requires a combination of an ongoing formative assessment which is informal and diagnostic. Moreover, according to the Revised National Curriculum Statement the learning activities should address more than one related assessment standard within a learning outcome and relate assessment standards across learning outcomes within the grade. Assessment standards are the knowledge, skills and values that learners need to show to achieve the learning outcome in each grade. For example, in grade 8 for Learning Outcome 1, assessment standards suggest that the learner should use a range of techniques to perform calculations, and they must also use a range of strategies to check solutions and judge the reasonableness of the solution. For learning outcome 2, they must investigate and extend numeric and geometric patterns looking for relationships or rules, including patterns. They must also describe, explain and justify observed relationships or rules in their own words or in algebra. Furthermore, they must represent and uses relationships between variables in order to determine input and/or output value in a variety of ways.

Therefore, teachers are expected to use it to diagnose problems and make the learning of Mathematics more effective. Formative assessment happens informally and all the time. Shepard (2000) states that teachers should look for clues that describe learner's ability and use it to construct a theory about the specific need of the learner, But the critical question is, do educators know how to practice formative assessment in their classrooms and do they know what their learners are expected to achieve at various levels of education system.

1.3 Focus and Purpose of the study

According to Allais (2006) after the transition to democracy in 1994, South Africa urgently needed to reform its education and training system and this reform included the change in assessment system. He further indicates that the problem that South Africa was trying to solve was not unique; in many countries around the world it was a recent phenomenon that large numbers of young people were completing secondary education without becoming ready to compete in the global economy. The South African policies are all about improving, monitoring and supporting teaching and learning. Equity is clearly an important theme in new assessment (Gipps, 1998). According to Joffe (1993) the main criticism of the traditional assessment is that it is limited, both in what is assessed and the means of assessment. She further indicates that traditional assessments often do not tell us what we want to know about

our learners. Therefore, ahead of the 1994 election, the Centre for Education Policy Development (CEPD), provided the future ruling party with a policy framework that shaped out the character of a unitary education system dedicated to equity and national development (ANC, 1994). Mathematics was essential in the education system and formative assessment was seen as an assessment that will improve learning and teaching in Mathematics as it is defined as an assessment for learning (Singh, 2004). In particular, Kahn (2006) indicates that the framework argues for Mathematics to be compulsory through out the years of schooling and schools were provided with resources to ramp up Mathematics. The main complaints were centered on the lack of basic skills in literacy and Mathematics that are considered core to the further training or employability (Kivilu, 2006), but Kahn's findings still demonstrates that the country is still underperforming. Christie (1999) states that Mathematics results in 2006 indicates that at most 20% of South African schools were functioning adequately, the other 80% of schools were 'essentially dysfunctional'. This led her to conclude that South Africa is faced with serious problem.

In the light of what has been said in the literature about formative assessment in Mathematics, the problem is clear that although the education system is making a paradigm shift, the evidence offered by Harley and Wedekind (2004) suggest that schools have responded differently to C2005[2]. Perhaps they have also responded in differently to formative assessment as formative assessment is a key concept to the new curriculum. According to Joffe (1993) even in the United Kingdom experienced teachers who use a wide range of teaching techniques in the classroom, have baulked initially at the introduction of the complementary assessment which is formative and they have taken some time to feel confident in using them. According to her, to expect relatively inexperienced South African educators to take such a statement seriously, with no further directives or training, is unrealistic. She further points out that, if the assessment practice were supported by adequate in-service and pre-service training, the situation might be quite different.

According to Kivulu (2006), the critical question to ask is whether as a country we have well articulated standards (or benchmarks) against which the performance of our learners can be assessed. He further asks, if the public, especially the key stakeholders in education can claim

[2] C2005 refers to Curriculum 2005. When the new curriculum was implemented, it was expected that the roll out would be complete by 2005.

to have a thorough understanding of such standards. Do educators and parents understand and know what their learners are expected to achieve at various level of the education system? Malcolm (1999) states that educators find the curriculum and assessment policy difficult, especially the distinction between summative and formative assessment because there is lack of clear guideline for planning assessment. Furthermore, he believes that the biggest problem is the lack of guidance and little understanding as how formative assessment is to be implemented. Consequently, many teachers have independently interpreted and implemented it differently (Malcolm, 1999) and this causes confusion and possibly lowers the standard of education.

Jansen (2002) demonstrates that in the case of the new curriculum teachers were only trained for five days and the curriculum was not accompanied by any detailed sense of how these teachers would actually implement radical new ideas in under-resourced classroom. Furthermore, Jansen (2002, p.200) indicates that this is because "the making of education policy in South Africa is best described as a struggle for the achievement of broad political symbolic that would mark the shift from apartheid era to post apartheid society". He says these policies were just a political symbolic, it did not engage with actual classroom condition and was bound to fail. On the other hand, Chisholm (2002) argues that there was lack of alignment between curriculum and assessment policy as well as clarity regarding assessment policy and practice. Actually the introduction of different assessment started a debate about its significance in the context current and social transformation (Harley and Wedekind, 2004).

Since formative assessment is a key concept on CRA, this study explores teachers' perceptions of formative assessment and how they translate it into practice within a context of Mathematics teaching in a South African school. The study examines the nature of assessment techniques used by educators at the school and explores its relationship with practice. It further aims to determine whether the educators are willing to adapt formative assessment practice to meet the changing demands of South African school education as prescribed by the New Curriculum Statement (NCS) in grade 8.

1.4 Rationale for the study

The study is motivated by both personal and research imperatives. As an educator, my

personal observations and other anecdotal evidence (such as experiences of my colleagues) indicates that formative assessment is not clearly understood or applied. Formative assessment in Mathematics grade 8 requires a set of clearly defined criteria, performance indicators and variety of appropriate strategies that enable educators to provide constructive feedback to learners. Assessment criteria specify how the person assessing the learner can know whether she/he has demonstrated that an outcome has been achieved at a particular level. The key performance indicators are guidelines for teachers to assess whether learners are making progress towards achieving the outcomes (Brodie, 1991). Furthermore, formative assessment allows the educators to identify the learners' progress. It monitors and supports the process of teaching and learning. It is used to inform educators and learners about the learner's progress so as to improve teaching and learning. Formative assessment in Mathematics also gives information in order to help learners to grow and make progress and learners can compete in the global world.

However, based on my experience as an educator, there is little guidance as to how formative assessment is to be implemented. Teachers are supplied with complicated Mathematics instructions about how to assess learners' performance at various levels. Some teachers feel that it only increases the paper work and wastes much time that could be used for teaching (Harley and Wedekind, 2004). The problem associated with formative assessment can be attributed to the contextual realities in which many teachers in South Africa work, and also possibly to their simplistic knowledge of formative assessment. The central view about formative assessment is that which is used to inform educators and learners about learner's progress in order to improve his/her learning (Boston, 2002).

Formative assessment suggests that the feedback given to learners should help learners to improve and it also suggests that it should be available at any time to enable the learner to grow. In support of the anecdotal evidence I mentioned earlier, that very few teachers know and understand the objective and implementation of formative assessment, Singh (2007) discovered that many Mathematics grade 8 educators have independently interpreted and implemented the formative assessment policy as deemed most appropriate according to personal experience. He further indicates that the manner educators have implemented formative assessment may not reflect policy intention.

Against this background, I decided to explore formative assessment in Mathematics grade 8

since Mathematics is compulsory in South African's schools and essential that learners in grade 8 must achieve a 40% pass (level 3) in Mathematics to progress to the next grade. Educators are expected to use the learners' continuous assessment to determine a learner's level of achievement since the Department of Education bases Grade 8's progression on what they have achieved through the year (continuous assessment) without a compulsory formal examination. Therefore, the purpose of formative assessment is to help learners to achieve and make progress. In my school approximately 80% of grade 8 learners annually are not ready to progress because they are unable to pass Mathematics.

This begs the question: Why are they performing poorly when they have teachers who can guide, help and motivate them throughout the year to achieve? According to Davis (1988) Mathematics appears to be a weird thing in most classrooms. He says there is virtually no real Mathematics in it, what is taught is a collection of rituals for manipulating symbols on paper. For most learners these rituals are quite remarkably meaningless. For example when learners look at a quadratic equation they do not even see an equation instead they see some symbols that refuse to make sense, and they see themselves as faced with a task they would really prefer to avoid. McNeill (1988) agrees that he was generally a good learner in a good school, until he went to high school (Grade 8). That is where he developed a negative attitude towards Mathematics. According to Joffe (1993) there is evidence that mismatches between school Mathematics and out-of-school Mathematics exist for many learners from all sub cultural groups. She demonstrates that many children do not achieve well in the school system, but cope in the everyday world. Brodie (1991) argues that learners should learn that Mathematics is more than a collection of concepts and skills to be mastered and...demonstration of good reasoning should be rewarded even more than learners' ability to find correct answers.

1.5 Critical Questions

To explore the grade 8 educators' perceptions and implementation of formative assessment in Mathematics, the study focused on two research question, which are:

1. What are the teachers' perceptions of formative assessment in mathematics?

2. How do teachers use/apply formative assessment in Mathematics?

1.6 Significance of the study

This study intends to explore the teachers' perceptions of formative assessment and their implementation. The exploration probes into how teachers design the task; how they instruct it to learners and the nature of feedback they give to learners. Given the varied perceptions of educators towards formative assessment in Grade 8 Mathematics and towards Department policy, as well as the influencing contextual realities, this study hopes to:

- Clarify contentious issues about Mathematics assessment in Grade 8, which could be extended to other grades and regions;

- Make available information about the pereceptions of formative assessment that educators have so that intervention and remediation programmes may be designed. The findings from this study might be useful to educators as they have the opportunity to reflect and improve their assessment techniques in the teaching of Mathematics

- Motivate curriculum developers to take an interest in developing Mathematics learning material that will take into consideration teachers' and learners' contextual realities.

1.7 Overview of Chapters

Chapter 1 introduced the concept of assessment in Mathematics, and described the purpose of the study as an exploration of teachers' perceptions of formative assessment in Mathematics in grade 8, as well as how such teachers in grade 8 translates their perception into practice. It provided a brief history of Mathematics in relation to the curriculum reform implemented in a post apartheid South Africa and discussed the move from summative to more formative types of assessment in mathematics. It summarized the rationale for undertaking this study, and presented the contextual and personal imperatives that motivated the undertaking, particularly that my personal observations and other anecdotal evidence (such as experiences of my colleagues) as well as existing literature that indicated that formative assessment was not clearly understood or applied.

Chapter 2 constitutes a literature review. It focuses on the history and reconceptulisation of assessment. Different types and purposes of assessments in Mathematics are explored. Concepts and examples of practical formative assessment in Mathematics are presented. The theoretical and conceptual frameworks that frame the study are described. Using a symbolic interactionist perspective, the chapter examines how teachers and learners negotiate the meanings of teaching and learning, within the spaces of context, perspective and cultural background.

In ***Chapter 3***, the research design and methodology selected, the rationale behind its use, its appropriateness, and limitations will be described. The sampling method used, the use of the research instruments selected and the issues of reliability, validity, and trustworthiness of the data gathered, and data analysis are discussed. Discussion about the ethical issues and limitations of methodology is also presented.

Chapter 4, analyses the data in response to the critical questions, viz *what are the teachers' perceptions of formative assessment in mathematics? How do teachers use/apply formative assessment in Mathematics?* To do this the findings are divided into two different subsections using a semi-structured interview schedule for critical question 1, and an observation schedule for critical question 2. Using the interpretational approach the data will be discussed under specific themes which emerge from the data.

Finally in ***Chapter 5***, we discuss several insights that emerged from the study as well as recommend continued support and training for educators.

Chapter 2 - Literature Review

2.1 Introduction

Assessment is acknowledged to have many different purposes and audiences. According to Broadfoot (1996) assessment is an important sphere of interest and contention among educationist and assessment practices, and is central to educational accountability. Muller (2004) agrees that assessment is the most important instrument in the education system and it is one of the policy levers in any education system. Furthermore, he states that assessment is the most important system for signalling systemic efficiency and accountability. This chapter therefore, intends to present different aspects about assessment and different kinds of assessment. The literature review begins with a discussion of the history and reconceptulisation of assessment where the different types and purposes of assessments in Mathematics are explored. Teachers' assessments in Mathematics are then examined in which concepts and examples of practical formative assessment in Mathematics are presented. The conceptual framework that underpins this study, that is, symbolic interactionism, is also described. Finally the relationship of learning to formative assessment in Mathematics is discussed, and selected threats to formative assessment in Mathematics are presented.

2.1.1 History and Reconceptulisation of Assessment

Assessment has a long history and has been widely used to measure the achievement of learners. Assessment practices are central to educational accountability. Since the 1920s multiple-choice, standardized test and commercial tests have been widely used to measure the achievement of learners (Madaus, Raczek and Clark, 1997). These tests were conducted for selection and certification and this type of assessment was linked to the behaviorist theory of learning; learning was seen to be tightly sequenced and hierarchical and teachers were teaching to test to ensure learning (Shepard, 2000). They were not teaching and assessing to help learners to progress so as to improve learning. Muller (2004) indicates that during apartheid era assessment was solely norm-referenced, summative and aggregative. Norm-referenced is assessment in which the performance of a learner is compared with the performance of a group of similar learners. Gipps and Stobart (1993) assert that assessment in United States was seen as an important policy tool, an array of federal and state legislation

promoting or explicitly mandating standardized testing programs. She further states that it was seen as a resource devoted to education to measure the output of learners' test performance on available multiple choice tests. The selection has been the most pervasive role of assessment over years. For example learners were judged by specific type of assessment; those learners who were able to get a higher grade were given a chance to go to universities for a profession (Shepard, 2000). Furthermore, he points out that formal assessment was generally instituted to replace patronage with legal formal status determined through formal assessment. Gipps and Stobart (1993) state that it regulated access to specialized higher education, to the different positions and to government posts. Actually assessment was linked with bureaucratic forms of control as it selected those who were deemed suitable for training as well as certifying those who were deemed to be competent.

South Africa is also prepared to compete in the global world, following the trends in the globalization of the world market and emphasis on measuring output – the recent trends shows assessment as being used to control and drive curriculum and teaching (Gipps, 1994). The South African government made a paradigm shift in its approach to assessment from norm-referenced to criterion-referenced assessment. According to Muller (2004) perhaps the principal aim of the policy reform was to unite the divided strands of the education and training curriculum and certification system into integrated system. Perhaps the nations are more aware than before, that their fortunes in the world depends on the educational level of their population; this makes every country improve its education system, which includes improving assessments. The National Curriculum Statement in South Africa is clearly promoting a form of assessment that focuses on the development and growth of learners rather than on judgment and promotion, the basic assumption is that assessment should help learners to " reach their full potential successfully" (DoE, 2002, p. 287).

In South Africa and in other countries, there has been a considerable reconceptualisation in the nature of assessment. Many of the developments, according to Gipps (1998) include performance assessment, portfolio and authentic approach. This has a rather different approach from the traditional standardized test or examination. Gipps (1998) shows that the focus of assessment has shifted forward to a broader assessment of learning and formative assessment is one assessment that is used for learning and it is used to enhance learning for each individual (Gardner, 2006). The purpose of the new assessment according to Gipps (1998) is not for selection and certification but it allows greater flexibility in style of

assessment. Assessment practice is analyzed as an intergral part of teaching and learning, showing the ways in which certain forms of assessment can be used to enhance learning. Wolf, Bixby, Glenn and Garner (1991) state that the new development in assessments are part of a move to design assessment that support learning and provide more detailed information about the learner.

Therefore, there is a growing demand for authentic assessment, even the Revised National Curriculum Statement emphasizes assessment, and each learning area statement includes a detailed section on assessment. In this new curriculum, assessment should provide indications of learners' integration and application of skill and it should also help the learners to make judgment about their performance, set goals for progress and provoke further learning. To meet the standards, different ways of teaching and learning are used to give opportunities to every child and to promote each learner's talent. The new assessment is linked with what Darling-Hammond (1997) calls "Client accountability" because every learner is entitled to receive the best, equal education. However, according to Christie (2001) there is no such thing as equal education/assessment in schools. She says schools are woven into broader social patterns of inequality in historically changing ways. Christie (2001) demonstrates that schools themselves are not equal to each other, and do not offer the same learning experience to the communities they serve.

According to Shepard (2000) in the more recent trends, the focus of assessment has shifted towards a broader assessment of learning. The new development design shows clearly that the emphasis is on a form of assessment that intends to support and improve teaching and learning. She further indicates that the broader range of assessment tools are needed to capture important learning goals and processes and to connect assessment more directly to ongoing instruction. Moreover, she demonstrates that the broadening of the assessment approach will offer learners alternative opportunities to demonstrate their achievement. A key aspect of this reform according to Yackel (1992) has been to devise more open ended performance tasks that teach learners to reason critically, to solve complex problems and apply their knowledge in real world context. For example, Yackel (1992) argues that learners should be able to explain their mathematical thinking and provide justification as the need arises. Other current examples of authentic tasks includes organization of disciplinary content, considering alternatives, elaborating written communication, working with problems connected to the world and this apply to experiences beyond the school. These assessments

are real and are for formative purposes, they are connected to learners' every day lives, they make sense and are meaningful, and therefore they can help learners to construct school knowledge more meaningfully.

In Mathematics, Yackel (1992, p.138) reveals that "formative assessment includes project classrooms; Mathematics instructions which consist of discussion of problems". In this situation, the educator poses a problem to the class and allows learners to work in pairs to solve problems posed on worksheets. The whole class discussion and educators should allow learners to explain the solution/methods they have developed during small group work. Actually, the new curriculum encourages and emphasizes the need for educators to make a paradigm shift from traditional assessment to Outcome Bases Education. The shift requires a change from delivering "content" to learners to facilitating the development of "skill knowledge and value" through formative assessment (Fleisch, 2002). Therefore, teachers are expected to be well equipped to improve their facilitation skills, as Fuhrman (1999) states, the new accountability is trying to place more emphasis on learners' performance and less on compliance with regulations in their accreditation or certification of district and schools. However the implementation of OBE is compounded by several factors, and Mathematics under this new system is obviously influenced by these.

Jansen (1999, pp. 2- 6) points out several factors that debilitate against OBE in South African schools. Some of his arguments were that it does not take cognizance of what happens inside schools, how classrooms are organized and what kind of teachers exist within the system, that the management of OBE will multiply the administrative burdens placed on teachers, that OBE requires trained and retrained teachers, radically new forms of assessment, classroom organization with facilities, more time for managing this complex process, constant monitoring and evaluation, retraining of educational managers, parental support and involvement, new form of learning resources such textbooks and other teaching and learning aids.

2.1.2 Types and purpose of assessment in Mathematics

There are many different methods of assessing Mathematics and different ways in which they can be used. The new curriculum shows that different types of assessment in Mathematics serve important functions within OBE. According to Joffe (1993) Mathematics sourcebooks

in Queensland, emphasize the need to encourage learners to be active participants in the learning process, rather than passive receptacles of facts and figures. She further indicates that more time is to be devoted to practical work, problem solving and group discussion. Therefore, it is essential that assessment should reflect the broad classroom approaches to the teaching and learning of Mathematics (Department of Education and Culture, 1991).[3]

Sieborger and Macintosh (1998) mention some types of assessment that can be used in teaching and learning Mathematics. For example, they indicate that informal assessment is an assessment which is carried out as part of normal classroom teaching – it takes place without the learner realizing that it is happening; while the teacher is aware that he or she is assessing, e.g. asking and answering questions in class. They demonstrate that the main use of informal assessment is to help learners by finding out how well they are coping and encouraging them to do better. Formal assessment is an assessment which is specially arranged and is not part of normal classroom teaching; it is an assessment where learners are aware that they are being assessed. Seborger and Mancintosh (1998) suggest that teachers need to improve formal assessment to gain greater validity. They argue that learners must be to be told about the assessment because the better they are told, the better the learning and the better the assessment. Black and William (1998) on the other hand reviews a wide range of methods available to assess the learning performance of learners and this includes oral, written, group, self, peer and individual assessment.

In order to improve the assessment and make better use of feedback from it, teachers need to be accountable to learners and find the method that fits best with the purpose of the assessment (Sieborger and Mancintosh, 1998). The Department of Education (2002) suggests that teachers can use the CASS model to decide on better assessment. Continuous Assessment (CASS) is therefore a commended model for the assessment of learners as it covers all the OBE assessment principles. According to the DOE (2002) the principles of CASS ensure that assessment takes place over a period of time and is ongoing, supports the growth and development of learners, provides feedback from teaching and learning, allows for the integration of assessment into teaching and learning using integrated assessment tasks or activities, and uses recognized methods for gathering information on learner achievement.

[3] Cited in Joffe (1993, p.4)

Furthermore the DoE emphasizes that teachers should use the CASS model for five purposes, viz. *baseline assessment* which is a type of initial assessment usually used to establish what known. It assists the teacher with planning so that she or he can build on the learning activity or learning programme that is already planned. Results from this type of assessment are not always recorded. *Diagnostic assessment* – this is a type of assessment that a teacher uses to find out about the nature and cause of the learning barriers experienced by a specific learner. This allows the teacher to provide appropriate support, intervention strategies, guidance or reference to specialist help and support needed by learners. Barriers to learning should be identified as soon possible in the school year. *Summative assessment* gives an overall picture of a learner's progress at times when teachers have to give an overall progress reports such as end of term or year or on transfer of a learner to another school.

However, these reports should not be based on a once-off assessment activity or an examination. A teacher should plan summative assessment carefully from the beginning of the year and choose a variety of assessments strategies to provide learners with a range of opportunities to show what they have learnt. Systematic valuation is an assessment of educations system using national indicators such as learner achievement. Here the teacher would monitor learner achievement at regular intervals (grade3, 6, 9) using nationally agreed intervals to evaluate the appropriateness of the education system. *Formative assessments* are considered as part of instruction and the instructional sequence. It is a core part of the new curriculum. It is a self reflective process that intends to promote student attainment.

Formative assessment has a long history. It is defined as the bidirectional process between teacher and learner to enhance, recognize and respond to the learning. It has evolved as a means to adapt learners' needs. It serves an important function, For example, through formative assessment, the positive achievement of the learner may be recognized and discussed and the appropriate next step may be planned. The DoE indicates that it monitors and support the process of learning and it is used to inform teachers and learners about a learner's progress as to improve learning. The information should be of a kind and be available at a time that will enable the learner to grow through constructive feedback. Therefore, formative assessments are for learning and its purpose of is to enhance learning not to allocate grades. The goal of formative assessment is to improve, and is embedded in instruction. However, according to Assessment Policy in the General Education and Training

(2002) these types of assessment are not mutually exclusive and should be integrated in the overall assessment process.

2.1.3 Teachers' assessment in Mathematics

The previous section has argued that formative assessment is an assessment for learning (Gardner, 2006). On the other hand, Brodie (1991) demonstrates that the three assessments including formative focus on assessment as part of learning, i.e. baseline assessment which tries to find out what learners already know where they start a topic. Diagnostic assessment is concerned with finding out what individuals can and can not do and formative assessment is concerned with tailoring the teaching to accurately meet the need of the learners. And it should at least aspire to high standards of validity and reliability (Davis, 1995). Therefore, this aspect will show how different educators use assessment for formative purposes. Assessment has always been part of education. Mathematics assessment usually involves tasks, exercise, tests and examinations.

De Lang (1996, p.63) states that "in mid eighties Mathematics educators that propagated the teaching of Mathematics by application represented a small unique group. Emphasizing the value of necessity of application in Mathematics education was judged as theoretic and practical action against the dominance of pure Mathematics in schools raised by the new Mathematics movement". According to Moodley (1992) in the 1960s', Mathematics education emerged as a field of scientific study. At that time behaviorist psychology was very influential. Dikgomo et al (1997) point out that behaviorists regarded learning as central topic for study, they believed that human functions such as perception, habit, motivation , emotion, language, intelligence and personality, is learnt . Furthermore, he reveals that this method of Mathematics teaching is labeled as drill and practice, which Stoker (1991) says are very prevalent. In this approach educators would assess learners' performance at the end of the chapter or term. From the motivational point of view it is obviously better if a teacher envisages the results of assessment in such a way that learners have the opportunity to get better results as times go by (Sieborger and Macintosh, 1998).

The goals and principles of assessment according to De Lang (1996) have changed towards matching assessment to teaching and learning process. Different Mathematics educators' use different teaching and assessment approaches to develop learners' knowledge; for example,

some Mathematics educators use the cognitive approach, which they call an investigation approach (Dikgomo et al, 1997). This is because they build their mathematical lessons around mathematical investigation and problem solving. She further indicates that such investigation creates a mathematical environment in which learners can develop thinking processes and skills which are fundamental to meaningful, independent and creative Mathematics. In Mathematics, authentic assessment is essential because if the assessment is not authentic it appears to be a weird thing in most Mathematics classroom.

Therefore, the new goal in Mathematics assessment emphasizes reasoning skills, communication and development of critical attitudes which are called "higher order thinking skills" (Brodie, 2000). According to Sieborger and Macintosh (1998) educators have been using different assessments to motivate learners to learn because educational assessment is part of the process of learning, not something separate. Therefore these changes force educators to focus on "thinking assessment as well". In the States of Victoria, Australia, assessment in Mathematics was used to change the teaching and learning of Mathematics especially linking application, modeling and assessment (De Lang, 1996). Educators use ongoing assessment all the time in their Mathematics classes to make judgment about how learners are coping; whether they understand, whether there is a need to recap, and so on. They also use interactive assessment to allow for communication between them and learners so that they can facilitate oral presentation and report back (Joffe, 1993). Furthermore, she says extended task have been used interactively to assess a range of skills and processes.

The new ideas about assessment in Mathematics emphasizes that Mathematics should be real i.e. it should reflect our lives. Davis (1995, p.55) emphasizes that "real Mathematics should deal with finding problems, conceptualizing problems, considering someone's else alleged solution and asking if they are any gaps in the reasoning process, recognizing ambiguities and solving them and many other matter of that sort". Educators are encouraged to use assessment that support and enhance Mathematics learning which is for formative purpose. For example Brodie (1991) says educators should represent the ideas of the community of mathematicians and bring these into the classroom in order to enable learner mathematical development. Furthermore, Bennet et al (1994) indicate that teachers are also asked to reflect on their own questioning strategies. For example, in talking with learners the teacher should ensure that questions are genuinely open-ended – that learners have problems to solve without a subtly indicated expected answer, and that they are encouraged to speculate,

hypothesize, predict and test out ideas with each other and with the teacher. This will help learners to feel sufficiently encouraged and secured to be able to express and explore their thoughts, feelings and emotions.

The above views demonstrate that educators use different activities/assessment in their classrooms because they also believe that Mathematics assessment carries the responsibility for learners' development. Brodie (1991) says this means that the tasks that are used for assessment purpose need to be thought about and designed in a new way. The new way shows that assessment should link to learning and this type of assessment is known as formative assessment and it raises the standard of achievement when done appropriately (Black and William, 1998). The evidence offered by Volmink (1990) indicates that many educators give learners opportunities to experience the social construction of Mathematics knowledge in their classroom; they also allow learners to discuss, evaluate and mutually agree on ideas. The central claim by Boaler (1993) proves that the open-ended participative approach of learning can be made available to all kinds of learners through formative assessment. She advocates a process of learning and teaching in which learners are given ample opportunities to discuss different solution in Mathematics problem, to investigates problems independently and employ a variety of methods to address and solve these problems. The emphasis of formative and development aspect of assessment means that at this point the policy is supporting classroom assessment /assessment for learning.

Hatono (1996) reveals that many educators pose interesting problems or place a problem in a pragmatic or familiar context and allow learners to discuss and construct their own knowledge, which allows learners to reason. Mathematics reasoning according to Davis (1995) involves seeking answers to the question. Question like; what is it that is true? How can I be sure? What kind of reasons are convincing? Why is it true? He argues that mathematicians construct Mathematics by asking questions, conceptualize problems, develop strategies for solving them, and develop hypotheses. The underlying assumption is that Mathematics is a dynamic, growing filed, where new knowledge is continually constructed by mathematicians. According to Volmink (1990) many Mathematics educators agree that they give learners opportunities to the social construction of Mathematics knowledge in the classroom by allowing them to discuss different tasks for formative purpose.

According to De Lang (1996) Mathematics study demonstrate that it is important to use an appropriate range of assessment instruments to enhance learning. For example, investigation provides an ideal context for students to engage at some considerable depth in application and modeling, it might challenge the learners to investigate. On the other hand Boaler (1993) demonstrates that assessment questions and classroom examples should reflect real life demands and make Mathematics more motivation and interacting. Lave (1988) suggests that the specific context within which a mathematical task is situated is capable of determining not only general performance but choice of mathematical procedure.

All these activities should be done for formative purpose; Yackel (1992) agrees that Mathematics educators used formative assessment in their classes to develop and motivate learners. They ask learners question and ask them to explain their solution methods to each other and then the educators use the information to "scaffold" them[4] . Neo-Vygotskian, the social constructivist to learning (e.g. Newman, Collins and Brown, 1989) provided a base for analyzing assessment practice which might embody "scaffolding" and this hold the potential for making feedback more formative in a way that the matched teachers espoused intentions. However, some educators, according to Yackel (1992) pose tasks and allow learners to discuss or ask comparison questions for formative purposes. He says in an inquiry in a Mathematics classroom, the educator might pose questions to a learners which is giving an explanation to assist the learner in verbalizing his/her thinking, to encourage the learners to reflect on what they are saying or to genuinely seek information about the learners' thinking.

Moreover, William (1999) agrees that it is hard to find rich, good questions for formative purpose and these lead teachers to ask any kind of question, especially easy questions that do not develop critical thinking. He reveals that many teachers can not make a good question. For example, if learners are learning about fractions, they develop naïve conception that the larger fraction is the one with smallest denominator and the smallest fraction is the one with largest denominator. He further indicates that this approach leads to an incorrect response to the second. In this sense, the first item is much weaker item than the second because many learners can get it right for the wrong reasons.

[4] Scaffolding is a form of help, Maybin, Mecer and Steirer (1992) indicates that it is help which will enable learners to accomplish a task which is not easy to manage it on your own. I discuss this term in greater detail later in this chapter.

"e.g:

Item 1 (Success rate : 88%)

1.1 Which fraction is the smallest"

a) $\frac{1}{6}$ b) $\frac{2}{3}$ c) $\frac{1}{3}$ d) $\frac{1}{2}$

Item 2 (success rate: 38%)

1.2 Which fraction is the largest?

a) $\frac{4}{5}$ b) $\frac{3}{4}$ c) $\frac{6}{8}$ d) $\frac{7}{10}$

This shows that poor questions lead to misconceptions. William (1999) argues that these unintended conceptions are the results of poor teaching.

Although educators are using different approaches to motivate learners, formative assessment seems to be the most promising way to reduce the unacceptably wide variation in attainment that currently exists in Mathematics (William, 1999). Therefore, educators should use rich questions in Mathematics. William (1999) suggests that questions should not always come from the educator because there is substantial evidence that learners learning are enhanced by getting them to generate their own questions. However, Dikgomo et al (1997) point out that no matter what our teaching philosophies are, what actually happens in a class is largely affected by the learners' perception of how they are going to be assessed. Therefore, educators should try to use assessment to influence learners to work effectively in small groups. Educators are also encouraged to give learners activities which will give them opportunities to ask questions. This can help the teacher to identify the problem of the learner. Formative assessment when done properly can improve the standard. Evidence reveals that formative assessment is an essential component of teaching and learning and teachers are expected to use if effectively (Black and William, 1998).

2.1.4 Concepts and examples of formative assessment in Mathematics

According to the Department of Education (2002) formative assessment is a core part of OBE teaching and learning Mathematics, it is used to support the learner developmentally and to

give feedback to the teaching and learning process. Educators should build many opportunities to assess how learners are learning and then use this information to make beneficial changes in instruction. This diagnostic use of assessment provides feedback to teachers and learners and it is called formative assessment (Boston, 2002). Formative assessment integrates learning and assessment and it is called assessment for learning (Gardener, 2006). Educators use it to diagnose problems and make learning more effective. Formative assessment happens informally and all the time; it monitors and supports the process of learning and is used to inform teachers and learners about learner's progress so as to improve learning (Department of Education, 2002). It gives information in order to help learners to grow and make progress.

However, Boston (2002) says formative assessment becomes formative when the information is used to adapt teaching and learning to meet learners' needs. Scaffolding and feedback are the underpinning concepts in formative assessment. Boston (2002) demonstrates that feedback given as part of formative assessment help learners to become aware of any gaps that exist between their desired goals and their current knowledge, understanding or skill and guide the actions through necessary to obtain the goals. According to (Gipps, 1994, p. 120) "educators use feedback to make programmatic decisions with respect to readiness, diagnosis and remediation. Learners use it to monitor the strengths and weakness of their performance, so that aspects associated with success or high quality can be recognized and reinforced and unsatisfactory aspect modified or improved". However not every feedback contributes to the improvement of teaching and learning, and the one which is considered more helpful is the qualitative one, where the teacher will tell in detail what the learner ought to do to improve. The giving of grades (e.g. 20/50) is not productive formative feedback because it does not contribute to the improvement of learning. Shalem and Steinberg (2001) emphasize that educators who want to make their assessment formative need to be able to answer these questions about each assessment task they give, e.g. 1. What is the aim of this assessment, i.e. exactly what do I want to assess? 2. Do learners understand what is to be assessed, i.e. are the instructions clear and comprehensive? 3. Are there clear assessment criteria? 4. Do the assessment criteria focus on worthwhile and higher order thinking? 5. Do the learners understand why they receive a particular result? 6. Does the feedback make sense to the learner? Does the feedback focus on what is important? In this way educators become more able to give relevant and supportive feedback. Feedback, for a long time has been regarded as an important feature of the teaching and learning activity. For example, a model by Bloom

(1976, cited in Gipps, 1994), contains feedback, correctives and reinforcements as vital components of the instructional process. In Bennett's model (1982, cited in Gipps, 1994) educator's feedback mirrors the learner's involvement, understanding and achievement.

In teaching, educators employ information about learners' knowledge or understanding of facts and skills to feedback into their own teaching. Therefore feedback diagnose educators teaching, thus it reflects strengths and weakness of teaching so that whatever decision that will be taken by the educator will be based on the feedback. Feedback confirms correct responses, telling the learners how well the content is being understood, and it identifies and corrects errors or allows the learner to correct them. This correction function is probably the most important aspect of feedback (Gipps, 1994). Feedback of learners' attainment brings about motivation, confidence into learners and even encourages them to strive for more. Therefore, educators are expected to give useful feedback to learners, feedback that can encourage, support, develop and motivate the learner, even the comments of the weakness must be positive.

Scaffolding is also essential part of formative assessment. It refers to the step taken to reduce the degrees of freedom in carrying out some task so that the learner can concentrate on the difficult skill she/he is in the process of acquiring (Mecer, 1995). According to Maybin, Mereer and Stierer (1992) this term is increasingly used to describe certain kind of support which learners receive in their interaction with teachers and other "mentors" as they move towards new skills, concepts or levels of understanding. This is a term which helps to portray the temporary, but essential nature of the mentor's assistance as the learner advances in knowledge and understanding. Scaffolding is clearly a form of "help" but not just any assistance which might help a learner accomplish a task. It is 'help' which will enable learners to accomplish a task which they would not have been quite able to manage on their own, and it is 'help' which is intended to bring learners closer to a state of competence which will enable them eventually to complete such a task on their own (Maybin et al, 1992). The term scaffolding was originally used by Bruner as a metaphor for depicting the form and quality of the effective intervention by 'learnered' person in the learning of another person. He reveals that scaffolding refer to the steps taken to reduce the degree of freedom in carrying out some task so that the learner can concentrate on the difficult skill she is in the process of acquiring.

Therefore, rather than simply telling the learners what to do or using direct questions the teacher helps the learners to clarify their own understanding. In that case the teacher's injections encourage the learner to identify the problem and offer solutions herself. Bruner (1996) demonstrates that if the learner is enabled to advance by being under the tutelage of an adult or a more competent peer. Then the teacher or the aiding peer serves the learner as a vicarious form of consciousness until such time as the learner is able to master his own action through his own consciousness and control. When the learner achieves that conscious control over new function or conceptual system, it is then that he is able to use it as a tool, up to that point, the teacher in effect performs the critical function of 'scaffolding' the learning task to make it possible for the learner, in Vygotsky's words, to internalize external knowledge and convert it into a fool for conscious control".

According to Mecer (1995) successful 'scaffolding' requires the adult to be sensitive to the learner's competence in the task- responsibility is handed over to the extent that the learner shows that she/he is able to cope with it. For Bruner (1996) scaffolding describes a particular king and quality of cognitive support which an adult can provide, through dialogue, so that a learner can more easily make sense of a difficult task. He describes as a form of 'vicarious consciousnesses' provided by the adult for the benefit of the learner.

Since the goal of formative assessment is to gain an understanding of what learners know and don't know in order to make responsive change in teaching and learning, techniques such as teacher observation and classroom discussion have an important place alongside analysis of test and homework (Boston, 2002). Therefore, Mathematics teachers are encourages establishing a culture of learning right at the beginning. Doyle (1983) produced the most elaborated model of classroom social process which is linked to formative assessment because its purpose is to support and motivate learners.

According to Doyle (1983) this model view classroom as complex social setting within which teachers and learners are in continuous process of adaptation to each other and the classroom environment itself. In Doyle's view, the assessment system in operation in the classroom is at the heart of the process. She says learners must learn what the teacher will reward and the teacher must learn what the learner will deliver. Mutual respect leads to co-operation between the teacher and the learner. Doyle's model conceives classroom task process as cyclic. It assumes that teachers plan the task they will present to learners, or will allow their learners to choose, on the basis of clear and specific intentions e.g. 'Asande needs work reinforcing factorizing trinomials' or 'Mandiso is now sufficiently competent in the basic geometry and this should now be extended to applied or practical problems'.

On the other hand, Torrance and Pryor (2001) argue that it is important that teachers attempt, by observing or questioning, to obtain a clear view of learners understanding and misconceptions. The omission or lack of diagnosis stores up problems for later stages of learner's learning.

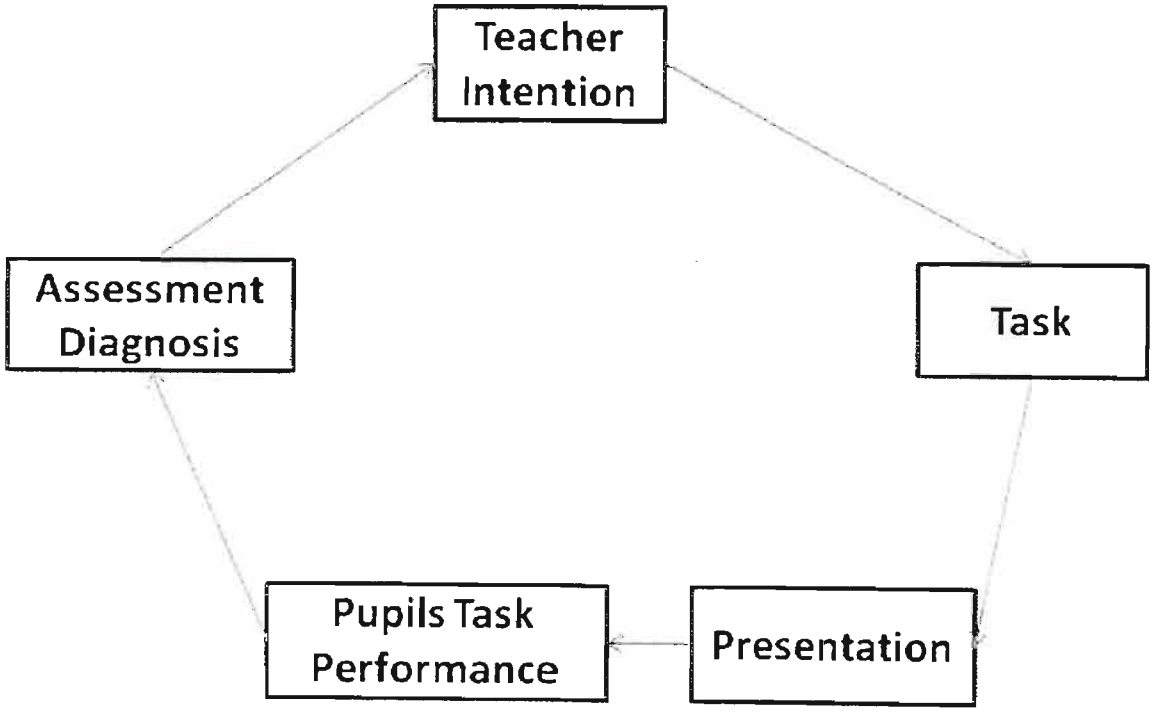


Figure 2-1: Model of classroom social process adapted from (Doyle, 1983)

Torrance and Pryor (2001) show that lack of diagnosis often accompanies teachers who limit their attention to the product of their learner's work rather than focusing on the processes employed by learners in arriving at the answer. The argument is that when faced with learner's errors, teachers need to shift from a strategy which simply tells the learners that they are wrong to the one which help them find out and correct their mistakes. According to Plowden (1967) teachers must avoid the twin pitfall of demanding too much and expecting too little. He says learners must be assigned tasks which sustain motivation, confidence and progress of learning. The role of a Mathematics teacher is to create an enabling learning environment. Therefore, teachers need to follow the practical model offered by Torrance and Pryor (2001) in Figure 2-2.

Many scholars, like Black (1998), Torrance and Pryor (2001), Boston (2002) and others agree that the teacher's role is to guide, monitor and motivate learners. Therefore teacher should shift from 'telling' and 'describing' to 'listening and 'questioning' and probing for understanding. Black and William (1998) encourage teachers to questioning and classroom

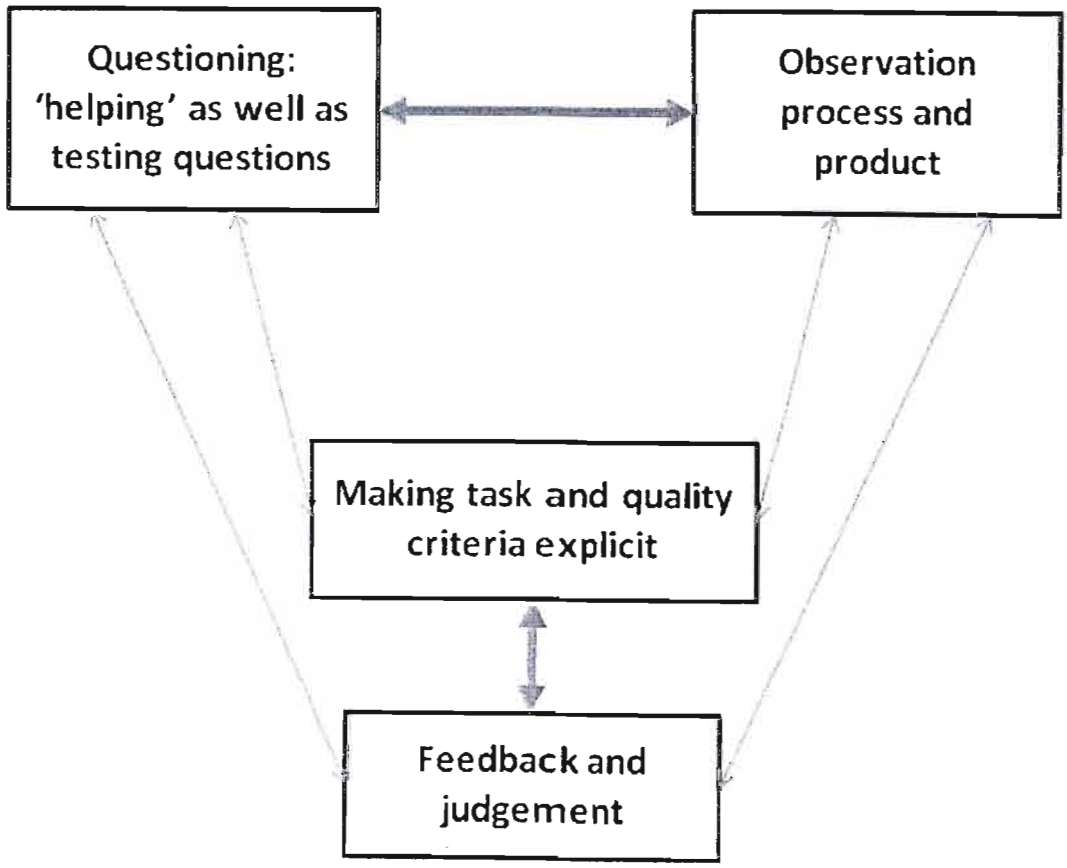


Figure 2-2: Formative assessment in practice (Torrance and Pryor, 2001, p.673)

discussion as an opportunity to increase their learner knowledge and improve understanding. Furthermore, they indicate that teachers need to make sure that they ask thoughtful, reflective questions rather than simple, factual ones and then give learners adequate time to respond. In order to involve everyone Black and William (1998) suggest strategies such as inviting learners to discuss their thinking about a question or topic, then ask representative to share the thinking with others, Presenting several possible answers to a question then ask learners to vote on them, ask all learners to write down an answer , them read a selected few out loud, have learners write their understanding of concepts before and after instruction, ask student to summaries the main ideas they have taken from the discussion or assigned reading, allow learners to complete few problems or question at the end instructions and check the answers. Interview learners individual or in groups about their thinking as they solve the problem, assign brief, in –class writing assignment.

Teachers' intervention should take place at all levels: class, group and individuals, helping and supporting the learners as necessary. Dikgomo et al (1997) suggest that teachers need to intervene in a manner which positively encourages learners. They say in order to do this, the Mathematics teacher needs to organize, facilitate, motivate, initiate, explain, observe, listen, encourage and questioning. Questioning is an important skill for both teacher and learner to learn. Johnson (1991) says good questions and their responses will contribute to a climate of thoughtful reflectiveness. Effective questioning forms an integral part of discussion and effective classroom atmosphere to work in groups, to encourage thinking and to use the problem-centered approach. Therefore, Mathematics teachers need to acquire effective questioning techniques. Furthermore, Johnson (1991) indicates that good questions will not only find out what the learner have learned, but will provide for different levels of thinking. The most important reasons for using questions is its value for stimulating and directing thinking to enable learners to become independent learners (Johnson, 1991).

However, questions are not all good; there are questions that are not good and teachers need to be critical and careful when designing questions for formative purpose otherwise it might be difficult to give feedback to learners. Southwood and Spanneberg (1996) argue that teacher need to know what constitutes a good question. They say good questions should be open ended, allowing for a range of responses, indicating the learner's level of thinking and understanding, rather than closed, one – word answer types of questions. For example, teachers might ask open ended question such as "What number can you make with 2, 3, and 6

instead of close question 6-2+3 =?. The Mathematics teacher needs to encourage learners to talk about what they are thinking and to recognize their own inconsistencies. In this way, the pupils will have a far better understanding than if their inconsistencies had merely been pointed out to them. Appropriate questions can be asked in order to do this without judgmental.

2.1.5 Relationship of learning to formative assessment in Mathematics

According to Wikepedia[5] formative assessments are for learning. Formative assessment and learning are intertwined because formative assessment determines whether learning is taking place, what learning took place and what learning still need to take place (Torrance and Pryor, 2001). The above view indicates that formative assessment is essential in the process of learning because the goal of it is to improve teaching and learning and to enhance learning not to allocate grades. According to William (1999) formative assessment is more important because it has the power to change the distribution of attainment. On the other hand the Department of Education (2002) indicates that the purpose of formative assessment is to monitor and support the process of learning and teaching. It is used to inform educators and learners about their progress so as to improve teaching and learning. Therefore, formative assessment is concerned respectively with the support of learning and teaching.

Furthermore, formative assessment is used to identify assessment that promotes learning by using evidence about how far learners have gone (Singh, 2004). According to Black and William (1998) appropriate use of formative assessment would raise the average achievement learners and that shows that formative assessment develop both the teacher and the learner, and it prepares the learner to be able to solve everyday problems.

The fact is, formative assessment is the responsibility of the classroom teacher. William (1999) states that formative assessment seems to be the most promising way to reduce the

[5] http://en.wikipedia.org/wiki/formativeassessment

unacceptably wide variation in attainment, that currently exists in Mathematics classrooms. According to Boston (2002) it is tightly linked with instructional practices, and it is embedded in instructions, so formative assessments are considered as part of instruction and the instructional sequences. Therefore, what children are taught is reflected in what they are assessed. Teachers need to consider how their classroom activities , assignment and tests supports learning aims and allow learners to communicate what they know, then use this information to improve teaching and learning. Teaching is more than just presenting material; it is about infusing curriculum content with appropriate instructional strategies that are selected in order to achieve the learning goals that the teacher has for her/his learners (Hopkins, 2001)

The practice of formative assessment has to be informed by a model that is detailed in that it provides guidance about the way in which a learner progresses in learning and it is linked to a clear conceptual vision of the curriculum and to clear learning goals (Black, 1998). The Constructive theory of learning informs the development of formative assessment; it sees intellectual abilities as socially and culturally developed through scaffolding and giving feedback to each learner frequently after constructing his/her knowledge. Constructivist orientation challenges prior views of the learning process as transmission of information to passive receivers (Collins, et al 1989). Constructivism theory argues that learners make sense of school knowledge in relation to their prior knowledge and experience. This is linked to the constructivist idea that knowledge is not "handed down by God" or found in the world somewhere, rather it is created and developed (i.e. constructed) by human beings. Von Glaserfeld (1996) explains that constructivism is rooted in the epistemological principle that knowledge consists not in the discovery of a separate objective autological reality but in adaptive cognition that individuals use to organize their unique experience world.

Formative assessments are very important in this view of learning; they develop both the teacher and learner. It prepares the learner to be able to solve everyday problems. It also helps the teacher to use different strategies to help different learners. According to Black (1998) formative assessment when done properly can improve standards. Formative assessment is an essential component of teaching and learning, and therefore teachers are expected to give learners feedback so that they can use the information to develop themselves.

The purpose of satisfying demands for public accountability is linked with summative assessment. Summative assessment enables a teacher to assess how much a learner has achieved by a certain stage. It is the assessment, which is used to report to others about the achievements of a learner e.g. other teachers, parents and the public. It points to past performance. Summative assessment is used to decide whether or not a certain outcome has been achieved. This assessment is needed to inform the next person about each learner. For example, a new teacher might need an overview of each learner's recent achievements and progress in order to be able to anticipate the progress and nee of each. Therefore, teachers need to give evidence of previous learning. This form of assessment responds to the public and the new accountability purpose.

Formative and summative assessments are therefore related to each other; and they cannot be separated. Black (1998) says that these assessment labels describe two ends of one spectrum of practice in school assessment rather than two isolated and completely different function. Teachers need to use both assessments for the purpose of new accountability. In summative assessment a learner shows his/her competence and creativity to the public and a teacher gives evidence about the learners' ability and achievement for accountability purpose. At the formative end, the teacher conducts assessment, draws inferences, plans action and deals with the consequences, for example, by revisiting his/her teaching. At the summative end, the conduct of assessment, drawing of inferences, and planning of action goes beyond the teacher and perhaps the school. It is important to emphasize that there should be no clear rules as to whether a given assessment exercise aims in themselves to be formative or summative – it will depend on how they relate to the learner's work and to the way the results are interpreted and used. Some maybe more useful for one purpose than the other, some may be useful for both. If schools are to have incentives to support powerful learning, assessment must have a good representation (Black, 1998). Therefore, they must relate both purposes of assessment.

2.1.6 Threats to formative assessment

Practical formative assessment is not easy as it is seen. It is complicated, and Erickson (2007) reveals that teachers can fail to make formative use of assessment data even though those data were available in a timely manner. There are many reasons that might lead to failing, one reason offered by Erickson (2007) indicates that this can be because teachers do not know how to interpret the assessment information to pinpoint possible alternative pedagogical

moves that might be taken. For example, re-teaching in a certain way and reassessing. The other reason could be the pressure from outside classroom; for example, if the teachers are required to keep up with a pacing schedule and finish the prescribed syllabus. Another threat has to do with general cultural assumption that is about the basis nature of teaching and learning. Nicholson (1992) argues that the most important threat is the barriers/obstacles to problem solving. Formative assessment is linked to problem solving and if teachers themselves are not familiar with problem solving then it will be difficult to guide the learners. The teacher's unfamiliarity with problem solving leads to fear and hesitation, and a teacher cannot take learners further than he has gone her/himself.

Nicholson (1992) argues that teachers must themselves be problem solvers and must then guide and assist pupils in the art of questioning, reflecting and finding strategies. Another threat is that even if teachers attempt approaches on problem solving, there is a tendency to say too much to the learner instead of letting them struggle to develop their own problem solving methods. Teachers have conflicting expectation of their old 'telling' with their new 'facilitating' roles. However, Nicholson (1992) demonstrates that there is a challenge posed by the problem solving approach to the teacher's role; form that of being an instructor to that of being a collaborator and facilitator and some teachers might feel threatened.

2.2 Theoretical framework and conceptual frameworks

2.2.1 The need for a Framework

A framework is essential in a research project because it can help us to explain why we are doing a project in a particular way (Sana, 2003). Henning (2004) states that it enables the researcher to theorize about his/her research. Researchers can either use a conceptual or theoretical framework to frame their study. A conceptual framework is potentially so close to empirical inquiry, they take different forums depending upon the research questions or problem (Sana, 2003). Vithal and Jansen (1997) mention that it might link two or three concepts or principles without being developed into a full blown theory. A theoretical framework can be thought as a map with conceptual direction. It is like the lenses through which you view the world (Henning et al, 2005). Vithal and Jansen (1997, p.17) describe a theoretical framework "as a well developed coherent explanation of event". Positioning research to a theoretical framework is essential because it reflects the stance the researcher

adopts in her research. The aim of this study is to explore teachers' perceptions of formative assessment and their practice, and specifically asks the following critical questions: What are the teachers' perceptions of formative assessment in mathematics? How do teachers use/apply formative assessment in Mathematics? The critical questions in this study are guided by the interpretive framework. This focuses on how meaning is made. Reality is socially constructed through the interactions of people and knowledge is subjective because people help to create meaning. The study is qualitative in nature as it is based on how individuals make meaning in their daily settings and how they make meaning of their world through interaction. Henning (2004) demonstrates that this kind of research aims to understand the individual experience and perceptions of people in their working and living environment in their unique context and background.

2.2.2 Framework of the study

Symbolic interactionism

Symbolic interactionism is a theoretical framework that informs this study because the focus is on curriculum practice and is based on how teachers construct their own action and meaning when implementing formative assessment. According to Woods (1983) Symbolic interactionism is useful if you are interested in curriculum as practice, because at the heart of symbolic interactionism is the notion of people as constructor of their own actions and meanings. The fundamental assumption is that the best way of understanding what is happening, is through the eyes and interpretation of the teacher, i.e. how do teachers and learners see events and how they make sense of them. That implies that teachers should provide a rich and stimulating body of sensory experience for learners, so as to enrich their thinking (Jacka, 1984). Therefore, the analysis of teachers using formative assessment follows a socio-constructivist perspective which co-ordinates the psychological position of constructivism with the sociological position of symbolic interactionism.

Symbolic interactionism also places emphasis upon the use of discovery teaching and learning procedures. In the qualitative interpretive approach, context and human interaction are important as the situation is constructed, and it is for the interactionist to discover their construction (Woods, 1983). Therefore, the practice of formative assessment will be informed by a model of teaching that is detailed in that it provides guidance about the way in

which a teacher practices it and this is linked to a clear conceptual vision of symbolic interactionism theory. The theory of symbolic interactionism derives from Elumer (1969) who maintains that it is useful in explaining how learning and teaching occurs in the social setting of classroom (Cobb et al, 1989) and in this case it explains the meaning that individual educators have developed in the course of interaction with the learners. Jacka (1984. p.159) states that "the emphasis on symbolic processes in interactionist theories implies that teachers should provide a rich and stimulating body of sensory experiences for learners so as to enrich their thinking". This approach according to Woods (1979, p. 17) "concentrates on how social world is constructed by people, i.e. how they continually strive to make sense of the world, how they assign meanings and interpretations to events, and the symbol is used to present these meanings". Furthermore, it emphasizes learners' and teachers' own subjective constructions of events, rather than the researcher's assumption about them. In this study the focus is based on how teachers practice formative assessment in Mathematics classrooms and this theory will show how teachers construct their own action and meaning since formative assessment also allows constructive teaching and learning. Woods (1979) asserts that what really counts is how teachers and learners interpret classroom events. The context of this study is grounded in a symbolic interactionism epistemology, that meaning is socially constructed.

The situated nature of formative assessment

In an attempt to gather data to explore the teachers' perceptions of formative assessment in Mathematics and their practices, a symbolic interactionism approach will assist. According to Woods (1983) the symbolic interactionism approach leads one to focus on certain concepts; the main ones are contexts, perspectives, cultures, strategies, negotiation and careers. In a qualitative approach context and human interaction are of importance as the situations are constructed, and symbolic interactionism is used to explore the phenomena in its natural setting.

Teachers' context

Context is a key element in understanding teacher's activity. Therefore, context is very important when theorizing. Schools consist of different contexts, and situations, and people's

interpretations have been shown to differ among them (Woods, 1983). Context or situation is not just the scene of action – it has an effect on that action, an effect which is both determining and enabling. Since situations are constructed, a contextual issue plays an important role in the process of teaching and learning Mathematics. At this particular school teachers argue that the environment is not conducive, therefore they are not able to give learners ample opportunities due to a lack of resources and large class numbers.

Moreover, according to Boaler (1993) the field of Mathematics does not currently have an extensive or well developed knowledge based about the particular ways in which teachers may mediate curriculum approaches to make them equitable, for example, the assessment practices and learning practices to which they may need to pay explicit attention. Boaler (1993) further says the development of such knowledge base seems to have been severely hampered by the pervasive public focus on curriculum approach. He demonstrates that teachers, researchers, mathematicians and policy makers have all argued about the teaching approaches that should be used in classrooms.

The model in Figure 2-3 illustrates the importance of context in teaching and learning. Cohen, Raudenbush and Ball (2000), cited in Boaler (2000) have proposed that Mathematics

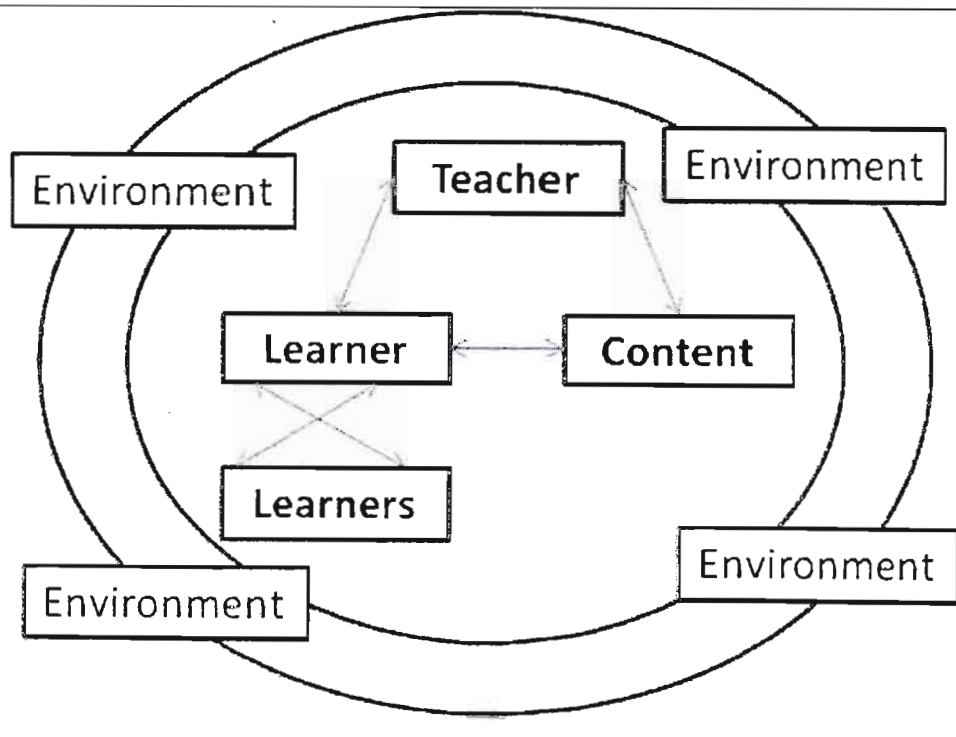


Figure 2-3: "Instruction as interaction of teachers, learners and content in environment". (Cohen, Raudenbush and Ball 2000 cited in Boaler 2000, p.76)

teaching and learning could be represented by an instructional triangle.

Boaler (2000) proposed that learning opportunity takes place at the intersection of the vertices of the triangle and that few learning occasions can be understood without considering of the contribution made by the teacher, the learners, the discipline of Mathematics and the way that they interact with the environment which is their context.

Furthermore, according to Woods (1979) situations are what we make them, they are constructed. For example, it is the responsibility of the Mathematics educator to construct and create the environment that is real to the learners. The school environment should not differ from outside learners' life environment. Therefore in a school there are different contexts and they are interpreted differently according to different people, because there are several alternatives that are appropriate in different context. Woods (1979) further states that since situations are constructed, it is the task of an interactionist to discover how they are constructed, and not to take them for granted. Therefore, even the officials should take into account that the design curriculum can be interpreted differently in different context; the most important thing is that curriculum in practice needs to be guided by curriculum plan.

During the process of teaching and learning, negotiation forms interaction between the teacher and the learner. According to Woods (1983) negotiation has a significant role in the process of teaching and learning. He asserts that school life is a continuous process of negotiation by which meanings are continually constructed. On the other hand, he emphasizes the influence of social context and environment on cognition. He says human beings do not exist in isolation and therefore do not learn in isolation, so they need to negotiate knowledge.

Bennet et al (1995) also emphasise the role of negotiation and sharing in children's classroom learning. Killen (1996) demonstrates that teaching is only teaching if learners learn. He defines teaching as the process of helping learners to understand information and to transform it into their own personal knowledge where teachers become facilitators of knowledge. Therefore, teachers should negotiate with learners, and the learners must bring schemas of their own to bear on any given topic, and some of these must shared with others. This process is one by which learners actively make sense of the world by constructing meanings, because they are not 'empty vessels'. Therefore teachers should try to help them by using

formative assessment, to change their beliefs to be more in line with those held by the mathematical community.

Perspectives are also important during teaching and learning; according to Woods (1983) it refers to the framework which people make sense of their world. These concepts are significant where learners and teachers construct their own realities and define solution. Each school has its different culture; this develops when people come together for specific purposes done intentionally or unintentionally, willingly or unwillingly. The cultural background of the individual enables the individual to create his/her own reality. According to Woods (1983) each culture constructs its own 'reality' and no doubt, this construct influences the way members of a culture perceive and understand the things and ideas they are confronted with in life. Culture then is an essential component for one's creation of reality. The dynamism of culture is reflected in the dynamic nature of learning, of constructing reality and of teaching.

Therefore, the culture of Mathematics educators and their learners will assist me to understand what they are doing in class and why they are doing it. Woods (1983) indicates that people develop between them distinctive forms of life, i.e. ways of doing things or not doing things, forms of speaking, speech speaking, subject of conversation, rules and codes of conduct and behavior, values and beliefs, arguments and understanding. According to Woods (1983) through the process of socializing, people are inducted into certain cultures, for example social class, religion, occupational or ethnic nature. Woods (1983) reveals that many cultures that exist in schools are actually actively constructed by learners and teachers.

In every classroom there are goals that need to be achieved, so the strategies should be considered to achieve the goals. According to Woods (1979) strategies are ways in which particular parties are able to assert their definition of the situation. Woods indicates that perception and cultures are linked to action through strategies and they are ways of achieving goals. Therefore, educators plan the strategies and assessment that will meet the goals that they have set. During observation, I will observe how teachers strive to achieve the goals. This can be done by using different types of assessment for formative purpose.

According to Woods (1983) it is important to understand a person's career, not in terms of formal structure but in terms of identity. Therefore, when interviewing the educators, I also

tried to understand their commitment. The way they do things shows how committed they are under any circumstance.

2.3 Conclusion

In this chapter I reviewed the history and reconceptulisation of assessment as well as the different types and purposes of assessments in Mathematics. Teachers' assessments in Mathematics were examined and examples of practical formative assessment in Mathematics were presented. The theoretical and conceptual frameworks that underpin this study were described. Using a symbolic interactionist perspective, how teachers and learners negotiate the meanings of teaching and learning was examined, and the role of context, perspective and cultural background, emphasized.

In the following chapter, I describe the research design and methodology, its appropriateness, and limitations. The sampling method used, the use of the research instruments selected and the issues of reliability, validity, and trustworthiness of the data gathered, and data analysis, ethical issues and limitations are also discussed.

Chapter 3 - Research Design and Methodology

3.1 Introduction

This chapter presents the philosophical and epistemological position of the study and also demonstrates how these link with the research paradigm through which the inquiry is approached. The research design and methodology selected to generate data for the study, its appropriateness, and limitations will be described. I describe the sampling method used, and justify the use of the research instruments selected and discuss the issues of reliability, validity, and trustworthiness of the data gathered and the analysis thereof. Finally ethical issues and limitation of methodology will be demonstrated

The study is an interpretive study which is conducted within a qualitative research paradigm. The main idea within the context of the interpretive paradigm is to understand the subjective world of human experience. According to Cohen, Manion and Morrison (2007) interpretive approaches focus on action or intentional behaviour. This study focuses on the participant Mathematics teachers and their teaching methods and strategies. The research questions explore the teachers' knowledge of formative assessment in Mathematics grade 8 and their practice at a high school in Hammarsdale. These teachers, who participated voluntarily, were selected purposively because they were Mathematics teachers teaching grade 8.

According to Mouton (2001) the word *design* means a plan or blue print of how one intends to conduct the research. Merriam (1998) reveals that this plan assembles, organizes, and integrates information and it results in a certain end product (research results). However research design is not a mere plan but a logical structure of an inquiry that is aimed to answering the research question. The distinction between research design and research methodology is described by Mouton (2001) who asserts that the research design concentrates on the end product, while the research methodology is merely concerned with a research process and the kind of instrument and methods to be used.

Henning (2004) asserts that methodology is the epistemological home of an inquiry – it refers to the tools that will be used as to bring the research design to fruition. Methodology does not only concern itself with the description of those sources, methods and instruments, it actually

addresses the importance of using such sources. Furthermore, Henning (2004, p.36) defines research methodology as the "coherent group of methods that complement one another and that have the goodness of fit to deliver data and findings that will reflect the research question and suit the research purpose". It does not deal with a group of methods, but it addresses the question of why those methods have been chosen and used.

3.2 Context of the school

Context refers to a situation and schools consist of different contexts and situations. According to Woods (1983) context or situation is not just the scene of action – it has an effect on that action, an effect which is both determining and enabling. Figure 3-1 is the map

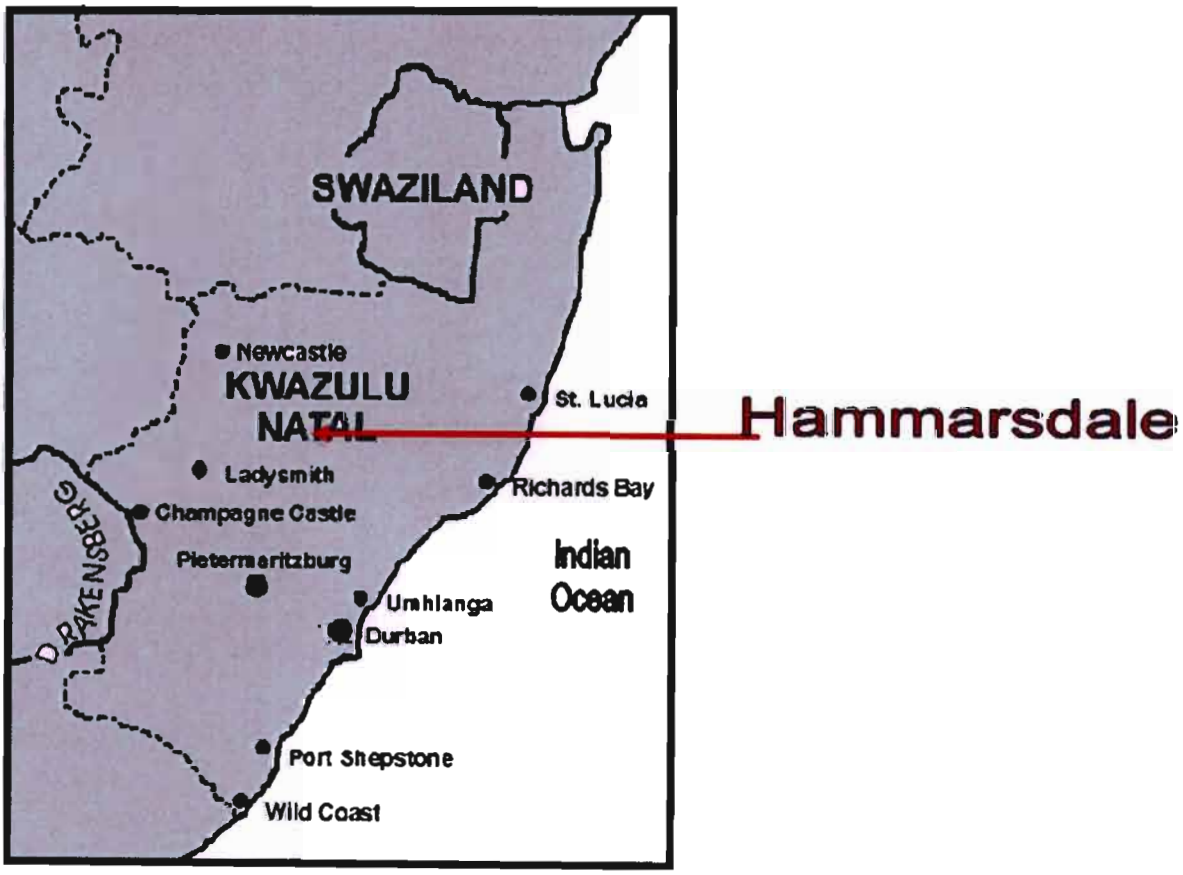


Figure 3-1: Map of Hammarsdale (in the Province of KwaZulu-Natal, east coast of South Africa) www.places.co.za

of Hammarsdale where the school that is studied is situated.

This is a government school founded in 1978. The school is located in a rural area, in Hammardale in the outer west of Durban where all learners are black Africans. The staff comprises 27 male and female educators and 915 male and female learners. The learner-teacher ratio is on average 80:1. In this school Mathematics is taught in English, however teachers switch codes if it is necessary. There are six Mathematics teachers in the school and only four teachers teach grade 8. All grade 8 learners must learn Mathematics and there are almost 82 learners in each class. The facilities in the school are limited as it does not have resources to run up the day to day activities such as copier, computers, handouts, textbooks and so on. However, the school has a functioning timetable and the culture of learning and teaching is conducive.

3.3 Methodological Approach

3.3.1 The Interpretive Paradigm

The term paradigm[6] refers to "the way of thinking, perceiving or approaching work". Denzin and Lincoln (2000, p157) describe a paradigm as a basic set of beliefs that guide action and comprises ethics, epistemology, ontology and methodology. It allows an in-depth understanding of educators' experience. This study is located in an interpretive paradigm with its emphasis on experience and interpretation of formative assessment. It focuses on how people make sense of their reality. According to Cresswell (2008) interpretive research focuses on developing an in-depth analysis of a single case or multiple cases. Furthermore, in the interpretive paradigm, reality (ontology) is socially constructed and its knowledge (epistemology) is self objective, built from experience and interpretation or meaning which implies that knowledge is constructed in the mind of an individual. Cohen et al (2007) indicates that in the context of the interpretive paradigm, the essential thing is to understand the subjective world of human experience. This is where research methodology seeks to clarify, understand and interpret the communication of speaking and acting subject. Therefore, this study intends to focus on the knowledge and practice of the individual

6 http://en.wiktionary.org/wiki

Mathematics educator (the participants experience and perception of formative assessment in Mathematics and their experience in their day-to-day working environment). This interpretive research was employed to probe the everyday experience of implementation of formative assessment in Mathematics classroom.

According to Henning et al (2005) interpretive approach is qualitative in nature, and therefore the study is based on how individuals make meaning of their world through interaction. The qualitative approach is suitable because it enables me to explore and gain insight into what teachers know about formative assessment and how they practice it. I am interested in finding out why people think the way they do; not how many people think in the way they do. By conducting the qualitative research, I am also not interested in educators' surface opinions as in survey research, but I wish to understand the teachers' perceptions of formative assessment and how they conduct it.

Interpretive paradigm employs both qualitative and quantitative techniques, but it favours qualitative methods of data collection and analysis more than those of quantitative and it also offers rich and thick description of a phenomenon, situation and activity in order for one to understand the subjective world of human experience (Neuman, 2006). According to Cresswell (2008) qualitative research is an inquiry approach useful for exploring and understanding a central phenomenon. To learn about the phenomenon, the inquirer asks participants broad, general questions, collects the detailed views of participants in the form of words or images, and analyzes the information in description and themes. In the study the participants will be described intensively (Henning, 2004)

An interpretive research paradigm is the most suitable appropriate paradigm for this study, as this study is seeking the reality on the teachers' knowledge and practice of formative assessment in Mathematics at a high school in Hammarsadale. The knowledge to be gained about teachers has been developed from teachers' experience and their interpretations as well as the interpretation of the researcher. Therefore, since this study is framed within the interpretive paradigm, it actually focuses on how people make sense of their reality and allow in-depth understanding of people experience.

3.3.2 The case study

Different scholars like Cohen et al (2007) and Henning et al (2005) agree that a case study is developed within qualitative research, they are step of action, and it is distinguished from other types of qualitative research because they have intensive descriptions. According to Bassey (1999) the nature of the research question informs the approach to be used. The research questions in this study explore the teachers' knowledge of formative assessment in Mathematics, grade 8 and their practice in a high school at Hammarsdale, Durban. Therefore, this research is a case study of using formative assessment in classroom Mathematics. A case study is the presentation and interpretation of detailed information, it is an in-depth study. Cohen et al (2007, p. 253) define it as the "the study of an instance in action". Henning et al (2005) assert that it focuses on the interaction between context and action; this will help me to probe deeply and analyze intensively the multifarious phenomena (Cohen et al, 2007). They further state that a case study is the "presentation and interpretation of detailed information about a single subject". Other scholars like McDonald and Walker (1997) in Merriam (1998) argues that a case study is the examination of a phenomenon while Creswell (2008) considers a case study to be thorough analysis or an investigation of a single or many cases. Therefore, a case study observes the characteristics of an individual unit, a child, a class, a school or a community (Cohen et al, 2007). The purpose of such observation is to probe deeply and to analyze intensively the multifarious phenomenon.

A case study strives to portray what it is like to be in a particular situation. Henning et al (2005) indicate that in a case study the main assumption is that a phenomenon is investigated as a "bonded system". The major characteristic of a case study is that its design is employed to gain in-depth understanding of the situation and meaning of those involved. This rationale is visible in the selection of the sample as described below:

3.3.3 The Sample of a case study / Purposive Sampling

In this study the sample is selected on purpose. Purposive sampling according to Mouton (2001) is when you select the sample on basis of knowledge of the population, your own knowledge or use expert judges to identify candidates. In this study, the participants chosen purposively were those teaching Mathematics in grade 8.

I used a case study approach in order to examine a phenomenon in its real-life context. Cohen et al (2007 p.53) explains that case studies provide a unique example of real people in real situations, whilst Merriam (1998) explains that "a case study is an examination of a specific phenomenon such as a programme, an event, a person, a process, an institution or a social group.

According to Merriam (1998) in qualitative research, a sample is selected on purpose to yield the most information about the phenomenon of interest, which in this case is formative assessment in Mathematics grade 8. The 'case' in the study refers to the purposive sample which comprises of the experiences of four grade 8 Mathematics educators from a high School in Hammarsdale, Durban. The three teachers are males and the other is a female. Their ages range from thirty-one to forty two years and the first teacher has 19 years experience in teaching, and the second teacher has 7 years experience. The third teacher has 20 years in teaching and the fourth teacher has 25 years experience. The older teachers were exposed to both the traditional method of teaching and to the Outcome Based Education method. The four teachers are 'adequately' qualified in terms of government requirements; they all hold a teacher's diploma which they obtained in recognized colleges. Their primary language is IsiZulu and they always switch codes to make sure that learners understand. Code switching refers to explaining both in English and in the learners' vernacular. The four classes that these teachers teach have an overall total of 253 grade 8 learners. To collect further data, two teachers from this High School were selected for lessons/classroom observation; one task and six marked scripts from each teacher were analyzed.

A small sample was selected precisely because I intended to explore their knowledge and practice of formative assessment in Mathematics in depth. According to Cohen et al (2007) sample size is also determined to some extent by the style of the research. They further demonstrate that in the qualitative style of research it is more likely that the sample size will be small. I chose site sampling (Van Manen, 1990) because it is based on identifying groups of individuals at a site for research purposes and in this research study it involved grade 8 Mathematics educators. Four seasoned Mathematics educators would have certainly provided sufficient data for a small scale study and shed optimal light on formative assessment in Mathematics (grade 8). The four educators identified were willing and available to participate in the research study.

3.4 Data collection

According to Carrim (2004) qualitative research has increased use of interviews and observations as a research method. Creswell (2008) and Henning (2004) assert that qualitative approaches require multiple sources such as documents, archival records, interviews, observation and physical artifacts. According to Picciano (2004) these methods may be combined. Thus the methods of data collection used in this study are appropriate and suitable for the purposes.

In this study I used the strategies of classroom observation, semi-structured interviews and document analysis (assessment policy and the task designed by teachers) to generate data in response to the critical questions – "What are the teachers' perceptions of formative assessment in Mathematics" and "how do teachers use/apply formative assessment in Mathematics?" The semi-structured interview is more suitable to identifying how people think since it is more open-ended than a fixed-response questionnaire. The first stage of the data collection was the semi-structured interview, and subsequently observations were conducted. These are described in the following subsections.

3.4.1 Semi-Structured Interview

Interviews are research instruments that are commonly used to obtain qualitative data. It is a data collection technique that involves oral questions of respondents either individually or in groups. An interview situation makes possible exploration of important aspects of a study in greater detail that may not be covered by other instruments (Verma and Mallick, 1999). They may be used as a means of evaluating or assessing a person in some respect; for affecting therapeutic change, for selecting, for gathering data as in surveys or experimental situations. (Cohen et al, 2007). Furthermore, they indicate that in each of these situations, the respective roles of the interviewer and interviewee may vary and the motives for taking part may differ. There are many types of interviews. According to Cohen et al (2007) interviews may be formal, which are called structured interviews, in which a pre-specified set of questions are asked and answers recorded on a standardized schedule. Interviews may also be less formal, which are called semi-structured interviews – this is when the interviewer is free to modify the sequences of the questions, change the wording, explain them or add to them.

In this study the interview is composed of eight questions (See Appendix D) and the interview is semi-structured (less-formal) to allow probing if the answers are incomplete. Interviews allows the researcher to further probe the way in which people make meaning of things, why they do and it also allow them to clarify the meaning. Therefore, four grade 8 Mathematics educators in this high school were interviewed using the semi-structured interviews which were tape-recorded and transcribed after the interview. The interview provided the most direct evidence about teachers' perceptions of formative assessment and generated thick descriptions of the phenomenon under study.

This study used a semi-structured interview to get more information from the four teachers. Cohen et al (2007) describe semi-structured interview as providing access to what is inside a person's head, it makes it possible to measure what a person knows (knowledge or information) what a person likes or dislikes (values and preference) and what a person thinks (attitudes and beliefs). Therefore, the interviewer must do his or her job well so that the participant is sincere and well motivated, then accurate data may be obtained. In this research study, I planned to relate to what other Mathematics educators had to say about implementation of the assessment policy, especially formative assessment. Furthermore, there was a need to have a greater flexibility and freedom for the purpose of obtaining relevant information with regards to formative assessment in Mathematics grade 8. It was also necessary for participants to easily and freely discuss sensitive issues. A semi-structured interview provided me with the above requirements.

A semi-structured interview, as described by Kvale (1996) is an interview with the purpose to obtain descriptions of the life world of the interviewee, with respect to interpreting the meaning of the described phenomenon. The researcher would also be able to probe initial responses. Knight (2003) on the other hand sasserts that semi-structured can be highly structured and used for the purpose of reality. When planning the semi-structured interview, the researcher has to keep in mind that the interviewer will only be an instrument for administration of the interview schedule. The interviewees are given the power and responsibility to make known their truth and hopefully they will make an effort to do so. Smith, Harre and Van Langenove (1995) demonstrates that although the researcher has a set of pre-determined questions in the interview schedule, the interviews must only be guided by the interview schedule rather than dictated by it. In this case study the semi-structured interview schedule was clear, accurate, specified and easy to understand. Simple and easy

terminology was used in asking questions so that participants had a clear understanding of the questions and answering was not a difficult task.

Participants were asked to set the dates for interviews and they were also given an opportunity to choose where they wanted to be interviewed. The interviews were to be held where participants were comfortable and they all agreed for it to be held in their classrooms. Stenhouse (1975) suggests sitting side-by-side rather than face-to-face so that we can symbolize that together we are facing a common task, rather than confronting one other. Although Walker (1985) says sitting side-by-side creates communication difficulties, I decided to use his suggestion to make the participant comfortable. Sitting side-by-side helped us to speak freely and feel at ease and most importantly we were both comfortable.

After conducting the semi-structured interview, the participants found themselves re-thinking about what they said and some felt that there was a gap between what they intended to say and what they actually said. One participant said that by participating in this study she was finally given a chance to air her views about this new curriculum and the different assessments.

3.4.2 Observation

According to Henning (2004) observation may be brief and serve only as a discreet tool for gathering information. It must be planned before hand and organized into a detailed observation schedule. Betram (2004, p.90) says "observation means that the researcher goes to a school or into a classroom and observes what is actually taking place there". Furthermore, observation can be structured or unstructured and it can be participant or non-participant. Structured observation is when a researcher has a very clear idea of what he/she is looking for in the classroom. Unstructured observation means that the researcher writes down a description of what she sees happening in the classroom (Bertram, 2004). A participant observer is when a researcher joins the everyday routines and he/she stays for a long time, while a non-participant is when the observer watches the situation openly but does not participate (Henning, 2004). I this study, non-participant observation was used to capture the process of teaching and learning. Cohen et al (2007) demonstrates that observation data are attractive as they afford the researcher the opportunity to gather 'live' data from 'live' situations.

To verify the results of the interview, two educators from same school were selected for classroom observation. The selection was based on the results of the interview, i.e. teachers who seems to know better about formative assessment. Qualitative researchers also use observation as a research technique because they are interested in individual experience (Carrim, 2004) and observation in this research study of Mathematics educators in grade 8 conducting formative assessment was appropriate because I required data on physical setting and the management of the formative assessment process. Morrison (2001) cited in Cohen et al (2007) agrees that observation enables the researcher to gather data on the physical setting (classroom) and the human setting (grade 8 Mathematics educators being observed conducting formative assessment).

Therefore through observation, I obtained first hand data rather than reported data. When observing, I noted how interaction occured in the classroom i.e. who spokes, how learners were arranged, the way in which Mathematics was dealt with and so on. Observation reflected the classroom interaction between the teacher and the learners. Lankshear and Knobel (2004) states that observation involves carefully planned, deliberate and systematic examinations of what is taking place, who is involved and where everything is happening. Therefore, the observation schedule was carefully planned and I was going to observe learners and educators engaged in the teaching and learning process for the purpose of developing and motivating learners. The observation schedule assisted me to select particular aspects to focus on.

I also had to observe the tasks that teachers designed for formative purpose. Behavior of learners also had to be observed, as well as how the educators were managing working with eighty two learners in one class. The two teachers were observed twice in their Mathematics classrooms. The first observation was well structured because I had a clear idea of what I was looking for (Appendix f). The second observation was unstructured which is known as narrative observation (Vithal and Jansen, 1997).[7] Therefore, everything was written down during the lesson, i.e. description of what I saw happening in the classroom.

I was given an opportunity to observe how Mathematics educators designed and applied assessment for formative purpose in Mathematics. As an observer in the Mathematics

[7] See Appendix G

classrooms I was able to gather richer data.

3.4.3 Document analysis

Bertram (2004) points out that the researcher can use various documents as their source of data and analyze these documents using a method called content analysis. Therefore, in the study I have analyzed the curriculum statement / assessment policy to find out what is required from the teachers who said they practiced and used formative assessment to monitor teaching and learning and learners progress. The use of these documents was not only for its content value but for the purpose of implementation and this also helped me in determining whether the participants were implementing the assessment policy as required by the Revised National Curriculum Statement guidelines on assessment for grade 8.

Furthermore, the task was analyzed to find out how the teachers designed a task for formative purposes and to determine whether the task was related to formative purpose. I specifically observed the nature of the task e.g. instructions, the language and its relevance to the topic of the lesson, and I also analyzed the quality of the written feedback given to learners.

3.5 Data analysis

In data analysis, I used an interpretational approach, which used thematic codes in order to capture the qualitative richness of the phenomenon (Neuman, 2006). The collected data was arranged in a logical order and it was categorized into meaningful categories. I then looked for relationships between the categories i.e. looking for a common pattern in the data (Bertram, 2004). The common pattern of interaction in an interview context is a transaction that takes place between seeking information on the part of the interviewer and supplying information on the part of the interviewee. The data and the interpretations were analyzed and examined thoroughly.

3.6 *Ethical issues*

The ethical issues of informed consent and confidentiality involved in the interviews were cleared with the four participants verbally and by means of a letter, explaining what I was doing and why I was doing this research study (Cohen et al, 2007). The participants were

reminded that the research would not be harmful to the research subject, whether directly or indirectly and that confidentiality would be maintained.

Letters seeking permission were sent to all relevant stakeholders, i.e. the Department of Education, the Ward Manager, the principal of the school and the colleagues (see Appendix C). Permission was granted by the Department of Education to conduct the research (see Appendix B). The necessary ethical forms were forwarded to the University of KwaZulu-Natal to expedite ethical clearance. The copy of an ethical clearance is also attached (see Appendix A). Lankshear and Knobel (2004) reveal that within educational research, ethics is concerned with ensuring that the interested well-being of participants is not harmed as a result of the research being done. They also describe that harm can range from participants experiencing affronts to their dignity and being hurt by conclusion that are drawn about them, all the way through to having their reputations or creditability undermined publicly.

Therefore, in those letters I did not hide the purpose of the study, so that they would consent to participation in the study in their school being fully informed of the requirements and process. Letters to the participants further assured them that the information they were going to provide would remain confidential and after the completion of the thesis it will be destroyed. Participants were treated with dignity, fairness, openness of intent, disclosure of methods and respect for integrity (Leedy, 1997). Participants were also given assurance in relation to the issue of confidentiality and anonymity. They were assured that the data will be used for research purposes only and all records would be kept safely with the university and disposed after five years. The participants were once again allowed freedom to withdraw from the study at any stage for any reasons. They were informed verbally and in writing that they were not obliged to take part in the research study. All the participants agreed to be interviewed. Finally, participants were provided with an ethical declaration form to append their signatures after reading and understanding the contents of the letters. They felt at ease after the detailed discussion of the ethical issues surrounding the study. According to Merriam (1998) a good qualitative study is the one that has been conducted in an ethical manner.

3.7 Validity and trustworthiness

Validity and reliability are essential to effective research. Validity and reliability means that research is credible and trustworthy (Meree, 2007). The term "understanding" is more applicable than "validity" in qualitative research and refers to the honesty, richness and depth of the data generated (Cohen et al, 2007). Data or methods are not as important as the meanings that participants give to the data. Interviewees were given the transcript to read in order to determine whether their views were correct and genuine.

The use of two or more methods to study human behaviour is called methodological triangulation which elicits a richer description of the phenomenon under study. Greater researcher confidence in the results is possible when several methods produce similar data (Cohen et al, 2007). In this study I used semi-structured interviews, observation and documentary analysis which form a triangulation of methods that increase the validity and trustworthiness of the study.

3.8 Challenges and Limitations

This case study is a study of one school in a rural area and as such is limited in the extent to understanding what teachers know about formative assessment and how they translate their knowledge into practice. Since the school is in a rural area, it might not reflect what is happening in urban schools.

As I am a member of staff, gaining access to the school was easy. However, I had problems when I had to interview teachers because they were busy preparing for moderation. However, they allowed me to interview them. Four teachers were interviewed but I could not probe deeply due to time constraints imposed due to the quarterly examination and educators were busy. Home visits were impossible because they all had family responsibilities.

I was unable to observe two lessons from each teacher. During the observation one educator felt intimidated when I took the tape recorder to record the lesson. I tried to assure him that it is only for the study but he said he was not comfortable and that I had to switch off the tape and observe without recording. When I wanted to observe the second lesson, he said he was busy preparing for exams, and cancelled the second observation schedule. I therefore only

observed one lesson of his and two lessons from the other educator. He did not give me marked scripts to see the feedback that he gives to the learners. Using different methods was time consuming considering that teachers were preparing for exams and they had to submit CASS for moderation to the Senior Education Specialist at the District office. Given the timeline of my own studies especially for data collection, the data collection could not be scheduled at any other time. It is acknowledged however that timing is essential and that future research must take cognizance of participant and institutional schedules.

3.9 Conclusion

In this chapter I outlined the specific research used in the study, viz. semi-structured interviews, observation and documentary analysis and motivated for the use of these methods. I described the ethical issues involved in this research and outlined the challenges and limitations of the study.

In Chapter four I will analyze the data in response to the critical questions, and discuss these under specific themes observed from the data.

Chapter 4 - Data Analysis

4.1 Introduction

This research study explores teachers' perceptions of formative assessment in Mathematics and how they translate it into practice. This research is qualitative in nature and according to McMillan and Schumacher (1993, p.486) cited in Bertram (2004, p.141) "qualitative researchers integrate the operations of organizing, analyzing, and interpreting data and call the entire process *data analysis*. In this chapter the response to the critical questions, viz. *What are the teachers' perceptions of formative assessment in Mathematics* and *how do teachers use/apply formative assessment in Mathematics*, is captured.

The findings are divided into two different subsections which will answer the two critical questions. For the first critical question a semi-structured interview schedule (see Appendix D) was used to elicit the data, and for the second critical question, an observation schedule was used (see Appendix f). Lastly the policy document was analyzed to determine what is expected from teachers who are using formative assessment in their classrooms to improve teaching and learning.

The interpretational approach which uses thematic codes in order to capture the qualitative richness of the phenomenon was used to analyze the data (Neuman, 2006). The collected data was then arranged in a logical order and it was categorized into meaningful categories. I then examined the data for relationships between the categories, i.e. looked for common patterns in the data (Bertram, 2004).

In this study, the educators' knowledge, practice of formative assessment and assessments tasks that educators design for formative purpose were the focus of organizing data and analyzing the rich data that was collected. This case study gives the researcher a rich experience of the reality of what happens in grade 8 Mathematics classroom with regard to formative assessment (Cohen et al, 2007).

The four selected educators were interviewed about their knowledge of formative assessment, and two educators were observed when conducting the lessons. Their tasks that were

designed for formative purposes were also analyzed. These methods were used to see if educators practiced what they said they knew and to gather data in order to explore the teachers' knowledge of formative assessment and their practice. The data generated were categorized into four broad themes, viz.1. Type of assessment used by Mathematics educators for diagnostic assessment; 2. Teachers' knowledge of formative assessment; 3. Difficulties experienced in applying formative assessment; and 4. Opinion and changes in the current assessment practice (formative assessment).

4.2 Findings

4.2.1 Teachers' perceptions of formative assessment in mathematics

The themes assisted me to answer the first critical question that asked what teachers knew about formative assessment. Therefore, this section examines teachers' responses when they were interviewed with regards to their knowledge of formative assessment.

All respondents demonstrated that they used different types of assessment to monitor and encourage learners to enjoy Mathematics. For example, they all pointed out that they used informal and formal assessments. They were asked to describe what they understood by informal and formal assessment. The responses included: informal assessment was the assessment of learners during the process of teaching, e.g. asking and answering questions in class, discussing in groups, involvement in group work, exercises in class, homework, charts and posters. Responses from educators showed that they use different types of assessment and showed an understanding of using different types of assessment. These are some responses from the two teachers:

Teacher 1 avers:

> *"Although it is not easy to work with large numbers in class, but I try the best and I always pose interesting problems when I enter the class. This draws the attention of learners and allows them to discuss the problem in their groups. I always give them ample of time to discuss and when they present their findings I encourage them to justify their answers. Sometimes I encourage them to pose problem of their own and encourage them to bring in their prior skills and ideas.*

This helps me to understand the learners and assist me when teaching that topic".

Teacher 2 differs in his response:

"Yes I am using different assessment and actually even before the new curriculum, I was using different assessment. There is no ways you can teach Mathematics, you need to use different strategies if you want your learners to enjoy Mathematics. The first thing that I do in the class is asking questions, sometimes I asked about what we did, sometimes about their experience or about the problem that will reflect to their real life. This helps me to see if we are in the same boat or not. This method usually motivates them to explore various ideas and they enjoy".

These two teachers demonstrated that they create a stimulating environment in their classroom, they organize and structure activities and develop resources to help learners identify and work towards an attainable goals. Furthermore, they demonstrated that they are acutely aware of the important interaction of hands-on activity and of maturation in determining learning outcomes. Furthermore, teacher 2 made it clear that there was nothing new; indicating that it was perhaps only the terminology, since he claimed that he was doing what was required from long ago. Therefore, the above responses show that educators understood that the focus was not only on content but was on what learners knew and what they could do with the knowledge.

The feelings of Teacher 3 and 4 differ from Teacher 1 and 2 because they indicated that although they used different assessment types, they do not use all the types of assessment suggested by the NCS document. They revealed that they use worksheets, exercises, class work, homework, test and examination, and emphasized that they assess learners frequently and keep the records, from which it may be inferred that these records are kept as evidence. Furthermore, they indicated that they are aware of other types of assessment such as baseline, diagnostic and formative that they could use to help learners but were unable to use them with ease in their context.

According to Teacher 3, the government and other stakeholders expect Mathematics teachers to use assessment to motivate and help learners. But Teacher 3 asserted that it was difficult in her school due to large classes. She said:

> *"Imagine giving learners an assignment and you are expected to give feedback to each learner and that can take the whole year. The second problem that I have is related to resources, as you can see there are no computers and copiers in this school and what can you do if you want to design an authentic assessment. So, that is the problem, they argue that we do all these assessment but it is not do-able here".*

Teacher 4 also agreed that she used different types of assessment but found the new requirements unrealistic and problematic. She claimed that change was not necessarily for the best, i.e. one can get worse results. For example, she revealed that when she tried the group work approach, it did not work in her context due to the large number of learners in her class. She also stated that group-work masks real achievement because some learners who cannot read or perform simple tasks use the group-work to "hide". She also stated that

> *"There is no space to perform these activities. It became very strenuous for me because the majority of the learners do not participate in these activities that need them to construct their own knowledge."*

The findings indicate that Teacher 3 and 4 are willing to use different types of assessment that can promote the culture of learning and improve the learners' performance, but they argue that there are difficulties due to context. They asserted that they were not willing to use certain types of assessment unless the government attended to the issue of large classes. They said they would not suffer because of government negligence.

Furthermore, the four teachers mentioned that since the numbers of learners in their classes are very high, it creates a serious tension for them. Large numbers seem to be a considerable problem, because teachers are not able to handle large classes and hence there is no effective teaching and learning. The main principle of formative assessment in Mathematics is that feedback and scaffolding are essential to the conduct of effective teaching and learning when

used appropriately, but the question is, how can teachers scaffold and give feedback to 82 learners in the same class?

On the other hand, Teacher 1 and 2 demonstrated that even though there were problems, they confirmed that they always tried their best. They pointed out that sometimes it was not easy but they were trying and they could see the improvement.

The issue of large classes is experienced by the teachers as a major constraint on what they understand the main expectation from the new curriculum to be – i.e. working with learners in the class in a differentiated manner. However, the evidence shows that teacher 1 and 2 are committed to the process of designing assessment for formative purpose, despite this contextual factor.

Knowledge of formative assessment

In this theme teachers were asked about what they knew about formative assessment. The four educators had different views and knowledge about formative assessment:

Teacher 1 stated:

> *"I know that formative assessment is an assessment that I am expected to use every day in class to monitor and encourage learners throughout the learning process. Formative assessments help me to identify learners who need help and it also helps me to improve the teaching strategies. It also helps the learners to see their progress throughout the year.*

Teacher 2 said:

> *"It is an assessment that I use when I teach. Sometimes you need to pose questions to learners to see where they are, these questions I ask with formative purpose. I use the information to improve the teaching.*

According to the Department of Education, assessment that is used for teaching and learning purposes is called formative. The finding showed that teachers 1 and 2 in this high school knew and understood what was meant by formative assessment because they indicated that

they used different assessments to enhance learning. Their responses also indicated that they understood that formative assessment was an assessment that helped them in their teaching since it monitored and supported learners throughout the learning process. They agreed that formative assessment helped them to identify learners who needed special attention. Furthermore, they knew that formative assessment helped them as teachers to determine learners' progress and to guide them where to improve their teaching. They also defined formative assessment as an assessment that was used to help learners to see how they were progressing throughout the year. Teachers 3 and 4 has different views about formative assessment. When they were asked about what they knew about formative assessment they appeared puzzled, and Teacher 3 said:

> *"We have been using different teaching and assessment strategies to help our learners to improve, the only difference now are that we have to record every activity that the learner performs to have evidence when the learner fails".*

Teacher 4 avers,

> *"(Hhayi angazi, angiyazi leyonto) No I don't know, I don't know that thing what is, can you explain it maybe I know it is just the terminology"*

I explained what I meant and she said:

> *"Okay well, I use different assessment but for records because the Department want to see the records if the learner fails".*

The findings reveal that Teacher 3 and 4 did not understand what was meant by formative assessment and they felt that formative assessment was just a change of terminology. They pointed out that actually it was what they had been doing since they started teaching and they called it informal assessment. However, according to the Assessment Policy Document (2002) the term "informal assessment" does not mean the same thing as the term "formative assessment". Informal assessment refers to the style or mode of gathering information about learners while formative assessment refers to the use that is made of any information whether it was gathered formally and informally. On the other hand, teachers 3 and 4 feel that there was a very serious confusion in current education terminology. They said the government

was often changing things and they were not sure which to use. Furthermore, they argued that it was not helpful to imply that everything about the new curriculum must be new and different. They confirmed that when they felt overwhelmed, they reverted to what they knew and did best.

This indicates that perhaps the two teachers use different assessments mainly for the purposes of keeping records and not for formative purposes of helping the learners. They pointed out that formative assessment was the assessment that they designed every day to prepare learners for the final examination and records were kept in the learners' portfolio as evidence, as this was required by the Department of Education.

Confusion around the terminology

According to the teachers, there is very serious confusion in current education terminologies. The two teachers seem to struggle with terminology used by the policy makers, and they actually confirmed that they did not even know what formative assessment meant. Teacher 3 pointed that:

> *"I cannot understand the terminology that is used, for example what is the different between informal assessment and formal assessment. I think if I can change I can just confuse myself. I am using informal assessment and I am happy with it.*

Teachers 4 said:

> *"Really why should we use different confusing names for the same thing, according to the understanding informal assessment is formative and I use those assessment although I do not have time to give detailed feedback. The government is actually making the education more complex and the government confuses us and actually he is also confused.*

Teacher 1 and 2 actually felt that the terminologies were confusing but they were willing to understand them because they felt that it would help them improve. Teachers attributed their

lack of knowledge to the complex and ever changing terminologies used by government. The teachers seemed to fear not understanding exactly what was expected of them.

When teachers were asked if formative assessment assisted them in their teaching they responded differently. Teacher 1 and 2 agreed that sometimes it helped but sometimes it did not. Teacher 1 said:

> *"Formative assessment helps me to identify learners' problems and when I identify the problem I use different strategy to teach or to assess. However, sometimes it is not easy to identify the learner with a problem because they are too many in the class and some learners are reserved they don't want to be identified, so they make sure that they hide with others".*

Teacher 2 also confirmed that formative assessment assists him in his teaching because it creates a stimulating environment. He said:

"I am able to use different strategies e.g. re-teach; re-assess to help the learners progress. The results of formative assessment also help me to give relevant feedback to learners and it also helps me to scaffold the learners in a way that help them to understand so that they can improve and progress. However, using formative assessment can be time consuming especially when you are working with large numbers".

Teacher 3 also affirmed that:

> *"It helps me to see if I have achieved what I was teaching and it also help learners to see if they are making any progress.*

Teacher 4 emphasizes that she have not seen any changes so far and she said:

> *"Actually may be it is because I do not even know how to use it"*

Teacher 1 and 2 both feel that the results helped them in their teaching process because they were able to judge themselves from learners' work. It showed that they were able to learn and

change pedagogy from the learners' results. However, teacher 4 did not feel the same way because she was not using it, not because she did not want to use it but because she did know what it meant. She argued that it was not helpful to imply that everything about the new curriculum must be new and different. She confirmed that when she felt overwhelmed, she reverted to what she knew and did best.

All four teachers revealed that it was not easy to practice all the principles of formative assessment in their contexts. They said they have large class numbers, approximately 82 in each class and it was difficult to give each learner special attention, viz. to attend to each learner's problems, give each learner constructive feedback and to talk to learners on an individual basis. They said it was very strenuous and it was really not working in their context. However, they agreed that learning is at the very heart of their profession. Teacher 1 said:

"after all, the main purpose of schooling is to help this process to happen".

They emphasized that their life's commitment as teachers was to assist learners to learn how to learn.

Further, the findings showed that teachers 3 and 4 used the different assessments to keep records rather than for formative purposes or to help the learners. They pointed out that formative assessment was the assessment that they designed every day to prepare learners for the final examination and records were kept in the learners' portfolio as evidence, since it is required by the Department of Education.

Teacher 3 argued that even the Senior Education Specialists were only able to tell them to design and use different assessment for formative purposes but did not demonstrate these themselves. He said:

> *"They only give us examples of tasks for formative purpose, but they do not show us how to practice it. Actually the tasks that they used are the tasks that we have been using in class to prepare our learners for final exams and it is actually what we are doing in class, using different assessment to keep records as the government wants each learner to have a portfolio".*

Furthermore, the policy documents argued that teachers needed to give learners opportunities to reason, and to scaffold their understanding by using assessment for learning, which is, formative assessment. Formative assessment could allow educators to give learners feedback that could motivate and develop the learners holistically. According to Gipps (1994) formative assessment was developed to meet individual and systemic needs of assessment within the education system. Black (1998) states that formative assessment gave information in order to help learners improve and make progress. He further indicates that it should inform educators and learners about learners' progress in order to improve learning. Gipps (1994) demonstrates that feedback on performance can operate at a number of different levels: results of individual learners can provide feedback to the teacher about both the learners' progress and the teachers' success.

Difficulties experienced in applying formative assessment

As I researcher I also wished to know the difficulties that were experienced when applying formative assessment. The responses of Teacher 1 and 2 were almost the same. They felt that it was not easy to change. Teacher 1 argued that:

> *"A person cannot change in a day, I am trying but we also need additional resources to practice and to perform what is expected from us, really I am trying the best to use different types of assessment for formative purpose and sometimes I use the own money because the school is poor even if you just want to make a copy there is no copier. Sometimes I even ask learners to pay R2.00 so that I can make copies for them".*

Teacher 2 also suggested that:

> *"The government should make our school conducive for learning by providing everything that we need to enhance and improve teaching and learning because we are working under worse context. We are trying but we can do better than this if we can have manageable learners in class and relevant resources".*

(1) Additional resources

The responses indicate that teachers understood that formative assessment required them to change from the old way of assessing but they felt that it was not easy since designing assessment for formative purposes demanded resources. They also demonstrated that it was difficult to apply formative assessment because it required teachers to use a variety of assessment techniques which needed resources. Teacher 3 and 4 revealed that when they wanted to design worksheets or case studies that would encourage improvement in their learners, they were not able to do that because there was no computer to design the task, there was no copier to make copies for each learners. They also stated that if the learners were required to conduct research or investigations, there was no media centre at school and the library was quite a distance away for them to gather the information. If learners were required to complete projects, they did not have money to buy the material, and that the school was unable to supply them with small things. They emphasized that they found it difficult to deal with these problems.

Teacher 3 and 4 had different views and actually mentioned that they did not want to implement formative assessment under the circumstances they were working in.

Teacher 3 laughed and said:

> *(Hhayi vele angiyisebenzisi) No, I am not using it. You know the government thinks we are overseas where they have everything and teaching only +- 30 learners in class".*

Teacher 3 stated that:

> *"I experience learners who are not willing to learn or to do anything in class such that I just change to the old way to see if everyone understands what I am teaching".*

The findings show that Teacher 3 and 4 present the lack of resources as challenges or barriers to their implementation of formative assessment or wanting to try it in their classes.

(2) Time Consuming

The four teachers felt that they needed time to change and they felt that time will be lost while they were trying to grasp the correct pedagogy and strategies. They argued that using different types of assessment for formative purpose was actually time consuming. This was confirmed by Fullen (1991) who stated that change needed much time and we could not change overnight. Teachers also feel that it increased paper work. Teacher 1 stated that:

> *"Formative assessments are good assessments, but the problem is I do not have time to mark all the assessments in time such that I am not able to give feedback to learners. The best assessment for formative assessment is oral questioning because I am able to give feedback immediately. With the other types of assessment, it is not easy for example if I give a learner a research, she/ he can do it in a week and I can take two weeks to mark 160 scripts and giving feedback to each learner is not easy so I end up generalizing. Sometimes I do not even mark the tasks because there is no time".*

Teacher 3 also confirmed that:

> *"I teach five periods a day and when I am free I plan for the following day and design tasks for the next day and when I try to mark it takes forever because there are 82 learners in each class and I teach three classes. The fact is there is no time for different assessment otherwise you can end up assessing and not teaching".*

The other two teachers also felt that there was no time to practice new ideas effectively. They felt that the implementation of the different assessments would mean they less time for teaching. Teacher 4 asked:

> *"When can I teach if I always give learners assessment? and the other learners always copy form the other learners. This formative assessment is a joke, waste of time and energy".*

(3) Increasing Paperwork

The responses indicated that the change in assessment only increased the paper work. Teacher 1 states:

"I think assessment has been broadened not reduced the paper work, which is time consuming. I am expected to record everything done in class e.g. class work, worksheets, orals, presentation, assignments, projects, group work etc. This makes me to find the self with many papers in the file and desk which I sometimes lost them".

Three teachers complained about the current assessment practice, which they felt had been reduced to "paper work" because they are expected to keep the records for every activity that were done in Mathematics classrooms. The assessments for formative purpose must appear in each learner's portfolio for evidence that a learner is progressing or not. They also mentioned that at the end of the year they were expected to use the assessments as a year mark (75 %) and learners only write exams for 25%.

Some teachers felt they since they have so many documents in their file, it is easy to misplace them. They argued that since they were expected to record everything they did in class they would always have large amounts of papers which are either mark-lists or learners' activities. They confirmed that it was not easy during change, because it involved different people and different contexts. According to Fullen (1991) change is a very difficult thing; he points out that education is complex and its reform is even more complex. To succeed we need to link a number of key aspects of knowledge and to maintain the connections before and during the process of change. Fullen (1991, p. 79) describes change as "a journey, not a blue print". Changes do not run themselves, it requires people to be willing to change and try new ideas all the time. Teachers were asked the kinds of difficulties they experience in applying formative assessment and the study indicates that they encounter different and similar problems when they try to change their approaches.

In this theme teachers were asked about their opinions and changes in the current assessment. They responded differently.

Teacher 1 emphasized that he has changed;

"I use various methods to assess the learners; although it is not easy because of the problems we encounter everyday". He continues saying "change is not a one

day thing, it is a process and I hope I will meet the requirements of formative assessment one day".

Teacher 2 feels that he could not assess learners' everyday and he pointed out that:

"I do assess learners frequently, but not every day. Sometimes you need to explain some terminology to learners, there are some topics that do not allow us ask learners and we need to explain those topics to learners instead of giving them opportunity to discuss.

The other participants felt everything about the current assessment was time wastage. Teacher 3 emphasized that:

"It just a waste of time, time for teaching, teaching is important and learners can learn if we teach. But if we keep on writing things some learners especially those who are not committed are bored".

Teacher 4 also felt that:

"It just a waste of time and this thing destroy the education system because instead of teaching, we are expected to assess learners now and again"

Responses from teacher 1 and 2 showed an understanding of the current assessment and the findings demonstrated that they were willing to change but there were some factors that did not allow them. They were aware that designing tasks formative purpose could enhance their teaching and learning and they knew that formative assessment was for learning. This was confirmed by teacher 2 who indicated that sometimes he allowed learners to discuss so that they could learn and sometimes he explained facts. According to Miles (1993, p.82) "change is a process of coming to grips with new personal meaning and so it is a learning process". It requires a lot of hard and clever work on the ground and what really matters for complex goals of change are skills, creative thinking, and committed action. It can be attained when teachers try hard to practice formative assessment. However, teachers have different views and opinion about these changes.

The findings demonstrate that teachers do assess learners formally and informally, however they seem to value recording of written performance (as in tests for example). The teachers found it difficult to record informal observation of learner's performance. This has implications for their use of formative assessment. It is also possible that teachers need more clarity about why it is important to keep records.

Aims of formative assessment

The respondents were asked about the purpose of assessment. Teacher 1 and 2 confirmed that they used formative assessment to develop and encourage their learners, as well as to try different strategies that would improve their teaching with the hope that learners would gain. They also indicated that it helped them to give feedback to learners.

Teacher 3 was confused and he said:

> *"I am not sure what you mean by formative assessment, the only thing I can say is that I use all kinds of assessment and I keep the records and those assessment also help the learner to see if she or he is progressing or not".*

The findings show that teachers used different assessments for different purposes; some teachers used it to monitor, encourage and develop learners while others used it for self-reflection. Teacher 1 and 2 actually know that formative assessment is used to develop the learner and to inform the teacher about the learner.

Using feedback

The following responses revealed that teachers used formative assessment to give learners feedback. When teachers were asked how they give feedback they responded differently.

Teacher 1 said:

> *"I do give feedback to learners but in the own way. For example, when I mark the tasks, I identify common problems and write them down. When I go to class we discuss those problems with the learners. I do feedback oral because the class is*

too large. However, I know that the correct way is to give feedback to each individual but it is not possible in the context.

Teacher 2 indicates that:

"I do give feedback to learners, usually I write the comments in their task, but sometimes I give feedback in groups. I identify similar problems and ask learners with similar problems and give them feedback. However, it is not easy considering the classes we are teaching".

Teacher 3 and 4 said they do make comments (such as outstanding, good, you can do better) and ask learners to make corrections. They asserted that they told the learners what they were supposed to do. They confirmed that they tell them in class and they also said there is no time to attend each individual.

The findings show that teachers do give feedback to learners. However, according to Black (1998) some feedback is more effective than others. Teachers feel that feedback can be given in many ways, so they usually give oral feedback because it saves them time. Furthermore, he says feedback is the most important aspect of formative assessment. It is the assessment that is used to inform educators and learners about a learner's progress in order to improve learning. The study shows that teachers are also aware that feedback is important but they confirmed that it is not easy to give feedback to large classes.

Furthermore, the first aspect about applying formative assessment is the idea of on-going assessment in teaching and learning. It is expected that formative assessment will encourage and develop learners' competence in a progressive way. Teachers feel that they practice formative assessment everyday when they assess their learner because they use various methods that can prepare learners for the world and help them to solve everyday problems. Teachers also show that they give feedback to learners, although they can not do it in an individual basis but they do give feedback to the class.

4.2.2 How teachers apply formative assessment in the Mathematics classroom

The second critical question asks how teachers apply/use formative assessment in Mathematics classroom. To answer the second critical questions, an observation schedule was used (See Appendix f) and Teachers 1 and 2 were observed during the lesson presentation. Two lessons were observed from Teachers 1 and six scripts from learners were analyzed to see how the teacher gives feedback to learners. Only one lesson was observed for Teacher 2 because he was preparing for examination and he actually cancelled the appointment claiming that he was busy.

The researcher wanted to see what teachers do when they apply formative assessment. How were the learners arranged in the classroom? Were they all boys' groups, or all girls' groups? Were they mixed? How were they arranged? The most important thing was to see who dominated throughout the lesson – was it a teacher or was learner participation allowed? I also wanted to observe how the teachers present issues (that is, do they present the issues as incontestable "facts" or was discussion about them allowed?)

Analysis of the selected educators

The chosen teachers', Teacher 1 and 2 were Zulu speaking teachers. They possessed a recognized teachers' qualification and they have been teaching for the past 5 to 8 years. Teacher 1 is actually studying ACE (Mathematics literacy) at UKZN. The other teacher, for the past three years has been attending an in-service training course offered by the Mathematics organization in his school. He is also aware of the new approach to teaching Mathematics in which learners are encouraged to construct their Mathematics understanding through interaction with both learners and the teacher (Yackel et al, 1990). Actually they both design tasks that have formative purposes.

Lesson observation: Teacher 1

Teacher 1 and 2 demonstrated that they knew what formative assessment was, and the findings indicated that although they encountered difficulties they were always trying their best to practice formative assessment in their classrooms. Data was collected in two of the grade 8 (12- 15 years) classes in the school. It was analyzed to explore how teachers

practiced formative assessment, how they designed tasks/activities for formative purpose and the type of feedback given to learners. These classes were chosen because the interviews suggested that the teachers of these classes (Teacher1 and 2) knew and understood better what was meant by formative assessment purposes. The learners in these classes did not have textbooks, only exercise books in which they did their written work. There was a green board, chalk and fewer table and chairs than the number of learners, which meant that some of the learners had to share the same table. There were approximately 82 learners in each class. All of them were second language English speakers. The learners sat in groups (crowded). During the observation, there were 8 groups with each group having 8-10 learners.

The way Teacher 1 introduced the lesson captured the learners' attention. This was because he tried to relate the lesson to an everyday experience and activity or an enjoyable activity – he used an example of cakes and almost everyone likes cakes. The main purpose in this Mathematics lesson (Teacher 1) was to introduce learners to the concept of "ratio" – 'how we say ratios, how we write them in symbols, how we increase and reduce them". This could be expressed as the main outcome of the lesson. "Cooking" was used as a familiar context to start learners' thinking about increasing and decreasing quantities in a given ratio. In most recipe books, you will be told how many people the recipe caters for. If you want to bake for more or less people, you need to increase or decrease the quantities in the recipe.

Group 1

L1	L2	L3	L4	L5
	L9	L8	L7	L6

Group 2

L10	L11	L12	L13
L17	L16	L15	L14

Group 3

L18	L19	L20	L21	L22
L27	L26	L25	L24	L23

Group 4

L28	L29	L30	L31	L32
L33	L33	L34	L35	L36

Group 5

L28	L29	L30	L31	L32
L33	L33	L34	L35	L36

Group 6

L28	L29	L30	L31	L32
L33	L33	L34	L35	L36

Group 7

L28	L29	L30	L31
L33	L33	L34	L35

Group 8

L28	L29	L30	L31	L32	L28	L29	L30
L33	L33	L34	L35	L36	L33	L33	L34

Figure 4-1: Teacher 1 seating arrangement

Figure 4-1 shows that Teacher 1 arranged the learners in groups to allow them to discuss with each other and share their experiences. It was important that learners felt comfortable in

their learning environment to explore and experiment. However, according to Gooding and Stacey (1993) when using grouping, it is not a good idea to put weak learners with high achievers, as the learners who struggle may be too shy to offer their suggestions.

The first lesson started 5 minutes late and the teacher posed some questions to learners. The questions required the learners to state what they used when they were baking or cooking, and the quantity they used. These questions allowed learners to discuss in their groups and it allowed the teacher to move around and scaffold the learners. After 30 minutes, the teacher asked one learner to tell the class about their discussion. During the presentation the teacher asked questions that lead learners to explain their findings. After the presentation the teacher explained to them the concept of a ratio, gave them more examples of ratios and showed them how to write a ratio.

Learners were also presented with series of general problems which varied the presentation of the sum. Some problems were formulated in terms of numbers only and some were formulated in terms of pictures only (in the form of drawing of a situation) and some were formulated in terms of both pictures and numbers. Learners used different representations for the problems. It was interesting to observe that all learners were engaged in discussion in their groups and asked the teacher questions. According to Southwood and Spanneberg (1996, p.22) mistakes need to be viewed as positive parts of learning process and as stepping stones to learning. Therefore, the teacher also saw learners' mistakes as stepping stones, and helped them throughout the task. At the end of the lesson the learners submitted the tasks.

The above view demonstrates that Teacher 1 understood that the focus of learning activity had moved away from churning out answers to a focus on developing the problem solving skills which will enable learners to interpret and make sense of answers. The teacher moved around observing what learners were doing and he also interviewed them to obtain a clear view of learners' understanding and misconceptions. This indicated that the lesson was learner centered because learners were actively involved in the lesson.

The following day the teacher entered the class and asked learners to settle down. He asked oral questions about the activities they did the previous day. There were no groups this time, and after a short revision he gave learners an individual formal activity (Appendix H). Learners were not allowed to talk unless they wanted to speak to the teacher. The teacher

moved around observing what learners were doing. According to Doyle (1983) teacher intervention should take place at all levels: class, group, and individual – helping and supporting the learners is necessary. Therefore, the teacher facilitated the assessment and intervened in a manner which positively encouraged learning. He explained some terms to learners.

The above views show that Teacher 1 was no longer a 'transmitter' passing on facts and rules to be regurgitated by an unquestioning 'audience'. Nor was the Mathematics teacher merely a facilitator who set up the learning situation and then left the learners to get on with it. Although, the assessment was formal, the teacher was still prepared to intervene in a positive manner.

Lesson observation: Teacher 2

Teacher 2 came five minutes late; apparently he was delayed at the staffroom because he was looking for a duster and chalk since they share these. He took another 5 minutes checking an attendance register.

After 10 minutes the lesson began. He asked them if they have found what is meant by ratio. Learners were shouting and raising hands. He gave five learners a chance to explain and he added to what was said by the learners. He asked them to give examples of ratios, learners shouted different numbers (e.g. 1 dot dot 3, some said 1 is to 6). The teacher asked one learner to write the example on the board and asked others if the learner was correct. After a 20 minutes discussion between learners and the teacher, the teacher enquired about the roll of the boys in class, and the learners responded that it was 37. The teacher wrote this number on the chalkboard and labelled it as "boys"; he then enquired about the number of girls and wrote the answer "45" on the board, alongside which he wrote the label "girls. He explained to the learners that the ratio of boys to girls is 39:45. He explained that since he asked about the boys first, the ratio "will start with the boys". He asked the learners if they understood and they responded, "Yes sir". He then gave learners an activity, which was the same as that given by Teacher 1 to his class.

The above scenario shows that teacher 2 has also shifted from 'telling and describing' to listening and questioning and probing for understanding. He did not explain ratio to learners

but he encouraged them to investigate what is ratio, and allowed them to give their own examples. The learners were not arranged in groups, but were allowed to discuss with each other. The learners dominated in the lesson which indicates that the lesson was learner centered and learners were given sufficient time to discuss. The teacher did not transmit facts but he encouraged them to share ideas. The teacher created an enabling learning environment.

4.2.3 Criteria used

For assessment to be able to correctly drive teaching and learning, it has to be planned against the outcomes to be achieved. According to Versfeld and Dyer (1997) an important part of any assessment is the criteria used by the teacher because making your criteria known can be a valuable tool in the learning process as learners become aware of what is expected of them and are eventually able to monitor their own and each other's development. The criteria serve as a guideline as to what learners must achieve and the findings show that the setting of performance criteria does take place in the teaching and learning situation in grade 8. This can assist teacher to know where learners are and to evaluate their teaching.

The findings indicate that teachers 1 and 2 used criteria to mark learners' assessments; this was confirmed by the tasks that they haddesigned for learners (Appendix H). Furthermore, during the lesson, I observed the teacher speak about the criteria to the learners. Versfeld and Dyer (1997) reveal that it is helpful to discuss the criteria beforehand, and let the learners discuss and add to them, which can be done even with young children

4.2.4 Tasks analysis

The manner in which tasks are designed and executed will determine whether they are for formative purposes or not. Task analysis was an important component of this study as it was an essential yardstick by which to ascertain whether teachers were indeed facilitating students' knowledge production and skills.

This theme explored the tasks given, the observation focused on the clarity of instructions, the manageability of the tasks, and whether the tasks were closed or open-ended. This was because the tasks that intended to meet formative purposes must be designed clearly and could involve learners in manipulating information and ideas by "synthesizing, generalizing,

explaining hypothesizing to arrive at conclusions that produce new meanings and understandings" (Collins, Brown and Newman, 1989). This can help them to relate aspects beyond the school, especially when they are able to connect what they are doing in class to the world. Collins et al (1989) argue that learners must make connections to the world beyond the classroom.

Teacher 1 believes that learning is enhanced by connections to everyday life. As baking/cooking are familiar everyday activities, calculations that were related to baking and cooking were assumed to be more meaningful to learners. Perhaps there was also the assumption that understanding ratio would help learners in their baking or cooking. Teacher 2 also tried to relate the ratio to learners' experience as he had asked them about what they saw in class (i.e. number of boys and girls) and demonstrated how ratio was written. Both teachers actually tried to give learners opportunities to construct their own meaning by using everyday activities.

The structure of the task for the second lesson used by teacher 1 was of a closed type. A structured task is one that breaks down assessment activities into manageable parts. Moreover, the instructions were clear and understandable; they also included higher order thinking skills. The learners knew what was expected from them, they made connections to the world beyond the classroom. For example, the learners actively interacted with the teacher to make sense of the activity. According to Collins et al (1989) instructions must offer multiple opportunities for learners to use conversation, writing and other forms of expression to process information. When the learners felt that the language was not accessible the teacher was there to guide them. He switched the code when learners asked for explanations, and he explained to them in their mother tongue.

Task 2 used by Teacher 1 was not long and was manageable, as it actually related to the learners' everyday life. The questions were clear and easy to understand, and the task was directly relevant to the topic. They learnt about ratios and the task required them to write the ratio of different animals on a farm, the ratio of girls to boys in grade 10 and the ratio of an increased rectangle. The task was formative because it was used to inform the educators and the learners about their progress in that lesson. The assessment of the task intended to help find out who needed special help in ratios; this was in concordance Black (1998) who asserted that the purpose of supporting and improving learners was linked with formative

assessment. The National Curriculum Statement (assessment policy documents) argues that teachers should always find out how their learners are progressing and how they could assist them to improve learning, for this reason the policy states that all assessments can be used to greater or lesser extent for formative purposes. Although the teachers gave marks to the tasks, he used the task to help learners to improve writing 'ratios' and he encouraged them during oral feedback and in their scripts. They indicated that they would ask learners to re-submit their tasks after giving them feedback. Although the second task was for summative purpose, the teachers decide to make it formative because the learners did not perform well. According to The National Curriculum Statement (assessment policy documents) teachers should decide at the start whether the assessment task will be for summative or formative purpose or both.

The task was context-based; the learners worked on a contextualized task. Tasks that are contextually designed help learners to see that Mathematics make sense because it involves reasoning and thinking skills, which require more than mere manipulation of symbols. Brodie (1991) shows that Mathematics (and Mathematics education) at least partly, depends on the socially shared development of stronger, more conscious links between Mathematics experience and everyday life culture. The tasks allow learners to explore reasons, make sense and think creatively. For example, in the second activity the learners were supposed to reason and find the number of girls first before they wrote the ratio. Such activities can enhance and improve the way learners think.

4.2.5 Learners' performance

Teacher 1 allowed the researcher to observe two lessons and two tasks, as well as analyse two learners' scripts. In the first lesson the class met for 55 minutes and typically began with 5 to 10 minutes of dusting tables and chairs. Much of the remaining time was occupied by discussion with the teacher and group discussion. After the discussion, the remaining time was used for writing a short class work. In second lesson, the teacher gave them the activity (worksheet) and he became a coach, facilitator, guide or mentor in a "cognitive apprenticeship" who inspired and nudged the learners to do the active work of learning.

Figure 4.1 below shows 80 learners who wrote 2 tasks that were designed for formative purposes. The first task was informal and the second task was formal. The graph shows learners' performance in 2 tasks. (i.e. task1, informally and task 2 formally). The learners

performed well in the first task which was informal. They were enjoying the task and I assumed that they understood it. Before the teacher left the class, he gave oral feedback about the task and explained some content and questions, showing them what they were expected to do. He left the class and asked the learners to write some corrections. The following day nothing much was said, only a short revision. After that they were given an individual task.

The graph in Figure 4-2 demonstrates that learner's performed well in the first task, although they only started the topic that day. They actually performed poorly in the second assessment. However, the teacher offered a second chance to learners who had underperformed. In the second task they were still working individually. This evidence demonstrates that learners perform better when they are working together in a relaxed environment. However, it might happen that some learners do not discuss but they only take each other's work. This is confirmed by the second task which was formal. Furthermore, this suggests that informal assessments for formative purpose are not valid and they do not show

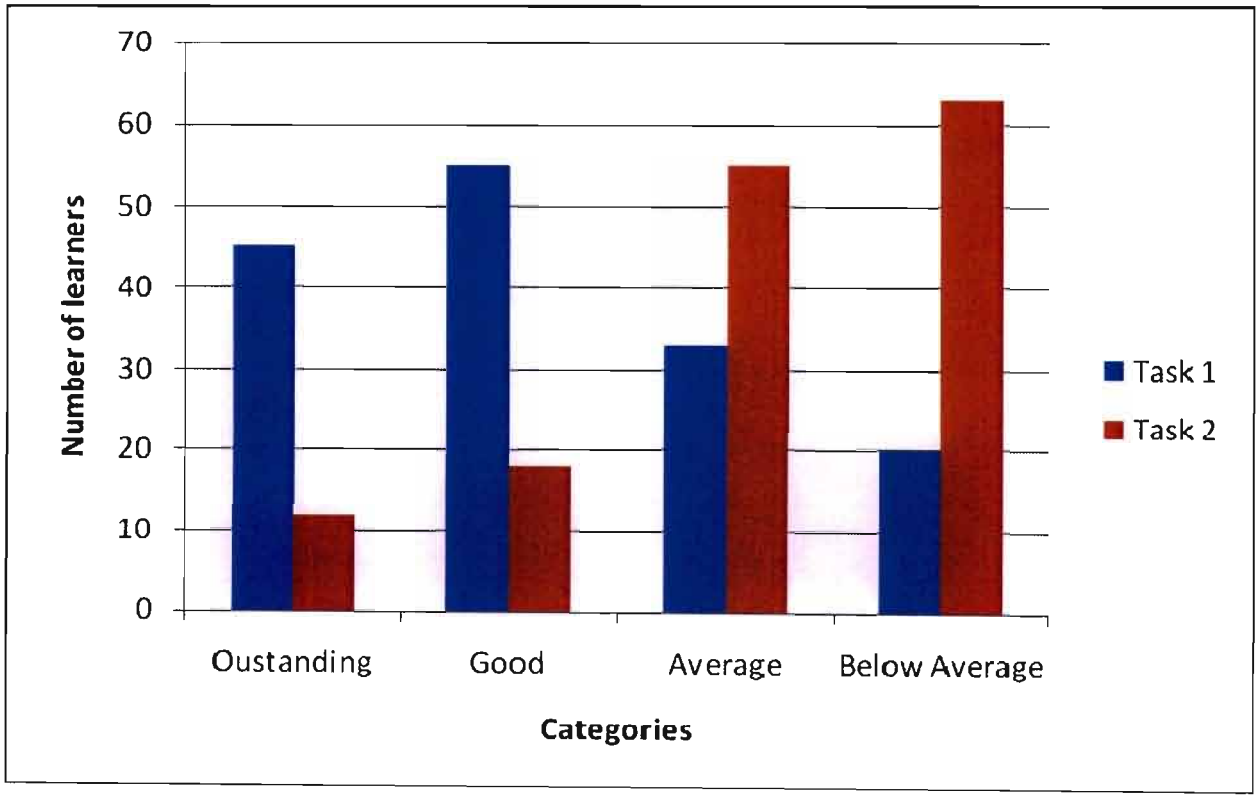


Figure 4-2: Leaner's performance on the tasks

a true reflection.

4.2.6 Feedback condition

4.2.7 Feedback is a key to Formative assessment

Teachers who claim to apply formative assessment are expected to give relevant feedback to learners. Feedback can be given anyhow as long as it benefits the learners. According to Mitchell and Koshy (1993) giving meaningful feedback is part of the learning process and shares the responsibility between teachers and learners. On the other hand Black (1998) reveals that assessment should provide short feedback so that obstacles can be identified and tackled. Furthermore he indicates that feedback from assessment creates many profitable new teaching and learning opportunities immediately after the results of the assessment are known. The feedback provided during the assessment cycle while the process is in progress is done for the purpose of determining areas of success and weakness. The educator also identifies the areas in which intervention and support is needed. This kind of feedback is referred to as formative assessment because it supports the development of learning.

Moreover, the findings show that teacher 2 gave learners oral feedback to help them improve where they went wrong. This was confirmed when I analyzed the scripts of the learners. The scripts only showed the marks that learners received (e.g. 20/35, fair). I approached Teacher 2 again and asked how he gave learners feedback. His response was:

> *"I always give oral feedback because I am working with large numbers and anyway feedback takes place through discussion in class. There is no time for individual attention".*

According to Black (1998) however, the written feedback should help learners to make progress and development. Feedback should not discourage learners but it must show the learner what progress has been made and what still needs to be achieved. Outcomes based education suggests that feedback should tell the learners where and how they cam modify their effort in order to improve their performance. It may mean that some learners have to re-submit an assignment or re-do the content part so that knowledge is sufficiently grasped. Therefore, "teachers ought to vary their pace style of teaching according to the needs they diagnose about their learners (Black 1998, p.25)".

The findings demonstrate that teacher 1 gave learners' written feedback. This was confirmed through the tasks analysis. The teacher wrote the score and some comments in the script (e.g. 15/3, you have tried your best, but you can still do better than this). Throughout the task teacher 1 wrote some feedback, for example, showing the learner how he/she was meant to do the sum.

4.2.8 Assessment forms used by Mathematics educator

According to Teacher 1 formative assessment creates a stimulating environment, and learners are free to discuss and make progress from what they are doing because they are given sufficient opportunities to create their own meaning. For example, the teacher asked:

"How many butter and sugar do you put when you are baking?

Learners responded differently:

"It depends"

"Sir, sir raising her hand, I put 1 butter and 4 cups of sugar"

The teacher responded:

"Okay you can discuss that in your groups and you can report back"

The learners discussed the problem and gave the teacher the feedback. The teacher gave learners class work and they were allowed to discuss it. He allowed them to construct their own meaning through their experience. He observed and interviewed the learners during their discussion. Therefore, the findings showed that Teacher 1 used different techniques of assessment for formative purpose, and he also confirmed that he used different assessments such as investigation, projects, role play, case studies, research, tests and other types. He organized and structured activities and developed resources to help learners identify and work towards attainable goals. The finding shows that Teacher 1 designed a lesson that would interest the learners. He posed interesting problems, placed a problem in familiar context, encouraged learners to bring their prior skill and ideas, used peer interaction for motivation, intervened in peer interaction whenever appropriate, and gave ample opportunities to reflect

after successful performance. Teacher 1 saw his role as empowering or liberating his young ones, assisting them to become self-directed, to inform their own meaning and to develop their own way of mastering their environment. Teacher 1 agreed that using different types of assessment for formative purposes has assisted him to encourage and motivate their learners, He said it also assisted him to know when to intervene, re-teach and reassess so that learners could achieve the required learning outcome.

In conclusion, Teacher1 and 2 in this particular school use different assessment methods and techniques for formative purposes. However, Teachers 3 and 4 use assessment to keep records as evidence that they have used different assessments as required by the Department of Education. The findings show that Mathematics teachers in this school are aware that they should use different assessment methods to enhance their learners, but their context may not be conducive enough to practice what they wish to practice.

4.3 Document analysis

To explore the extent to which formative assessment is integrated into and used in the learning process, the assessment policy document was analysed.

The Mathematics department in this school does not have its own assessment policy but uses the standards set in the Department of Education Assessment Policy for grade R-9. According to the policy document, assessment should be conducted formatively and summatively. Furthermore, the policy emphasize that assessment should be conducted on a continuous basis, hence the reference to continuous assessment.

The findings show that Mathematics teachers in this school are trying their best to implement the assessment policy as it is required by the Department of Education. However, the finding demonstrates that it is not easy as the department assumes, due to contextual factors, deficiencies in teacher understanding, and insufficient training.

4.4 Conclusion

In response to the critical questions asked in this study, viz. What are the teachers' perception of about formative assessment in Mathematics, and, how do teachers use/apply formative

assessment in Mathematics, the data was categorized into two subsections: in terms of responses to the semi-structured interview questions, and the observation schedule respectively. The policy documents were then analysed to determine whether educators were fulfilling what was expected of them in the classroom. It was found that although all educators are attempting to understand and implement Departmental policy in Mathematics assessment, various levels of perception amongst teachers still exist. However, the four Teachers demonstrate that it may be easier to use formative assessment in a resourced environment. Although Teacher 3 and 4 feel that that they do not know formative assessment, the findings demonstrate that they are actually unaware that they *are* practicing it.

In the final chapter, Chapter 5, several insights that emerged from the study are discussed, as well as recommendations are presented.

Chapter 5 - Conclusion and Reflection

5.1 Introduction

This study began with explaining the introduction of Outcomes-based education (OBE) in post apartheid South Africa (i.e. since 1994) that resulted in several changes in assessment, especially in Mathematics. One of the most innovative shifts by the South African government was the move from norm-referenced to criterion-referenced assessment (CRA) by setting a system of common norms and standards across different education practices in which learners are assessed according to an explicit and agreed upon set of criteria. This curriculum reform and transformation was undertaken to purge the old education of apartheid inequalities and propaganda. Using this as a basis, the study explored teachers' perception of formative assessment and how they translated it into practice within a context of Mathematics, in a high school at Hammarsdale, in KwaZulu-Natal. It also aimed to determine whether the Mathematics educators were willing to adjust to the new formative assessment practices as prescribed by the New Curriculum Statement (NCS) in grade 8.

5.2 Discussion and Emerging Insights

The data analysis indicates that grade 8 Mathematics teachers were willing to use different types of assessment for formative purpose. The two teachers who were observed actually saw formative assessment as part of the learning activity. However, there are many circumstances that did not allow them to use formative assessment effectively. Findings substantiate that many teachers felt that these changes were merely political, and it revealed that teachers generally settle into the system they find working, and either accept and live with its constraints, or resist the change.

Furthermore, the study demonstrated that although Teacher 3 and 4 indicated that they did not know formative assessment; their responses showed that they sometimes use it. This indicates that the teachers did not know the term but are practicing formative assessment in their context.

The symbolic inteactionism theory was useful in explaining how learning occured in the social setting of classroom (Cobb et al, 1991). This study showed that the meaning that individual learner has developed throughout the learning process stemmed from the interaction between teachers and themselves. In particular, the learners understanding of what constitutes an explanation are interactively constituted as they engaged in the process of explaining to each other and with the teacher through formative assessment. The two teachers that were observed related to the whole classroom groups although it was not easy because of the large number. The lesson observed from Teacher 1 and 2 demonstrated that they did not just accept answers but they showed the learners that it was insufficient to just report/say the answer and they helped them to produce a more meaningful answer. The findings indicated that the focus of the discussion between the teachers and learners shifted from how learners solved the problem to helping learners develop an understanding of the different between verifying a result and explaining how they arrived at the answer.

Furthermore, the findings demonstrate that the teachers felt that the Department did not plan effectively the whole process of teaching and learning. According to Kahn (2004), successful teaching requires appropriate pedagogic content knowledge, self confidence, committed learners, stable and well managed schools, and basic teaching resources. The following insights are gleaned from this study:

i. While educators are keen to use methods of assessment that are innovative and learner-centered, they are varied in their levels of knowledge of the meanings of formative assessment, as well as what is required of them as prescribed in the NCS. In the new curriculum educators are expected make a shift from traditional assessment to Outcome Bases Education, from content based to facilitating the development of skills, knowledge and value through formative assessment (Fleisch, 2002). Teachers are expected to be well equipped since the new accountability is trying to place more emphasis on learners' performance and less on compliance with regulations in their accreditation or certification of district and schools (Fuhrman, 1999). However the implementation of OBE, and specifically in this study, Mathematics, is influenced by the level of skill, and knowledge of teachers themselves as well as their perceptions of and towards assessment. Given the short periods of training and the cascading models of training implemented by the Department, teachers are still insufficiently trained in the implementation of NCS.

ii. Economically-disadvantaged schools will have more difficulties in designing formative assessments as this requires greater resources

iii. Assessment as required by the NCS is time consuming and increases paperwork

iv. One of the most debilitating factors in assessment was the large class sizes. This interfered with effective classroom management, useful informal assessment, and individual feedback to learners.

The above insights have concordance with Jansen's (1999) assertions that OBE implementation in South African schools does not take cognizance of what happens inside schools, the organization of classrooms, the type of teachers that exist within the system, the increased administrative load, that OBE requires trained and retrained teachers, radically new forms of assessment, classroom organization with facilities, more time for managing this complex process, constant monitoring and evaluation, retraining of educational managers, parental support and involvement, new form of learning resources such textbooks and other teaching and learning aids.

5.3 Conclusion and Recommendations

Although it is more than a decade after the introduction of OBE and the refinements to the production of the NCS, educators still demonstrate differing levels of understanding and application of NCS policy, especially with regards to assessment. Since the research reviewed indicates that formative assessment prepares learners holistically and is used to inform educators and learners about progress in order to improve teaching and learning, formative assessment cannot simply be dismissed as a neo-liberal form of technical rationality that the state deploys to regulate teacher's work. Especially that the study showed that the teachers have the ability to create and manipulate their situation or context to solve the problem; symbolic interactionism is one tool that may develop the learners.

During the lesson observation teachers did not tell the learners what to do or how to do it, but allowed them to construct their meaning, guided them and enriched their thinking through questioning. This is called a discovery teaching and learning process, which goes hand in hand with formative assessment. In formative assessment teachers must help learners to link

what they already know with what is new to them. Learners must also be encouraged to ask for clarity before they tackle any problem. Operations must be dealt with accordingly and where possible learners must engage in saying them and also writing them down. In the study the two teachers were clearly trying to incorporate some of the features of progressive education, for example, they asked learners to construct their own knowledge from prior-experience. However, the challenge is for teachers to design tasks for formative purposes that they can use to give feedback to learners that show them where and how they can modify their work. There is also the issue of diversity in the classrooms that needs to be considered. Teahers also ought to vary their pace and style to address formative purposes.

Based on these findings, further research is needed to address the identified problems; for example, investigating how to implement formative assessment with large classes or exploring the use of formative assessment with limited resources.

Since the successful implementation of the policy is dependent upon the front line educators, further teacher development and support should be forthcoming from the Department. It is recommended that for more effective learner-centered assessment the Department of Education should develop a specific assessment unit that will develop training programmes to be conducted with smaller numbers of educators at more schools and on a more frequent basis. A return to "in-service" training programmes is also envisaged by this researcher.

While the intent of policies are laudable, if they ignore the difficulties faced by educators in their varying contexts, wide disparities will continue to exist between curriculum in plan and that in practice, and implementation will be done as a rule of law rather that embraced for the positive educational ideal it is meant to promote.

Bibliography

African National Congress. (1994). A policy framework for education and training. Johannesburg: ANC.

Assessment Reform Group, (1999). Assessment for learning: Beyond the black box. Retrieved 21 February, 2009, from http://www.edb.gov.hk/filemanager/tc/content-3122

Allais, M. (2006). Problem with qualification reform in senior secondary education in South Africa. In J. Gamble & M. Young (Eds.), *Knowledge, curriculum and qualification for South African further education* (pp.1-23). Cape Town: HSRC Press.

Bassey, M. (1999). *Case Study Research in Educational Setting.* Buckingham: Open University Press.

Bertram, C. (2004). *Understanding Research: Learning guide and Reader (2nd Ed.)* Cape Town: School of Education and Development Faculty of Education UKZN.

Bennet, N. & Dunne, E. (1994). How children learn: Implications for practice. In B. Moon & A.S. Mayes (Eds.), *Teaching and learning in the secondary school.* (pp.56-62) London: Routledge.

Black, P.J. (1998). Testing friend or foe? Theory and Practice of Assessment and Testing: What and how to assess. *Journal of Education Research 2 (7), 280 – 312.*

Black, P. & William, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy and Practice*, *5*(1), 7-74.

Black, P. & William, D. (1998). Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappan*, 80(2), 139-147.

Boaler, J. (1993). The role of contexts in Mathematics classroom: Do they make Mathematics more "real" for the learning of Mathematics. *Cambridge Journal of Education, 13*(2)12-17.

Boaler, J. (2000). Pedagogy and Power: Exploring the relationship between "reform" curriculum and equity. Stanford University.

Boston, C. (2002). The concept of formative assessment. Practical assessment, research and evaluation. Retrieved 21 February, 2009, from http://PAREonline.net/getvn.asp?v=8&n=9

Broadfoot, P.M. (1996). *Education Assessment and Society: A sociological analysis.* Philadelphia: Open University Press.

Brodie, K. (2000). Constraints in learner-centered teaching. *Journal of Education*, *25*(7), 131-160.

Brodie, K. (1991). Using language in Mathematics classroom: a teacher's approach. *Pythagoras, 27*, 17-23.

Bruner, J. S. (1986) *Actual Minds, Possible Worlds.* London: Harvard University Press.

Bruner, J. (1996). *The culture of education.* (4th ed.) Cambridge, Harvard University Press.

Carrim, N. (2004). *Project in education: Learning guide and reader.* University of Witwatersrand: Johannesburg.

Chisholm, L. (2002). *Reflection on curriculum revision: The making of the Revised National Curriculum Statement.* Paper presented at Kenton Conference, Krugersdorp, 2002. (Unpublished)

Chisholm, M. L (2003). The state of curriculum reform in South Africa: The issue of curriculum 2005. In R. Southall, A. Habib & J. Daniel (Eds.), In *State of the nation* (pp.268-289). Cape Town: HSRC Press.

Christie, P. (1999). OBE and unfolding policy trajectories: Lesson to be learned. In P. Christie & J. Jansen (Eds.), *Changing curriculum studies on outcome based education in South Africa* (pp.279-292). Kenwyn: Juta.

Christie, P. (2001). Improving school quality in South Africa: A study of schools that have succeeded against the odds. *Journal of Education, 26*(3), 40-65.

Cobb, P., Yackel, E., & Woods, T. (1989). Young children,s emotional acts while doing mathematical problem solving. In D.B. McLeod & V.M. Adams (Eds.), *Affect and mathematical problem solving: A new perspective*(pp.117-148). New York: Springer-Verlag.

Cohen, L., Manion, L., & Morrison, K. (2007). *Research Methods in Education (6th Ed.)* London & New York: Routledge, Taylor & Francis group.

Collins, A., Brown, J. S, and Newman, S. (1989). Cognitive apprenticeship: teaching the crafts of reading, writing, and mathematics. In L. Resnick (Ed.) *Knowledge, learning, and instruction* (pp.453-494). Englewood Cliffs: Erlbaum,

Constitution of Republic of South Africa Act, 108 (1996).

Creswell, J.W. (2008). *Research design: Qualitative, quantitative and mixed methods approaches* (3rd Ed.).Thousand Oaks,CA Sage Publicashions.

Darling-Hammong, L. (1997). Supporting teaching and learning for all student; Policies for authentic assessment systems. In A. Lin Goodwill (Eds.), *Assessment for equity and inclusion: Embracing all our children* (pp 38-59). NewYork: Routledge Publishers.

Davis, A. (1995). Criterion- reference assessment and the development of knowledge and understanding. *Journal of Philosophy of Education, 29*(1), 3-21.

Davis, R.B. (1988). The world according to Mcneill. *Journal of Mathematics Behavior, 7*(3)51-78.

De Lang, J. (1996) Using and applying Mathematics in Education. In A. Bishop, K. Clements, C.Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International handbook of Mathematics education* (pp.49-97). Dordrecht, Kluwer Academic.

Denzin, N.K. & Lincoln, Y.S. (2000). *Handbook of qualitative research*. New York: Sage.

Department of Education. (2002). *Revised National Curriculum Statement, Grade R-9 (School) Policy Mathematics*. Pretoria: Department of Education.

Dikgomo, P., Sutner, M., & Roman, L. (Eds). (1997). *Theory and practice of mathematics teaching. Johannesburg*: University of Witwatersrand.

Doyle, W. (1983). Academic work. *Review of Education Research, 53*(7), 159-200.

Elumer, H. (1969). *Symbolic interactionism*. Engelwood Cliff: Prentice Hall.

Erickson, F. (2007). Practice in classroom, schools, and teacher communities: Some thoughts on "Proximal" Formative Assessment of student learning In Moss, P.A. (Eds.). *Evidence and decision making*. Massachusetts: Blackwell Publishers.

Fleisch, B. (2002) Managing education changes: *The state and school reform in South Africa*. Johannesburg: Heinemann.

Fuhrman, S. H. (1999). *The new accountability* (CPRE Policy Brief No. RB-27). Philadelphia:Consortium for Policy Research in Education. Retrieved December 11, 2005, from http://www.cpre.org/Publications/rb27.pdf

Fullen, M. (1991). *The Meaning of Educational Change*. London: Cassell Educational.

Gardner, J. (2006). *Assessing and learning*. London: Sage Publication.

Gipps, C.V. (1994). Developments in educational assessment or what makes a good test? *Assessment in Education*, 26(1) 283-291.

Gipps, C.V. (1998). Socio-cultural aspects of assessment. *Review of Research in Education, 24*(2), 335-392.

Gipps, C. & Stobart, G. (1993) *Assessment: A teacher's guide to the issue*. London: Hodder & Stoughton.

Gooding, A., & Stacey, K. (1993). Characteristics of small group discussion reducing misconceptions. *Mathematics Education Research Journal*, 5(1), 60 - 73.

Harley, K. and Wedekind, V. (2004). Political change, curriculum change and social transformation, 1990 to 2002. In Chisholm, L. (Ed.), *Changing class: education and social change in post –apartheid South Africa* (pp.195-220). HSRC: cape Town.

Hatano, G. (1996). "A conception of knowledge acquisition and its implication for Mathematics" in Steffe, L., Nesher, P. , Cobb, P. and Goldin, G. (Eds), *Theories of mathematical learning* (pp.197-217). New Jersey: Lawrence Erlbaum.

Henning, E. (2004). *Finding your way in qualitative research.* Pretoria: Van Schaik.

Henning, E., Gravett, S. & Van Rensburg, W. (2005). *Finding your way in academic writing.* (2nd Ed.). Pretoria: Van Schaik.

Hopkins, D. (2001). *School Improvement for Real.* London: Routledge Falmer.

Jacka, B.(1984). Assumption and theory underlying educational practice. In W.Mcvitty (Ed.), *Children and learning: Primary English Association* (pp.217-315). Australia: Delamar Publishers.

Jansen, J. (1999). Why OBE will fail. In J. Jansen & P. Christie (Eds.), *Changing curriculum:studies on outcome based education in South Africa* (pp.145-156). Cape Town: Juta

Jansen, J. (2002). Political symbolism as policy craft: Explaining non-reform in South African education after apartheid. *Journal of Educational Policy, 17* (2), 199 -215.

Joffe, L.S. (Ed.). (1993). *Assessment options: Broadening the range in inventing knowledge, contents in curriculum construction.* Cape Town: Maskew Miller Longman.

Johnson, D. R. (1991). *Making minutes count even more.* New York: Dale Seymour Publication.

Kahn, E. (2000). A case study of assessment in grade 10 English course. *The Journal of Education Research, 93*(5), 276-286.

Kahn, M. (2006). 'Matric Matters', In V. Reedy (Ed.), *Marking matric: Proceeding of a colloquium* (pp.213-224). Cape Town: HSRC Press. Retrieved 21, February 2009 from http:// www.hsrcpress.ac.za

Kivulu, M. (2006). The matriculation examination: How can we find out if standards are falling? In V. Reddy (ed.), *Marking matric: proceeding of a colloquium* (pp.33-34). Cape Town: HSRC Press.

Killen, R. (1996). Outcomes-Based Education: Rethinking teaching. Paper read at UNISA October 1996.(Unpublished)

Kilpatrick, J. (1993). The chain and the arrow: From the history of Mathematics assessment. In M. Niss. (Ed.), *Investigations into assessment in Mathematics education. An ICMI Study.* (pp. 31-46). Dordrecht: Kluwer

Knight, P. (2003), *Small-Scale Research.* London: Sage Publications.

Kvale, S. (1996). *Interviews: an introduction to qualitative research interviewing.* London: Sage Publications.

Lankshear, C. & Knobel, M. (2004). *A Handbook for Teacher Research: From design to Implementation.* London: Open University Press.

Lave, J. (1988). Cognition in practice. UK: Cambridge University Press.

Leedy, P. D. (1997). *Practical research planning and design (6th Ed.)* Columbus: Prentice - Hall, INC Publishers.

Madaus, F.G., Raczek, A.E., Clark, M.M. (1997), The history and policy foundations of the assessment movement. In A. Lin Goodwill (Eds.), *Assessment for equity and inclusion: Embracing all our children* (pp.1-15). NewYork: Routledge Publishers.

Malan, B. (1997). *Excellence through outcomes.* Pretoria: Kagiso Publishers.

Malcolm, C. (1999). *Thought of South Africa: that is not assessment that is teaching.* Paper presented in lab talk. Science teachers association of Victoria, Australia, in Press' conference held at the University of the Witwatersrand Johannesburg on the 15 -17 March 1999.

Maree, K. (Ed.) (2007). *First Steps in research.* Pretoria: Van Schaik Publishers.

Maybin, J., Mercer, N. and Stierer, B. (1992). "Scaffolding" learning in the classroom, in K. Norman (ed.), *Thinking voices: The work of the national oracy project* (pp.243-266) London: Hodder & Stoughton.

Mecer, N. (1995). "Scaffolding learning". In Mercer, N. & Littleton, K. (Eds.), *The guided construction of knowledge: Talk among teachers and learners, and learners multilingual matters Thinking* (pp.34-56). Routledge: Taylor & Francis Group.

Merriam, S. B. (1998). *Qualitative research and case study applications in education.* San Francisco: Jossey-Bass Publishers.

Miles, D. (Ed.). (1993). *Constructive change: Managing technology transfer.* Geneva: ILO

Mitchell, C. & Koshy, V. (1993*). Effective teacher assessment: Looking at children's learning in the primary classroom.* London: Hodder & Stoughton.

Moodley, M. (1992). Teaching and learning Mathematics: what counts. In M. Moodley, R.A. Njisane and N.C. Presmeg (Eds.), *Mathematics Education for In-service and Pre-service Teachers.* Pietermaritzburg: Shuter and Shooter.

Mouton, J. (2001). *How to succeed in your Master's and Doctoral Studies, A South. African Guide and Resource Book.* Pretoria: Van Schaik Publishers.

Muller, J. (2004). Assessment, qualification and the NQF in South African schooling, in L. Chisholm (Ed.), *Changing class: education and social change in post apartheid South Africa* (pp. 262-274). Cape Town: HSRC Press.

National Department of Education. (2002). Assessment Policy in the General Education & Training Band, Grade R-9 AND Abet. Pretoria.

Neuman, L. W. (2006). *Social Research Method: qualitative and quantitative approaches (6th Ed.)* Columbus: Pearson and Az Publishers.

Nicholson, M. J. (Ed.). (1992). "Problem solving" in Mathematics education for in service and pre-service teachers. Pietrmaritzburg: Shutter and Shooter.

Niss, M. (1993). Assessment in Mathematics education and its effects: An introduction. In M. Niss. (Ed.), *Investigations into assessment in Mathematics education: An ICMI Study* (pp. 1-30). Dordrecht: Kluwer.

Picciano, A. (2004). *Education research primer*. New York: Continuum.

Plowden Report. (1967). Children and their primary school, 55317. England: HMSO and the Queen's Printer for Scotland.

Sana, M. (2003). Healthy women – Healthy communities project. Retrieved 4 March, 2009, from http.//www.mujersana.ca/msproject/frameworki-ephp.

Shalem & Steinberg, (2001). Teaching and assessment. Course Reader. University of Witwatersrand, Johannesburg.

Shepard, L.A (2000). The role of assessment in a learning culture. *Education Research*, *29*(7), 4 – 14.

Sieborger, R. and Macintosh, H. (1998). *Transforming assessment, a guide for South African teachers.* (1st edition.) Cape Town; Juta & Co Ltd.

Singh, P. (2004). *Towards improving equity in assessment for Tertiary Science Students in South Africa: Incorporating an oral component, an unpublished thesis submitted for the degree of Doctor of Philosophy.* University of Kwa-Zulu Natal.

Singh, V. (2007). *Exploring the foundation phase educators understanding of assessment, an unpublished thesis submitted for the degree of masters.* University of Kwa-Zulu Natal.

Smith, J., Harre, R., & Van Langenove, L. (1995). *Rethinking Methods in Psychology*. Thousand Oaks: Sage Publications.

Southwood, S. & Spanneberg,R. (1996). *Rethinking the teaching and learning of Mathematics*. Pretoria: Via Africa.

Stenhouse, L. (1975). *An introduction to Curriculum Research and Development*, London: Heineman.

Stoker, J. (1991). Constructing meaning through language: a way forward in primary Mathematics. *Pythagoras 25*(4), 28-30.

Tema, B. (1995). Democratising the matric biology syllabus. *Perspectives in Education, 16*(1), 30-66.

Torrance, H. & Pryor, J. (2001). *Developing Formative Assessment in the Classroom: using action research to explore and modify theory.* British Educational Research Journal, 27(5), 615-631.

Van Manen, M. (1990). *Researching lived experience: Human science for an action sensitive pedagogy.* Ontario: The Sit house Press.

Verma, G.K. & Mallick, K. (1999). *Researching Education Perception & Techniques.* Philadelphia.

Versfeld, R. and Dyer, D. (1997). Ways of assessing. In Versfeld, R (Ed.), *Words for all, a handbook for teachers of multilingual classes* (pp.64-72). Manzini: Macmillan Boletwa.

Vithal, R. & Jansen, J. (1997). *Designing your first research proposal: a manual for researchers in education and social science.* Lansdowne: Juta & Co.

Volmink, J. (1990). The nature and role of proof in Mathematics education. *Pythagoras, 27*(23) 7-10.

Von Glaserfeld, E. (1996). Introduction: Aspects of Constructivism. In C.T. Fosnot, (Ed.), *Constructivism: Theory, perspectives, and practice* (pp. 3-7). New York: Columbia University.

Walker, R. (1985). *Doing Research*: A handbook for teachers. London: Methuen & Co. Ltd.

William, D. (1999). Formative assessment in Mathematics: Part 1: Rich questioning. *The Mathematics association, 5*(2), 15-18.

Wolf, D., Bixby, J., Glenn, J. and Garner, H. (1991). *To use their minds well: Investigating new forms of student assessment.* In review of research in education. *American Education Research Association. 17*(1), 31-74.

Woods, P. (1979). *The divided schools*. London: RPK.

Woods, P. (1983). *Sociology and the school: an interactionist view points*. London: RPK.

Yackel, E. (1992). "The evolution of second grade children" understanding of what constitutes an exploration in Mathematics class. Paper presented at ICME, 1992, Quebec City.

Yin, R. (1983). Application of, Case Study Research. California, Sage Publication.

Appendix A – Ethical Clearance

UNIVERSITY OF
KWAZULU-NATAL

University of KwaZulu-Natal
Research Office
Govan Mbeki Centre
Westville Campus
University Road
Chiltern Hills
Westville
3629
South Africa
Tel No: +27 31 260 3587
Fax No: +27 31 260 2384
E-mail: naidoos-k@ukzn.ac.za

25 March 2010

Ms T K Ngwenya
Faculty of Education
School of Education & Development
Edgewood Campus

Dear Ms Ngwenya

PROTOCOL. "Formative Assessment in Mathematics Grade 8: Teachers' knowledge and practice
ETHICAL APPROVAL NUMBER: HSS/0136/10 M

In response to your application dated 26 March 2010, Student Number: **208528863** the Humanities & Social Sciences Ethics Committee has considered the abovementioned application and the protocol has been given **FULL APPROVAL.**

PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

Professor Steve Collings (Chair)
HUMANITIES & SOCIAL SCIENCES ETHICS COMMITTEE

cc: Supervisor (Ms R Sookrajh)
cc: Mrs R Govender

Appendix B – Permission from the Department of Education

kzn education
Department:
Education
KWAZULU-NATAL

MS TK NGWENYA
14 FREY ROAD
PINETOWN
3610

Enquiries: Sibusiso Alwar
Date: 23 November 2009
Reference: 0080/2009

PERMISSION TO INTERVIEW LEARNERS AND EDUCATORS

The above matter refers.

Permission is hereby granted to interview Departmental Officials, learners and educators in selected schools of the Province of KwaZulu-Natal subject to the following conditions:

1. **You make all the arrangements concerning your interviews.**
2. **Educators' programmes are not interrupted.**
3. **Interviews are not conducted during the time of writing examinations in schools.**
4. **Learners, educators and schools are not identifiable in any way from the results of the interviews.**
5. **Your interviews are limited only to targeted schools.**
6. **A brief summary of the interview content, findings and recommendations is provided to my office.**
7. **A copy of this letter is submitted to District Managers and principals of schools where the intended interviews are to be conducted.**

The KZN Department of education fully supports your commitment to research: **Formative assessment in mathematics grade 8: teachers' knowledge and practice**

It is hoped that you will find the above in order.

Best Wishes

R Cassius Lubisi, (PhD)
Superintendent-General
03/12/2009

...dedicated to service and performance beyond the call of duty.

KWAZULU-NATAL DEPARTMENT OF EDUCATION
POSTAL
PHYSICAL
TEL

Appendix C - Consent Letters

14 Frey Road
Pinetown
3610

09 June 2009

The Principal
Private Bag X 1083
Hammarsdale
3700

Dear Madam

Requesting for permission to conduct a research

For the research project, I would like to conduct a semi-structure interview with Grade 8 Mathematics Educators and observe two lessons for each Educator. The purpose of the study is to explore teachers' knowledge of formative assessment and how they translate it into practice.

I am hereby requiring your consent to allow me to approach the grade 8 Mathematics Educator to participate in the study. The semi-structured interviews will take place after school hours and the observation will take place during the non–teaching periods. No real names will be used in the write-up of the interview. Anonymity and confidentiality will be assured at all times.

Thank you for your co-operation.

Yours Sincerely

Ngwenya T.K

"Formative Assessment in Mathematics Grade 8: Teachers' knowledge and practice"

I _____

(full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

_____

Signature of Participant Date

School Stamp

"Formative Assessment in Mathematics Grade 8: Teachers' knowledge and practice"

Dear Mathematics Colleague (Grade 8)

Re- permission to participate in a Research Study

For the research project, I would like to interview Grade 8 Mathematics Educators and observe two lessons from each Educator. The purpose of the study is to explore teachers' knowledge of formative assessment and how they translate it into practice.

I would like your consent to conduct the semi-structure interview and observation. The semi-structured interview will be recorded by writing down during the interview itself and it will also be recorded. Furthermore, I will observe two lessons from each educator and I will not participate in the lesson, I will only sit in class and observe what is happening. Lastly, I will ask for two tasks and three marked scripts from each teacher to analyze them.

The transcripts will be given to you to read for verification.

Thank you for your co-operation.

Yours in Mathematics

Ngwenya T.K

Appendix D – Interview schedule (Semi-structure interview)

Critical question: What are teachers' perceptions about formative assessment?

1. What types of assessment do you use in your mathematics classroom for diagnostic?
2. What do you know about formative assessment in mathematics?
3. Does it assist you in your teaching? How?
4. How do you use the results of formative assessment to reflect on and improve your teaching?
5. What kinds of difficulties do you experience in applying formative assessment? Why?
6. What is your opinion of current assessment practice?
7. What changes have you made regarding formative assessment in you mathematics classroom in the last five years?
8. Have you learnt anything new by using formative assessment in your mathematics classroom?

Appendix E – Interview transcripts

What are teachers' perceptions about formative assessment?

Teacher 1

1. Researcher: What types of assessments do you use in your mathematics Classroom for diagnostic?
2. Teacher: "I use different types of assessment, informal and formal e.g. oral questioning, class work, case studies, investigation, projects, assignments, test etc. Although it is not easy to work with large numbers in class, but I try the best and I always pose interesting problems when I enter the class. This draws the attention of learners and allows them to discuss the problem in their groups. I always give them ample of time to discuss and when they present their findings I encourage them to justify their answers. Sometimes I encourage them to pose problem of their own and encourage them to bring in their prior skills and ideas. This helps me to understand the learners and assist me when teaching that topic".
3. Researcher: How do you find it, is it easy to use different types of assessment?
4. Teacher: Although it is not easy to work with large numbers in class, but I try the best and I always pose interesting problems when I enter the class. This draws the attention of learners and allows them to discuss the problem in their groups. I always give them ample of time to discuss and when they present their findings I encourage them to justify their answers. Sometimes I encourage them to pose problem of their own and encourage them to bring in their prior skills and ideas. This helps me to understand the learners and assist me when teaching that topic".
5. Researcher: What do you know about formative assessment in mathematics?
6. Teacher: "I know that formative assessment is an assessment that I am expected to use every day in class to monitor and encourage learners throughout the learning process. Formative assessments help me to identify learners who need help and it also help me to improve the teaching

strategies. It also helps the learners to see their progress throughout the year.

7. Researcher: Do you use it? And how does it assist you in your teaching?
8. Teacher: yes, I try to use it, although sometimes it is not easy considering the number of learners we are working with. But, anyway when I use it I can see the difference, because I am able to see if the learners are progressing and if they are not I change the strategy and use other method of teaching. It also helps me to identify learners who need help and it also help me to improve the teaching strategies. Moreover, it also helps the learners to see their progress throughout the year.
9. Researcher: How do you use the results of formative assessment to reflect on and improve your teaching?
10. Teacher: "Formative assessment helps me to identify learners' problems and when I identify the problem I use different strategy to teach or to assess. However, sometimes it is not easy to identify the learner with a problem because they are too many in the class and some learners are reserved they don't want to be identified, so they make sure that they hide with others".
11. Researcher: What kind of difficulties do you experience in applying formative assessment?
12. Teacher: There are many difficulties that I experience, since I am working in a rural school with no resources. "A person can not change in a day, I am trying but we also need additional resources to practice and to perform what is expected from us, really I am trying the best to use different types of assessment for formative purpose and sometimes I use the own money because the school is poor even if you just want to make a copy there is copier. Sometimes I even ask learners to pay R2.00 so that I can make copies for them".
13. Researcher: What is your opinion of current assessment practice?
14. Teacher: it is working especially in well resourced schools and anyway it is a good assessment. The only thing it is not easy in the context, but I hope the government will create conducive environment for us. And if formative assessment is used appropriately it can help the learners.

15. Researcher: What changes have you made regarding formative assessment in mathematics classroom in the last five years?

16. Teacher: As I have said, I have tried different types of assessment and I encourage learners to justify whatever they say. However, some types of assessment fails e.g. research and investigations, this is because learners don't know where to find the information since they do not libraries let it alone internet.

17. Researcher: Have you learn anything new by using formative assessment with your mathematics classroom

18. Teacher: Yes, actually learners are always active and they enjoy learning mathematics because they bring their prior knowledge and they share what they experience with each other. They enjoy discussing and reporting back.

Teacher 2

1. Researcher: What types of assessments do you use in your mathematics classroom for diagnostic?

2. Teacher: formal and informal, Yes I am using different assessment and actually even before the new curriculum, I was using different assessment. There is no ways you can teach mathematics, you need to use different strategies if you want your learners to enjoy mathematics. The first thing that I do in the class is asking questions, sometimes I asked about what we did, sometimes about their experience or about the problem that will reflect to their real life. This helps me to see if we are in the same boat or not. This method usually motivates them to explore various ideas and they enjoy".

3. Researcher: How do you find it, is it easy to use different types of assessment?

4. Teacher: No it is not easy, actually kulikhuni kakhula (it is very difficult) especially because I am working with large numbers.

5. Researcher: What do you know about formative assessment in mathematics?

6. Teacher: I know that it is an assessment that is used while you are teaching. Sometimes you need to pose questions to learners to see where they

are, these questions I ask with formative purpose. I use the information to improve the teaching.

7. Researcher: Do you use it? And how does it assist you in your teaching?
8. Teacher: yes sometimes, and I am able to use different strategies to help learners e.g. re-teach; re-assess. The results of formative assessment also help me to give relevant feedback to learners and it also helps me to scaffold the learners in a way that help them to understand so that they can improve and progress. However, using formative assessment can be time consuming especially when you are working with large numbers".
9. Researcher: How do you use the results of formative assessment to reflect on and improve your teaching?
10. Teacher: I use the result to give feedback to learners, usually I write the comments in their task, but sometimes I give feedback in groups. I identify similar problems and ask learners with similar problems and give them feedback. However, it is not easy considering the classes we are teaching".
11. Researcher: What kind of difficulties do you experience in applying formative assessment?
12. Teacher: The government should make our school conducive for learning by providing everything that we need to enhance and improve teaching and learning because we are working under worse context. We are trying but we can do better than this if we can have manageable learners in class and relevant resources. I experience many different problems because, firstly if you want to design assessment for formative purpose you need resources and you need learners who can read and who are also committed and in the case the learners struggle to read so I need to explain every sentence to them and that takes a lot of time. (*Nje akulula nangezingane esisebenza ngazo*) it not easy with the learners we are working with.
13. Researcher: What is your opinion of current assessment practice?
14. Teacher: well (*kona iyasiza*) it is helping especially to learners who can think critically and learners who are committed to learn., But for other learners it is like you are just wasting time because they do no write or

participate in any discussion and there is nothing we can do because you cannot punish the learner for not writing or not participating in class (*uzoboshwa*) you will sued.

15. Researcher: What changes have you made regarding formative assessment in mathematics classroom in the last five years?
16. Teacher: I benchmark with other mathematics teachers and with mathematics association and yes I have seen some improvement in other learners.
17. Researcher: Have you learn anything new by using formative assessment with your mathematics classroom
18. Teacher: yes, some learners enjoy mathematics and they are always willing to do something or task

Teacher 3

1. Researcher: What types of assessments do you use in your mathematics classroom for diagnostic?
2. Teacher: "Yes I am using different assessment and actually even before the new curriculum, I was using different assessment. There is no ways you can teach mathematics, you need to use different strategies if you want your learners to enjoy mathematics. The first thing that I do in the class is asking questions, sometimes I asked about what we did, sometimes about their experience or about the problem that will reflect to their real life. This helps me to see if we are in the same boat or not. This method usually motivates them to explore various ideas and they enjoy". "Imagine giving learners an assignment and you are expected to give feedback to each learner and that can take the whole year. The second problem that I have is related to resources, as you can see there are no computers and copies in this school and what can you do if you want to design an authentic assessment. So, that is the problem, they argue that we do all these assessment but it is not doable here".
3. Researcher: How do you find it, is it easy to use different types of assessment?
4. Teacher: No it is not easy and I don't even want to start not unless the government make the environment conducive.
5. Researcher: What do you know about formative assessment in mathematics?

6. Teacher: Angazi lutho (I don't know anything) because even if we attend workshops, no one tells you exactly what they mean by formative assessment, actually they can not even give us examples of assessment for formative purpose" "We have been using different teaching and assessment strategies to help our learners to improve, the only different now are that we have to record every activity that the learner performs to have evidence when the learner fails".

7. Researcher: Do you use it? And how does it assist you in your teaching?

8. Teacher: No I do not use it, I only use class work and class test, sometimes I do ask oral questions. "It helps me to see if I have achieved what I was teaching and it also help learners to see if they are making any progress.

9. Researcher: How do you use the results of formative assessment to reflect on and improve your teaching?

10. Teacher: (*uma I formative assessment kukubabhalisa I classwork.*) If formative assessment is about writing class work, then it helps me to see if learners have understood what we were doing in class.

11. Researcher: What kind of difficulties do you experience in applying formative assessment?:

12. Teacher: (Hhayi vele angiyisebenzisi) No, I am not using it. You know the government thinks we are overseas where they have everything and teaching only +- 30 learners in class".

13. Researcher: What is your opinion of current assessment practice?

14. Teacher: it just a waste of time, time for teaching, teaching is important and learners can learn if we teach. But if we keep on writing things some learners especially those who are not committed became bored

15. Researcher: What changes have you made regarding formative assessment in mathematics classroom in the last five years?

16. Teacher: I tried to use projects, assignments, presentation and other types of assessment, but it did not work for me especially because I am working under this circumstance 82 learners in one class hhayi shem it not easy.

17. Researcher: Have you learn anything new by using formative assessment with your mathematics classroom

18. Teacher: Not yet, because (vele angisebenzisi kangako) I am not using it that much

Teacher 4

1. Researcher: What types of assessments do you use in your mathematics classroom for diagnostic?
2. Teacher: I use different types of assessment but I find that the new requirements are unrealistic and problematic. Change is not necessary for the best i.e. one can get worst of it. For example when I tried the group work approach, it did not work in the context because the number of learners in the class is big; there is no space to perform these activities. It became very strainers for me because the majority of the learners do not participate in these activities that need them to construct their own knowledge." "There is no space to perform these activities. It became very strainers for me because the majority of the learners do not participate in these activities that need them to construct their own knowledge."
3. Researcher: How do you find it, is it easy to use different types of assessment?
4. Teacher: No it is not, instead it just frustrates me, because even the learners are not prepared to perform, they do not want to read or write and there is nothing I can do about it they have their rights.
5. Researcher: What do you know about formative assessment in mathematics?
6. Teacher: (*Hhayi angazi, angiyazi leyonto*) No I don't know, I don't know that thing what is, and can you explain it maybe I know it is just the terminology"
7. Researcher: Do you use it? And how does it assist you in your teaching?
8. Teacher: well, I do not use it because I do not know how to use it or which assessment are for formative purpose "Actually may be it is because I do not even know how to use it"
9. Researcher: How do you use the results of formative assessment to reflect on and improve your teaching?

10. Teacher: I always give learners oral feedback after writing or doing anything in class

11. Researcher: What kind of difficulties do you experience in applying formative assessment?

12. Teacher: I experience learners who are not willing to learn or to do anything in class

13. Researcher: What is your opinion of current assessment practice?

14. Teacher: it just a waste of time and destroy the education system because instead of teaching, we are expected to assess learners now and again.

15. Researcher: What changes have you made regarding formative assessment in mathematics classroom in the last five years?

16. Teacher: Ey, Nothing I am still doing what I was doing before the new curriculum nothing new, i.e. giving learners a test, or class work or homework and giving them an oral feedback.

17. Researcher: Have you learn anything new by using formative assessment with your mathematics classroom

18. Teacher: No, not yet

Appendix F – Observation schedule

1. How were the learners arranged in the classroom? In all boys' groups? In all girls' groups? Mixed? How?
2. Did the teacher dominate throughout the lesson or was learner participation allowed?
3. Did the teacher present issues as incontestable "facts" or was discussion about them allowed?
4. Whose voice could you hear the most in the classroom?

Appendix G– Lesson transcript

Day 1: 19 October 2009, 09h00

1. Teacher: Good morning learners
2. Learners : Good morning teacher
3. Teacher: How are you this morning
4. Learners : we are very well thank you are how are you teacher
5. Teacher: I am fine, do you know what I like most
6. Learners : NO sir
7. Teacher: I like cakes, who can bake for me? Who knows how to bake?
8. Dudu : (raising her hands) I can bake, the mother taught me how to bake.
9. Teacher: okay what do we use when we are baking?
10. Learners : (Shouting) we use sugar, water, salt, butter, eggs and flour
11. Tecaher: ok! Ok! Settle down, what is the first thing that you make if you want to bake, boys you can also see you mom baking. What do you think Asande….
12. Asande: yes sir! She usually put butter and sugar and mix it
13. Tecaher: is that true clss?
14. Learners: yes sir
15. Teacher: and how many buuter and sugar do you put Dudu
16. Dudu: eh…. It depends
17. Zinhle: Sir, sir raising her hand) I put 1 butter and 4 cups of sugar
18. Teacher: wu….(looking shocked) 4 cups, you like sugar hee..
19. Zinhle: yes sir, but the mother put 2 butter and cupds of sugar
20. Tecaher: I would like to eat your mom's cake. Okey (writing in the board) Zinhle's mother puts 2 butter with 3 cups of sugar. This is a ratio of 2 to 3 written as 2:3
21. Mfana: a ratio!! What is a ratio?
22. Tecahcer: a ratio is the quantitative relation between two similar magnitudes determined by the number of times one contains the other intergrally (swiching the code) uma ubuka izinto ezimbili noma ngaphezulukwa 2 kuthi kuhlangana kanjani eg uma upheka uphuthu you need water salt and maize meal, so udinga amazi angakanani, imphuphu enganganani, no swayi ongakanani) ie (looking at two or more different things and trying to compare them at the same time eg if you want to

cook porridge you need water an dsalt and you need to a specific amount of salt for a certain amount of water).

23. Thoko: (Mumbling) so Dudu's ratio is 2 to 4
24. Teacher: What did you say Thoko, you said 2 to 4, why do you think so?
25. Thoko: Because she puts 4 sugar
26. Tecaher : and then the 2, where do you get it
27. Thoko : (looking) down eh…
28. Teacher: do you agree class
29. Learners : No sir
30. Lwazi: She put 1 butter, so 1t is 1to4
31. Teacher: yes, can someone come and write Dudu's ratio
32. Phindy: (Stood up and went to the board, she wrote) 1:4or 4:1
33. Tecaher: why do you think it is 1: 4 or 4:1
34. Phindy : because sir, it is the same thing
35. Tecaher: How? What do you think class
36. Mbali: No sir, it is not the same she put one butter which is 1 and 4 sugar which is four (standing up) you write like this 1:4
37. Tecahers : others what do you say, do you sgree
38. Learners : Yes sir
39. Dudu: I think because we started with buuter so we write it first
40. Teacher: Yes class, so it is very important to look what is written first, so you can be able to write the ratio. Okey suppose Zinhle puts 2 butter how many sugar will she put?
41. Sindy: 4 sugar (standing up) like this 2:4
42. Learners: No! No! No!
43. Teacher: what can anyone come and explain
44. Mandiso: (stood up with 1 pen and four pencils) she puts 1 butter (showing a pen) and four pencil (showing the pencils) then if she put 2 butter (taking another pen) then she will need another four pencils (taking them from learners) and there will be 8. so she will have 2 butter (showing the pens) and 8 sugar (showing the pencils) so I can write it like this (2:8)
45. Teacher: Who does not agree with her?
46. Learners: Mumbling (Isikhokho) (ie she is clever)

47. Teacher: okay since we agree with Mandiso, I want you to write this activity (writing in the board), you can discuss in your groups.

Day 2: xx October 2009, 08h00

1. Teacher: Good morning, okay I went miles trying to make copies for you, so please do not loose these.
2. Learners : Yes sir
3. Teacher (Handing out the worksheets) try to work on your own, unless you have a problem, I am here to assist you.

Lesson observation: teacher 2

Teacher two came five minutes late; apparently he was delayed at the staffroom because he was looking for a dust since they are sharing it and a chalk. He took another 5 minutes checking an attendance register.

After 10 minutes the lesson started. He asked them if they have found what is meant by ratio. Learners were shouting and raising hands. He gave five learners a chance to explain and he adds from what was said by the learners. He asked them to give examples of ratios, learners shouted different numbers (e.g. 1dot dot 3, some said 1 is to 6). The teacher asked one learner to write the example in the board and he asked others if the learner was correct. After a 20 minutes discussion between learners and the teacher, the teacher asked the number of boys in class, learners said 37, the teacher wrote on top boys and below 39, he asked again the number of girls, learners said 45, the teacher wrote : and on top he wrote girls and below 45. He said so the ratio of boys to girls here in class is 39:45 and this is how we write ratios, and you start with what you see first, for example I asked about the boys first so the ratio will start will the boys. He asked the learners if they understand. The learners said "yes sir". He then gave learners the activity. The activity was the same with teacher 1 activity.

Appendix H – Tasks designed for formative purpose

Grade 8- Task 1

Question 1

Using the ration of butter to sugar that is used by Zinhle's mother as 2:3 complete the following. The first one is done for you

i. 4 parts of butter: 6 parts of sugar = 4:6
ii. 6 parts of butter: ----- parts of sugar = _____
iii. 10 parts of butter: ------ parts of sugar = _____
iv. 100 parts of butter: ------ parts of sugar = _____

Question 2

Write the ratio of the following

i. Boys to girls in class
ii. Female teachers to male teachers

Grade 8- Task 2

Question 1

The following live on a farm 12 cows, 10 sheeps, 20 hens, 5 dogs, 2 cats, 3 children and their parents. Write down the ratio of

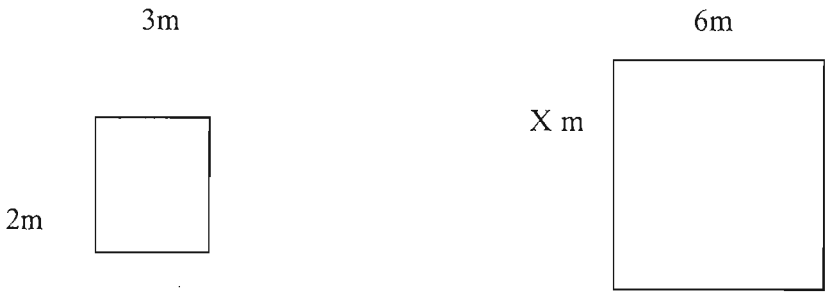
i. Cows to sheep
ii. Dogs to cats
iii. Sheep to hens
iv. People to animals

Question 2

In grade 10 classes there are 60 learners of whom 42 are boys; write down the ratio of girls to boys.

Question 3

The rectangle on the left is increases in size. Length and breath stays in same ration to each other, the breath of the longer rectangle is 6 m, find its breath.



2:3 **6:x**

Assessment criteria

Question 1

i. Ability to write in a correct way (1)
ii. Able to write correct ratios (5)

Question 2

i. 1. Ability to interpret the task and show some working (2)

ii. 2. Able to write a correct ratio (1)

Question 3

i. Ability to calculate the breath of increased triangle (2)

Appendix I- Learners scripts

Appendix I- Learners scripts

Excellent

QUESTION 1

i. 4 parts of butter : 6 parts of sugar = 4:6 ✓

ii. 6 parts of butter : 9 parts of sugar = 6:9 ✓

iii. 10 parts of butter : 15 parts of sugar = 10:15 ✓

iv. 100 parts of butter : 150 parts of sugar = ~~100:150~~ 100:150 ✓

QUESTION 2

i. 27 Boys in class : 28 girls in class = 27:28 ✓

ii. 16 female Teachers : 14 Male Teachers = 16:14 ✓

Showe understanding of the concept.

MATHS

17 NOVEMBER 2009

Question 1

i) 4 Parts OF butter : 6 Parts of Sugar = 4:6 ✓

ii) 6 Parts OF butter : 3 Parts of Sugar = 6:3 ✓

iii) 10 Parts of butter : 5 Parts OF Sugar = 10:5 ✓

iv) 100 Parts OF butter : 50 Parts OF Sugar = 100:50 ✓

Question 2

i) ratio = 19:31 ✓

ii) ratio = 13:17 ✓

QUESTION 1

a 12:10 ✓

b 5:2 ✓

c 10:20 ✓

d 5:49 ✗

QUESTION 2

a 42 60 - 42 = 18 = RATIO = 42:18 ✓

girls are 18 learners

QUESTION 3

a 3:12

b 6cm : mx = 6:9

6:9

MATHS QUESTION1

a) 12:10 ✗

b) 5:2 ✗

c) 10:20 ✗

d) 6:49 ✗

QUESTION2

a) H2:H8 ✓

QUESTION3

a) 3:12

b) 6CM : MX = 6:9

Need to work on H.C.F again.

MATHS

17 NOVEMBER 2009

Question 1

(i) 4 Parts OF butter : 6 Parts of Sugar = 4:6 ✓

(ii) 6 Parts OF butter : 3 Parts of Sugar = 6:3 ✗

(iii) 8 Parts of butter : 5 Parts OF Sugar = 10:5 ✗

(iv) 100 Parts OF butter : 50 Parts OF Sugar = 100:50 ✓

Question 2

(i) ratio = 19:31 ✓

(ii) ratio = 13:17 ✓

Need to improve on H.C.F.

(a) 12 : 10 ✓

(b) 5 : 2 ✓

(c) 10:20 ✓

(d) 3 : 49 ✗

Question 2

= Ratio = 42 : 18 ✓

Question 3

area = L x B

1. 30m x 20cm ✗ ~~2. 6m~~ area = L x B

= 600cm²

= 6m x 6m ✗

= 36m²

Need to know on how to workout area problems against the ratio.