

**THE ROLE OF BELIEFS, CONCEPTUALISATIONS AND EXPERIENCES
OF OBE IN TEACHING PRACTICE**

By

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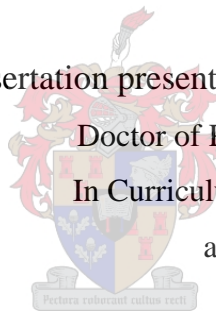
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DECLARATION

I, the undersigned, hereby declare that the work contained in this dissertation is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.

SIGNATURE



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DATE: December 2010

Abstract

The implementation of OBE has significant implications for teachers' work; adopting an OBE approach entails reconstruction of professional knowledge and a redefinition of planning procedures, teaching approaches and assessment practices. A teacher attempting to make sense of OBE, learning outcomes, assessment standards, band levels, NQF, etc. will inevitably bring his/her worldviews, past experiences and beliefs into the process of teaching and learning, and would also need to engage with new concepts to keep track of the changes in meaning and priorities. Within this changing education scenario OBE, as an initiative, offers opportunities for new pedagogies to flourish, marking a departure from the safe haven of traditional pedagogy. Therefore a perspective on teachers' beliefs regarding OBE can provide an alternative interpretive lens for researchers through understanding teachers' actions and thoughts.

Purpose: The aim was to examine strategies teachers employ in their classrooms in response to their beliefs about OBE. Teachers' epistemological beliefs were explored and linked to OBE pedagogical frameworks and classroom management practices. Their belief systems were divided into three categories – the teachers' views about OBE, mathematics knowledge, and the teaching and learning of mathematics. This study was based on the belief that conceptions are specific meanings given to phenomena, derived from different experiences involved in helping individuals make sense of their world. Furthermore, those worldviews in turn influence how new information is perceived.

Methodology: The researcher adopted a qualitative exploratory design. The method of choice for this study was a combination of elements of phenomenology and ethnography. Nineteen teachers were interviewed and observed. The sample was drawn from two former Model C schools and three township schools. Data were analysed qualitatively.

Findings: The findings confirmed that there are multiple beliefs that constitute a personal epistemology. Therefore, to investigate some unique entities of the belief system such as OBE requires examining the broader belief system. The majority of teachers responded to OBE implementation with uncertainty, anger, frustration and anxiety. In the absence of certainty about OBE and faced with a myriad of classroom

challenges, teachers relied on their experience to make decisions regarding what was important to know, they drew on their own personal teaching theories more than what they thought about OBE to make judgments of learning processes.

This study concludes that the link between teachers' beliefs, conceptualisation of OBE and teaching practice is weak. Their beliefs about the nature of mathematics knowledge, teaching and learning mathematics had stronger connections with, and represented the basis for teachers' pedagogical purpose behind their preferred teaching practice.

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Dedication

To my parents:

This study is dedicated to you for your unwavering love, support, guidance and perseverance; during difficult times you taught me never to give up. The thirst for academic excellence you planted in me drove me to where the eagles dare.

May your souls rest in peace.

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CHAPTER ONE

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

This chapter provides a brief overview of the socio-political changes characterising the educational landscape of South Africa (SA) and also gives a brief outline of the organisation of the education system with a special focus on the Further Education and Training (FET) band. The study aimed to draw upon socio-constructivism and social cognitive theories to provide a basis for understanding how teachers approach outcomes-based education (OBE) instruction in mathematics classrooms. Conceptualisations, beliefs systems and experiences of OBE were explored.

During the apartheid era South African society was divided – the white minority was separated from the black majority. The state's per capita school expenditure on black learners was significantly lower than that for white learners during the apartheid period (Botha, 2002:361). The apartheid regime also created 36 public higher education institutions for different racial groups. The white minority had access to the best and well-resourced institutions, while the majority had marginal resources. The education subsidy for universities was unequally distributed for different population groups; this created inequalities of unimaginable dimensions (Botha, 2002:362). Learners from different population groups had unequal opportunities to further their education, the labour market granted preferential treatment to whites; employers became selective and showed preference for graduates from particular institutions (SAQA, 2000:8). Against this background the need for South Africa to introduce changes at the systemic level became urgent.

The South African Constitution (1996) defines schooling as a public goal and fundamental right, a force for social improvement. It is a moral and political practice that presupposes preparation for a particular form of social life and vision of the community. The elections in 1994 dismantled apartheid policies and paved the way for changes in the country's social institutions, including educational institutions. Moreover, the Constitution states that everyone has the right to a basic education

(including adult and further education), and that the government must implement reasonable measures to make education available and accessible to all (Republic of South Africa, 1996b:15). The Constitution clearly defines the role of the national Parliament as enacting legislation pertaining to the establishment of national norms and standards, education frameworks and policies (Heckroodt, 2002:8).

The government maintains that education is the key to economic development and plays a crucial role in enabling South Africans to improve their lives and by so doing contribute to a productive and democratic nation (DoE, 1997:6). After 1994 the Department of Education provided new directions for education in the country through enabling infrastructures such as the National Qualifications Framework (NQF) and the first outcomes-based national curriculum framework. The ultimate purpose and justification for the educational reform was to improve the overall quality of education and training in South Africa. A National Curriculum Statement, which is outcomes-based, has been implemented in the General Education and Training (GET) band and has been phased in from the 2006 in Further Education and Training (FET) schools.

The South African qualification Authority (SAQA, 2000:11) has adopted an eight-level qualifications framework. The levels are incorporated into three broad bands: General Education and Training (level 1), Further Education and Training (levels 2 to 4), and Higher Education and Training (levels 5 to 8). The national Department of Education has been responsible for the development of the national core curriculum such as Curriculum 2005 and the National Curriculum Statement (NCS). Providing curriculum and content guidelines for public schools is a responsibility of specialist divisions within provincial departments of education. The responsibility of selecting learning materials is shared between individual schools and provincial education departments. Examinable education outcomes at provincial level are governed by the national core curriculum (Geel, 2005:5).

1.2 THE FURTHER EDUCATION AND TRAINING BAND (FET)

The FET band comprises Grades 10 to 12 of formal schools and vocational training institutions. The guiding principle of the FET band is integration of formal schooling and vocational training providing an educational framework that links sub-sectors to enable progression and credit transfer (Keery and Blom, 2007:5). The vision of the Department of Education (DoE) is to maintain a coordinated system that is able to respond to local, national and international needs. However, this attempt at integration is deemed problematic by some, because the dichotomy between education and training is complex and not adequately articulated in the policy documents (Keery and Blom, 2007:8).

Furthermore, the FET system is viewed as an attempt by the South African government to align itself with the recommendations of UNESCO regarding articulation between secondary and vocational education. Countries are urged to move towards policies that integrate the development of skills in basic education programmes, and to merge knowledge and practical skills (UNESCO, 2005:13). The main purpose and mission of FET are to respond to the human resource needs of the country for personal, social, civic and economic development (Geel, 2005:2).

It is with reference to this band that this study investigates mathematics teachers' implementation of the intended national curriculum. Mathematics is generally viewed as a communication tool in modern high-technology societies; therefore in times of educational reforms the rules about what constitutes mathematics knowledge and how it should be taught will also change (Darling-Hammond, 2000: 167). The emphasis of the study, however, is on teachers' beliefs, conceptualisation and experiences of OBE rather than on the pedagogy of mathematics.

1.3 OUTCOMES-BASED EDUCATION (OBE)

The curriculum for all bands in the schooling system is outcomes-based. According to Killen (2000:6), OBE is a philosophy of education that embodies and expresses a set of beliefs and assumptions about learning, teaching and the systemic structures within which these activities take place. OBE shifts the focus away from inputs and

processes of educational systems to outputs, i.e. improvements in learners' achievement of outcomes, as well as school and system performance.

Spady (1994: 19), an advocate of OBE contends that OBE means focusing clearly on what is essential for all learners to achieve success at the end of their learning experiences and then organising everything in the educational system to ensure success. Central to this shift is a change in expectations of learners' learning, which has implications for the practice of teaching and for the organisation and management of schools (Brogan,1994:3). This means starting with a clear picture of what is important for learners to be able to do, and then organising curriculum, instruction, and assessments to make sure the intended learning process eventually happens – a design down and deliver up model. Therefore, it is assumed that an OBE approach introduces effective use of teaching and learning strategies to improve student outcomes.

The introduction of outcomes-based education in South Africa heralded a major transformation in education, and was intended to serve as a vehicle to improve access, equity and quality. It became evident that this systemic transformation demanded complex consultative processes at all levels. The pressing question that needed to be addressed at the system level was: What should the outcomes of this learning process be? The South African government acknowledged that the implementation of a new curriculum would bring forth different responses from teachers: some would willingly engage with new teaching strategies, while others would either resist or choose to be indifferent. In addition, the government claimed that questions around the epistemological strengths and weaknesses of OBE as a curriculum framework have to be asked (SAQA, 2000: 11). Debate was encouraged and practitioners had to consider the effectiveness of their own practice in relation to different views (SAQA, 2000: 11).

Educational reform in South Africa was imperative; however, the processes of initiating these reforms proved to be challenging for the new government. There was a need to make education more equitable, democratic and liberating, and at the same time confront global and national challenges. It would be fair to say that the educational reconstruction in South Africa followed international trends. New and

emerging theoretical frameworks were introduced, ostensibly to improve the quality of education. One consequence of introducing new and emerging theories is changes in teachers' experiences of teaching and learning.

According to Prickel (2000:3), OBE appears to fit into the emerging theories of cognitive humanism. His explanation of cognitive humanism aligns it with the tenets of both cognitive and humanistic theories. Central to this approach is the view that both the teacher and the learner engage in knowledge creation. The whole person is emphasised and the prior knowledge of the person is recognised. The notion that knowledge and understanding are developed from one's own construction of meaning has contributed largely to changes in contemporary teaching practices and the learning processes of today's learners (Prickel, 2000:4). It is in this context that this study seeks to investigate teachers' beliefs, conceptualisation and experiences of OBE.

1.3.1 Reaction to educational reforms

Change in any society will always evoke a variety of emotions ranging from total rejection to enthusiastic acceptance. OBE has not been without controversy and fuelling the debate is confusion about what OBE means (Brogan, 1994:3). OBE can be described as a global educational curriculum reform phenomenon with adaptations and local responses in South Africa. Cross, Mungadi and Rouhani (2002:176) argue that OBE is part of a flow of ideas through globalisation processes and converging trends in educational systems throughout the world, with few exceptions; it remains an experiment at different levels of national policy.

Killen (2000: 6) acknowledges that the concept of educational accountability was one of the driving forces behind the introduction of OBE and that the stimulus came from the political, economic and educational environment. According to SAQA (2000:11) South Africa as an emerging market had to take up its position in the global village and embrace the new vocabulary of knowledge, reasoning, competence and outcomes.

The key features of South Africa's transition to democracy included the adoption of neo-liberal policies within an uncertain framework of political and moral compromise

between political players (Chisholm, 2005:84). Similar trends of criticism are seen in Australia, New Zealand, and the USA, where it is evident that changes in education are believed to further disadvantage those less able to compete in the market (Whitty, Power, and Halpin,1998:43). Put differently, the scope of government has narrowed and civil society has become increasingly defined in market terms. It needs to be understood that South Africa as a developing nation strives to be a competitive player in the global arena; therefore, educational reform might be seen as a vehicle to serve the needs of a knowledge economy.

The capacity of governments to solve educational problems is widely questioned. Whitty *et al.* (1998:44) contend that there is a need for policy research to consider the extent and character of policy borrowing, modelling, transfer and copying which occur across boundaries of nation states and which lead to universalising tendencies in educational reform. Despite the market-orientated policies in South Africa, the dominant discourse within the state has been one of rights, development, social justice and nation building (Chisholm, 2005: 84). These debates led to questions regarding the influence of the technocratic OBE approach on the *development of consciousness and creativity in the practice of teaching and learning in schools* (Fakier and Waghid, 2005:54).

The OBE reform movement in South Africa sparked crises within academia, the public and other major stakeholders such as trade unions. The critique of OBE has been waged with reference to its origins and conceptual basis, political participation, knowledge and pedagogical features, issues of policy formulation, design issues and management of its implementation (Gross *et al.*, 2002:177). In addition, the mentioned authors identified tensions within the system: curriculum framework versus applicability, conditions of implementation and actual practice in schools, and expected outcomes in relation to the capacity of teachers to translate them into reality. The very process of policy formulation is criticised by Jansen (2002:202), who asserts that there is gap between policy formulation, implementation planning and practice, and argues that policy formulation was more about political symbolism than valid educational reform. It should be noted that the educational reform occurred during the period of a broader social change in South Africa that has not ended. Therefore, it is believed that these debates are likely to continue for a considerable time.

This study assumes that it is not possible to have a curriculum that can fit all requirements at any given level of schooling and that contestation within educational reform movements is both necessary and progressive. It provides the platform for reflexive dialogue and change. A sense of citizenship should drive all stakeholders to seek solutions. Chisholm (2005:82) acknowledges that the curriculum process is inevitably an ever-evolving process that is driven by complex forces.

However, Le Grange (1999:11) asserts that it is not enough to criticise the educational reforms without engaging in processes that generate alternative possibilities. He argues that outcomes are broad enough to encompass a range of smaller skills that are specific and clear enough to be taught and assessed. He also argues that transformation does not lie outside of current events (in this case the introduction of OBE) but in viewing such events as the carriers of new possibilities.

Pertinent themes from the literature reveal that teaching is a complex and context-specific activity that requires a personally meaningful professional knowledge base for teachers. In this context teachers will make informed choices about classroom practice. In the process of change, understanding teachers' epistemological beliefs and their relation to education becomes essential. The relationship between teachers' knowledge and their practices is; however, always open to debate and interpretation.

Despite the criticism levelled against OBE, teachers are invariably placed at the centre of curriculum-implementation debates. They are expected to translate educational policy into classroom practices, to make and remake their role in a new dispensation. This would involve interpretive thinking, revealing what they know and do not know about OBE-related pedagogies, and also what they believe constitutes knowledge, teaching and learning. Consequently, there might be a need to investigate the complexities of deeply entrenched beliefs, values and assumptions of teachers who have to translate policies into the reality of the classroom.

1.4 BACKGROUND TO THE PROBLEM

The implementation of OBE has significant implications for teachers' work; adopting an OBE approach entails reconstruction of professional knowledge, redefinition of planning procedures, teaching approaches and assessment practices. The OBE curriculum framework is underpinned by a learner-centred approach, and learning is regarded as an active construction of meaning, and concomitantly teaching is understood as an act of guiding and facilitating this learning (Killen, 2000:8). Teachers have a primary responsibility for enabling learners to achieve the goals and objectives and to acquire the skills and knowledge necessary to implement outcomes-based learning and assessment. Brogan (1994:6) maintains that high academic standards are needed in teacher preparation to ensure that individuals entering the teaching profession are fully prepared in the knowledge, pedagogy, and learning assessment techniques needed to teach successfully in an outcomes-based system.

Systemic reform requires background knowledge of the type of instruction that is necessary for change to occur. Diekelmann and Scheckel (2004:386) recommend that reformers need to focus on the development of teachers' knowledge and skills before they focus on changing structure, which in this case would be the educational system. They argue that teachers need the opportunity for development so that they might learn to teach differently and develop shared goals and beliefs about what good teaching is really about.

The South African curriculum change proposals require understanding the nature of knowledge, learning and application of different theories. The debate about knowledge for curriculum development revolves around what constitutes adequate knowledge, the function of knowledge, who decides what knowledge to be included in the curriculum and what are the relationships of certain subjects to the cognitive development of learners, and mode of delivery (Kolodner *et al.*, 2003:500). A teacher attempting to make sense of OBE, learning outcomes, assessment standards, band levels, NQF, etc. will inevitably bring his/her worldviews, past experiences and beliefs into the process of teaching and learning, and would also need to engage with new concepts to keep track of the changes in meaning and priorities. Within this changing education scenario, OBE, as an initiative, offers opportunities for new

pedagogies to flourish, marking a departure from the safe haven of traditional pedagogy. This innovative thinking creates a new space where teachers can focus on new meanings and practices (Diekelmann and Scheckel, 2004:387).

However, in this study it is acknowledged that teachers implement the new curriculum in an environment of great uncertainty, an environment that presents many challenges. The entire educational reform movement evokes continuous criticism and debate, but to some degree teachers were excluded from the grand debates and sophisticated critiques made by academics. Criticism of OBE comes from diverse sources and encompasses a variety of concerns about theory and implementation. Teachers are central to the implementation process, yet their wealth of experience and cognitive processes of thinking and reasoning that they bring to the educational arena are often largely ignored.

The view of teaching taken in this study is that it is largely an intellectual activity where complex practitioners make complex decisions and adopt the role of transformative intellectuals. The term transformative intellectual was coined by Giroux (in Darder, Baltodano and Torres, 2003:119), positions teachers as professionals who have the capacity to engage critically with social realities. The assumption is that teachers strive to do better in what they do, they examine the assumptions underlying what actions, and they critically question what they do and why. Therefore, to be able to explore teachers' classroom management within the changing educational environment, it is imperative to understand their own epistemological beliefs regarding learning, teaching, education and knowledge.

Scheurman (1995:4) links educational problems to the lack of attention on the part of educators to ways of knowing as well as their lack of understanding about epistemologies operating within the classroom. This study proposed that there was a need to know how personal epistemologies interact with the social contextual factors of policy implementation. It also aimed to document teachers' lived experiences of how changes in the realm of educational policy are related to changes in the instructional and learning practices.

1.4.1 Beliefs, teaching and learning

Theories of epistemological beliefs focus on the individual's perception about what knowledge is, where knowledge comes from, and the degree of certainty with which knowledge can be held. These beliefs are part of, and may direct processes involved in, teaching (Niff and Whitehead, 2005:3). Levin and Wadmany (2006:159) define beliefs as *an implicit set of often unconsciously held assumptions regarding educational issues such as knowledge, teaching, learning and curriculum*. Bartolome (in Darder *et al.*, 2003:465) argues that in traditional classrooms the teachers' particular beliefs and socio-cultural identities remain in the background, but in a classroom where social identity is central to the context, teachers' beliefs about knowledge, learning and learners often takes centre stage. She posits that teachers can offer their experiences and join with the learner to reinterpret and reframe current educational concerns in order to develop pedagogical structures that speak to the day-to-day reality, struggles, concerns and aspirations of learners.

Howard and Hoge (2002:20) found that teachers often reveal a consistency between their beliefs about knowledge and instructional practices. Therefore, a perspective on teachers' beliefs can provide an alternative interpretive lens for researchers through understanding teachers' actions and thoughts. OBE tends to be oriented towards constructivist models which propose that people create their own meaning and understanding, combining what they already know and believe to be true with new experiences and knowledge that confront them. Therefore, OBE could empower teachers and develop capacities to respond to diverse learner needs, allowing teachers to create new knowledge and to improve the delivery of curriculum content.

In a mathematics classroom teachers need to be well grounded in various perspectives and the specific ways these relate to mathematical teaching (Darling-Hammond, 2000:52). There is substantial evidence that supports the claim that teachers who have had advanced preparation for teaching are more confident and successful with learners than those who have had little or no initial preparation. Furthermore, Darling-Hammond (2000) argues that a command of evidenced-based teaching is liberating, as it enables teachers to devise new procedures rather than following a uniform set of teaching strategies (Darling-Hammond, 2000:52). Questions have been raised

regarding the ability of teachers with low-level, poor-quality preparation to think critically; do they have the cognitive tools for higher thinking? Do they have the tools to grapple with the transfer of ideas; do they try out new ways of thinking and reasoning? Darling-Hammond (2000:52) argues that there is little room in today's society for those who cannot manage complexity, or for those who cannot find and use resources and continually learn new approaches.

This study intended to examine the beliefs and personal theories mathematics teachers hold, to explore how they construct the theoretical underpinnings of OBE, and how these systems influence their teaching experiences.

1.5 STATEMENT OF THE RESEARCH PROBLEM

The implementation of outcomes-based education in 1998 came with new terminology, modes of delivery and assessment practices. Life-long learning and flexible modes of delivery such as learner-centred approaches became prominent in the education language (Jansen, 1998: 324). However, Jansen (1998:324) indicates that the concept of 'outcomes-based education' can be very confusing because there are various interpretations of it. For some it may represent central control on the part of education planners who specify the outcomes, while for others it may mean complex learning processes which are not easy to assess. Moreover, teachers have cited challenges associated with it, including how to strike a balance between curriculum content and the OBE process, restructuring classroom practices to allow for expanded educational opportunities and creating new methods for assessment (McNeir, 1993: 18).

The new OBE curriculum required not merely the application of skills, but an understanding of theoretical tenets and a demonstration of a capacity to transfer knowledge and skills across different contexts. But there are also other difficulties with the OBE curriculum. Jansen (1998:325) asserts that the language of OBE is too complex and that OBE policy is based on flawed assumptions about what happens inside schools, how classrooms are organised and what kinds of teachers operate within the system. This specific argument seems to put teaching practice in the middle of the controversy surrounding the successful implementation of OBE.

Teaching is believed to be a personal invention, although pedagogy is the foundation of optimally effective teaching, it tends to be more suggestive than prescriptive. According to Wilen, Ishler, Hutchinson and Kindsvatter (2000:4), teachers will be more effective if they maintain their own personal identity and integrity whilst being guided by the tenets of pedagogy. This study assumes that teachers have implicit theories of knowledge, education, teaching and learning, and that these theories or basic beliefs will modulate their approach to classroom management, including their views of alternative knowledge conceptions.

The assumption of the education reform process in South Africa is that teachers will change their teaching and assessment practices and align them with the requirements of the new system, based on the belief that what is taught and the way it is taught in the classroom influences the quality of education at the school level. The OBE model expects teachers to integrate into their teaching practice an understanding that all learners can learn, albeit at different rates and in different ways; they are expected to understand the need to respond to differences by creating multiple paths to learning for individuals and groups of learners, including learners with special needs. This view, if well articulated and implemented, places high demands on teachers to be educational theorists and transformative intellectuals.

A report published by Edusource (1997:6) found that most mathematics and science teachers were not qualified to teach these subjects, and although 85% of mathematics teachers were professionally qualified as educators, only 50% had specialised in mathematics. It is unlikely that this has changed a decade later. Also, concerning teachers' general qualifications, data from the Department of Education show that in 2005 out of 287 165 teachers, only 98 069 had matric plus four years teacher training, and only 33 381 had postgraduate qualifications (Department of Education, 2005: 16). As mentioned, OBE is characterised by a complex language and requires an appropriate level of educational preparation on the part of teachers so that they can comprehend and translate its constructs into the classroom situation. Moreover, Jansen (1997) argues that South Africa's teachers may not be capable of handling the conceptual and administrative demands of an OBE system. This view is supported by Chisholm (2005:84), who laments the inadequate training of teachers and lack of

financial resources to prepare teachers effectively and efficiently. Given the magnitude of the complexities facing teachers in South Africa, it might be important to investigate what happens in classrooms. More particularly in this case: what knowledge base, experiences and beliefs do teachers draw on?

Against this background this study intends to explore how teachers construct a personal understanding of the core principles of OBE, and how this understanding leads to questioning and reformulation of their assumptions about the nature of their role and application to their teaching practices.

1.5.1 Research questions

The problem statement (stated in interrogative form) for this study was:

What are teachers' epistemological beliefs, understanding, experiences and practices of OBE?

To address the research problem, the researcher intended to answer the following questions:

- What are the teachers' epistemological beliefs regarding, education, teaching and learning?
- What is teachers' personal understanding of OBE?
- How do teachers experience OBE curriculum implementation?
- To what extent have teachers' understanding and experiences of OBE impacted on their teaching/classroom management practices?
- Do teachers' personal beliefs affect their adoption of suggested OBE classroom management strategies?

1.6 PURPOSE STATEMENT

This study intended to explore and describe the epistemological beliefs, conceptualisation and experiences of teachers regarding OBE and the possible relationship between their perceptions of OBE and their pedagogical practices. The

aim was to examine the strategies teachers use in their classrooms in response to OBE policy imperatives. Teachers' epistemological beliefs were explored and linked to OBE pedagogical demands and classroom management.

1.7 SIGNIFICANCE OF THE STUDY

South Africa is a society in transition; significant changes are taking place at a rapid rate and there is a perceived gap between policy statements and classroom realities. Government schools in South Africa are faced with enormous challenges, and teachers are expected to deliver the new curriculum and meet the teaching quality standards set by the Department of Education (1996a). The teachers' application of pedagogical knowledge, skills and attitudes is based on how they comprehend the new system. This will enable them to accept personal responsibility for student success, articulate their new role adequately and create adequate opportunities for learners to achieve the expected outcomes.

Brogan (1994:6) states that education is not a destination but a journey, and therefore OBE should be viewed as a process and not a product. Given the process perspective, the data generated from this study could inform the evolving educational policy processes in South Africa by investigating teachers' understandings and experiences of the new system, their personal narratives about education, knowledge, teaching and learning, and how these translate into practice. The data generated during the study could provide teachers, educators and policy makers with insights into the meaning of educational change, and stimulate dialogue and debate on how classroom practices and student achievement might be improved.

The researcher envisages that this study would help readers to understand how teachers could be empowered to examine their personal beliefs and understandings of OBE theoretical frameworks, and to get teachers to constantly reflect on their pedagogical approaches in different contexts.

This study views OBE as a point of departure not a destination, assuming that educators and policy makers will remain open to new ways of thinking based on the discovery of new ideas, including those that this study might produce. The unique

contribution of this study will be to explore and describe the relationship between implementation of policy and teachers' own epistemological beliefs and understandings. Prickel (2000:12) contends that teachers are continually contributing to new knowledge and insights within the practice of teaching and learning, and that their teaching strategies are adapted and applied from tested and non-scientific theories, and their personal beliefs – exploring these processes might prove to be illuminating.

This study intends to highlight the interplay between teachers' epistemological beliefs, the implementation of OBE and classroom management. It sheds light on teachers' beliefs in their ability to implement the policy based on their own personal understanding. It was anticipated that the findings from this study may engage with the discourse of critiquing OBE, which tends to view teachers as victims of a changing educational landscape with no power to modify the context, observe, assimilate and develop actions, in reaction to the new teaching and learning challenges. Research has shown that teacher empowerment does have a significant impact on instructional practices and student achievement (Elmore, 1995:24).

This research was focused on mathematics teachers in Gauteng secondary schools. Secondary education (a section of FET) has a critical role to play in providing youths with the capabilities to engage in critical thinking, to communicate their ideas clearly and to make professional judgments. However, this sector is also faced with challenges to redefine itself. The problem of the status of mathematics education in South Africa has been widely documented; many studies comment on the poor mathematics results in the matriculation examination, for example. Some of the problems cited include inadequate subject knowledge of teachers and inadequate communication ability of learners and teachers in the language of instruction (Howie, 2003:3).

This study will offer critical insights into how mathematics teachers articulate new meanings and translate those meanings into critical decisions to enhance student outcomes. Greater understanding of teachers' beliefs and actions could assist in changing the realities within the classroom. The study could assist policy makers in gaining unique insights into the transformational role of teachers in a context which

faces several challenges with respect to the implementation of OBE. Teachers' current knowledge and experience should provide the basis for policy formulation regarding instructional methods. This study will show different ways of viewing and facilitating classroom practices. The literature reveals that teacher's personal beliefs do impact on instruction. If the teacher believes learners can maximise their chances of learning regardless of environmental conditions or background of learners, then she/he will apply all possible strategies to achieve student outcomes (Prickel, 2000:14).

1.8 THE GAUTENG PROVINCE CONTEXT

This study was conducted in Gauteng province, South Africa. The Gauteng province is one of South Africa's nine provinces and, as such, it is obligated to observe and adhere to the principles of cooperative governance and conduct its activities within the parameters of the South African Constitution. The legislative authority of the provinces is vested in its Provincial Legislature in terms of Section 133 (2) of the Constitution. Conferred upon it is the power to pass a constitution for its province (Republic of South Africa, 1996). Implementation of education policy (except higher education) is the responsibility of provincial authorities. The vision of the Gauteng Department of Education vision is:

To deliver smart services of high quality, and strives to be at the cutting edge of curriculum development, and provide access to quality lifelong learning opportunities. These initiatives will be shaped by principles of redress, equity, and ubuntu. One of the priorities is to build skills of young people through strengthening the FET sector. Continuing improvement of classroom practice will be ensued through curriculum practices and standard setting and monitoring to empower learners scientifically through mathematics and technology. (Department of Education, 1995)

The technical education sector has been successfully transformed into a viable FET sector with eight colleges operating on thirty-three campuses. The aim of the provincial legislature is to consolidate support for the FET and to provide curriculum resourcing, staff development and infrastructure improvements (Department of Education, 1997:7). Accordingly, in Gauteng province the FET sector will see urgent

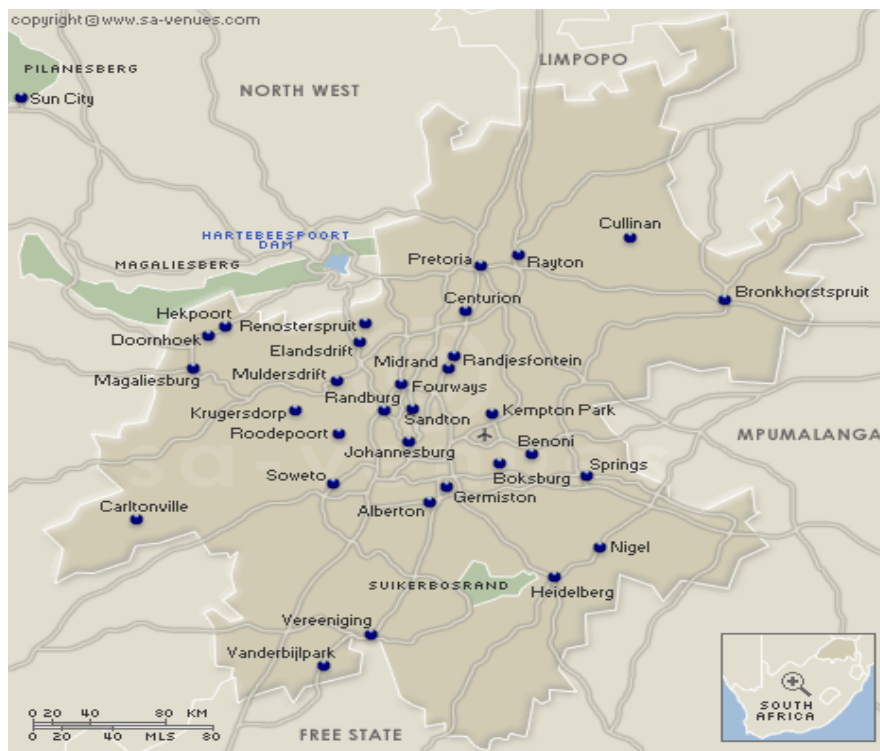
redress related to programme offerings and capacity building in schools. This study presumes that this will translate into improved student outcomes, and empower and build the confidence of teachers to meet challenges brought about by the new educational reforms such as OBE. Below is the detailed map of South Africa showing its nine provinces (including Gauteng province) and the important cities and towns in each province. A map of Gauteng province also provided.

Figure 1.1 Map of South Africa:



<http://www.nationsonline.org/maps/>

Figure 1.2 Map of Gauteng



www.sa-venues.com

1.9 CLARIFICATION OF CONCEPTS

For the purposes of this study, the relevant terms are defined below:

○ **Outcomes-based education**

A philosophy of education that embodies and expresses a set of beliefs and assumptions about learning and teaching, and the systemic structures within which these activities take place (Killen, 2000:6). OBE offers a new space where teachers can focus on new meanings and practices (Diekelmann and Scheckel 2004:387). For the purposes of this study OBE is defined as theory of education to transform education and change the way in which teaching and learning takes place.

○ **Teacher**

A reflective intellectual who continuously builds and rebuilds knowledge to make sense of the subject content and the processes involved to make this knowledge

meaningful in the classroom. The teacher is seen as an inquirer into the state of things – the way things are and what they might be.

- **Teaching practice**

Teaching practice as used here refers to the art of emphasising thinking, understanding, reasoning and applying knowledge without neglecting basic skills. It is based on the understanding that learners construct knowledge (Monfils, Camilli, Firestone and Mayrowetz, 2000:18). Therefore, teaching is viewed as an intellectual activity within which practitioners make complex decisions and adopt the role of transformative intellectuals. This study defines teaching practice as a multidimensional process in which teachers constantly respond to learning needs by providing opportunities for active, deep learning using multiple approaches.

- **Learner**

Any person being educated or trained at an educational institute (Department of Education, 1996:7), defined as a person who is self-directed and involved in the construction of personal meaning and knowledge.

- **Learning**

This is defined as deep understanding in terms of what learners can generate, demonstrate and exhibit as to what they know and can do (Monfils, Camilli, Firestone and Mayrowetz 2000:18).

- **Knowledge**

Knowledge is incomplete and constantly being constructed and reconstructed; it develops via integration of a range of learning activities and construction of meaning. Knowledge is adaptive and evolves through dialogue with socio-cultural factors that influence the final product of meaning (Prickel, 2003:16).

- **Personal professional beliefs**

Dunkin (1990:280) defined beliefs as the patterns of ideas and feeling possessed by individuals concerning teaching; this provides the framework of cognitive and affective attributes that underlie planning, decision making and implementation in relation to teaching. Beliefs refer to implicit theories about teaching and learning which influence approaches to teaching. For Levin and Wadmany (2006:159) personal professional beliefs concern a tacit set of often unconsciously held assumptions regarding educational issues such as knowledge, teaching, learning, schooling and the curriculum.

Beliefs are involved in helping teachers make sense of OBE; they also influence how information is perceived and whether it is accepted or rejected. This study assumes that beliefs about OBE cannot be divorced from beliefs about learning, teaching, schools and education.

This study also assumes that beliefs about any educational system manifest an interconnected, intertwined belief system embedded in a personal philosophy or worldview.

- **Conceptualisation of OBE**

The Collins English Dictionary (1991:333) defines conceptualise as forming a concept, or concepts, out of observation, experience, data, etc. Conceptualisation of OBE in this study means forming a concept of what OBE is, or interpretation of OBE that is based on a range of interrelated factors including experience, observation and reading.

- **Experience of OBE**

The Collins English Dictionary (1991:546) defines experience as *direct personal participation or observation; actual knowledge or contact; to participate in or undergo*. This study defines experience of OBE as a totality of mentally processed teaching and learning events that construct a reality for teachers.

1.10 ASSUMPTIONS

This study is based on the following assumptions:

- A classroom is a complex social environment in which teachers' beliefs about knowing and learning interact in a dynamic manner through dialogue and self-reflection;
- Understanding of OBE is personally constructed and modified by the social context in which learning takes place;
- Teaching practice is an evolving process that allows practitioners to develop and grow throughout their lives, constantly observing, assimilating, developing actions and reactions, experimenting and testing beliefs (Kelly, 1977);

- Teachers ground their professional practices within an analysis of their ontological values, live their professional practice in terms of how they realise these values as lived practices (McNiff and Whitehead, 2005);
- Beliefs act as a lens with the potential to distort or could act as barrier to engaging in facilitative practices;
- Human interaction is the result of personal experiences and assessment of current situations which is mapped into possible courses of action that actors think best suit their needs.

1.11 RESEARCH METHODOLOGY

1.11.1 Research design

The focus of this study was on understanding the meanings, values, beliefs and experiences of teachers faced with a new educational approach. The study adopts a qualitative descriptive method, using a broadly ethnographical approach as a design. One of the major distinguishing characteristics of qualitative research is the fact that the researcher attempts to understand people in terms of their definition of their world. It focuses on the subjective experiences of individuals and is sensitive to the contexts in which people interact with each other (Mouton, 2001:65). The focus of this study was on analysis of patterns, values, worldviews, meanings and beliefs about OBE; this therefore required a holistic approach to capture all aspects related to OBE processes.

A combination of methodological approaches was used to enhance understanding of teachers' life worlds. The triangulation of ethnography and phenomenology enabled the researchers to highlight the interpretations of OBE, whilst at the same time considering OBE and teaching practice in terms of teachers' backgrounds and day-to-day experiences. Phenomenology is defined by Cottrell and McKenzie (2005:224) as the study of meanings of lived experiences for several individuals about a concept or a phenomenon. The question that phenomenology asks is: What is the meaning, structure, and essence of the lived experience of the phenomenon? On the other hand, ethnography asks the question: What are the cultural characteristics of the social group under study, what are their beliefs, values and practices? Ethnography is described by Wiersma and Jurs (2005:77) as the process of providing holistic and

scientific descriptions of educational systems, processes and phenomena within their specific contexts.

Drawing on approaches from both ethnography and phenomenology had more theoretical and practical relevance than using one approach; the two approaches are philosophically compatible. Some authors argue that the degree to which ethnography is conducted in its purest form is sometimes controversial, but today there is more diversity in both principle and practice, and there is a presumed preference for pragmatic pluralism (Johnson, Long and White, 2001:245). Ethnographical research is phenomenological in nature; it stresses the careful description of phenomena from the perspective of those experiencing it. This study intended to develop an understanding not only of what OBE means, but of how it was perceived by mathematics teachers experiencing new teaching and learning processes. The purpose of ethnography is to close the distance between an outsider's interpretation (etic perspective) and the meaning of the life experience to the participant (emic perspective) (Cottrell and McKenzie (2005:225). This study assumed that all social phenomena are products of a negotiated reality within which many versions of events or strategies for dealing with, and interpreting, the social world are possible (Johnson *et al.*, 2001:245).

Qualitative research involves a design that emerges in the field as the study unfolds. It identifies characteristics and the significance of human experiences as described by subjects and interpreted by the researcher at various stages of abstraction (Wiersma and Jurs, 2005:77). It is assumed that the meanings of OBE will evolve as the researcher conducts dialogical discussions with participants, and that the themes that emerge will form the basis for further data collection. Qualitative methods are essential in identifying, documenting and confirming unknown aspects of human actions. Educational knowledge must be closely linked to values, patterns and beliefs of human groups (teachers); therefore, qualitative methods are better suited to discover the subjective meanings of those involved in education (Wiersma and Jurs, 2005:78). Discovery of meanings that teachers attach to OBE is regarded as the basis of knowledge generation in an open, enquiring manner; in this way teachers will be encouraged to share their ideas and beliefs about their experiences of the new

educational system. Through the process of inductive discovery, the researcher will describe and document diverse and common understandings of OBE.

1.11.2 Sample and sampling method

Ethnographic methods rule out statistical sampling because generalisability, a goal of inferential statistical methods, is not necessarily a goal of ethnography. The objective is informational, i.e. to provide a wealth of detail so that the uniqueness and individuality of each case can be represented (Cohen, Manion and Morrison, 2001:112). A non-probability sampling was utilised; there was no need to randomly select individuals, because manipulation, control and generalisation of findings were not the intent of this inquiry. The first stage of the sampling plan involved purposively sampling participants at two former Model C schools. This involved the researcher listening attentively to ideas presented by teachers and then identifying key informants in the same schools. The sampling was complimented by snowballing. Snowballing entails referral to other informants in the study; which ensures that informants who are knowledgeable about the topic are included in the study (Wiersma and Jurs, 2005:79). Key informants who volunteered and were identified by others were included in the sample. The second stage involved repetition of a similar process in three township schools within the selected region. The reason for choosing former Model C and township schools was that both categories of schools had unique characteristics, given their location in different historical, socio-economic and cultural contexts.

The sample size consisted of nineteen teachers, while variation was included by purposefully selecting newly qualified and more experienced teachers. The process of sampling continued until a point of saturation was achieved. Saturation refers to the repetition of discovered information and confirmation of previously collected data (Polit and Hungler, 1996:316); in this case, the researcher continued until no new data from teachers emerged. This was done to ensure transferability and confirmability. Transferability refers to *the extent to which findings from data can be transferred to other settings or groups and is thus similar to the concept of generalisability of findings* (Polit and Hungler, 1996:316). Confirmability refers to *the objectivity or neutrality of the data*, such that two or more independent people would reach an

agreement about the data's meaning (Polit and Hungler, 1996:315). According to Leininger and McFarland (2002:88), confirmability refers to *documented verbatim statements and direct observational evidence from informants, situations and other people who firmly and knowingly confirm or substantiate the data or findings.*

1.11.3 Data collection

Data were collected by applying unstructured data-collection approaches utilising unstructured observation, documentary analysis, in-depth individual interviews and semi-structured focus group interviews. Focus group interviews were used to explore the conceptions and meanings teachers attached to OBE; this allowed more flexibility in the design of the interview schedule, which focused on individual meanings and experiences.

Observation was used to observe teachers in action; the observation schedule was informed by data obtained from focus group discussions, which allowed the researcher to interpret and understand how meanings of OBE were translated into classroom management practices. The aim of observation was to gather first-hand information in a naturally occurring situation. The researcher took detailed handwritten notes while observing. It was assumed that using multiple sources would elicit rich data and a range of meanings of OBE, teaching processes and the role of teachers. Unstructured approaches provided in-depth data of the teachers based on what they said verbally, how they explained events and interpreted their meanings and actions in the classroom.

Documentary analysis involved data elicited from records and reports of papers and policies from the Department of Education, National Curriculum Statements, curriculum guides, textbooks, assessment records, report cards, samples of teachers' and learners' work.

1.11.3.1 Data-collection process

In qualitative research successful fieldwork is usually determined by the accessibility of the setting and the researcher's ability to build up and maintain relationships with participants (De Vos, 1998:34). The researcher sought to establish a cordial atmosphere and to lay the foundation for relationships of trust. A sense of equality between the researcher and participants was created as far as possible. The researcher began with informal visits to the schools, introduced the study, explained its purpose and obtained approval from the school. Informants were assured of confidentiality and anonymity.

1.11.3.2 Research setting

The study was conducted in a natural setting consistent with the philosophical orientations of qualitative research. The assumption is that the behaviour of individuals in groups is a dynamic process of complex interactions and consists of more than a set of facts, statistics or even discrete incidents (Best and Kahn, 2003:34). The study was carried out in schools, which are real-life settings, free of the constraints typical of more conventional research procedures. The researcher had a chance to observe, to enter into a dialogue with participants, and interpret actions in terms of how the participants viewed the situation, and how they interpreted their thoughts on OBE.

1.11.4 Data analysis

The researcher maintained meticulous records of interviews, observations, focus group interviews and documentary analysis and documented the process of analysis in detail. All data were computer processed and preserved electronically.

Data were analysed qualitatively using Becker and Geer's (1970:65) phases of ethnographic analysis to classify and index the materials. Data in this phase were converted to more manageable units that could be retrieved and reviewed. Underlying concepts and clusters of concepts were identified, and related concepts were grouped together to facilitate the coding process. A grouping system was developed, and data

coded according to the categories. Nodes and node definitions were created. Coding and categorisation were done repeatedly as new sights developed into emerging meanings/understandings.

Data were continually examined for saturation of ideas and recurrent patterns of different meanings, expressions, structural forms, interpretations related to teachers' beliefs about OBE and its relationship to teaching practice. The researcher engaged in creative reflection and abstract thinking to synthesise meanings that emerged during previous phases into themes that transcended the created categories and sub categories. A comparison was made across the themes so as to generate research conclusions and recommendations.

1.12 TRUSTWORTHINESS

The researcher used Lincoln and Guba's (1985) model in Leininger and McFarland (2002: 90) to enhance the trustworthiness of this study.

1.12.1 Credibility

Credibility refers to the accuracy of the description of the phenomenon under investigation. The portrayal of reality must be faithfully represented and plausible to those who have experienced that reality (Gillis and Jackson, 2002:216). The researcher spent a considerable amount of time with participants collecting data and repeatedly interacting with participants.

1.12.2 Dependability

Data-quality checks and an audit trail were developed so that other researchers, when following the audit trail, would be able to arrive at comparable conclusions. The researcher attempted to maintain a high level of integrity throughout the study by providing an extensive description of events. The researcher submitted raw data, the node reports comprising the coded data and the interpretations to the research supervisor. All raw data and the node reports were filed.

1.12.3 Conformability

Personal interests and biases were confronted and bracketed at the beginning of research. The researcher reaffirmed that what she saw, heard and experienced was based on empirical data, and not simply expressing her own opinion. Confirmations were sought from the informants that the interpretations were true reflections of their perceptions of OBE. This was done through sharing the reflections with the informants and asking them to validate the findings.

1.12.4 Transferability

Data were collected in Gauteng; however, the beliefs about OBE and the implications might ring true in social contexts in other parts of South Africa. The researcher provided an extensive description of findings to enable readers to assess the resonance of the findings in other settings.

1.13 ETHICAL CONSIDERATIONS

1.13.1. Human rights of the respondents

In this study participants were informed of the aims of the study, the procedures to be followed, the credibility of the researcher and how the results will be published. Informed consent was sought prior to the commencement of the study and participants were informed about their option to withdraw from the study at any time, if they so wished. Participants' rights to privacy and confidentiality were ensured.

1.13.2 Rights of the institutions

The proposal was submitted to the Gauteng Department of Education to seek approval. The study did not commence until such permission had been granted.

1.14 CONCLUSION

This chapter provides an overview and basis for this study and highlights the major focus of the study, which is the lived role of teachers in the new educational dispensation. The next chapter elaborates on some fundamental challenges for the education and training of teachers in South Africa. It also focuses on the resource distribution, beliefs of teachers and challenges to the implementation of OBE.

1.15 STRUCTURE OF THE THESIS

- **Chapter 1: Introduction**

The chapter provides an overview of the study, the statement of the research problem, aims of the research and the methodological framework that guides the inquiry. Definitions of terms relevant to the study are also given. An introductory background is provided about the events leading to the introduction of OBE as an educational system, with an emphasis on the FET band. A brief summary of major tenets of OBE are outlined as well as reactions to the educational reforms. The core of the study – the teachers' conceptualisation, beliefs, and experiences of OBE – is outlined.

- **Chapter 2: Literature review**

This chapter covers existing literature that deals with the topic of this study. This was done by looking at the viewpoints of various authors who wrote on the topic, including views of both proponents and opponents of OBE. The chapter puts the principles of OBE into historical perspective and ties OBE to a broader social context, the events leading to the adoption of OBE, the key players in the reform movement and the role of teachers. A detailed explanation of the key characteristics of OBE and its links to constructivism is provided and used to explore teachers' beliefs, conceptualisation and experience, as well as the relationship between these beliefs and instructional practice. Emphasis is placed on quality in education and teachers as agents of change, since this study views teachers as transformative intellectuals. The study considers beliefs, conceptualisation and experiences as intertwined; therefore the use of beliefs in this study involves elements of conceptualisation as well.

- **Chapter 3: Research design and method**

Chapter 3 focuses on the research design and methodology that were used. It presents a discussion on the characteristics of a qualitative methodology, followed by the rationale for the adoption of this approach. This chapter discusses in detail the research population, research instruments and the methods used for data analysis,

including issues of integrity and trustworthiness.

- **Chapter 4: research findings**

The chapter presents a discussion of the research setting, including the rationale for its selection for this study. The characteristics of informants are also outlined to identify any patterns emerging from teachers with similar qualifications, experience and location of school. The chapter also provides the data-analysis framework adopted in this study to analyse and interpret data obtained from informants. It outlines the way that analysed data were recorded and interpreted and the findings of participants' responses to the questions put to them. This is followed by an elaboration of significant themes derived from the data.

- **Chapter 5: Conclusions of the research results and recommendations.**

This chapter provides a synthesis of the findings and the focused literature review, and establishes a framework for conclusions derived from the analysis of the data. Recommendations that arose from the findings for further research on implementation of educational reforms in South Africa and the need for a new way of thinking about teachers' belief systems in educational reforms are also discussed. Beliefs are seen to inform professional guidelines for teaching, influencing what is or is not possible. It is for this reason that that this chapter focuses on teachers' epistemological beliefs and their links to an OBE pedagogical framework and classroom management practices.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Through an analysis and synthesis of the relevant points as they emerge from the literature review, this chapter provides an overview of OBE as an approach to education and discusses its implementation in South Africa. Characteristics of OBE are outlined and discussed within the framework of constructivism. The chapter discusses what proponents of OBE say and also what is stated in South African education policy documents. A brief overview of arguments against OBE is examined in relation to the philosophy of OBE and socio-political dynamics. The chapter further discusses models of effective teaching and relates these models to the principles of OBE.

Furthermore, research evidence or findings regarding epistemological beliefs and conceptual models that support the existence of a relationship between beliefs and teaching practice are presented.

2.2 OBE AS A TOOL FOR TRANSFORMATION

South African society was built on enforced racial division and apartheid laws aimed at separating the white minority from black majority; as a result, blacks had separate schooling, funded at a lower level than that of whites (Botha, 2002:361). The policy of apartheid created thirty-six public higher education institutions for different racial groups. The white minority had access to the best and well-resourced institutions, while the majority had institutions with marginally adequate resources. The education subsidy was unequal for different population groups; this created inequalities of unimaginable dimensions (Botha, 2002:362). Learners from different population groups had unequal opportunities to further their education; the labour market granted preferential treatment to whites; employers became selective and showed a preference for graduates from particular institutions (SAQA, 2000:13). After its first democratic

elections, the need for South Africa to introduce changes at the systemic level therefore became urgent. During the apartheid period the school curriculum was very prescriptive, content-laden, detailed and authoritarian, with little space for teacher initiative (Jansen, 1999:58).

Change was inevitable in South African education policy; there was a need to provide a legislative framework to provide equitable education for all. The Constitution of South Africa defined schooling as a public goal and fundamental right, a force for social improvement. Education was seen as a moral and political practice that presupposes a preparation for a particular form of social life and vision of community. The elections in 1994 ended the policy of apartheid and paved the way for change in the country's social institutions, including educational institutions. Moreover, the South African Constitution (1996) states that everyone has the right to a basic education (including adult and further education), and that the state must take reasonable measures to make education available and accessible to all (Republic of South Africa 1996b:15). The Constitution clearly defines the role of the national Parliament as enacting legislation pertaining to the establishment of national norms and standards, education frameworks and policies (Heckroodt, 2002:8).

The South African Schools Act of 1996 created an enabling framework for the provision of access to and equality in schools, and greater democracy in school governance. The National Qualifications Framework (NQF) was established to integrate education and training, and C2005 was aligned to the NQF. The state recognised that education is the key to economic development and plays a crucial role in enabling South Africans to improve their lives so that they could contribute to developing a productive and democratic nation (Department of Education, 1997:15). Critical thinking, rational thought and deeper understanding were seen as the means to breaking down class and gender stereotypes. The education system was also viewed by some as a catalyst for economic development (Schultze, 2003:6). The ultimate purpose and justification for educational reform was to improve the overall quality of education and training in South Africa as part of a broader agenda of transformation. As part of the agenda of transformation a National Curriculum Statement, which is outcomes-based, was implemented in the General Education and Training (GET) band and Further Education and Training (FET) band (Geel, 2005: 76).

In South Africa OBE became a vehicle for system change, an attempt to move education in the direction of measuring quality of education not by inputs but by learners' actual achievement. The new vision for education was to integrate education and training into a system of lifelong learning. OBE was adopted as the approach that would enable the articulation between education and training, recognition of prior learning and increased portability (Engelbrecht and Harding, 2008: 59). The South African OBE model includes contextualised learning characterised by individualised approaches to learning, critical thinking, problem solving and self-empowerment. The education transformation was intended to prepare critical thinkers, who would be able to develop creative methods of problem analysis and find authentic solutions. In this new system teachers are viewed as key role players and contributors to education as they are expected to be designers of learning programmes, materials, leaders, administrators and managers as well as being the mediators of learning (Department of Education, 2006).

OBE promised far-reaching reform; it offered a balance between school autonomy and accountability. Spady's (1994) model found resonance in South Africa; it was viewed as a vehicle to address core systemic issues that included equity, equality and quality in education. It offered an alternative to apartheid education, which did not prepare learners for the realities of the 21st century. OBE promised to narrow the gap between content learning and complex performance abilities. The new curriculum's aim was to develop a whole person with role-performance abilities in all aspects of life (Killen, 2000:9).

The aim of educational transformation is to empower teachers who are expected to translate outcomes into desirable learning activities, modes of delivery and assessment. The ultimate success of the proposed changes relies, quite specifically, on the way teachers respond to these calls for change because, as Handal (2003:49) points out, only teachers' *understanding and transformation of reform proposals into teaching action can change educational practice*. These calls for change caused concern among many teachers, and continue to do so; in some cases this is because they do not understand what they are being asked to do and in other cases because the suggested changes challenge their fundamental beliefs.

The success of any educational reform is based on recognising the complexities of interrelationships between instructional practice and deeply entrenched beliefs, values and assumptions of teachers. It takes a significant amount of reflection by teachers to gain in-depth understanding of outcomes-based education and also to adjust to the impact that it might have on the curriculum, pedagogy and assessment (Manson and Mwakapenda, 2007:90). Teachers might therefore require support in learning how to plan for, deliver, assess and report on experiences of learners as they seek to achieve outcomes. Furthermore, the necessary leadership and high-quality learning materials for reform to be successful are needed. It is through curriculum leadership and training that teachers could be supported. The critical question is whether teachers have been exposed to the necessary leadership, and whether they have received the training and sustained support from the DoE to fulfil their roles in a new dispensation?

Teachers had to adapt further, with the introduction of the Revised National Curriculum Statement (RNCS) in 2003 (the RNCS was the outcome of the revision of Curriculum 2005 aimed to streamline and simplify the language of its predecessor). The RNCS gave rise to Learning Area Statements – what learners are expected to know for each grade in different subjects (learning areas); each province was expected to formulate its own contextualised learning programmes from the NCS (Cross *et al.*, 2002: 188). The RNCS brought clarity to the learning outcomes, but inequalities in schools still persisted and the day-to-day teaching/learning experiences have not changed.

2.2.1 The political and social nature of educational policies in South Africa

In framing this study it is useful to outline the socio-political events leading up to educational changes in South Africa and to focus on the establishment of an OBE curriculum. The South African government was compelled to engage in large-scale educational reforms so as to change the apartheid education system. The decision to introduce OBE was informed by an international movement in educational reform of the past four decades aimed to improve the quality of education. However, the literature shows remarkable similarities all over the world, namely that schooling and

other educative practices are not driven by a specific global educational policy, but are rather shrouded in claims of effectiveness, accountability and economic policies (Allais 2007; Whitney *et al.*, 1998). Therefore, pedagogical practices focus on developing “economically productive persons” rather than an educated community. The aims of globalised competition are well served by this approach to education which is constructed within the language of the markets in order to bring about measurable outcomes (Whitney *et al.*, 1998).

Schooling is continually being designed according to market principles and South Africa is no exception to this phenomenon. Chisholm (2005: 86) noted that curriculum reform in South Africa went through a complex process involving stakeholders such as unions, the African National Congress (ANC) and university-based intellectuals. In the events leading up to the adoption of the Revised National Curriculum Statement (RNCS) business and labour had a major influence on the curriculum process; teachers’ unions were not represented in the review of the curriculum, but they were included - albeit in small numbers in the revision process that created the RNCS (Chisholm, 2005: 86).

Allais (2007:63) extends this debate and notes that transition in South Africa was a dual process involving South Africa’s transition to a democracy and its role as a player in an interconnected global economy after 1994. South Africa was caught up in a period of intensifying globalisation and a commitment to devolved forms of management and therefore could not risk isolation. The consequence was that democracy was compromised in the process – democracy depends on commitment to public values such as public education and the common good. The erosion of these commitments by the revival of the free market is a threat to the foundation of democracy (Allais, 2007:63). According to Allais (2007:63), there is tension between global and local goals. South Africa had an obligation towards its citizens to change the system of education, but in formulating a policy it introduced a counter-productive process that involved consultation with international experts to formulate an educational policy (OBE). That policy failed to resonate with local educators on the philosophical and practical levels as it had in other parts of the world especially the UK, Australia and USA.

As mentioned in preceding sections, OBE was seen as an ideal model that had the necessary ingredients for preparing South African citizens to participate in a globally competitive world. The model was introduced to ensure that the state had control over what takes place in education. The new post-apartheid government viewed OBE as progress and yet there have been questions about the role of states and the eroding powers of nations in the face of globalisation. International market systems are believed to influence states so that they abandon national agendas such as public service. And so the question arises as to whether curriculum policy change in South Africa after 1994 was a state initiative or the outcome of a state that had capitulated in performing its role?

The new curriculum reform in South Africa resonated with the language, policy and practice of education in many countries internationally (Chisholm, 2005:81). Others, such as Cross *et al.* (2002:180) explain that the haste with which OBE was implemented could be attributed to the government needing to give the impression that change was taking place and that the expectations of disadvantaged groups were being addressed. They view the process as the 'cleansing' of the old oppressive system in the form of narrowly expressed competencies. Jansen (2002:200) concurs that educational policies were formulated in the political domain rather than in the realm of practice; he refers to the political symbolism of this process and laments the lack of an implementation plan, or rather that less attention was given to the details of implementation.

Formulating proposals for curriculum change or design requires insights into the nature of knowledge, child growth and development, and the appropriate application of different theories. It is questionable whether stakeholders in South Africa spent sufficient time considering such issues. Jansen (2002:205) attributes the neglect of vigorous educational/pedagogic debate in the curriculum policy-making process to the role of international experts who were used in designing/making new educational policy and indicates that the state was more preoccupied with issues of lifelong learning, competencies and outcomes-based education, and these are prominent signals of an international orientation. Nevertheless, he contends that this situation is not unique to South Africa as all nation states develop education policies with a symbolic purpose in mind. In a similar way Elmore (1995:23) points out that even if

systemic reforms aim to change teaching and learning practices, research shows that changes in structure are not related to changes in teaching and learning. Waghid (2003:266) supports this argument and asserts that OBE is not sufficient to change education in South Africa. As Williams and Burden (in Skuy, Young, Ajam and Lomofsky, 2001:3) put it, *merely altering the syllabus is not in itself sufficient to promote change; it is the way in which teachers methodically mediate the curriculum which is significant*. Research has shown that the majority of South African teachers struggle to decode the outcomes-based curriculum (Soudien and Baxen, 1997: 450). This study intended to explore and examine how teachers negotiated this unknown terrain, which was presented in a highly complex language and purported to replace many aspects of what teachers had practised for many years.

The ruling party, the African National Congress (ANC), had to take the lead in state affairs, including education policy; it had to assert its position as a legitimate, democratically elected political player. As mentioned previously, it had to project its vision to create democracy and equity, and redress the imbalances of the past; it had a moral obligation to the people of South Africa. South Africa has a difficult history and faces complex challenges in the search for excellence in education and OBE was introduced by the government ostensibly with the intention to embrace and reflect the values of the new democracy.

The idea of education being a profoundly political exercise is a global phenomenon; from the teaching of values to competing demands for educational resource allocation – these are inescapable features of political debates. In the face of globalisation, the state still controls expenditure and wields law-making power. It is also important to understand the socio-cultural context of policy and the forces that shape policy formulation, especially in a diverse society such as South Africa, and to take cognisance of the fact that policy analysis is itself an ideological exercise. The pace of educational reform in response to politico-economic factors never slows, but simply responds to new stimuli and new developments in markets as capital takes on a global significance within a global agenda (Study Book EDU8151, 2004:44).

The discussion so far highlights the complexity of curriculum change, that is, the multiple and competing forces that influence the development of national curriculum frameworks. However, it may be necessary to move beyond the world of critique and assess how South Africa benefits from an inevitably globalised economy. While OBE has its basic flaws, South Africa does need an education system that addresses the shortage of economic skills as well as issues of citizenship, development and individual accountability. Operating at the micro-level of the classroom, teachers have to interpret the national curriculum statements and translate them into meaningful learning activities for their learners. Documenting how teachers conceptualise the new curriculum and how they experience it could provide important insights into what trickles down from policy into the classroom, and how this weighs up against teachers' own beliefs and how such beliefs influences their agency.

2.3 THEORETICAL ASSUMPTIONS THAT FRAME THE GOVERNMENT'S OBE POLICY

The government chose a curriculum approach that brought about profound changes in the educational system. The advocates of OBE made strong suggestions based on principles of equity, access and redress. At this point, however, it might be useful to look at the definition of OBE proposed by Spady (1994), an educational theorist whose work has influenced the development of OBE internationally. He states that OBE is a method of curriculum design and teaching that utilises the philosophy that all children can learn; it focuses on what learners can actually do after they are taught. It addresses key questions such as: What do we want the learners to learn? Why do we want them to learn it? And how can we best help learners to learn it? And lastly, how we will know what they have learnt? In a nutshell OBE is about developing a clear picture of what learners should be able to do successfully (the outcome) at the end of a significant educational experience. The outcomes become the starting point for developing the content and assessment methods (Spady, 1994:12). Learning needs are met through various teaching strategies; progress is measured on actual achievement after providing learners with adequate opportunities to reach their potential.

Spady (1994) explains that the theory of OBE rests on three assumptions:

- Every student can be a successful learner;
- Success once experienced leads to greater success;
- Teachers need to understand that they have control over the conditions which make it possible for success to be enjoyed by all learners.

Therefore, taking all three assumptions into account, OBE is seen to emphasise achievement rather than simply measurement; the emphasis is on what and whether learning has taken place. It is learner-centred in that the emphasis is on what the learner should be able to know, to understand, to demonstrate and to become.

2.3.1 The five basic principles of OBE

Spady's (1994) theory of OBE advocates a holistic, constructivist approach to learning; it encompasses educational theory as well as classroom practice (Dalziell and Gourvenec, 2003:2). Spady's five principles are discussed below.

a. *Clarity of focus about outcomes*: According to this principle, there must be a clear picture of what learners need to know and do, and everything in an educational system should be organised to enable learners to perform successfully at the end of their learning experience. Outcomes are mostly curriculum or content based and it is possible to measure what the learners are capable of doing. OBE requires learners to demonstrate competence far beyond that of mastering narrow skills. It goes beyond 'structured tasks' by demanding that a student demonstrate his/her skills through performing more challenging tasks such as writing a project proposal, analysing case studies and giving case presentations, etc. OBE identifies higher-level thinking and synthesis of information, and the ability to plan and organise tasks (Department of Education, 1997).

Moreover, the outcomes should be driven by the real world contexts in which graduates will have to live and work; they are defined as demonstrations of learning, something a learner can do or demonstrate, which is life-role focused. It is a demonstration of the entire range of learner experience and the capabilities that underlie it (Spady, 1994:13).

Outcomes are not values or beliefs; they are reflective of what learners can actually do with what they know. This is the procedural knowledge that is emphasised in OBE. The main idea is the approach to planning, delivery and evaluation, requiring everybody to focus attention and effort on desired outcomes (Killen, 2000: 4).

The focus on outcomes encourages integration of knowledge; subject fields lose their boundaries in an attempt to present a holistic curriculum that focuses on future roles. Research indicates that integration of knowledge develops habits of mind which permit truths from one field to illuminate facts from another (Taba, 1962:174). OBE unifies the curriculum by combining closely related areas into one field and horizontal relationships of various areas of learning are packaged into outcomes. This approach will support learners as they try to make information meaningful for themselves by organising it in a coherent fashion. Taba (1962:175) points out that integration permits a more natural relationship of ideas, facts and concepts drawn from different areas of knowledge that approximate those that prevail in real-life situations. One would assume that learning outcomes give focus to the organisation of content; the challenge is to ascertain which elements should serve as the focus for life problems, roles, interest and experiences, or what should be the core ideas.

b. ***Real-life situations:*** According to Spady (1994:16), learning is not significant unless outcomes reflect the complexities of real life and give prominence to the life roles that learners will eventually face. Killen (2000) argues that there is merit in specifying what we want learners to learn, merit in directing teaching towards helping learners to learn things, and merit in assessing whether they have learned it. However, there are challenges and questions that need answers – how can these outcomes be attained in a day-to-day teaching/learning process?

The literature reveals a wide range of questions regarding who determines what learners should know. What type of knowledge is appropriate for particular societies? What is the purpose of schooling? Do universal, compulsory outcomes address specific learning needs and future roles? It must be said that these questions are as old as education itself, they are not uniquely related to OBE. There is no one educational system that can claim final authority over others.

c. ***Designing backwards/down***: This involves designing the curriculum backwards by using the major outcomes as the focus and from that point linking all planning, teaching and assessment decisions directly to these outcomes. This provides learners with a clear path to pursue and achieve desired learning (Spady, 1994:28).

d. ***Consistently high expectation of success***: teachers and administrators are encouraged to set the expectation that OBE is for all learners. Learners are expected to succeed and are encouraged to engage deeply with the issues they are learning and to achieve the high challenging standards. It is believed that learners' level of motivation increases as they gain access to success (Killen, 2000:6). Teachers and learners are partners in an educational experience, and OBE promises new and diverse possibilities, as well as empowerment for both learners and teachers. Learners are active participants who engage in meaningful and deep learning; they are explorative and inquisitive, and teachers are empowered to choose content, delivery methods and assessment techniques to ensure achievement of learning outcomes (Dalziell and Gourvenec, 2003:2). Consistent with high expectation is the notion of quality that is embedded in OBE. It is presumed that high expectations will lead to better-prepared teachers, who are committed to bring about change to improve the quality of education. Another critical dimension in OBE is teacher-learner relationships; the partnerships in the classroom context should have all the ingredients of mutual respect and dialogue, with teachers expected to be lifelong learners and also able to learn from the classroom encounters (Dalziell and Gourvenec, 2003 :2).

e. ***Expanded opportunity***: this entails recognising diversity in learning preferences and provides flexibility in how learners can reach and extend themselves beyond specified outcomes; it develops the curriculum to give scope to every learner to learn at his/her own pace and caters for individual needs and differences; for example, the expansion of available time and resources will allow all learners to succeed in reaching the exit outcomes. Time is viewed as a flexible resource for both learners and teachers. Duration, frequency and precise timing when learning activities occur can be reorganised and adjusted before it is time to demonstrate mastery (Spady, 1994:30). This conceptualisation of OBE is based on the notion that successful learning promotes further success. Learners should also be provided with multiple opportunities to improve the quality of their work. The enabling outcomes that learners need to

demonstrate at certain stages will inform teachers on the progress of the learners and they in turn will provide expanded opportunities to enhance achievement of critical/exit outcomes. Learning activities need to represent a balance of various opportunities of learning and various levels such as application, synthesis and evaluation; this will enhance capacity and motivation to learn.

2.3.2 Clear definition of instructional methods

The proponents of OBE argue that the instructional methods form the basis or cornerstone of teaching practice; therefore, OBE advocates various alternative modes that must be used by teachers to teach in order to assist learners achieve the critical and developmental outcomes by emphasising themes such as problem solving, team work, critical thinking, communication, and appreciation of the impact of knowledge on the world, reflection, collaboration and citizenship (Department of Education, 2003). This might require changes in teaching and learning such as developing an inquiry-based pedagogy. However, there are several questions regarding the definition and interpretation of these instructional methods by educators, policy makers, and teachers. Do all teachers have positive and challenging expectations of learning success? Do the circumstances in the schools allow OBE to evolve naturally? Do teachers have the capacity and skills to facilitate acquisition of knowledge? Do they share similar understandings of the idea of facilitation? The emphasis of OBE appears to be on the learning processes and teaching practice is understood broadly as facilitation without explicitly outlining the techniques; it is left to educators to form their own mental schemas of how to implement this concept in real practice.

Teachers are expected to be innovative and creative, to develop challenging and interactive tasks to enhance learners' achievement of outcomes. Teachers being mediators of knowledge as Mason (1999:141) describes them, means that they will have their own narratives about OBE, mathematics teaching (in this case), integration of knowledge and facilitation; it is important to understand how they make meaning of the new teaching approaches and how these beliefs influence activities and interactions in the classroom. King (2006:7) posits that *the process of implementing OBE involves deconstruction and reconceptualisation of the curriculum from a practice framework; undertaking a major curriculum change necessitates examination of values and beliefs underpinning this practice.*

2.3.3 Assessment in OBE

The assessment in the National Curriculum Statement (NCS) is based on the principles of OBE. The DoE established the national protocol on assessment which aims to standardise recording and reporting for schools from Grades R to 12 within the framework of the National Curriculum Statement for General Education and Training (GET) and Further Education and Training (FET). It also provides a regulatory framework for the management of school assessment records and basic requirements for learner profiles, teacher and learner portfolios, as well as report cards and schedules (Department of Education 2005:5). The NCS assessment protocol reflects a shift from criterion-referenced assessment that was recommended in Curriculum 2005 to a form of standard reference assessment based on a set of outcomes that define what the learners are expected to achieve. There is a set of grade-specific assessment standards that defines the levels of knowledge, skills and attitudes that learners will be required to demonstrate (Vandeyar and Killen, 2006:8).

The entire OBE curriculum is driven by assessments that focus on well-defined learning outcomes and not primarily by factors such as how long the student takes to achieve the outcomes or which path the student takes to achieve the target. The fact that assessment in OBE focuses on the achievement of learning outcomes implies that learners with different abilities will follow different paths to reach their goals and may complete tasks at different times (Vandeyar and Killen, 2006:7).

Teachers are being encouraged to think of attainment of each outcome as a continuum of possibilities rather than in dichotomous terms. This requires testing integrated meaning-making in authentic contexts. Learners are also encouraged to use higher-order thinking and problem solving. Assessment needs to be developmental and integrated into learning. Teachers are to identify the small, context-specific outcomes they want learners to achieve, and to assess learners' performance against these outcomes using agreed standards. What is important is consideration of evidence of achievement (Vandeyar and Killen, 2006:8).

It is advocated that classroom assessment should be both informal and formal, and should be indicative of learner achievement; that feedback also should be provided to learners to enhance the learning experience. Techniques suggested for informal

assessment include observation, discussion, learner-teacher conferences, or informal classroom interactions. Formal assessments could include practical work, projects, tests, oral presentations, exams or demonstrations. Progression and promotion to the next grade should be based on recorded evidence (Department of Education 2005:6). A skill observation profile for each learner is helpful and allows teachers to focus on certain aspects of a learner's competence. Teachers are expected to allow opportunities for learners to talk or write about their own learning, allowing them to assess whether learners are coping emotionally and intellectually – teachers could keep a journal or diary and use them to provide constructive feedback to learners (Department of Education, 2005:4).

In addition, OBE requires ongoing feedback between learner and teacher; continuous assessment helps to determine the extent to which learning outcomes are achieved, to monitor the progress of learners, and determine the timing of assessments. The timing of assessment depends on the readiness of learners as determined by the teacher. Records of learners' performance should indicate progress towards achievement of outcomes; reporting will be accomplished through report cards, parents meetings, school visitation days, class or newsletters (Department of Education, 2005:8). Teachers need to examine these policies from an informed position; however, they can only do so if they have an in-depth understanding of the principles of OBE. Assessment has always been a thorny issue and will continue to be so for many years to come. The orientation or the principles that guide teaching will influence the assessment models teachers choose.

2.3.4 Critical conditions for successful implementation of OBE

As mentioned, the advocates of OBE believe that it can succeed because it creates a successful environment of focused learning, raised expectations, student accountability and expanded opportunity for motivating learners. However, the literature suggests that there are conditions that need to be met to ensure success.

- Each learner needs to be given more than one chance or block of time in which to reach the expected standard. Therefore, this requires no time-bound curriculum; however, the curriculum in South Africa is time bound and there is an urgency to complete 'the syllabus' and prepare learners for external

assessments conducted by the Department of Education (DoE) – this is particularly true at Grade 12 level.

- The path for getting to the stated outcomes should be clear; everybody should share a similar understanding of the meaning of outcomes and assessment instruments should be both valid and reliable. Definition of outcomes should be broad in their vision, but specific enough to be taught and measured.
- Teachers should be involved in all stages of decision making. It has been documented that if teachers do not understand and relate to the changes in education, the system is bound to fail. Teachers should be supported and given adequate training to unleash their potential as transformative practitioners.
- Enough time should be allowed for real change to happen – change always brings about tension and anxiety, and so needs to be managed effectively by making sure that all stakeholders are adequately equipped to deal with the transition.
- Resources – there must be adequate resources to allow teachers to be creative and provide learners with various opportunities to achieve the learning outcomes.
- Teacher-learner ratio – big classes prevent teachers from reaching all learners and providing adequate opportunities to learn; the workload of teachers needs to be reasonable.
- A positive culture of learning and teaching should be in place and schools should be centres of learning.
- There should be a unified and sustained vision among all stakeholders (Jansen 1999; Vandeyar and Killen, 2006; McNeir 1993; Kundlas 1994).

Reports of success with OBE have been documented. A school in Minnesota implemented OBE successfully by focusing on communicating the vision of OBE both internally and externally in the districts, developing pilot programmes, empowering staff, building capacity, being flexible in regulation, and providing specialised training for principals (Sams and Schenkat, 1990:74). It appears that synergy is created when participation is increased and the voices of the people concerned are heard.

2.4 OBE AND CONSTRUCTIVIST PEDAGOGY

OBE seems to find relevance in a constructivist approach that views schooling and education as transformation. Fundamental principles of learning theories that are collectively referred to as constructivism hinge on the following postulations: a) the use of prior knowledge for new learning; b) active involvement in the learning process through problem solving; and c) knowledge which is continually changing (Schultze, 2003:6). One of the basic assumptions of constructivism is that people are active learners and must construct knowledge or meaning for themselves, and that knowledge evolves through negotiation and discourse. The creation of knowledge from experience and the use of that knowledge to support new learning represent fundamental principles of any constructivist instructional model. In terms of this approach teachers are also viewed as learners who are engaged in construction of meanings, including that of OBE. Knowledge is seen as constructed by interactive involvement of the person, through mental and physical processes, and within environmental exposure (Prickel, 2000:4)

Learning is achieved by exploration and experimentation. Successful teaching and learning employing the social constructivist model hinges on the cognitive ability, internal motivation and collaborative learning skills of the learners as much as on the external motivation comes from the teacher's pedagogy. It is essential that teachers develop the skills that address learners' needs to participate within a constructivist learning framework. Teachers are expected to make choices regarding materials that provide scaffolding and involve the learner actively; they are required to respond to different learning preferences by providing multiple cognitive networks and pathways as well as providing constructive feedback in assessment (Schultze, 2003:6). In this way the teacher determines and controls the number of tasks to be learned and, based on the progress of the learner, he/she provides support, extends the range of the learner and permits the attainment of tasks not otherwise possible. The principles of OBE rest on similar assumptions.

In social constructivism knowledge is not seen as being transferred intact from the teacher to the learner. Instead knowledge is seen as being constructed in the mind of the learner. Schultze (2003:6) further argues that each learner brings his or her own prior knowledge and experiences to any learning situation. Learners make sense of the

new knowledge and then develop their original concepts as learning takes place.

Constructivist philosophy does not dictate how one should teach; however, it does make it incumbent upon the teacher to deal with each learner as an individual, to value diversity of perspective, and to recognise that the learner's behaviour is a direct reflection of his/her life experiences. Constructivist teaching practice assumes that the motivation to learn is internally generated by the child. One key notion contends that since the learner has an active role in interpreting the learning process, education should be child directed not teacher directed (Prickel, 2000:4). OBE encourages active participation of learners and teacher facilitation of learning; this principle resonates with constructivism. Collaborative learning is another example of where groups of learners construct new knowledge as they collaborate to identify problems and seek solutions.

According to Spady (1994:45), the whole goal of knowledge acquisition is to cultivate the ability to function successfully in life roles such as being a constructive producer, citizen, family member and lifelong learner. This understanding is based on the conception that the role of education is to create a 'new social order'. Therefore, OBE requires teachers to conduct their classes in a way that is far from routine; that introduces multiple forms of inquiry and leads to learners' engagement and empowerment. As envisaged in the OBE model, the goal of outcomes is to cultivate the ability in school-leavers to function successfully in life roles.

2.5 CRITIQUE OF THE PHILOSOPHICAL ORIENTATION OF OBE

The transition to OBE sparked national debate and attracted a great deal of criticism. Critiques of OBE encompassed a variety of concerns about theory and implementation. While some perceived OBE as the educational innovation required for equity, redress and equality, others saw it as a system that had already failed in other countries. Critics argued that the historical origins of OBE include behavioural traditions which focus on external observable behaviour. This is perhaps the main criticism of OBE, namely that learners are required to demonstrate the ability to perform visible and accessible behaviours. This approach is consistent with the mastery learning model; competence and performance are brought to the centre stage

of education (Fakier and Waghid, 2004:56). The mentioned authors further argue that OBE fails to recognise that human behaviour and understanding entail a complex series of activities, none of which can be defined in terms of outcomes.

The key features of OBE that attracted fierce criticism were its knowledge base, rigid outcomes, the central role of business and labour in its adoption in South Africa, low participation of educators in its conception, and its inaccessible language. The debate included questions around the purpose of education, the impact of globalisation on education policy and the role of international experts. Its detractors are mostly concerned with the emphasis on outcomes at the expense of knowledge acquisition and its emphasis on procedural knowledge; they are critical of what they see as an input-based model that underpinned apartheid schooling. Mason (1999: 138) refers to this heavy emphasis on procedural knowledge as problematic, as it sounds as if learners are expected to know how to perform a task without providing them with the associated critical theory.

Pre-determined outcomes were criticised in many quarters (Fakier and Waghid, 2004; Jansen, 1999; McKernan, 1993) for failing to take into account the complexities of the curriculum and the importance of the individual context in which every act of teaching occurs. The point that critics make is that human behaviour cannot be defined in terms of outcomes, or the interpretation of outcomes as an indication of learner responses to learning. They suggest that education should be an open-ended activity and the ideas of remediation and reassessment must be built into any education system. This notion is supported by Waghid (2003:255), who contends that rigid outcomes run counter to the basic elements of education and stifle the autonomy, growth and development of both teachers and learners.

McKernan (1993:345) provides further insights questioning the notion of predetermined outcomes and asserts that they contradict the liberal conception of education and knowledge. He states that treating knowledge as a means to a specific end denies the possibility that educational experiences are valuable for their own sake. The linear OBE model does not promote not reflection or self-examination, but dictates the ends of learning before teaching and learning have begun. He noted a tendency also for outcomes to be stated in such a way that external testing is the only

way of determining whether or not they have been met. He also questioned how education will maintain a balance between curriculum content and the OBE processes, restructuring teaching practices to allow for expanded educational opportunities and creating methods of assessment.

Critics also argued that outcomes were externally imposed and externally monitored through standardised exams. The idea of national testing is viewed as an antithesis to the very fundamental principles of OBE, i.e. learner autonomy, learner needs, flexibility and self-pacing, and that this would appear to be self limiting. Peters (1973, cited in Kelly, 1977:25) writes that education *can have no ends beyond itself since it is its own end, to be educated is not to have arrived at a destination, it is to travel with a different view*. Education should develop personal autonomy, understanding, cognitive perspectives and recognition of the values of certain kinds of activity. Outcomes represent a utilitarian view of education to learners. Predetermined outcomes negate the very scientific premise that every scientific hypothesis is problematic and subject to modification or rejection. Learners and teachers need to be allowed to evaluate the outcome of experience.

Strong arguments against OBE point to the demise of knowledge or disciplinary content. OBE is critiqued for lacking conceptual coherence, and as having inadequate mechanisms for sequencing, progressing and pacing (Allais 2010). Most recommend the reversal of the current curriculum and the adoption of basic education, as advocated by Morrow (2007, in Shalem and Pendlebury, 2010). Allais (2010:29) seems to be against the idea of teachers being the designers of curriculum – she states that teachers' basic role is helping learners to know what they need to know and be able to do. This argument however, does not acknowledge the role that competent teachers can play as creators of learning material and curriculum.

2.5.1 Implementation challenges

The second level of critique centres on implementation challenges. At the heart of the argument is the view that OBE is structured so as to preserve and perpetuate social class differences. Some critics of OBE say the system further entrenches inequality in South African schools. They argue that some teachers in the previously advantaged

schools were in a better position to implement the changes; they were better resourced, well qualified and well supported by the school governing bodies that controlled the schools' budgets and admission policies. The majority of teachers were faced with extremely complex conditions, large classes, teaching overload as a result of rationalisation of teaching posts, inadequate resources and limited understanding of what was required of them (Jansen, 1999:137). OBE required teachers to be architects of sophisticated educational designs that were alien to most of them. Several studies indicated that teachers were not ready to implement the new learning model. Chisholm (2000:48) found that there was a huge gap between what teachers professed to know about OBE and what they actually did in the classroom. This discrepancy was attributed to teachers not having adequate conceptualisation of the fundamentals of OBE.

Jansen (1999:139) predicted that OBE will fail because it was founded on inaccurate assumptions about what happens in the classrooms. He also added that provinces used ineffective approaches for implementation, which was confusing for teachers. Additionally, very few teachers and trainers had first-hand knowledge of the types of curriculum and teaching envisaged and very few schools had the capacity to manage the changes. Cross *et al.* (2002) as well as Jansen (1999) point out that the legacy of discriminatory funding policies are still visible today; the differences in resources, qualifications, experience and expertise in schools pose complex challenges for the successful implementation of the system. They assert that OBE documents were problematic and led to a variety of interpretations by trainers, education department officers, non-governmental organisations (NGOs) and writers of learning materials. This was further exacerbated by the fact that most of the teachers' and trainers' own experiences and habits were very different to those outlined in C2005 (De Waal 2004:55). In cases where schools and teachers embraced learner-centred education, the original vision of C2005 was lost in the implementation and also that the progression of concept development from grade to grade was also often inadequate because of the focus on integrating learning areas (Jansen 2002; De Waal, 2004: 56).

There have been many subsequent critiques of OBE in South Africa and abroad. For example, training programmes and support were found to be insufficient and often did not model the approaches they were promoting. Policy making and implementation

was a top-down bureaucratic process with multiple complex layers that made teachers' roles challenging. Teachers' experiences and existing professional insights were largely ignored. As the critics had warned, implementation became extremely problematic. The Chisholm Review Committee (2001) concluded that the complexity of the structure and design of the curriculum had compromised the implementation of C2005. Furthermore, poor departmental support to teachers, weak support of teacher training, tight timelines, lack of learning support materials and the general lack of resources had negatively affected the implementation of C2005, and the revision of the curriculum did not result in changes in the critical areas of teacher training and resources (Chisholm, 2000:27).

Central to this thinking is the belief that the strength and purpose of OBE rely not only on its theoretical principles, but on its successful implementation by the teachers. The current generation of teachers had been working in difficult conditions for their entire professional life; however, most demonstrated creativity and good student outcomes. Prior to the introduction of OBE, some rural schools in Limpopo province produced good matriculation results; one of the schools (Mbilwi High School in Venda) consistently made it to the top ten of the most progressive school nationally. This province has grossly under-resourced schools, yet witnessed high-level activity in the improvement of qualifications among teachers. This study contends that the focus should be diverted to the quality of teacher education and recognises that teaching practice is fundamental to curriculum reform. Also, the over-emphasis on lack of resources as the main constraint to achieving aims of OBE portrays teachers as helpless beings who cannot think beyond the limits of resources. This study assumes that teachers are creative beings and have the capacity to overcome challenges, that they can create learning environments that foster critical thinking and problem solving, as demonstrated by teachers in the secondary school in Limpopo.

It is important to understand how teachers make decisions in the midst of these challenges and complex curriculum changes. Much as contextual issues are important in classroom decision making, there are also other factors at play such as the personality of the teacher, level of preparation, commitment to the profession, culture of learning, ownership of the reforms as well as other issues that are important to the professional lives of teachers. At the end of a learning episode change occurs in both

directions; the change is the outcome of an educational encounter. People (in this case teachers) who have the power to drive this change hold personal beliefs about, and attitudes to, curriculum change and curriculum processes, and construct explicit meanings regarding these processes. Undertaking such a major educational change may challenge teachers at various levels of their personal and professional lives. The manner in which these challenges are negotiated will impact on the level of success in the implementation process.

2.6 CURRICULUM, EDUCATION, KNOWLEDGE, TEACHING AND LEARNING

Questions about what constitutes knowledge, the purpose of education and who decides on the outcomes are many (Jansen, 1999:65). Different schools of thought advance sound arguments regarding education, knowledge, learning and effective teaching. Globally the debate about knowledge for curriculum development centres on what constitutes adequate knowledge, the function of knowledge, who decides what knowledge to include into the curriculum, the relationship of certain subjects to the cognitive development and mode of delivery (Kolodner *et al.*, 2003). The notion of viewing education as means to an end, the lack of a comprehensive research base before OBE was implemented, and rigid vaguely defined outcomes were the strongest objections to OBE. The major controversy centred on content and process, and critics argued that OBE trivialises content (McNeir, 1993:16). They contended that knowledge is unpredictable and explorative and therefore cannot be packaged into specified outcomes.

Mason (1999:139) concurs that OBE neglects specific disciplinary knowledge in favour of loose interdisciplinary and cross-curricular outcomes organised around competencies. He also criticises the view of teachers as facilitators; according to him this description suggests a passive role. He argues that teachers are critical mediators of knowledge and that their role is more than facilitation; *it involves leading learners to increasing levels of complexity by providing scaffolding for them to reach the next level* (Mason, 2000:345).

Berlach and O'Neill (2008:49) argue that epistemic essentials form the core of any change, and unless such imperatives are considered at the planning stage of proposed curriculum innovation, operationalisation for the classroom is likely to fail. There needs to be an agreement on core concepts such as perceptual, intellectual and linguistic factors through which knowledge and understanding are achieved and communicated. With OBE this means agreeing upon what is meant by the model (theoretical dimension) and envisaging how the system could most effectively be implemented.

The emphasis on educational transformation in SA combined elements of social justice, redress, access and economics. The new education policy was used as an agent to address the inequalities of the past; therefore, the curriculum process had heavy political overtones. Some argued that South African OBE places less emphasis on what constitutes knowledge and the type of knowledge envisaged for the learner (Fakier and Waghid, 2004:54). Education is viewed as a tool for economic growth and development; the outcomes are thus driven by strong economic and political imperatives to produce learners that serve the interests of the market; the aim is to create a more productive, literate and technologically sophisticated workforce. However, Chisholm (2005:84) contends that despite the market-driven education policies, the discourse also emphasises issues of justice, development and nation building.

Similarly, the Western Australian model of OBE as indicated in Spady's 'Paradigm Lost', was shrouded in controversy. The teachers and university educators were alarmed that some courses that had been tried and tested and possessed content rigour were discarded in favour of vague outcomes (Berlach and O'Neill, 2008:52). Teachers viewed an 'open' interpretation of the curriculum, as advocated by OBE, as problematic, because it results in a lack of fundamental agreement on what constitutes the curriculum. Jansen (1998:333) supports this stance by arguing that OBE focuses on a given set of outcomes and sidesteps important issues of values in the curriculum; it enables policy makers to avoid dealing with a central question in the South African transition, namely what is education for? Who chooses curriculum content and under what conditions?

OBE does not make clear what clusters of knowledge or content should be brought together to facilitate learning, or the sequence and level of competence. Knowledge is reduced to the constructs that teachers and learners bring to the classroom or to group work activities to the extent that disciplines of knowledge might be neglected. The pedagogical and cognitive aspects of schooling in South Africa have been lost through over-emphasis on outcomes (Cross *et al.*, 2002:181).

What then constitutes adequate knowledge? What is the function of content in the curriculum? Or rather, what is the role of content in the development of mental processes? Taba (1962:172) answers these questions in *The Nature of Knowledge* by bringing to the fore the significance of subject area knowledge, and points out that a curriculum that is organised around selected basic ideas might offer possibilities of mastering special methods of thought and inquiry. Furthermore, he explains that the study of subject area knowledge should result in the acquisition of skills, attitudes and disciplined habits necessary for the discovery of new knowledge in a field. Disciplines and subjects vary in their impact on the mind of the learner; therefore, sound curriculum development needs to analyse what these variations are and strike a balance in organising curriculum content and instruction (Taba, 1962:180). He maintains that the nature of content determines the analytical, critical thinking and inquiry processes; however, he also acknowledges that it may be difficult to reach consensus as to what constitutes basic ideas and principles. It is assumed that it will also be difficult to agree on what knowledge is most worth including in a South African curriculum.

This argument raises questions regarding content and process, and about how OBE maintains this balance. What informed the selection of outcomes in South African OBE and what pedagogical processes were followed? Much has been said about the latter and the role of politics in the curriculum process. According to Jansen (1998:330), there is no evidence in almost 80 years of curriculum change literature to suggest that altering the curriculum of schools leads to changes in national economies. He notes furthermore that in South Africa there was never a process where teachers were allowed to conceptualise and make sense of OBE as curriculum policy.

What is the curriculum? One of the issues which make the task of defining a curriculum difficult is the fact that so many scholars in the field have previously attempted this task and they have come up with so many different conclusions. For years the debate about the curriculum has been over procedures, not over what counts as legitimate knowledge (Study Book EDU8151,2004:12). In some sectors the curriculum has been defined as content, plan, process and product. The South African approach appears to endorse the definition of the curriculum as a process; the emphasis of OBE is on the design, the planning of learning activities, the facilitation of learning and the learning process.

The literature documents another perspective, a critical complex empiricism. It indicates that knowledge is fragmented, diverse and always constructed by people coming from different contexts; such knowledge does not lend itself to propositional statements, i.e. final truths (Kincheloe,2004:2). Critical complex empirical knowledge does not seek justification by reference to universal truths; it is dialectical and therefore acknowledges that there is no single explanation of any phenomenon and no one question is superior to others. This view holds that tensions between accounts will persist and alternative perspectives will continue to struggle for acceptance. Critical complex empiricism never prescribes content and validated techniques for teachers to use. There is no certain knowledge about what subject matter to teach, or a proper way of developing curriculum, or a correct understanding of learners, or the right way to teach. The relationship between such knowledge and practice is always open to discussion and interpretation (Kincheloe, 2004:2).

This approach allows teachers to operate within a given structure that determines content and allows for individual interpretation and creativity. Teachers are viewed as scholars who are never fully educated; they are 'in process', waiting for the next learning experience such as the evaluation of learner response to the instructional method, and trying out new ways of taking them to the levels of problem solving and critical thinking as envisaged in OBE. The vision of OBE was to empower both teachers and learners by providing the tools of analysis, critical thinking, problem solving, creativity, inquiry and self-determination. However, much needs to be done to explore how these processes evolve during the classroom encounters, teachers' thinking processes, their beliefs regarding the purpose of education, teaching, learning

within an OBE environment, their opinions/beliefs regarding what is required of them, and how these beliefs translate into authentic pedagogy.

2.6.1 The philosophy/nature of mathematics

Questions about knowledge, teaching, learning and the curriculum underscore the need to explore what is really meant by knowledge of mathematics and knowledge about mathematics. The literature reveals a broad range of positions with regard to the nature of mathematics; the debates seem to revolve around whether mathematical objects such as numbers and points exist naturally or are human creations (Schoenfeld, 2004:256). The context of the current debate can be characterised by a number of issues, for example, the subject mathematics, the curriculum, the mathematics teacher, the learner of mathematics, the milieu of teaching, the relationship of mathematics teaching and learning, and its aims for society (Ernest, 2004:8). It is difficult to source literature on the nature of mathematics; however, the following themes appeared to be consistent in reviewed studies: a network of logical relationships and connections; appreciation of the role of proof; universality of the discipline – it is viewed as the basic language for other disciplines such as business, sciences and technology; the associated generic skills that make it ‘special’ such as logic, rational thought, creativity and problem solving (Mwakapenda, 2007; Cobb, Yackel and Wood, 1992; Burton, 1993). The South African National Curriculum Statement (NCS) Grades 10-12 defines mathematics as follows:

Mathematics enables creative and logical reasoning about problems in the physical and social world and in the context of mathematics itself.

The purpose of mathematics in FET is the establishment of proper connections between mathematics as a discipline and the applications of mathematics in the real world (DoE 2003:9).

This definition recognises creativity, logical thinking, problem solving, as well as the usefulness of mathematics. It is also presented as a universal discipline whose concepts could be utilised in other fields. It is generally believed that mathematics provides powerful conceptual tools that lead to theories of abstraction. There is also an ‘unspoken’ elitism and sense of indispensability associated with the discipline; perhaps this attitude could be traced to the statement by the famous 18th century mathematicians Gauss, who said that *mathematics is the queen of sciences*. Euclid’s

Elements, referred to as the postulate of absolute geometry written in the 300 BC by a Greek mathematician, served as the supreme exemplar of the possibility of certainty in human knowledge (Piccolo 2008:46). Hand, Williams and DeAnda (2007:154) support this understanding by arguing that the discourse of mathematics carries considerable weight and seem to perpetuate itself by virtue of this power: *K-12 mathematics has significant status, it serves as a gate keeper to higher education, it is perceived as a proxy for general intelligence and a marker of international dominance.*

Albert Einstein, on the other hand stated that *as far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality* (Skemp,1976:23). Other contentious issues around mathematics involve the role of theory, mathematics education and mathematics education research. English and Sriraman (2005:170) contend that much as there have been significant advances in mathematics education research, there has also been fierce critique against its lack of focus, its diverging theoretical perspectives and continued identity crisis. The possible explanation they give for the diverging perspectives is that mathematics, unlike other 'pure' disciplines, is influenced by *cultural, social and political forces*. Issues often raised include:

- The role of theory in mathematics education research;
- Currently accepted and widely used learning theories in mathematics education research;
- Constructivist learning theories;
- Theories of models and modelling and the impact of these theories on mathematics research, teaching, and learning;
- The relationship between researchers' beliefs about the nature of mathematics and their preference for a particular theory (English and Sriraman, 2005:170).

Despite diverging epistemological perspectives about what constitutes mathematics knowledge, two major positions that accommodate most views have emerged, namely Absolutist/Platonist and Relativist/Fallibilist perspectives (Ernest, 1989, 2004; Schoenfeld, 2004).

2.6.1.1 Absolutist/Platonist/Instrumentalist views of mathematics

The Platonist view, so named because of its roots in ideas of Plato, stems from an absolutist view of mathematics as a divine gift without error or contradiction. This school of thought believes mathematics to be infallible because of its existence beyond humanity (Ernest 2004:6). In this view mathematical knowledge is envisioned as a fixed subject of absolute truths (Schoenfeld, 2004: 263). In the Platonic view mathematics has evolved precisely as symbolic counterpart of the universe; *god's place in the universe has imposed mathematics upon humanity. Elevating the status of the subject beyond humanity can only mean not everybody will succeed*; it becomes a place where those who are specially blessed can understand mathematical truths, while many others are left behind (Schoenfeld, 2004:266). Abstract objects that are wholly non-spatiotemporal (unchanging and entirely non-causal), non-physical and non-mental (they have always existed and they always will exist) are emphasised. There is a belief that there are true mathematical theories that provide true descriptions of such abstract objects – *meaning that mathematical theorems provide true descriptions of such objects, for example, positive integers* (Schoenfeld, 2004:266).

Mathematics competence is directly related to what one knows (facts, procedures, conceptual understanding), and knowledge accumulates with study and practice. It is seen as an *objective, absolute, certain and incorrigible body of knowledge which rests on the firm foundations of deductive logic* (Ernest, 2004:8). The perfection of the domain is emphasised.

This view, according to Schilling(2009:4), would indicate that mathematic is not created but exists independently of the individual; she furthermore argues that the language used in textbooks to define mathematics conveys a certain image, for example, the language such as: *the theorem says*, indicates that the subject is something that can occur on its own without humans. This seems to suggest that the *reader of mathematics is not involved in creating knowledge*. Furthermore, she describes textbooks that project an instrumentalist view of mathematic as a collection of *unrelated but utilitarian facts and procedures* used by those trained with the tools to accomplish specific outcomes. It would then appear that this perspective portrays

mathematics as logical, closed and focused on ontology rather than meaning (Ernest, 1989a :13).

The curriculum in this view emphasises content and understanding, the focus of teaching is to help learners develop relational and instrumental understandings of the ideas and processes of the subject, that is, knowing why and how. The structure of the subject matter and lesson is offered in ways that fit the content and this calls for a variety of strategies to develop topics to be learned. Kuhn and Ball (1986:8) posit that teachers in this approach are expected to have the knowledge of the discipline and knowledge about mathematics. Knowledge of the discipline involves knowing about the evolution and growth of mathematical knowledge in the discipline community, for example, *knowledge about development of numeration systems as a wider base from which to evaluate curriculum materials*. Learners have an image of mathematics as confounding common sense and *obeying mystical laws which are inaccessible to ordinary individuals* but are conveyed by the teacher (Burton, 1993:10). The emphasis is on learners demonstrating the ability to get the correct answers and on using algorithms.

2.6.1.2 Fallibilist/Social constructivist view of mathematics

Social constructivism is a philosophy of mathematics that grew out of Vygotsky's (1978) work in social learning theory (Ernest, 2004:9). It rejects the narratives of certainty and claims that representations of mathematical knowledge cannot be divorced from acts of meaning construction; therefore learners are engaged in various cognitive actions acquiring this knowledge. This view demands a new way of understanding; the emphasis is on the context and meaning of mathematics for the individual, real-world application, process, collaborative learning and problem solving. There are no absolute truths; the question about correctness is replaced by usefulness (Ernest,2004:10).

The primary mode of learning is problem solving, and the curriculum and content are driven by learner needs. Teachers therefore do not feel compelled to follow a fixed schedule of content to be covered. Lessons are organised around activities to be completed by individuals or groups working cooperatively. Teachers are expected to have advanced problem-solving skills and advanced curricular knowledge, this

includes knowledge about resources, materials and tools that support applications of mathematics. Kuhn and Ball (1986:8) posit that knowledge in this area grows out of teachers' knowledge of mathematics and other disciplines; for example, *a teacher who is familiar with Islamic art might know that prints of the tiled floors can be used to teach geometry concepts of symmetry and tessellation*. Teachers need to understand ways to stimulate learners' interest and encourage participation.

Collaboration in learning is seen as a means to maximise engagement in the *critical mathematical processes* (Delaney *et al.*, 2008:178). Teachers must understand group dynamics and encourage small group learning, identify suitable projects and possess skills in questioning such as, for example, convergent or divergent questioning. This view emphasises the human activity aspect of mathematics by using concepts such as analysis, reasoning, enquiry, discovery and construction. Mathematical claims to truth are determined by agreement among humans.

2.6.1.3 Teaching and learning mathematics

Researchers have explored a number of alternative approaches to mathematics teaching; the field is replete with 'effective and good' strategies and methods related to pedagogy content knowledge. It is believed that teachers' knowledge of mathematics and their ability to utilise that knowledge in the classroom matter for the quality of instruction (Seago and Goldsmith, 2006:5). Furthermore, building on the model devised by Shulman (1986) cited in Piccolo, (2008:46), it would seem that the ability to teach mathematics content is influenced by general pedagogy, pedagogical content knowledge and mathematical content knowledge. Shulman (1986) describes content knowledge as the knowledge, understanding, skills and dispositions that students learn. General pedagogical knowledge is defined as broad teaching strategies, such as classroom management and pedagogical content knowledge as *the blending of content and pedagogy into an understanding of how particular topics, problems or issues are organised, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction*.

Another view that appears to extend Shulman's (1986) model is referred to as mathematical knowledge for teaching; this knowledge includes disciplinary knowledge as well as pedagogical content knowledge, that is, knowledge of how to

make mathematical ideas understandable to learners (Delaney, Ball, Schilling and Zopf, 2008:174). Therefore, effective and good teaching is dependent on the teacher's own understanding of mathematics and the ability to deploy it in teaching practice. Furthermore, Ball and Bass (2000:89) identified several core activities of mathematics teaching such as *figuring out what students understand, analysing methods and solutions different from one's own and comparing them, unpacking familiar mathematical ideas, principles, and choosing representations to effectively convey mathematical ideas.*

In terms of OBE, teachers are required to provide support for learners as they engage in mathematical sense making; this means having a sense of when to let learners explore and 'discover', and when to tell them what they need to know and knowing how to guide them without stifling their creativity. The National Curriculum Statement (NCS) was designed to reflect specific outcomes, topics learners needed to be taught; it included both general and content pedagogy skills such as planning lessons, activities and standards for assessment. Therefore, teachers are expected to be theorists, programme developers and experts in the field of mathematics. One of the areas that attracted the profound critique against OBE was that the policy ignored the disparities among teachers, the social relations in the classrooms and the qualifications of teachers (Jansen, 1998). Although the government identified mathematics and science as key school focus subjects to reach its education development goals – and mathematics has been made a compulsory subject in the General and Further Education and Training bands to increase pass rates in the subject – the persistently low pass rates have become a matter of urgent concern. Howie (2003) cited inadequate subject knowledge as one of the main contributory factors in the mathematics failure rate.

In response to these challenges, the government established the National Strategy for Mathematics, Science and Technology Education (NSMSTE) in 2001 with the goal of improving the quality of teaching and learning mathematics and science, and doubling the number of South African learners passing Higher Grade (HG) Mathematics (DoE, 2006). The need for pedagogical content knowledge is illustrated by Shulman's (1986, cited in Delaney *et al.*, 2008) calls for radical changes in professional

development programmes in South Africa. The following issues would need to be addressed as a matter of urgency:

- What teachers do during mathematics lesson – for example, the amount of time a teacher devotes to whole class instruction compared to working with groups or individuals;
- Beliefs about mathematics knowledge and mathematics teaching;
- Classroom context in which knowledge is used;
- Differences in the types and levels of sophistication of the explanations learners offer;
- Mathematics language used in school;
- Content of textbooks (Delaney *et al.*, 2008: 178).

The authors acknowledge that the issues raised above are understood and presented differently by various researchers. What is paramount is the knowledge of content and the presentation of that content in a way that is meaningful to learners. It is interesting to note that the issue of teachers' beliefs seems to appear in most literature that addresses mathematical knowledge and mathematics teaching and learning. This would suggest that, in the absence of consensus about best practice based on empirical evidence, the importance of teachers' beliefs would be elevated (Snider and Roehl, 2007:874).

2.7 THE CURRENT STATUS OF CURRICULUM REFORM IN SOUTH AFRICA

Widespread criticism against OBE continues in South Africa and critics have become more vocal, calling on the government to scrap the system. Mamphela Ramphele claimed in a conference in Cape Town that *OBE has failed the nation, weakened the educational system* and urged South Africa to return to basic skills such as reading, writing and reasoning. Furthermore, she argued that it does not represent the *world's best curriculum* (Ramphele,2009:2). She and many other educationists have challenged the government to accept the demise of OBE. The main argument centres on knowledge and OBE. Critics argue that OBE has failed to engage issues relating to

the quality and the character of knowledge. They claim that the essence of schooling and knowledge acquisition has been lost, and that an emphasis on justice and equity had the effect of making subject disciplines ambiguous (Soudien and Baxen, 1997:460). Spady also added his voice to these critics during his visit to South Africa in 2008; he asserted that the approach South Africa followed was never been the form of OBE he advocated. He alleged that South Africa confused transformational OBE with change to democracy.

As the debates rage on, teachers have become despondent and there was lack of will among learners to engage in learning. There has been a lack of progress in implementation and transformation; the benefits of OBE have not been particularly evident. The Minister of Basic Education therefore established a task team to look at the obstacles to implementing the curriculum in South African schools. The report presented to the minister showed that in most schools OBE has not produced the desired effects. It recommended changes that will relieve teachers and schools of some of the burdens experienced as a result of the current curriculum and assessment policies. The focus is to be shifted to quality, coherent, teachable curriculum and good teacher practices, thus allowing teachers adequate time to focus on their primary function.

This report confirms that the OBE philosophy was misunderstood or applied wrongly by both government officials and teachers. Responding to calls to abandon the OBE system, in November 2009 the minister announced: *We have signed the OBE death certificate* (Department of Education, 2009). The Minister asserted that education must return to tried and trusted teaching methods as OBE has failed to provide learners with essential skills; however, she was quick to add that South Africa is still committed to non-racism and equity, and that those fundamental values will still be delivered through critical outcomes. This is an indication that there is a strong intention to have learners who can read, write and calculate. The minister also mentioned that textbooks will be reintroduced and each learner will get one for each subject; English will be introduced earlier than Grade 3; external examinations will be introduced earlier; and there will be fewer projects and no more portfolios for Grade 12.

In a nutshell the changes recommended by the task team involve:

- Reduction of administration and reporting procedures;
- Initiation of changes in the curriculum to make the curriculum statements clearer and simpler;
- Teachers will develop only one teacher file irrespective of subjects taught;
- Learner portfolio as separate compilation of assessed tasks will no longer be required;
- Informal or daily assessed tasks are to continue but not to be recorded;
- Guidelines for each subject will be developed by the Department of Basic Education for teachers;
- Visits by curriculum advisors will be more supportive;
- National Catalogue of textbooks for Grades 10 to 12 will be utilised (DoE 2009:2)

The Minister of Basic Education's address signals a new wave of change; however, it is not known how this change will take place. This study presumes that policy makers will draw on past experiences and retain what is beneficial from OBE as they again grapple with a new identity for the South African educational system. It could also be argued that OBE does contain some principles that can benefit both learners and teachers, and that simply discarding it in totality would be a highly costly exercise that South Africa cannot afford.

The new proposals focus on the practice of teaching and teachers will be relieved of cumbersome administrative tasks; however, they are also encouraged to avail themselves of opportunities for professional development and to improve the quality of teaching and learning. It could be argued that until a complete curriculum revision takes place, teachers will still be confronted with elements/remnants of OBE. It must be pointed out that the OBE debates took place mainly in universities and the labour and business sectors, and that there was a low level of participation among secondary school teachers in such debates because it was assumed that the majority lacked the sophisticated language to engage in epistemic debates.

McNiff (2005:2) observed a tendency among the scholarly community to ignore or fail to acknowledge teachers as educational theorists; she refers to this state of affairs as epistemological hegemony in which higher education is seen as the site of knowledge generation and schools as sites for knowledge implementation. She argues that teachers need to be encouraged to engage in discourses on the epistemological base of professional education.

It is assumed that a perspective on teachers beliefs about OBE can provide an interpretative lens for policy makers to use in understanding teachers' personal theories and behaviour; it is also believed that the success of educational reform movement in South Africa hinges on teachers being articulate about the methodology of teaching an outcomes-based curriculum (or any other approach), and believing in its merit. Even though the Minister has signed the OBE death certificate, teachers are still operating in the outcomes-based education milieu, as nothing has been advanced yet to replace the outcomes. Just as in any other educational setting, teachers will still be expected to design learning activities until the new curriculum statements are ready. Even though the empirical work for this study was conducted during the recent developments that might signal the demise of OBE, this study could provide meaningful insights into the implementation of curriculum policy changes during further curriculum reforms in South Africa.

2.8 TEACHERS' BELIEFS AND PEDAGOGICAL PRACTICES

As mentioned above, this study explores the nature of beliefs, or implicit theories, that influence teachers' practices; it investigates how teachers make sense of OBE as well as their experiences of an outcomes-based curriculum so as to get an in-depth understanding of whether or not these beliefs match the system of educational reform that was advocated by the South Africa government over the past decade and a half. It has been widely documented in the literature that beliefs and practices are important for improving educational processes, and that they are closely linked to teachers' strategies for coping with the challenges in their daily professional lives (Pajares, 1992:310). Therefore, in order to understand how teachers approach their work, it is necessary to understand the beliefs and principles in terms of which they operate.

Research on epistemological beliefs has made an important contribution to education, most fundamentally in identifying epistemology as a category of informal knowledge that may play a role in an individual's reasoning and knowledge (Hofer and Pintrich, 2002:170).

A fundamental assumption of research on teacher beliefs has been that an individual's behaviour is ultimately a product of his/her beliefs; consequently any attempt to change the practice of teachers must of necessity involve change in the beliefs of teachers. Research shows that each teacher possesses an individual philosophy of teaching and learning that guides behaviour and becomes the basis upon which they defend and practice what they do (Hofer and Pintrich, 2002:171). An exploration of teachers' conceptualisation, beliefs and experiences of an outcomes-based curriculum is necessary, so that the development of teachers' personal philosophies of teaching can start from their current experiences and understanding.

This study refers to conceptualisation as arriving at the meaning of a concept or a generalisation as a result of things seen, experienced or believed. The study assumes that one needs to experience something in order to form a mental concept (belief); each belief corresponds to a unit of cognitive structure and in this way individuals create a mental framework (conceptualisation). The key focus of this study is therefore on teachers' beliefs about the nature of OBE and effect of such beliefs on classroom practice. The discussion of teachers' personal beliefs takes into account their experiences and conceptualisation. Fakier and Waghid, (2004:59) define education as a *critical dialogue between teacher and learners who are both constantly searching for truths*. Therefore, teachers persistently make curricular classroom decisions based on their own affective and cognitive schemes.

2.8.1 Definition of beliefs

Various researchers have suggested a number of definitions or descriptions of the term 'beliefs' over the past two decades (Barkatsas and Malone, 2005:69). A review of the literature suggests that there is no agreed definition of what the concept 'beliefs' means (Beswick, 2007: 111). The difficulty of defining teachers' beliefs may be complicated by the fact that teachers' thoughts are unobservable; therefore, they

are not as easily measured and evaluated as actions and their perceivable effects. Because beliefs have such a covert nature and might not be observable, even the teachers holding them may not recognise them (Prawat, 1992: 355). However, this is disputed by Hofer and Pintrich (2002:173), who view personal beliefs as elements of cognitive structure to which individuals can have conscious access and can articulate.

Researchers, in an attempt to develop a coherent definition, have conceptualised beliefs as a set of assumptions that teachers hold on various educational processes such as the curriculum, schooling, learners, teaching and learning, and knowledge. These beliefs are seen to act as mental models driving teachers' practice and processing of new information, or as mediators between curriculum goals and their actual implementation (Lising and Elby, 2005:373). Various typologies have been used to describe teachers' beliefs. For example, Fennedma, Carpenter, Franke, Jacobs and Empson (1996, cited in Barkatsas and Malone, 2005:71) categorised beliefs in four levels:

Level A: teachers who believe that learners learn best by being told how to do mathematics;

Level B: teachers beginning to question the idea that children needed to be shown how to do mathematics, but they have conflicting ideas;

Level C: teachers believe that children would learn mathematics as they solve many problems and discuss their solutions;

Level D: teachers who believe that children can solve problems without direct instruction and that the curriculum should be based on the learners' abilities.

The sequence suggests an 'upward' movement from absolutist/objectivist views to contextual and constructivist perspectives of knowledge and knowing (Hofer and Pintrich 2002:174). Pajares (1992:308) uses several subsets to define the term belief such as self-concept, self-efficacy, epistemological beliefs, attributions and subject matter beliefs.

While the endpoint of epistemological development seems to vary from model to model, *the fairly well established trend is that individuals move from some more objectivist perspective through a relativistic one, to a more balanced and reasoned*

perspective on the objectivist-relativistic continuum, with this latter position reflecting a more sophisticated manner of thinking (Pintrich, 2002: 400).

Is there a relationship between beliefs and knowledge? In his work Nespor (1987:319) considered that knowledge systems have a cognitive nature, while belief systems have an affective nature. Similarly, Pajares (1992:312) described knowledge as based on objective facts, and beliefs as based on personal evaluation and judgment. Therefore, Nespor (1987) and Pajares (1992) acknowledge beliefs as personal unique constructions with a cognitive dimension. Also, Wilen, Ishler, Hutchison and Kindsvatter (2000:14) found that a belief system has two bases, the intuitive and the rational. The intuitive consists of experienced-based impressions, traditional practices and personal needs. The rational component comprises pedagogical principles, constructivist approaches and scholarly contributions as well as examined practice. This theory of the affective and cognitive components of a belief system is considered logical and coherent for this study.

However, Nespor (1987:319) points out that teachers' beliefs constitute structural aspects that are distinctly different from knowledge systems; he argues that beliefs are influenced by previous events and experience. The past creates guiding images that act as filters of new information. A belief structure created from earlier experience may also be resilient enough to become the standard according to which new information is compared (Schommer-Aikins,2004:22). Therefore, any attempt to introduce educational reforms will not be fully realised unless specific measures are taken to examine and address this belief base.

Furingettin and Pehkonen (2002:44) distinguish between deep/core and surface beliefs and posit that deep beliefs are individual constructs and cognitive statements to which the beholder attributes truth and applicability, while surface beliefs are amenable to change and influenced by contextual factors. Other researchers appear to view beliefs as a component of one's personality and therefore difficult to change. Schommer-Aikins (2004:23), for example, argues that beliefs, once established in adulthood, are held onto tightly, that change does not come easily, and that any substantial change will bring discomfort and confusion. Schommer-Aikins (2004)

furthermore states that epistemological beliefs allow researchers to focus on certain components, but that this does not exclude looking at the whole system of beliefs.

This view is further supported by Archer (2000:1), who states that beliefs are fairly static. She asserts that once they are firmly established, it is difficult to change beliefs, and that people selectively choose information that conforms to their beliefs, even to the point of distorting evidence to make it fit. However, she also contends that the causal link between beliefs and practice is not clear. Bauch (1984:180) claims that core beliefs are not easily changed because they are the source of cues. She found that rigid adherence to a particular set of beliefs about instruction might limit what learners can obtain from schooling. In this case teachers who are rigid about mathematics instruction might find it difficult to change to more flexible modes of mathematics delivery. The need to find a balance was identified by Schommer-Aikins (2004:21), who proposed that epistemological beliefs need to be conceived as frequency distributions rather than continuums, as people might hold a mixed set of beliefs that have different characteristics.

The literature reveals that beliefs do not function in a vacuum but are embedded within other systems. These researchers highlight the interdependence between beliefs and other critical factors. Schommer-Aikins (2004:23) refers to this model as an embedded systemic model of epistemological beliefs. She cites several subsets of beliefs such as the social context, beliefs about mathematics teaching and self-regulated learning. Beswick (2007:112) supports this position and also proposes a range of factors that influence the development of beliefs, for example, the capabilities of learners regarding mathematics understanding, the resources and the support received from the policy makers. Similarly, Ernest (1989:15) refers to constraints and opportunities in the social environment of teaching such as expectations, learners' behaviour, curriculum, assessment approaches, and the teachers' level of thought as influential in the development of beliefs. This model suggests complex relationships between beliefs and other factors in the teaching/learning environment.

This study embraces all the above variations in the definitions of beliefs and assumes that beliefs about OBE are embedded in teachers' beliefs about knowledge, education

and mathematics instruction. Pajares (1992) and Nespor (1987) show beliefs to be essentially stable epistemologies that impact on teaching practice. Subsequent chapters will elaborate on the link between beliefs and instructional practice.

2.8.2 The relationship between beliefs and teaching practice

The link between beliefs and practice needs to be defined in concrete terms and supported by empirical evidence. It has already been mentioned in the previous sections that several theoretical and methodological difficulties surround attempts to examine teachers' beliefs, including the extent to which they influence behaviour. The study of epistemological beliefs has been done largely in terms of theoretical frameworks which assume that people have informal knowledge about phenomena that strongly affects their behaviour (Nist and Holschuh, 2005: 86). Personal epistemological beliefs reflect an individual's views about what knowledge is, how knowledge is gained and the degree of certainty with which knowledge can be held. They are seen as *integrated systems of conceptions* which function to give meaning to the interactions in classrooms; they also give meaning to actions by influencing judgments and therefore the natural tendency is to act in ways that reinforce those beliefs (Vandeyar and Killen, 2006:8).

Handal (2003:49) maintained that mathematics teachers' instructional beliefs reflect personal theories of knowledge and knowing, and they have been seen as influencing teachers' curriculum decisions. Handal and Herrington (2003:59) posit that mathematics teachers' beliefs can be thought of as individual perspectives on how one engages in mathematics tasks. The way teachers perceive teaching, learning, assessment and student abilities will have an impact on their classroom management. Chan and Elliot (2004:18) confirmed the possible causal effect of epistemological beliefs on conceptions about teaching and learning; their findings supported views in the literature that teachers' conceptions about teaching and learning are beliefs driven. Hammer and Elby (2002:4) also identify epistemology as a category of informal knowledge that may play a role in an individual's knowledge, reasoning, participation and teaching strategies.

Beswick (2007:95) found an important relationship between the beliefs of mathematics teachers and class perceptions of school environments, especially among teachers who created classroom environments consistent with the principles of constructivism. However, Beswick (2007) acknowledged that this relationship has been a subject of debate and controversy, meaning that the direction of this connection is open to question. Cobb *et al.* (1990, cited in Beswick, 2007:95) concluded that rather than beliefs and practice being related in a linearly causal way in either direction, they influence one another and grow together. They argue that it is necessary to study the belief systems and the degree to which they are held in order to obtain an in-depth understanding of the working of the teachers' thought processes. Buzeika (1996, cited in Handal and Herrington, 2003:62) asserts that some studies suggest that there is a relationship between beliefs and practice, with beliefs influencing behaviour, while in other cases it appears that instructional practice influences teachers' beliefs.

The studies that have analysed the relationship between these two constructs focused especially on the influence of cognitive and affective factors on teachers' beliefs. Romberg (1984, cited in Anderson *et al.*, 2005:10) identified mathematical content and beliefs as influencing teachers' plans and actions, and ultimately learners' performance. However, this model gives a linear representation that does not allow the possibility that actions and learners' performance could in turn impact on the teachers' beliefs and future planning of mathematics lessons (Anderson *et al.*, 2005:11). In the absence of consensus on this relationship, Cady, Meier and Lubinsky (2006:4) concluded that a common thread among researchers appears to be that as one matures and has more life experiences, one moves from acceptance of knowledge as certain and obtained from an external source to a consideration of a wider range of alternative views.

Bauch's (1984:20) study found a correlation between mathematics teachers' beliefs and educational practice; however, she contends that the findings did not strengthen the empirical understanding of these relationships. Cady *et al.* (2006:5) argue that the relationship between mathematics teachers' beliefs and classroom practice is dynamic, with each one influencing the other; teachers' practices are shaped by their beliefs about the nature of mathematics teaching and learning. Changes in teachers'

beliefs about teaching and learning are derived largely from classroom practice and the production of valued outcomes.

However, Kardash and Scholes (in Scott, 2005:63) maintain that beliefs can be false, or they can be based on insufficient knowledge; they draw distinct differences between the two concepts 'knowledge' and 'beliefs'. Others believe that the distinction is not realistic as the two are intertwined. Pajares' (1992:308) view is that knowledge and beliefs are linked. He states that beliefs strongly influence an individual's behaviour; however, he also asserts that the construct of belief does not lend itself easily to empirical investigation. However, Pajares (1992) and Furinghettin and Pehkonen (2002) suggest that *their strong affective component makes beliefs the best indicators of the decisions individuals make throughout their lives.*

Anderson *et al.* (2005:180) propose a new model that incorporates knowledge, beliefs, practices and the social context of teaching. The model was developed to reflect the influence of knowledge about mathematics, problem solving, how children learn, in-service education, the curriculum and resources on teachers' beliefs. These models seem to assume that beliefs dictate to a large extent the degree of teacher's engagement and approach to tasks, because they are organised into systems that are interrelated with others; for example, beliefs about teaching are likely to be linked with those about learning, schools and the curriculum (Scott, 2005:64).

Archer (2000:170) compared secondary and primary teachers' mathematics beliefs and studied the link between beliefs and practice. She found marked differences at the epistemological level for mathematics, i.e. the teachers' conception of the nature of mathematics and its place in the school curriculum. The study showed that primary teachers viewed mathematics as tied to learners' daily lives; this conception of mathematics translated into classroom activities that mirrored outside school activities and incorporated aspects from other learning areas. However, secondary school teachers viewed mathematics as self-contained and felt that it was their role to guide learners through its orderly, logical structure; these beliefs translated into fairly teacher-based teaching approaches. Taken together, these studies suggest a causal link between beliefs and instructional practice and also raise new questions and issues. One issue is the consistency and stability of this causal link.

Stipek, Givvin, Salmon and MacGyvers (2001: 225) reported consistency between mathematics teachers' beliefs and their instructions among twenty-one upper primary school teachers. They found that teachers who held traditional beliefs about mathematics showed more teacher-centred and performance-based behaviours. Coherence among beliefs was significantly associated with their self-efficacy and students' confidence as mathematics learners. These findings seem to support claims of an interplay between the power of beliefs and the direction of beliefs (Callejo and Vila, 2009: 113). If beliefs are centrally located and exert considerable amount of power regarding a particular issue, they will influence how other related issues are enacted.

The complexity of belief research is documented in other studies that showed inconsistencies between professed beliefs and observed practices. Karaagac and Threlfall (2004:138) found a widespread contrast in mathematics teachers' beliefs as expressed in interviews and their observed practice. Similarly, Chen (2008) and Levin and Wadmany (2006) found that teachers' technology use in the classroom was not necessarily aligned with their reported beliefs. Contextual factors such as school culture, resources, training and policies are believed to have played a significant role in these findings. They concluded that consistency of teacher beliefs and practices was a result of an ongoing negotiation process by which a teacher resolves conflict between organisational supports and local constraints; hence, teachers do not base each decision solely on their pedagogical beliefs.

Barkatsas and Malone (2005: 70) investigated mathematics teachers' beliefs and explored various links between these beliefs and instructional practice. They concluded that classrooms are complex environments and that political, social, cultural and historical factors influence practice. Their results indicated that beliefs were not always consistent with instructional practice; they found that beliefs about mathematics were more traditional than beliefs about mathematics teaching and learning. Also, prior experiences appeared to be a decisive factor and external exams kept teachers from implementing their beliefs in practice.

Yates (2006) studied the relationship between espoused beliefs and beliefs about teaching and learning after the introduction of a new constructivist reform curricular. The findings of this study revealed an interesting dimension. The beliefs about the nature of mathematics were unrelated to the teachers' beliefs about teaching and learning of mathematics; the beliefs about mathematics knowledge were also not related to age, experience and qualifications. However, the study found a significant relationship between teachers' experiences of reform and the use of technology and some assessment practices. The results of this study support the view that beliefs are multidimensional in nature and one person can hold different interrelated beliefs that are influenced by the context (Beswick, 2006:17).

In a similar vein Seaman, Szydlik and Beam (2005:197) replicated a study by Colliers (1972) on elementary education students' beliefs about mathematics and mathematics teaching. The study was undertaken to evaluate the reforms in mathematics teaching, more especially the change in the culture of schooling. They found that students of education held more constructivist beliefs than their counterparts thirty years earlier, especially regarding how mathematics should be taught. Initially education students held traditional beliefs, describing mathematics as a collection of rules, formulas and procedures. During the course of their programme they made a gradual shift towards constructivist beliefs; however, apparent contradictions in beliefs observed at the start of the programme were typically still present at the end. Thus it appears that though the students acquired new, more constructivist beliefs during the course of their programme, they did not develop vigorous philosophies of mathematics and mathematics education. The authors attribute this change in thinking to the reforms introduced to empower teachers and improve classroom management.

Similarly, Cross (2009:344) conducted collective case studies to investigate the alignment, cohesion and change in mathematics teachers' belief structures and how they influence their instructional practices. They specifically focused on how teachers organised their classroom activities, interacted with learners, and assessed learning. Additionally, the study examined the pervasiveness of their beliefs in the face of efforts to incorporate reform-oriented instruction. The study found great alignment between beliefs and practice in support of other similar findings in literature. It became evident in this study that teachers assimilated the new reforms through the old

belief system, resulting in minimal overall change. Beliefs about the nature of mathematics seemed to have a stronger influence than beliefs about mathematics teaching and learning; this suggests that reforms could engage teachers in the study of mathematics in a way that will foster a disposition towards conceiving of mathematics as a mode of enquiry. Ernest (1989:24) supports these findings and argues that the teacher's mental or espoused models of teaching and learning mathematics, *subject to the constraints of the school context, are transformed into classroom practices*. He also identified two factors that impact on teachers' beliefs: the constraints and opportunities in the social context of teaching, and the level of the teacher's thought. A high level of thought enables the teacher to reflect on the gap between beliefs and practice and narrow it.

These findings could have a significant impact on policy implementation, with special emphasis on the education programmes for teachers. This study did not intend to examine the influences on teachers' beliefs; however, in a beliefs study one cannot ignore the impact of schooling experiences on the belief system. The various studies cited show variations in the extent to which they explain the strength of beliefs and the direction of the connection between beliefs and teaching practice.

2.8.3 Quality in education, teachers as agents of change

Teachers are obviously important in initiating and perpetuating curriculum change; their views regarding effective teaching or quality education is helpful in planning curriculum improvement (Doll, 1996:342). The approach taken by this study is that teachers' beliefs about OBE are embedded in other belief systems such as those to do with the curriculum, education, knowledge, teaching and learning. Attending to teachers' epistemological beliefs regarding effective teaching and learning may provide another opportunity to understand their preferred instructional practices. Research reveals that the study of beliefs is critical to educational practice. Kagan (1992, cited in Murphy, 2000:34) argues that beliefs may be the *clearest measure of a teacher's professional growth* and that understanding them is *instrumental in determining the quality of interaction one finds among teachers*.

Therefore, the examination of teachers' beliefs introduces another dimension of the belief system, i.e. what constitutes quality in teaching and learning? The questions about the essential characteristics of effective teaching have been at the centre of education debates for decades. For example, Joyce and Weil (1992:4) affirm that the core of the process of teaching is the arrangement of environments within which learners can interact with content and build new knowledge; teachers design a plan, select content and identify effective means of engaging learners with content. In this model teachers are facilitators of learning, the architects of cognitive development and motivators who influence learners (Joyce and Weil, 1992:7). Teachers are encouraged to pay attention to individual perspectives, promote productive independence and enable learners to create their own destinations. Their model of effective teaching is based on similar premises as OBE, which encourages teachers to use enquiry-based teaching models that allow learners to engage with content by processing information and creating knowledge bases.

Cole and Chan (1987: 2) define effective teaching as *that which is in accord with established principles and which promotes student learning and enhances the cognitive, personal, social development of the learner*. This view reflects both elements of traditional and humanistic paradigms about the goal of teaching, but leans towards humanism. The humanistic view of the goal of education encourages personal and social development and supports self-determination, whereas the traditional view advocates strong commitment to learning and conformity. Cole and Chan (1987) drew from other research paradigms and developed a process-product model of teaching and grouped teaching principles into different categories, each of which can be related to a particular aspect of teaching, for example:

- a. 1st-order level involves effective communication – presentation, questioning, assigning tasks, feedback;
- b. 2nd-order level includes information organisation, control, motivation and reinforcement;
- c. 3rd-order level is about motivation and classroom management – lesson planning.

The authors provide a sound rationale for a teacher's actions that has a solid base in both theory and practice; teachers who have a sound knowledge of these principles

will be able to make instructional decisions that are appropriate for a particular teaching context. They argue that principles allow teachers to be flexible and adaptable; they don't specify rigid methods or techniques that teachers should use, and such principles are comprehensive and applicable to all subject areas at different levels. Similarly, Shalem and Slonimsky (2010) provide a critical analysis of Morrow's (2007) framework of thinking about the concept of teaching in *Learning to Teach in South Africa*. Special emphasis is put on the meaning of teaching, which according to Morrow (2007), is *the organisation of systematic learning that transcends contextual conditions*. The authors pay tribute to Morrow as one of the most distinguished thinkers in education, who argued for the reclamation of the importance of teaching practice, which should recognise basic teaching and its effects on learners. According to the authors, Morrow drew a lot of attention to the importance of understanding what teachers can do and think. Joyce and Weil (1992: 1) advance this argument and assert that teachers present powerful cognitive and social tasks to their learners and teach them how to make productive use of them; therefore, the major role of teaching is to create powerful learners.

Many models of teaching are mostly driven by an attempt to make the goal of education explicit. Joyce and Weil (1992:2) extended their argument and described school and classes as communities of learners waiting to explore the world and navigate it productively. They state the purpose of education is *increasing literacy, writing skills, and understanding the social world and devotion to its improvement, develop dignity and self esteem, and sense of efficacy to generate personal lives of high quality*. Others assert that the primary role of teachers in the schools is instructional, defined as the *systematic use of selected techniques, methods and strategies to create a dynamic interface between the curriculum and the learners* (Wilen *et al.*, 2000:153). This process involves the content (what shall be taught) and the methodology (how shall it be taught). The common thread in all these models is the role of the teacher and learner in an educational encounter. OBE makes this encounter explicit; learners create a common understanding through self-awareness and negotiation, and teachers build learning communities.

Since education revolves around what teachers do and think, their beliefs regarding the principles that work for a particular level and subject become paramount in any educational discourse.

It is evident from the literature that the most important outcome of instruction is the learner's increased capability to learn more easily and effectively in the future. Lifelong learners, as advocated by proponents of OBE, would acquire knowledge and skills because they have mastered the processes of learning. A review of the literature on effective mathematics teaching, mathematics education and philosophy of teaching reveals at least four dominant views on how mathematics should be taught:

- learner-centred;
- content focused with emphasis on conceptual understanding;
- content focused with emphasis on performance;
- classroom focused.

These views reflect different theories about effective teaching as well as assumptions about schooling and the purpose of education (Kuh and Ball, 1986:4). Elaborating on the learner-centred view which is consistent with OBE, mathematics teachers are expected to create opportunities for learners to be curious, empowering them to think logically and analytically. The National Curriculum Statement (NCS) offers clear implementation guidelines to teachers on what to teach, i.e. knowledge that learners need to know, clear progress in the areas between the grades, and assessment standards. In the new educational dispensation teachers need a solid foundation in various types of knowledge to make informed choices about OBE classroom practice. They are expected to make an individual diagnosis of learners' needs and link them to their pedagogical strategies and goals.

The OBE model infuses quality and accountability into the educational reform and teachers are expected to be reflective practitioners and utilise evidence-based pedagogy to enhance learners' outcomes. Killen (2006: 17) posits that if teachers want quality learning to occur in their classrooms, they must deliberately teach in ways that will enable and encourage learners to engage in intellectual activities.

That is, teachers must assist learners to *construct knowledge to produce discourse or performances that have value beyond school* (Killen, 2006:17). He draws on the Productive Pedagogy programme (PP) that was developed by Ladwig and Gore (2005). This approach directs teachers' attention to what really matters in helping kids to learn and focuses on challenging and demanding learning for all learners. It is very comprehensive and requires attention to many essential aspects of classroom teaching such as:

- Intellectual quality, which refers to helping learners to convert information into knowledge. In this way teachers are expected to use pedagogical practices designed to engage learners in higher-order thinking, which it is believed will lead to development of deep learning;
- Creating a quality learning environment. This dimension includes, among other things, teachers having high expectations of the learners, believing that all learners have the capacity to succeed by leading them to develop a sense of meaning, and allowing them to evolve;
- Authentic pedagogy – having a clear focus on outcomes that are of high quality;
- Relevance or connectedness, i.e. helping learners to see the big picture and make meaningful connections;
- Recognition of difference – inclusiveness and recognising difference.

Killen (2006:31) contends that each dimension of the PP programme will contribute to learners' achievement of outcomes that have a significance beyond school. The tenets of the PP programme resonate well with OBE principles of learning, that is, learning is developmental, motivation facilitates learning and exploration is the driving force of learning. This approach is also supported by constructivist learning and teaching, the view that teaching is involved in creating opportunities for learners to actively construct their own understanding in discussions with others, including the teacher. However, critics of OBE claim that the benefits are not evident and that learners are assumed to be naturally creative and active. These arguments raise the questions: What works? How will we know? Can an externally imposed curriculum allow teachers to operate according to their beliefs? These are some of the questions that are explored in this study.

2.8.4 Teachers as reflective practitioners

The discussion on quality teaching necessitates a review of the identity of teachers, the understanding of teaching taken in this study is that it is a vast intellectual activity within which teachers make complex decisions and adopt the role of transformative intellectuals. Teachers, in this view, are active and inquiring professionals. Their role is seen as one where the *ends of teaching and not just the means are subject to constant scrutiny* (Prickel, 2000: 8). A teacher is accordingly seen as inquirer into the state of things, as they are and as they might be. Therefore, the OBE advocated by the South African government is seen as the basis on which teachers reflect, analyse, appraise and make strategic decisions. Reflective practitioners explore and examine new and emerging educational systems such as OBE. Their practice will be informed by formal and informal theories about the processes and relationships of teaching.

An approach that views teachers as transformative practitioners acknowledges their freedom to practice their profession in terms of their beliefs, commitments, values and critical judgments. This view is based on an understanding that education is more sophisticated than meets the eye and that curriculum planning and implementation are results of complex processes that are cyclical and allow for modification in learning outcomes and teaching strategies. Teachers are experienced professionals and therefore, Flores (2001:15) posits that teaching experience is powerful, because it provides evidence that certain *unknown approaches* are equally effective. Experience provides justification for teachers to adopt certain teaching preferences/approaches; they have seen the evidence of effective learning, probably influenced by their own learning preferences or previous teaching strategies.

2.9 CONCLUSION

This chapter put the principles of OBE into historical perspective and locates OBE within a broader social context. The goals/aims of OBE are made explicit so to enable exploration of teachers' beliefs. OBE attempts to bring about quality in education by advocating models that encourage collaboration, analysis, reflection and discovery. Critique in education is viewed as a healthy process and a journey that has no end. OBE is no exception; there will always be protagonists and antagonists. South Africa

is still evolving and struggling to be more democratic; it has emerged from a difficult past and OBE is viewed as the beginning of the transformation of educational policy, not an end in itself. Learning outcomes should be viewed as open to continuous evaluation and reflect the road to travel rather than terminal points (Kelly, 1977:29). This requires teachers to strive to be up to date with current practices, to self-develop and to use evidence-based teaching models. Much has been said about the status of teacher preparation in South Africa and it would be naïve to generalise about this; even among the historically disadvantaged groups, there is evidence of high-level activity in improvement of qualifications among teachers, especially in the rural areas – a point that might be missing in most reviewed literature. These teachers operate in grossly under-resourced schools, learners are mostly from economically disadvantaged communities; however, some of these schools have produced above-average academic results.

OBE requires teachers to re-examine their identities, beliefs and practices, and create new meanings for teaching and learning, the new meanings that can influence educational policy in South Africa just as the country is about to embark on another wave of ‘change’, as announced by Minister of Basic Education.

Educational researchers have described beliefs in different ways. Some use terms such as personal theories and beliefs interchangeably, others lump beliefs together with opinions, attitudes and conceptions. Although it is universally acknowledged that beliefs play a critical role in decision making, the teaching and classroom environment is a complex phenomenon for both the teacher and the learner, and could overwhelm teachers’ beliefs. There is a general consensus that a single definition of the concept of ‘beliefs’ is neither possible nor desirable (Furingetti and Pehkonen, 2002:48). This study assumes that the multiple factors that influence teachers’ perceptions and experiences of OBE will take on special importance in the school setting, where teaching and learning become an interpersonal experience between the teacher and the learner.

It has been shown that teaching practice is a result of decisions teachers make based on the interpretations of the curriculum and their professional experience. Therefore, that way that OBE is defined, interpreted and understood by the teacher determines

how it is valued and ultimately how it is implemented. If OBE is to be understood in a useful way, it must be examined in the context of educational transformation processes, allocation of resources, and the purposes of education and schooling. How do we assess when individuals have engaged these processes in a vigorous way? The next chapter discusses the methodology followed in investigating teachers' beliefs, conceptualisation and experiences of OBE.

CHAPTER 3

RESEARCH DESIGN AND METHOD

3.1 INTRODUCTION

This chapter gives a detailed description of the methodology of the study, which includes the choice of research design, sampling methods and a detailed description of the data-collection methods, instruments and processes. In this present qualitative and exploratory research study, the researcher applied combined ethnographic and phenomenological approaches to explore and describe the role of beliefs, conceptualisation and experiences of OBE in the teaching practice of mathematics teachers in Gauteng province, South Africa. The participants were selected by applying non-probability sampling. The researcher collected data through unstructured interviews, focus group interviews and classroom observations. The National Curriculum Statement's intentions, topics and tasks were used as data-collection enablers to guide the data-collection process. Qualitative data analysis was applied following Becker and Geer's (1960, cited in Cohen, Manion and Morrison, 2001:148) phases of ethnographic analysis of qualitative data. Ethical principles were observed to protect the integrity of the research study. The researcher applied various measures to enhance the trustworthiness of the study.

This study was based on the premise that the teacher's world is a diverse and complex phenomenon, focused on his/her meanings, interpretations and experiences. The study aims to understand these meanings and how they evolved in a particular context. Specifically, it intends to understand some of the beliefs or implicit theories of teachers regarding OBE.

3.2 RESEARCH METHODOLOGY

Qualitative research regards reality as socially constructed and contextual. Qualitative research rests on a *paradigm that explains humans as conscious self-directing beings who are continuously constructing and re-constructing social reality* (De Villiers and Van der Walt, 2004:239). One of the major distinguishing characteristics of qualitative research is that *the researcher attempts to understand people in terms of their definition of their own world*. It focuses on the subjective experiences of individuals and is sensitive to the contexts in which people interact with each other (Mouton, 2001:194). Qualitative research involves exploring and describing the nature of a social phenomenon and the inter-relationships between its components. A holistic approach is maintained; the aim is to obtain an in-depth understanding of human beings, their experiences, values, beliefs and meanings that people attach to their daily lives (De Villiers and Van der Walt, 2004:238).

One of the characteristics of exploratory qualitative research is *to identify, document and confirm unknown aspects of human behaviour*. The qualitative researcher seeks to discover, account for and explain unknown phenomena. Discovery of meanings is regarded as the basis of knowledge generation. In an open, inquiring manner, informants are encouraged to share their ideas about their experiences. Through the inductive discovery process, the researcher describes and documents diverse and common features about the phenomenon under investigation (Streubert and Carpenter, 1999:16). In this study unstructured data collection was done in a naturalistic context. The researcher intended to capture the participants' life worlds with respect to OBE. Doing so enabled the researcher to explicate the phenomenon in diverse school settings in one of South Africa's provinces.

According to Pajares (1992:308), the study of teachers' beliefs has the potential to provide a significant insight into many aspects of teaching practice. Attention to teachers' beliefs can inform educational practice in ways that prevailing research has not been able to do and is essential to improving teaching practice. This study intends to specifically explore the impact of these beliefs on teaching practice in a period of transformation in education. Therefore, qualitative methods were best suited to discover the subjective meanings of OBE held by teachers. Because meanings and

beliefs are subjectively held, they are the most valuable psychological constructs to explore teacher education (Pintrich, 2002:402). Moreover, because they are also difficult to measure and define, a qualitative approach to the research was deemed to be appropriate. In order to infer a person's belief with any degree of accuracy, one needs several varied resources from which to draw those inferences. It is important to describe what the person believes and how their various beliefs are related to each other, such as their beliefs about OBE, education, teaching, learning and learners. Understanding beliefs requires a range of data from different data sources that offer multiple points of interpretation, such as asking a variety of open-ended interview questions, observing classrooms practices and analysis of documents.

Meanings and experiences of OBE are negotiated and defined continuously by all professionals and learners. With any change, teachers are expected to make a paradigm shift, and when they embrace and implement the OBE policy, they conceptualise and experience it subjectively. Teachers view OBE through existing lenses or conceptions of what constitutes teaching, learning and knowledge. Conceptions are specific meanings given to phenomena which mediate responses to a given situation (Cohen, Manion and Morrison, 2001:138).

These conceptions influence decisions that teachers make regarding lesson plans, presentation of content, involvement of learners in classroom activities and the nature of assessment tasks. Likewise, learners also carry their own meanings and experiences of OBE. The classroom encounters become a social activity characterised by either harmonious or conflicting understandings. A holistic approach was therefore needed to capture the life world of the participants. Capturing teachers' beliefs and lived experiences of OBE warranted a qualitative approach to this research, and specifically the application of the ethnographic method. Qualitative research enabled the researcher to explore concepts related to OBE, experiences, conceptualisation and teaching practice. During focus group interviews teachers were given an opportunity to think reflectively and to weigh up arguments; the discussion provided them with the opportunity to reflect on their own practices, the OBE curriculum, their personal theories, knowledge, their experiences and the environment in which they worked.

Qualitative research involves an emergent design that emerges in the field as the study unfolds (De Villiers and Van der Walt, 2004:243-244). It identifies *the characteristics and significance of human experiences as described by informants and interpreted by the researcher at various stages of abstraction* (Leininger 1996:36). According to De Vos (1998:280), an interpretive approach to research enables a better understanding of the social construction of reality or the process through which people make sense out of their lives and experiences. While conducting this present study, the researcher's continuous interpretations served as a basis for deciding on subsequent courses of action or areas of focus. As the study unfolded, the researcher reflected continuously on what emerged and made ongoing decisions with regard to the focus and process of data collection. Teachers' beliefs and meanings of OBE that evolved as the researcher conducted dialogical discussions with participants formed the basis for further data collection, including selection of other participants to provide rich information.

3.2.1 Research design

The researcher adopted a qualitative exploratory design. The method of choice for this study was a combination of ethnography and phenomenology. Fundamental to this position is the view that there are no 'real' natural laws concerning socially derived knowledge and therefore no possibility of a 'pure' method for the social or interpersonal sciences (Johnson *et al.* 2001:249). Wiersma (2000:237) refers to ethnography as a research process and the product of that process as *the study and analysis of local or indigenous people's viewpoints, beliefs and practices of a phenomenon*. It is specifically the science that deals with the origins, development and characteristics of human kind, including such factors as social customs, beliefs and cultural development. This definition could be extended to educational research as *the process of providing holistic and scientific descriptions of educational systems, processes and phenomena within their social and cultural contexts*. Ethnography is a naturalistic (largely emic) and open mode of inquiry aimed at discovering the informants' views of how they come to know and experience life. In this instance, it aims at describing and analysing practices and beliefs of teachers. Attempts are made to generate data from the perspective of the individuals being studied. Ethnography provides ways of assessing beliefs and practices in a natural context. It provides the framework for studying meanings, patterns, expressions and teaching practices, and

enables the researcher to understand the participants' daily experiences related to teaching in an evolving environment. Ethnographic observation focuses on *understanding what members need to know, do, predict and interpret in order to participate in the construction of ongoing events of life within a social group* (Wiersma, 2000:237).

Phenomenology is an attempt to explore the human inner world from the perspective of the experiencing subject. Exploring teachers' OBE beliefs, conceptualisation and experience in order to provide a description and interpretation regarding the role of these beliefs in instructional practice required deep probing. Variations in definitions of belief make research challenging, as various sources of evidence have to be present in order to determine beliefs or make inferences.

The researcher selected an unstructured data-collection method, which involves *a minimum of structure and researcher-imposed constraints* (Polit and Hungler, 1996:280). Unstructured *approaches provide for greater latitude in the answers given* (Streubert and Carpenter, 1999:23). Data were collected from key informants by means of in-depth interviews, focus groups, observations and document analysis. Ethnographers/phenomenologists contend that trustworthiness is enhanced through the use of multiple data-collection procedures and 'triangulation'. Triangulation is defined by Wiersma (1995, cited in Freebody, 2003:77) as a search for convergence of the information on a common finding of a concept. Common procedures recommended include observations, interviews, site documents and other supporting sources.

3.2.2 Population and Sampling

Qualitative research is not aimed at generalising results but rather *at achieving an in-depth, holistic understanding of the phenomenon of interest* (Polit and Hungler, 1996:238). Qualitative research requires that the data to be collected are rich in description with regard to people and places (De Vos, 1998:253). Therefore, a non-probability sampling approach involving a small sample is appropriate. In non-probability sampling not every element of the population has an equal chance of being

selected in the sample (De Villiers & Van der Walt, 2004:242; Polit and Hungler, 1996:238).

Sampling involves selecting a group of people, events, behaviours or other elements with which to conduct a study (Burns and Grove, 2001: 365). Key informants are people who *have been thoughtfully and purposefully chosen for the knowledge they have about the domain of inquiry* (Leininger, 1996:38). In the context of this study the key informants were considered to have first-hand knowledge of the implementation of OBE. The researcher therefore conducted purposive sampling. Purposive sampling involves *the conscious selection of informants by the researcher* (Burns and Grove, 2001:376). This ensures that informants who are knowledgeable about the topic are included in the study. Key informants were Grade 10 Mathematics teachers in Gauteng province. The reason for the selection of Grade 10 teachers was that the new National Curriculum Statements for FET grades were in the process of being implemented, with Grade 10 being the first level of the FET. The researcher involved teachers from various schools in different regions of Gauteng; the schools were demographically different and school contexts differed.

Fourteen (14) key informants were selected from three secondary schools located in townships and five (5) informants from two former Model C schools. The teachers varied in experience from three years to twenty years, had varied qualifications that ranged from a basic diploma in teaching (two-year post-high school qualification) to postgraduate qualifications. Experience in teaching mathematics ranged from three weeks to twenty years. There were seven females and twelve males in the sample, and their ages ranged from 28 years to 52 years.

3.2.3 Data-collection methods and instruments

The method of ethnographic research is an integrated process in which procedures are conducted concurrently. Phenomenologists believe that knowledge and understanding are embedded in people's daily world and truth emerges from those experiences (Burns and Grove, 2001:354). Phenomenological/ethnographic data-collection enablers such as in-depth probing were applied to guide data collection. These enablers allowed an exploration of consciousness and for emic and etic data to be

studied together. An *emic view is elicited from informants by what they say verbally, how they explain events and interpret their meaning and action modalities*. The *etic view is identified by comparing the participant's views against the observed societal view* (Leininger, 1996:39). Etic data often include the group's social structure, history, ecology and beliefs. The researcher ascertained the emic perspective, which included teachers' conceptualisation and experience of OBE, before reflecting on the etic perspective, which is the thinking that influenced the adoption of OBE policy, processes involved in the transformation of education in South Africa, teachers' role in the debates, and the general view of OBE held by the education fraternity.

An important part of ethnography/phenomenology relates to the idea of contextualisation; that is, to understand behaviour, the observer must understand the context in which individuals are thinking and reacting (Wiersma, 2000:249). Data were collected from five schools, two of which were situated in urban areas (former Model C schools) and three in predominantly African peri-urban areas, referred to here as townships. The teacher-learner ratio in township schools is 1:44; the surrounding areas of these schools are mainly informal settlements. The majority of township residents are either low-income earners, underemployed or unemployed. The urban schools serve mostly middle- and upper-income earners; ethnically mixed residents live in these areas that were designated for whites during apartheid. The schools can be characterised as middle class and learners are primarily white. The schools are well resourced; the teacher learner ratio is on average 1:24. The South African school system makes mathematics compulsory for secondary schooling. Learners are streamed into either pure mathematics or mathematical literacy. Therefore, schools would normally have five to eight teachers teaching mathematics across the classes. The study will include teachers of both pure mathematics and mathematical literacy.

3.2.3.1 Field entry

In qualitative research *successful fieldwork is usually determined by the accessibility of the setting and the researcher's ability to build up and maintain relationships with gatekeepers* (De Vos, 1998:258). The researcher should strive to establish a cordial atmosphere and to lay the foundation for a relationship of trust, and as far as possible

create a sense of equality between her and the informants; when people feel comfortable, they are more willing to share their emic views (Leininger, 1996:33).

It was important for the researcher to develop a relationship of trust with the informants. In order to create a sense of trust, the study applied Leininger's (1996:33) observation-participation-reflection model as an essential guide to enable the researcher to enter school settings and engage with informants while collecting data. The researcher gradually moved from being an observer and listener to a participant and reflector. The model is elaborated on below.

- **Observation with limited active participation**

The researcher spent two weeks at each school; one week was for observations and the other week for in-depth observations and interviews. The researcher participated in morning meetings to obtain first-hand experience of the interaction of teachers and a better understanding of the daily activities in the life of teachers. This method was applied to observe actions, reactions and interactions that occurred during mathematics teachers' encounters with other colleagues. In between the researcher held informal discussions with the mathematics teachers and their other colleagues, head of instruction and the principals, and used this period to introduce the study, its aims and methodology. The intention was to make everybody feel comfortable with the researcher's presence and to gain a good understanding of the general views and attitudes towards OBE. These data would enable the researcher to understand some of the influences on teachers' beliefs. A good number of mathematics teachers excused themselves from the study, notably the heads of instruction; however, they facilitated the interviews and provided good insights into how the school and the subject is managed in terms of OBE requirements.

The researcher gained the teachers' trust by obtaining informed consent from them to participate in the study and explained the importance of their participation to ensure the credibility of data. The informants were assured of confidentiality and anonymity. They were advised on the setting and the duration of the interviews. They were also made aware that they had the right to withdraw from the study at any stage, and would not be exposed to any harm during data collection. During this phase the

researcher became personally involved in the social world of the participants and closely observed them and attentively listened to them so as to obtain an inside view of their values, beliefs and experiences regarding OBE. This was done to provide the context of informants' experiences.

- **Active participation: In-depth interviews**

Freebody (2003:136) indicated that interviews are among the most widespread of methods for collecting data in social science. Open-ended interviews offer an authentic gaze into the soul of another. Interviews can provide insight into individuals' constructed social worlds and into ways in which they convey those constructions in the particular interactional setting. They also allow access to the thinking of a teacher to determine aspects of the teacher's thinking that cannot be captured by other modes of data collection.

To ensure validity and reliability the researcher focused diligently on the empirical details of the interview. The interview setting was negotiated in advance with the teachers, and the researcher selected appropriate times to conduct the interviews with the informants. The interviews were conducted face to face in the staffrooms during lunch breaks, immediately after school finished and occasionally during free periods (non-teaching periods). Key informants were encouraged to talk freely about their ideas on the meaning of OBE, their experiences and its possible impact on classroom management in teaching mathematics.

- **Focus group interviews**

Focus groups are a form of group interaction that capitalises on communication between the researcher and research participants in order to generate data. In these groups people are encouraged to talk to one another asking questions, exchanging ideas, commenting on each others' point of views and experience (De Vos,1998: 255). Focus groups were used in all five schools with a group of about 4 to 6 teachers; these groups included all mathematics teachers and heads of instruction to ensure content-rich data. Each session lasted about two hours. This method was useful for

exploring shared views and beliefs with respect educational transformation, OBE, and mathematics teaching and learning. The researcher developed separate profile sheets for each of the focus groups in order to compare issues such as the influence of the context, resources and the location of the school. In preparing to talk to teachers about their beliefs, the researcher began the session by asking the teachers to talk about their current experiences of OBE implementation. An interview schedule was constructed to serve as a guide; these questions guided the interview process and allowed teachers to raise issues and elaborate on general aspects of OBE. Information from the focus group was mainly used to enrich and influence the subsequent in-depth interviews.

- **In-depth interviews**

In-depth interviews allowed the researcher to collect materials regarding the main issues that were of key relevance to the study such as:

- Beliefs and conceptualisation of OBE: the focus was on how teachers made sense of OBE in order to reappraise an ongoing process of implementation;
- OBE features used as enablers for discussions; this gave an overview of their thoughts on the curriculum;
- OBE experiences: teachers were asked to narrate positive factors, challenges and opportunities;
- Classroom management practices and expectations;
- Beliefs regarding mathematics knowledge and ideal assessment methods;
- Beliefs regarding teachers' and learners' roles;
- Teaching approaches and rationale, their thoughts on how mathematics teaching occurs and how it should occur ideally.

Each formal interview session lasted for about one hour and included prompts designed to encourage teachers to talk freely about OBE and identify issues that were of importance to them. It was considered likely that such relatively spontaneous talk would provide evidence of teachers' most salient beliefs. During the unstructured interviews, the participants responded freely to open-ended questions in narrative form, thus sharing their perspectives with the researcher. The researcher asked

probing questions to guide informants to further elaborate upon their responses where additional information was required. This approach required teachers to reflect upon their understanding or definition of OBE, to describe ideally how mathematics ought to be taught and learned, and to compare the ideal with realities on the ground (experiences) and with their own teaching practices.

Beliefs were captured by using more than one question; for example, 'How do you think learning occurs in a typical OBE classroom?' followed by 'What are your thoughts on your own teaching approach?' 'What do you think of your approach to OBE?' 'What have been the most important sources of knowledge that have influenced your practice?' All interview sessions were audio-taped for transcription; an initial round of data analysis was conducted after each interview and interview questions were revised to further examine emerging issues. The review specifically sought to determine if the questions elicited personalised responses and an orientation towards knowledge.

3.2.3.2 Classroom observations

This phase was characterised by active participation in the field; the interviews were supplemented with observations through which the researcher obtained a deeper insight into the research topic. The observation schedule was negotiated and agreed by all parties. The first observation was mainly to familiarise the researcher with the classroom setting, number of learners and resources, and involved observing the patterns of interactions in the classroom. Some of the participation was stimulated by asking broad or general questions related to what was observed. This phase comprised identifying and describing the teachers' and learners' behaviour and expectations related to classroom activities. The observations were conducted in three stages: pre-observation informal interview to discuss the topic, lesson plan and the intended outcomes; observation of the lesson followed by unstructured interviews to gain clarity on the observed teacher behaviour and for the teacher to either confirm or reject the interpretation. Many of these conversations provided clarification of the teacher's intention at various points in the lesson and along with the observations added to the data from which teacher's beliefs were inferred.

The observation schedule was structured to determine the extent to which mathematics teachers applied or extended their beliefs about, and aspects of, OBE into their instructional practices. The main aim was to seek consistency between what teachers claimed during interviews and how those claims were integrated into the instructional practice. Several observation guides were developed to capture the narrative flow of each lesson. Write ups were extensive, focusing as much as possible on the flow of the lesson and the changing activities and mathematical topics that made that flow understandable. The observations were guided by a set of items that highlighted the dimensions of classroom instruction relevant to the principles of OBE, for example, the extent to which teachers maintained control vs. learner activity, facilitation, collaborative learning and structure of the lesson.

Teachers were asked in advance to select classes where new topics were introduced as well as classes with whom they had been working on a topic for a while. Teachers were grouped according to the type of mathematics they taught, for example, pure/advanced mathematics and mathematical literacy. The aim was to ascertain any similarities and differences in the teaching approaches for each group.

Observations of approximately three lessons (one observation was for 'getting to understand the context') for each teacher provided data on teachers' classroom practice as well as further opportunities to gather data from which beliefs could be inferred. The researcher documented specific and unusual events and observed behaviour regarding the introduction of the lesson, activation of prior learning, learner autonomy, facilitation and references made to real-life contexts and questioning methods.

During the process of observation the researcher kept field notes and analytical logs, collected documents on NCS, reviewed available lesson plans, talked to other teachers, heads of instruction and principals informally. Detailed notes concerning the content of the lesson, teacher and classroom behaviour, and interactions were made throughout each observed lesson; significant events and interactions were identified. Data were captured on the degree to which teachers focused on the rules and procedures of mathematics versus learners' interpretation and meaning making.

Instances of features of the classroom environment consistent with the teacher's beliefs and OBE principles were sought. Three categories were created to indicate teaching approaches – teacher-centred or traditional (when the approach was mainly transmission of knowledge and the teacher had a great deal of control over what is taught and how it is taught); evolving or mixed (when teachers combine both transmission and transformist approaches); transformist or learner-centred (when the learners participated actively in the lesson, contributing ideas and knowledge with a degree of control over what is taught) or a mix (showing both features).

To interpret and understand observational data, it is important to create a holistic view of the teachers' life world and to incorporate the professed beliefs into the preliminary analysis. Inferences on teachers' beliefs were made on the basis of the complete data set. Thus interview transcripts and the detailed notes made during and after each observation period were examined for evidence in support, contradiction or clarification of their belief responses during interviews. Excerpts were selected that represented the instructional interactions typical of teachers' common ways of interacting with learners and were used as prompts during interviews. Teachers were asked to narrate their beliefs and experiences, and additional questions were asked to probe and clarify what and why. They were asked to describe particular decisions they made and provide a rationale for their decisions; this approach allowed meanings to emerge and provided deeper understanding. Teachers had the opportunity to share particular episodes and to connect them to their meanings/understandings of OBE.

The post-observation interviews lasted for an average of forty minutes per participant. The data collected were rich in detail and allowed for a shared understanding of meanings between researcher and informant, and enabled the researcher to tie beliefs to specific behaviours.

Examples of post-observation interview questions are:

- Please explain X (observed episode) further or please describe what happened and explain reasons for those decisions.
- Identify episodes that the researcher might have missed.
- Is X (observed behaviour) your normal way of doing things?
- What did you try to accomplish and why?

- Did you achieve the outcomes?
- Would you do things differently at another time and, if so, why?

3.2.3.3 Analysis of documents

Probing and analysing teacher's thinking and reasoning required detailed data collection; in addition to the interviews and observations, documents were analysed to assist in clarifying what teachers said and what they did in the classroom. The emergent constructions of OBE needed to be grounded in the complex interactions within the classroom setting.

It was important to identify the key features of OBE and the Revised National Curriculum Statement (NCS) to provide a framework for data collection. Documentary analysis of lesson plans and the National Curriculum Statement for mathematical literacy and mathematics enabled the researcher to determine how curriculum intentions were implied in the guides. Outcomes, topics and tasks from the NCS teacher guides were studied prior to the observational visit. The researcher selected topics that teachers and learners were working on to examine the degree of creativity and initiative, and to support interpretation of outcomes and assessment standards. Subtle similarities and differences in the outcomes, content presented, structure and flow of the lesson were noted. Access to assessment tools was not provided, as teachers preferred to explain assessment approaches rather than make the tools available to the researcher.

○ Lesson plans

The lesson plans were analysed in relation to relevance with the NCS tasks and activities. The emphasis was on the logical connection between NCS outcomes and lesson plans, goals of the lesson, activities planned, instructional procedures, assessment and material used. The majority of teacher did not provide lesson plans; the researcher respected their decision to not to submit the plans, though a few were made available for analysis. The lesson plans that were made available provided the lens for the researcher to observe how these were operationalised in the classroom as well as the factors that prevented teachers from achieving the intended outcomes. During the pre-observation interview the teachers without written lesson plans were

asked to give an outline of the topic, intended outcomes and the teaching approach. All teachers were asked to provide a rationale for selection of content and teaching strategies.

3.2.3.4 Primary reflection and reconfirmation of findings stage

Leininger (1985:60) describes this stage as a stage of reflection, preliminary analysis and interpretation. During the reflection phase the researcher considered and interpreted the data collected. Reflection occurred during and after all phases of data collection. Reflections during data collection enabled the researcher to conduct a preliminary data analysis to determine whether to probe further or terminate data collection. The reflective-observation phase allowed the researcher to recapture the data-collection setting, events and processes. Understanding what transpired between the researcher and the participants is essential to obtain an accurate and full account of the situation (Leininger, 1985:53). The period of reflection was followed by confirmation of the findings with informants to ensure that the researcher had captured the data accurately and truthfully.

Questions that arose from the first analysis were used in the subsequent interviews; for example, participants were invited to give feedback on the transcripts and a new set of questions was generated. Focus groups were used as a complementary source of information to the interviews and classroom observations.

Focus groups were mainly utilised to generate questions and validate findings. Questions raised during focus group interviews to generate discussions were focused on how learning occurs in an OBE environment, perspectives about learning in general, experiences of OBE – what works and what doesn't, the role of contextual factors in teaching and learning.

3.3 Instruments and data analysis

The purpose of qualitative data analysis is to make sense of data and to ‘make meaning’ (Merriam, 1998:178 in Murphy 2000:15). The analysis process included organising, reading and dissecting data according to emerging thematic categories, eliciting recurrent themes across or within units of analysis, refining emerging concepts and themes with specific details through the process of data reduction, synthesising and integrating these themes, and deciding what to share with the community of readers (Bogdan and Biklen, 1992; Leininger, 1996; Cohen *et al.*, 2001).

Groups of teachers who matched a certain category were analysed as a case; for example, teachers whose instructional practices favoured certain teaching approaches. Patterns and categories observed during interviews were used as benchmarks for analysing incidents during classroom observations. Analysis of excerpts from observational data provided confirmation of evidence of beliefs teachers held. The beliefs and conceptions of OBE were differentiated based on the degree to which teachers’ explanations showed teacher-based/learner-based inclinations and the strength of the affective component as shown by both non-verbal and verbal declarations.

In this study the researcher applied Leininger’s (1996) and Becker and Geer’s (1960, cited in Cohen, Manion and Morrison, 2001:148) phases of qualitative analysis of data.

- ***Phase 1: Collecting, describing and documenting raw data***

This phase entails data collection, management and interpretation (Leininger, 1996:96). This stage of the analysis began once all the data had been collected from all sources. The data collected during the focus groups and individual interviews were captured on audiotape and verbatim transcriptions made. The aim of this stage was to organise data into manageable formats to allow systematic analysis. Tables were created with data on teaching approaches. The observational data were organised into personal and analytical logs, which were also transcribed. The personal logs included

descriptive accounts of what was observed during classroom observations and incorporated the researcher's reflective notes on the experiences. The analytical logs included a detailed review of the research questions and emerging ideas as the study progressed. All data were computer processed and preserved electronically, and files were secured with a password. The researcher transcribed the recorded interviews and the field notes. The researcher carefully read the transcriptions to obtain a general feel for the data and to plan a preliminary coding system.

- ***Phase 2: Identification and categorisation of descriptors and components***

This phase allowed a holistic viewing of data that had been collected and included *reduction of data by means of coding and categorising raw data* (Leininger, 1996:98). Codes are labels for assigning meaning to the descriptive data. During this stage the researcher coded the raw data and classified the coded data into categories. She created nodes and node definitions, and coded each data unit under an appropriate node. The frequency of each theme was noted, coding and categorising were done repeatedly as new insights developed into emerging meanings and according to how the coded data related to the emerging meanings. Each code was analysed for the explicit and implicit inferences that could be drawn in relation to the research questions (Wiersma, 2000:344)). Inductive category coding was combined with simultaneous comparison with other events and social incidents that had been observed during informal discussions in staffrooms. Sections from interview data were marked and linked to sections from observations. The aim was to seek key issues and categories to discover recurrent events or activities in the data to expand the range of categories. This process enabled the key variables in the study to be compared across the categories, giving rise to new dimensions and categories. For example, during the coding process notes were made that summarised the beliefs of the teacher; once the codes were determined, the responses were merged to depict a belief profile that presented a teacher's beliefs.

Phase 3: Pattern and contextual analysis

This phase entails a thorough examination of the data for saturation of ideas and recurrent patterns of different meanings, expressions, structural forms, interpretation or explanation of data related to the domain of inquiry (Leininger and McFarland, 2002:95). The emphasis during this phase is the development and clarification of concepts related to the specific investigation (Cohen *et al.*, 2003:114). Data were put into groups, subsets or categories on the basis of beliefs regarding OBE, mathematics knowledge, views of teaching and learning, and instructional practices. Descriptive codes were then drawn together and put into subsets and a typology developed in terms of the basic characteristics of OBE, for example, learner-centred/teacher-centered, provision of expanded opportunities, references to real-life situations and approaches to questioning. The researcher studied the units or segments of data to elicit the emerging meanings and identified interrelationships between the emerging ideas. This constant comparison between sets of beliefs and teaching practice provided the opportunity to identify similarities and exceptions to the emerging pattern of relations and allowed the researcher to become immersed in the data; this continued until the researcher felt that the data had been accurately interpreted. Inferences were made from the following data categories: teaching descriptors, teacher-learner relationships and assessment methods.

Teaching descriptors: Structure of content, lesson plan

- Dominant teaching method: constructivist, traditional and mixed.

- Linking to real-life events;
- Use of teaching aids;
- Questioning: Content-based questioning, process-based questioning, a mix of both.

Teacher/learner relationship: Teacher-learner interaction, content authority

Assessment: Assessment strategies employed

- Creativity.

The researcher shared the results with the participants to give them the opportunity to confirm whether the researcher's interpretations were consistent with the life worlds

they revealed during their participation. This activity enhanced the credibility of the research findings.

- ***Phase 4: Data synthesis***

The last phase entails data synthesis and interpretation (Leininger and McFarland, 2002:95). In this phase the researcher engaged in creative reflection and abstract thinking to synthesise the meanings that emerged during the previous phase into themes that transcended the created categories and sub-categories. Teachers provided the researcher with descriptive terms that had meaning for them. Once the beliefs had all been identified, data were interpreted in the light of the philosophical framework of OBE, and epistemic beliefs and pedagogy outlined in the literature review.

Qualitative content analysis was utilised to determine if there was evidence of these beliefs in actual classroom practice; the interpretation was carried out through a search for patterns in the data related to the above concepts. An observed response was represented as 'behaviours related to beliefs': key words such no evidence; weak evidence and strong evidence were used in order to group data and in identifying patterns. Themes were identified and a comparison was made across the themes to present research conclusions and recommendations.

The major themes that emerged were identified as:

- beliefs consistent with OBE;
- beliefs not consistent with OBE;
- practices related to beliefs; and
- practices not related to beliefs.

3.4 TRUSTWORTHINESS

In qualitative research reliability can be regarded as a fit between what the researcher records as data and what actually occurs in the natural setting that is being researched, i.e. the degree of accuracy and comprehensiveness of coverage (Cohen *et al.*, 2001:119). The purpose of ensuring reliability in data collection is to reduce threats to

reliability in the data-collection process. This makes it possible to replicate the study using the same research design and obtain comparable information. In qualitative inquiry the researcher constructs or reconstructs meaning in relation to the research question; therefore it is important to address the issue of trustworthiness ((Pope, Ziebland and Mays, 2000:114).

Trustworthiness refers to “the process of establishing the validity and reliability of qualitative research” (Polit and Hungler, 1996:312). The present study recognised the challenges related to studying beliefs and the emphasis was placed on providing the means to allow the teachers opportunities to bring to the surface their own theories about OBE. Teachers were given a wide scope to articulate their beliefs on, among other things, knowledge, teaching and learning. Lincoln and Guba’s (1985) model and strategies as documented in Leininger and McFarland (2002:88) were used to enhance the trustworthiness of this study.

3.4.1 Credibility

Credibility refers to direct sources of evidence or information from the people within their environmental contexts of their *truths’ held firmly as believable to them* (Leininger and McFarland, 2002:88). During data collection, the researcher spent considerable time with participants collecting data and repeatedly observing and interacting with them. Multiple methods of data collection were used to increase in-depth understanding of teacher beliefs, while triangulation of data offered credibility to the findings and enabled the researcher to cross-validate responses.

To enhance the credibility of the research findings, the researcher performed bracketing. Bracketing refers to suspending or laying aside what is known about an experience being studied (Burns and Grove, 2001:790). Researchers usually explicate their own beliefs about the research topic through the process of bracketing. This process is important in qualitative research because of the reality that the researcher develops a close relationship with participants (Burns and Grove, 2001:595). The researcher’s personal interests and biases were made explicit at the beginning of data collection by keeping a personal log book. In this log book she described her existing knowledge of OBE and understanding of teachers’ beliefs about the new system and

the conditions of schooling in black townships. She also explicated her own perceptions of OBE. The researcher attempted to deliberately put aside her own preconceived ideas and biases. She continually explored her position as researcher and lecturer, and how this may have influenced the participants' responses and her interpretations.

The researcher refrained from demonstrating her beliefs during data collection. She made every effort to avoid giving away any signs of surprise or disapproval. Revealing what the researcher believed upfront placed her in a better position to approach the topic in an unbiased manner. Explication of personal beliefs *makes the investigator more aware of the potential judgments that may occur during data collection and analysis* (Streubert and Carpenter, 1999:20).

3.4.2 Dependability

Qualitative research, being holistic, strives to record the multiple interpretations of, intentions in, and meanings given to situations and events (Cohen *et al.*, 2001: 120). Dependability of qualitative data refers to *data stability over time and over condition* (Polit and Hungler, 1996:313). An audit trail was established to enable a colleague (PhD candidate) to scrutinise the research method and the researcher's interpretations. To enhance the dependability of this study, data-collection methods were triangulated, which involved prolonged engagement and persistent observations in the field so that the results were consistent with the data. The researcher documented the research method and submitted raw data, the node reports comprising the coded data and the interpretations to the research supervisors. Continuous checks were built into the data-collection process by using informants' verbatim accounts, recording data on audiotapes, using descriptors when taking notes during classroom observations, and allowing informants to review the analysis of interview data and post-observation interviews.

3.4.3 Confirmability

Confirmability refers to *the objectivity or neutrality of the data, such that two or more independent people would reach an agreement about the data's meaning* (Polit and Hungler, 1996:315). According to Leininger and McFarland, (2002:88), confirmability refers to “documented verbatim statements and direct observational evidence from informants, situations and other people who firmly and knowingly confirm or substantiate the data or findings”. Confirmability is enhanced through a process of leaving an audit trail that entails a full and accurate description of the data-collection process, and the analysis methods and procedures as well as by ensuring that there is coherence between these aspects (Polit and Hungler, 1996:315). In this study the researcher established an audit trail as described above. She also sought confirmation from the informants that her interpretations were true reflections of their perceptions of OBE teaching practices as revealed during data collection. This was done through sharing the reflections with the informants and asking them to validate the findings.

3.4.4 Transferability

The premises of qualitative studies include the uniqueness and peculiarity of the situation, such that the study cannot be replicated – this is considered strength of the naturalistic research. The uniqueness of the contexts in which teachers operated cannot be replicated; however, Denzin and Lincoln (1994, in Cohen *et al.*, 2001) suggest that reliability as replicability can be addressed in several ways: a) stability of observations and b) parallel forms of paying attention to other phenomenon during the observation. The main focus of this study was on beliefs and conceptualisation; however, to increase replicability, the researcher increased the scope of the study by including other factors such as teachers' beliefs regarding knowledge and mathematics teaching and learning, and the role of contextual factors in the development of such beliefs.

Transferability refers to *the extent to which findings from data can be transferred to other settings or groups and is thus similar to the concept of generalisability of findings* (Polit and Hungler, 1996:316). According to Leininger and McFarland (2002:88), transferability refers to *whether the findings from a completed study have*

similar (not necessarily identical) meanings and relevance to be transferred to another similar situation, context, or culture. The researcher provided thick descriptions of the research setting, and what she had heard and seen in relation to teachers' beliefs and instructional practices during data collection. This should enable others to assess the transferability of the findings to similar settings.

3.4.5 Data saturation

Saturation of data refers to in-depth information of *all that is or can be known about the phenomenon under study* (Leininger and McFarland, 2002:88). Data saturation is achieved when no new data emerge, but previously collected data is repeatedly re-introduced into the study (Streubert and Carpenter, 1999:22-23). In this study the researcher collected data about beliefs and conceptualisation of OBE from key informants and made classroom observations until no new data emerged.

3.5 ETHICAL CONSIDERATIONS

Ethics is about what is wrong and what is right in the conduct of research. Since scientific research is a form of human conduct, it follows that such conduct has to conform to generally accepted norms and values (Mouton, 2001:238). The researcher needs to search for the truth, but not at the expense of participants or scientific integrity. Three ethical considerations taken into account during this study are discussed below.

3.5.1 Human rights of the respondents

A country's constitution contains descriptions of basic human rights, the aim of which is to provide protection to the citizens. Education researchers have an ethical responsibility not only to the participants in the study but also to society at large and to the teaching profession (Gillis and Jackson, 2002:347). In this study the researcher followed Ray's (1994) ethical framework or model (cited in De Villiers and Van der Walt, 2004:256).

In applying the right to self-determination, the researcher informed all participants that participation was voluntary and that they had the right to withdraw at any time during the study if they so wished. They were assured that the information gathered would not be used against them at any point. In the case where informed consent was required, teachers signed the consent form. The researcher explained the topic and purposes of the study to the teachers, heads of instruction and relevant principals. Permission to publish the findings of the study was also obtained. The researcher also obtained permission to quote the informants verbatim, so that important data were not lost.

During data collection the researcher demonstrated respect for teachers; the researcher used enabling and empowering communication strategies that allowed the teachers to express themselves freely and to tell their stories. Teachers were interviewed during their free time; this was arranged with the head of instruction, who made sure that the teaching programme of the school was not disrupted.

The participants' right to privacy and confidentiality was ensured. Interviews were conducted in private areas. The researcher sought permission from participants to record the interviews on audiotape. The reasons for capturing the interviews on audiotape were explained to the participants. As data were transcribed, identity codes were allocated to each informant's interview data. Only the researcher was able to relate a particular interview to an individual informant.

The researcher maintained a professional relationship with the participants by not imposing her status on participants. The researcher recognised that she was the co-creator of meanings, and accorded participants the power and freedom to share their experiences. The researcher refrained from being paternalistic and ethnocentric.

3.5.2 Rights of the institutions

Institutions, government agencies and universities in which research involving human subjects is carried out require specific information to make informed and responsible decisions regarding the ethical acceptability of a proposal (Gillis and Jackson, 2002:336). The proposal was submitted to the Gauteng Department of Education to

seek approval to conduct the research in schools. The study did not commence until permission had been granted. The names of the schools remain anonymous.

3.5.3 Scientific integrity

Scientific honesty refers to the *publication of true findings, and avoidance of plagiarism* (Mouton, 2001:240). In qualitative research this involves honesty in data collection, analysis and interpretation, giving the emic view of the phenomenon. In this study care was taken to portray the participants' and not the researcher's views. Findings were represented fully and not misrepresented. The researcher adhered to high technical standards, and all sources consulted were acknowledged.

3.6 CONCLUSION

This chapter explained the research design and method. Ethnographic principles were applied to explore teachers' conceptions and beliefs in order to provide a description and interpretation regarding those beliefs on instructional practice. Carrying out an ethnographic investigation enabled the researcher to more deeply and comprehensively gauge teachers' beliefs about OBE, their experiences and conceptions, and allowed for the inclusion of emergent contextual variables and patterns.

The researcher collected data through unstructured interviews, focus groups and classroom observations. The National Curriculum Statement intentions, topics and tasks were used as data-collection enablers to guide the data-collection process. Extensive interviews provided thick data so as to make inferences about beliefs and relations to instructional practice. Pre-observation interview data provided the context for observations; data from observations offered confirmatory evidence of the strength and direction of teacher beliefs. The strength of both cognitive and affective components of beliefs was examined in the descriptions and expressions provided by teachers. Qualitative data analysis was applied following Leininger's (1991) and Becker and Geer's (1960, in Cohen, Manion and Morrison, 2001:148) phases of ethnographic analysis of qualitative data. Ethical principles were observed to protect

the integrity of the research study. The researcher applied several measures to enhance the trustworthiness of the study.

Chapter 4 presents the research findings, data analysis and interpretation of the findings.

CHAPTER 4

RESEARCH FINDINGS

4.1 INTRODUCTION

Qualitative research was conducted to investigate the role of beliefs, conceptualisation and experiences of OBE in teaching practice. Analysis of the qualitative data was conducted using a predominantly inductive approach, which drew on relevant literature to interpret responses. The study provided an opportunity to probe more deeply into the beliefs of 19 participants. The emphasis was on providing a means to allow teachers the opportunity to bring to the surface their personal theories, experiences and beliefs about OBE and teaching in OBE environments. Studies have shown that an individual's progress through tertiary studies is likely to be strongly influenced by exposure to a variety of educational perspectives. However, it is possible that, in addition to educational experiences, life experiences and physical development may facilitate belief development, although it is not clear exactly how each of these factors influences the belief system of an individual (Schommer 1998:554).

Data collection was conducted to answer the following research questions:

What are teachers' epistemological beliefs, understanding, experiences and practices of OBE?

To address the research problem, the researcher set out to answer the following questions:

- What are the teachers' epistemological beliefs regarding, education, teaching and learning?
- What is teachers' personal understanding of OBE?
- How do teachers experience OBE curriculum implementation?

- To what extent has teachers' understanding and experiences of OBE impacted on their teaching/classroom management practices?
- Do teachers' personal beliefs affect their adoption of prescribed OBE classroom management strategies?

The sources of data were Grade 10 Mathematics teachers in Midrand and Pretoria, Gauteng province in South Africa.

4.2 RESEARCH SETTING AND PARTICIPANTS

4.2.1 Research setting

The research was conducted in three secondary schools situated in previously disadvantaged black townships and two former Model C schools located in affluent suburbs. The three township schools shared almost similar characteristics; they were under-resourced and had very large classes, with an average of 45 learners. The classrooms had few desks and chairs, and were overcrowded. The size of the class did not allow effective teacher-learner interaction; teachers could not move around freely to reach out to all learners. Ventilation and lighting were poor; the blackboard was the main instructional resource. Teachers had very little or no room to move in the classrooms. Most classrooms had broken windows, doors did not close properly and benches were broken. Chalk was in short supply and only white chalk was available in one of the schools.

One township secondary school appeared more organised and the reception area was neat and everything suitably arranged. There were three receptionists and the principal was up and about mingling with everybody. Learners appeared more disciplined and wore neat uniforms. There was less noise on the school premises, the garden and surroundings were well kept. Learners were all in classrooms, except at break times. The other township school had overgrown grass, the reception had scanty equipment, learners seemed to come in and to go as they pleased, and in between classes learners walked slowly and spent a lot of time chatting instead of moving quickly to the next class. Classes generally started late. Teachers looked on without reprimanding

learners. The head of the school seemed helpless. The third township school looked better than the second one, although the classrooms looked dilapidated and in need of some basic equipment, they were clean and the premises well kept. Teachers and learners looked determined and went about their tasks in a disciplined way.

The former Model C schools were well resourced; textbooks and other teaching aids were adequate. Student had access to computers, which had a variety of software packages. There were about 26 learners in each of the classes visited. Teachers were from different ethnic backgrounds. However, there were more white teachers than ones from other ethnic groups. Model C schools have a legacy of good governance, discipline and favourable teacher-learner ratios. These schools were governed by governing bodies that consisted of parents, teachers and learner representatives – the governing body controlled the finances, admissions and recruitment of teachers. They had a healthy budget and high standards of financial management.

4.2.2 Participants

Table: 4.1

Key: TS: Township school MC: Former Model C school

	Age	Qualifications	Teaching Experience in years	Years teaching mathematics	Type of school	Gender
T1	29	Advanced certificate in education	8	4	MC	Male
T2	33	Advanced certificate in education	12	12	MC	Male
T3	52	BTech	20	3 weeks	TS	Female
T4	51	BTech	13	13	TS	Male
T5	32	BTech	9	2	TS	Female

T6	46	BSc	22	2	TS	Male
T7	50	Tertiary education diploma	27	10	TS	Male
T8	43y	BSc	20	15	MC	Male
T9	32y	BTech	10	2	MC	Male
T10	52yr	Teacher diploma	28	4	MC	Male
T11	28yr	BSc Hons	3	3	TS	Female
T12	30yr	BA	7	7	TS	Male
T13	45	Teacher diploma	20	9	TS	Male
T14	40yr	Teacher diploma	15	12	TS	Female
T15	34	BTech	10	7	TS	Male
T16	26yr	BCom	4	4	MC	Female
T17	43	Advanced certificate in education	4	1	TS	Male
T18	30	BTech	6	6	TS	Female
T19	44	BSc	20	20	MC	Female

- **Interviews**

Interviews were used to provide a context for understanding teachers' views about transformation in education, their previous experiences and contextual factors impacting on education. McNiff and Whitehead (2005:4) contend that people's behaviours and views become more meaningful when placed in the context of their past and daily experiences. The broad topics generated from the interviews allowed the researcher to capture influences on their belief systems. The first round of interviews focused on what the teachers believed about OBE, their role, the learners' role and the support received from the Department of Education (*Ref.3.2.4*). The emphasis then shifted to OBE experience and teaching practice, including the resources they thought they needed to implement OBE. The researcher used two levels of analysis: an analysis of the initial interviews, and an analysis of the responses to questions on specific class observation data. The second analysis was used to provide confirmatory evidence of the role of beliefs in teaching practice. Focus group interviews were also used to validate data elicited from individual interviews and observations (*Ref.3.2.3.1*). Data from focus groups and individuals were combined.

Fundamental features of OBE were used to guide the questioning and the discussions of the meaning of the OBE curriculum and practice. Teachers' responses were categorised in four ways: beliefs and conception of the OBE curriculum, beliefs about teaching and learning in OBE practice, experiences of OBE implementation, general beliefs about mathematical knowledge and mathematics teaching.

Furthermore, the discussions were sub-divided according to their predominant belief system, which were described as traditional/fixed, evolving/transitional and transformative/reform based (*Ref. 3.3*). Traditional responses represent fixed beliefs that reflected beliefs in the old traditional teaching methods and pessimism about the success of OBE. These included beliefs that were not consistent with OBE objectives. Evolving or transitional responses reflected a mixed view of OBE, namely fixed and transformative. Transformative responses viewed OBE as necessary, inevitable and empowering. The categories generated by the researcher will be used to produce a summary of OBE beliefs for a group of participants.

- **Observations**

Prior to classroom observations preliminary interviews were held with the teachers to find out what they were planning for the lesson, the structure of the lesson and how lessons aligned with the set of beliefs drawn from interviews.

Classroom observation was aimed at observing how teachers implemented the new curriculum and whether their instructional behaviour was influenced by their beliefs and conceptions of OBE. The description of observations was guided by a set of questions that highlighted the dimensions of the lesson, the degree to which the teacher focused on rules and procedures, showing and telling versus the learners' interpretation and meanings, the use of teaching aids, group work, seating arrangements, reference to real-life situations, content coverage and assessment of learning.

Following the observations, in-depth interviews were conducted to triangulate data and to identify those beliefs that were demonstrated through teaching practice and those that were not.

4.3. RESEARCH FINDINGS

Findings from this study will be organised around the research questions and the core concepts of OBE.

4.3.1 Beliefs and conception of OBE curriculum

Questions were asked in a way that made it possible to elicit personally held beliefs about OBE. The researcher allowed participants to elaborate on and narrate their own perceptions, conceptualisations, feelings and understanding of OBE. Follow-up questions explored deeper issues that elicited from participants implicitly held beliefs. It was important to understand the tacit and implicit theories that drive teachers' practices and how these compared and contrasted with OBE philosophy and practice.

Various interpretations were advanced and demonstrated a wide range of understanding and personally held meanings of the OBE system: from simplistic to more sophisticated and advanced. Several factors seemed to impact on or influence teachers' conceptions of OBE, including personal beliefs about knowledge, schooling, education, teaching, assessment and learning, the level of teacher preparation, teaching experience, and experience of transformation and implementation of OBE within the school context.

All teachers agreed that OBE means focusing on learners and providing them with various opportunities to achieve the stated outcomes. However, they differed in the way they conceptualised the new system.

4.3.1.1 Traditional responses

The traditional responses are those that reflect some degree of awareness about OBE as a philosophical and practical approach to teaching. The views were not generally consistent with premises of OBE; however, there was some acknowledgement of certain aspects of OBE. The teachers who fitted into this category were T4, T7, T13 and T18.

Evidently there was resistance to certain facets of OBE and greater emphasis was put on the syllabus, the curriculum and acquisition of knowledge. These teachers were sceptical about the practicality of OBE; they expressed the view that the old system was better suited to teaching mathematics. In-depth probing revealed that the teachers used their 'unpleasant' experiences of implementation of OBE as their frame of reference. However, the researcher used many questions to enable them to bring to the surface those beliefs that were not explicit. These will be discussed below.

- **Philosophical framework of OBE**

The teachers described OBE as an impractical system that was being used to initiate change to the educational system in South Africa. These teachers viewed their role as authority figures in directing mathematics learning; therefore, OBE was viewed as an ill-defined system with unrealistic demands for learner-centredness. They expressed

anxiety about their competence as teachers and seemed to suggest that OBE took away their authority as teachers. Here are some of the comments made:

T18 I cannot say I know what this OBE is all about, all what I can say is it has changed the face of education in this country, we do not understand who we are anymore, we were mathematics teachers before, today, our role has changed.

Some responses indicated that change was necessary, but not at the scale of the changes brought about by the introduction of OBE.

T4 OBE is a radical change, we needed change in our educational system, there were too many role players in the change and teachers had very little input. Everything just changed overnight.

There was also some acknowledgement that certain aspects of OBE were useful to the educational system.

T18 OBE sounds good in other areas of learning, but in the natural sciences, it really doesn't make sense, all those vague outcomes...

Some responses indicated uncertainty about what to make of OBE; the uncertainty appeared to cause anxiety and in some instances anger at the helplessness teachers felt. Some teachers described OBE as an innovative system imported from rich countries and forced upon them without their being adequately prepared for it. They added that OBE had failed in many countries, yet South Africa decided to adopt it.

T13 I cannot say OBE is bad but I cannot say it is good either, it is just one system that was imported from overseas and forced onto us and we are learning the ropes at the same time we are expected to implement it, the learners are even aware that teachers do things differently, we not sure about the whole thing.

Various factors such as level of preparedness seemed to influence some viewpoints; further probing revealed the frustrations teachers felt prevented them from engaging meaningfully with the concept of OBE and interpreting its basic assumptions accurately.

T7 OBE is not balanced or maybe it is the way it was brought to us, we were not ready. The introduction could have been enhanced if we had been given courses before it was launched so that we could have a thorough knowledge, now it's like training while doing the job, and it is frustrating. For me OBE is a frustrating system.

This particular teacher did not have anything good to say about the new system; however, he acknowledged that OBE involves working together with learners and that teachers are also encouraged to give learners time to work independently.

One teacher also verbalised similar 'frustration' with the system:

T18 There is a problem making this OBE what it should be, it is failing, we still need some skills and thorough knowledge, we heard news that it has failed somewhere, why are they doing it here?

These reactions to OBE seemed to be influenced by a lack of basic knowledge caused apparently by inadequate training and preparation. Later on, it became evident that much of the anger was directed at the Department of Education (DOE).

- **Educational outcomes**

Teachers expressed reservations about some outcomes that were thought to be ambiguous. However, they also admitted that some outcomes were achievable, especially those that emphasised application. Others indicated that generalised outcomes for the whole country are not practical; others preferred mathematics to use content language instead of outcomes.

T18 OBE uses outcomes that are prescribed by the DOE, there used to be many of them now they have reduced the number to make the system more practical; these outcomes give teachers direction, although some of them are very confusing.

T13 The outcomes are similar for the whole of the country, how do you get that right? Every province and district is unique; the DOE should have left it to the provinces to develop relevant outcomes.

T18 Outcomes education sounds good on paper but with mathematics you need substance to teach, you cannot be focusing on outcomes all the time, there must be some form of concrete content.

The analysis of these responses indicated that teachers believed that mathematics needs to retain its boundaries and identity. Further explanation revealed that this view was influenced by their beliefs about the nature of mathematical knowledge, which

will be discussed in the subsequent sections. These views indicated uncertainty about the outcomes of OBE and mathematics teaching, especially in terms of the skills required to advance into science fields. They seemed to think that the present outcomes-based system is not adequate to prepare learners for advanced studies in the sciences.

- **Language of OBE**

Teachers also felt that the language of OBE was difficult to grasp, confusing and changes every day, for example, learning programmes, holistic plans, national curriculum statements, etc. However, some teachers acknowledged that the Revised National Curriculum Statement reduced the confusion somewhat:

T18 OBE came with new language and everything else changed, the language changes every time, and we get lost in all the jargon.

They could have kept some of the terminology to make the transitional phase smooth for everyone; there was really no need to change everything.

The teachers who were classified as reformist also confirmed the notion of the difficult language that OBE practitioners use; however, they differed in the interpretation of the new terms. For ‘traditionalist’ terminology such as collaboration and integration meant co-teaching and grouping learners according to their academic ability. By way of illustration, here is one comment:

T18 Collaboration means we have to teach together and give learners group work, so that they help each other and finish the work on time, we are regulated by timelines, so we have to cover all content timeously.

One teacher articulated views which were more consistent with OBE objectives; she appeared relaxed and seemingly accepted that she will do what is required and try to play by the rules despite a ‘*confusing environment*’; here is how she described her understanding of OBE:

T4 It is a system that requires learners to have a greater say in learning, we have to reduce teaching and teach across different subjects. Also, teachers need to use a variety of teaching methods to accommodate different learning styles. It is easier said than done.

In some instances they articulated fairly accurate understandings of OBE, although the interpretation was not necessarily aligned with the views of DoE officials

T7 OBE means all learners need to demonstrate an achievement of outcomes prescribed by the department of education, teachers have to do all what they can to make sure that learners pass, give them repeated test until they pass, teachers have to be facilitators and learners have to be active in acquisition of knowledge. I am just repeating what we are told everyday by DOE officials.

T13 In real fact OBE to me means being an all rounder, teach across learning areas and provide learners with different scenarios to enable them to comprehend the content and achieve the outcomes and that is impossible to achieve, we were trained in a particular field, how do we suddenly acquire multiple skills?

- **Expanded opportunities**

This concept was described by teachers as giving learners several opportunities to obtain a pass mark. Teachers mentioned that OBE is about assessing all the time and compromising teaching, and that they have no choice but to follow DOE guidelines and policies. They admitted though that there are some good things about OBE, but they were of the opinion that those were only few and overshadowed by the negative aspects.

T4 OBE make huge demands on teachers and learners alike, we have to create learning opportunities yet there is no time to do that, we have big classes and periods are 30 minutes, it is unreasonable to expect teachers to cater for each learner, we have a heavy teaching load.

T13 Expanded opportunities basically mean giving repeated assessments until the student passes.

T18 OBE requires learners to be put first and cater for different learning styles, but, I think it is good on paper, but difficult to implement.

Much as these arguments appeared reasonable, it was apparent that these teachers were reluctant to move beyond traditional ideas and develop a more expansive outlook, or rather move beyond an array of emotions they were going through. Teachers demonstrated strong emotions whenever the topic of OBE was brought up. Some viewed the researcher with suspicion, thinking she was from the Department of Education; a little persuasion reassured most teachers and they tended to open up.

- **Stability of OBE**

All teachers felt that OBE was not consistent and complained that changes were being implemented year after year; this appeared to be a source of anxiety and uncertainty.

T7 Every meeting you attend, they give you new things, new terms, and new systems, it gets so frustrating sometimes, some of them are not even confident in what they say, when you ask questions, they get aggravated.

One argued that C2005 was changed to the National Curriculum Statement and teachers were not consulted when those changes were made; yet they were expected to implement the new NCS. He indicated that:

T13 There has been some changes in the curriculum, now we have NCS, don't know why the changes were made, we are only expected to implement.

I guess the changes will make this curriculum coherent because it was kind of messy when we started, it was confusion everywhere, we are driven to despair by department officials who do not appear confident about OBE themselves.

Others shared his idea of hasty and unnecessary change without consulting broadly with the people on the ground; here is what one teacher said:

T18 OBE would have worked if the department asked about the best practices and infused those with the new order, not to make such radical changes. The whole concept of OBE was politically driven and had very little academic argument in it, it was about point scoring and just aiming to change everything the previous government believed in.

The support for retaining some elements of the old curriculum was apparent in these responses. Change appeared to be overwhelming and compounded by what was perceived as lack of support.

Additional responses:

T13 There was a need for change, but, you do not introduce radical changes, as you move towards the new you incorporate the ‘good old systems’. They should have surveyed best practices, there had been good teaching out there, teachers are disillusioned by the way things are done.

T7 I am not saying OBE as a teaching/learning system is bad, all what I mean is it is badly implemented, we are not yet ready, we definitely do not have a learner who ‘creates knowledge’ yet.

The teachers whose responses fitted more with transformative views supported this argument too:

T19 OBE is open to different interpretations and it depends on you how you perceive it and what you do with it. I believe it is a good system and needs to be well understood before we embark on major changes. The change is necessary and inevitable, however, we are rushing things, there is no hurry this system is here to stay why the rush? We could implement it slowly and the government should hear from the people on the ground on what works and what doesn’t’. I believe it will work if only the fear factor could be eliminated. Most teachers are fearful of change more than OBE itself.

Another teacher from the transformative group indicated that:

T8 the only problem I have about the OBE is the way it was rushed through, we don’t even get quality time to evaluate our work and improve on it, and we are doing everything from teaching to assessment in such a rush.

Others from the transformative groups had hope and confidence in the success of OBE with the proviso that the Department of Education gives a consistent and stable context for the system to survive. The general perception was that there were too many changes introduced and the reasons for the changes apparently did not cascade down to the teachers. Here is what one said:

T19 OBE is something we can achieve, the biggest problem is that every year they assess OBE, they need to give it a reasonable period to run, 5 years at

least and then evaluate it. What was bad about Curriculum 2005? We don't know, it would have been fair to let C2005 run its course.

- **Measuring success**

All teachers agreed that the current assessment approach meant changing teaching strategies and providing learners with more opportunities to achieve the outcomes. However, not all thought the system was effective. Some teachers seemed to believe that success should be measured by performance and reproduction of previously learned mathematics procedures.

T7 To know maths is to be able to use a range of tools to solve problems. We spend a lot of time measuring abstract concepts such as learners must show appreciation of... how do you measure that?

This argument was supported by another who said:

T13 Maths has its own rule when it comes to scoring performance, we have done it without much problems previously, now the DoE has added a lot of unnecessary things that have no relevance to maths knowledge.

OBE was believed to have lowered standards and the notion that all children can succeed was interpreted by some teachers as meaning that the learners should not repeat a grade.

T7 OBE has lowered standards – pass standard was 40% now in OBE 30%, learners don't work as hard as they used to. There is a lot of condoning even when they have failed and when they go to the next standard they perform below expected levels and teachers have to start afresh all the time.

Others felt that OBE assessment meant assessing all the time and at the expense of teaching content; they seemed to think that they needed adequate time to interact with learners and provide guidance in mathematics.

T13 OBE assessment has the good and the bad. The good thing about it is criterion referenced assessment that at least increases objectivity; however, there is too much assessment.

Reliability of scores was also a problem for these teachers as they felt that peer and self-assessment were ineffective.

T7 They overate themselves, meanwhile they are aware that they still need to work hard and provide sound solutions for problems or task given.

T4 Group assessments do not work, you will have learners of different abilities in a group, hard workers, and 'riders, how do you score their work?

- **Emphasis on content skills and rules**

Teachers appeared reluctant to depart from the traditional curriculum for fear that learners will miss the critical content. These teachers believed that mathematics knowledge was a collection of rules that needed to be taught through direct instruction. They believed that assessments were taking teaching time.

Here are some of the comments:

T13 Maths is a unique subject with multiple uses; you have to make sure that learners are well grounded in the basic operations

One of the transformists supported this view by saying:

T18 Much as we would like to allow student to discover or create knowledge, the type of subject does not yield to that, we still have to make learners practice maths skills.

T4 OBE makes the learners active participants and teachers facilitators of knowledge building that I am aware of. But, I do not believe in all that knowledge building by learners, how do they build what they don't know? I have to teach them, show them factorisation and equations. They need basic knowledge of Maths before they can begin to build any new knowledge themselves.

It appears that the focus of this response was on learner ability. The insight gathered from the data is that it is only after the teachers have transmitted the basic rules and some knowledge that learners will be able to construct mathematics knowledge.

There was a general feeling that mathematics content was compromised in OBE practice. These teachers emphasised the need to drill mathematics rules and procedures into learners to enable them to have a good grounding in the discipline.

4.3.1.2 Evolving responses

The teachers whose belief systems are described as evolving/transitional had somewhat mixed beliefs about OBE, as they presented multiple views about OBE curricula, resources, learners, schooling and knowledge. Their views were consistent with the premises of OBE to a large extent; however, they also expressed reservations and some degree of apprehension and uncertainty about the success of OBE. All teachers understood the new system as guiding learners towards a goal. One teacher recognised that OBE is a good system and that it has taught her new teaching models and assessment strategies; however, she thought it would not work in under-resourced schools:

T5 One thing positive about this system is that all learners are required to take maths, learners are streamed into maths literacy and pure maths depending on their ability. Maths is going to help the literacy group to be independent and give them critical skills such as calculating interests on loans, they will apply this knowledge in real life meanwhile, pure maths enable learners to think critically.

She seemed comfortable with the system, especially its focus on outcomes and learners. She also stated that the system allowed teachers and learners to identify what is important and worthwhile. Outcomes were viewed as being realistic and fairly measurable.

T5 It is all about outcomes, the learners are in the centre, and we need to make sure that learners achieve outcomes prescribed by the department of education.

This view was supported by another teacher who said:

T1 Outcomes demand a different outlook, they require going beyond and looking for ways of creating opportunities for learners to succeed. However, some of the outcomes tend to be vague and difficult to measure.

T6 After every outcome you are able to measure the success of learning, this is better than the old system where you had to wait till things went completely wrong before you diagnosed the learning need. The only issue I have with OBE is the universalism of outcomes, we need to 'regionalise' outcomes, and emphasise what is relevant for our province for example.

T5 I cannot say OBE is good or bad, it just something that we have to work and try to understand. It is not easy to absorb all these new concepts, we are trying our best. I believe in change and we needed some reforms in our educational system, but maths demands the teacher to lead learners in the right direction, they cannot just discover new knowledge themselves.

These views were consistent with some of OBE premises, but seemed to put more emphasis on knowledge or content. These teachers indicated that OBE overlooks the central role of a teacher, which is to give learners the analytical tools and to provide a context for learners to explore and discover.

Some of the comments regarded as illustrative of the evolving beliefs are:

T1 OBE has a lot of promise, there is a lot that has changed and we have to learn all that, however, there is also a lot of good from what we did previously that could have been incorporated in the new system.

T17 OBE sounds good, especially the outcomes, sample lesson plans from DOE, and rubric, but, I am not yet sure that what I am doing is right or not. Our biggest problem is we see people doing different things and that adds to my anxiety because I want to do the right things.

T2 Outcomes are reasonable and achievable, however, the context needs to be adapted, and presently nothing has changed in terms of our schools and the schools' management.

T15 Learners in OBE are quite active, which is good because that enables them to debate and see different viewpoints, the rubrics are good because they

know beforehand what they will be assessed on and that helps in improving student outcomes. But, I believe that maths requires a different OBE.

T14 OBE is grand on paper, all the talk, we have to wait and see what happens to the matriculants.

Some mentioned that they believed in the principles of OBE, but had some reservations about the apparent conflict between outcomes versus content; the emphasis on content and mathematical skills was evident from the data. Here is what one said:

T9 I believe OBE will work eventually, but it will have to undergo some changes especially in natural sciences. We need to be realistic here and talk content not emotions, attitude like some outcomes suggest. I believe in a holistic and comprehensive learning and utilisation of knowledge, hence I support the integration of learning areas to make maths meaningful for learners but some outcomes are good others lack substance; you have to realise that Maths demands particular skills.

These teachers demonstrated a mixed or multiple belief system. They believed that OBE is a good system; however, they appeared to have traditional views regarding the curriculum. They seemed to have conflicting views about OBE, as they thought it was a practical system, but at the same time they cited many challenges.

One mentioned that:

T5 I believe in designing down and delivery up because that gives chance to design lesson plan and arrange the activities to enable achievement of outcomes, for example, you start with outcomes and work towards achieving them. [But then he stated that] ... it is easy to articulate these theories but the delivery is problematic, we do as much as we can within the tight time frameworks, most of the time we overlook the outcomes and concentrate on content.

This seemed to suggest that OBE has potential, but there are challenges in the implementation.

T5 I appreciate this new system because it is not abstract; content is based on real-life situations, I see possibilities in OBE, it will work, it will. Everyone has to adjust to the new methods.

This teacher felt that the outcomes are achievable; if learners can just apply themselves diligently, they will achieve most outcomes. Teachers just have to find ways of overcoming challenges and give OBE a chance.

The teacher's role appeared to be given prominence over the learner's, the views seemed to be teacher centered. One said:

T1 Child-centredness means the teacher giving a structured content and allow student to work on problem tasks to demonstrate understanding of the basic operations, for example, I need to show learners how to construct bar charts, polygons and explain skewdness and such things, then I will give them enough time to problem solve.

T2 It is making sure that every child passes and nobody should repeat a class.

This particular interpretation that all learners need to pass seemed to be prominent and was found to be one of the major influences on teaching for the exams. However, some had different views; they regarded learner-centredness as providing different opportunities to enable the learners to achieve the outcomes.

T1 It is not possible for student to achieve outcomes in my subject only, it is not meant to be. Student will achieve outcomes after being exposed to different learning experiences. Hence it is important to integrate the material as much as possible.

T10 The problem with this approach though is you have a different set of learners in your class, grouping them and pacing content is one of the biggest challenges that we cannot resolve.

OBE was defined as an open system which had different meanings for different people. The impact of such different meanings was raised as a concern, especially with respect to learning experiences.

T2 We are doing different things in every class, therefore, the teaching/learning encounters are not consistent, I am not sure about the outcome of such diverse experiences. The fact is each one of us has a different interpretation of OBE and how it should be implemented, in my school there seems to be less uniformity.

4.3.1.3 Transformative responses

These teachers reflected advanced views and understanding of the complexity of the philosophical framework and practice of OBE. The strength of their descriptions of OBE and the expression of the relationship between educational transformation and teacher/learner empowerment was evident. For most of these teachers OBE brought hope for the formerly disadvantaged, and some teachers felt that the change was overdue. They stated that the experience gained is invaluable; as one put it:

T3 OBE has instilled pride in me, empowered me in many ways especially the assessment strategies.

T8 OBE means getting off our high control and authority position and give learners the opportunity to express themselves and take ownership of learning into their hands; this can be achieved by embracing the transformation and working within the system; changing the way we do things and learn new strategies of teaching and assessment.

This teacher demonstrated absolute enthusiasm about the new model and further elaborated:

T8 Change is painful; but we have to go through this and learn new ways of doing things, learn from each other, from learners, and even from government officials and curriculum developers. Sometimes those government officials confuse us, but it is not about them, it is about me finding the right way of teaching. We are all going through a learning curve.

Her views were supported by the others (T8, T11, T12 and T16). They all felt that learning outcomes are the perfect way of developing a holistic person, which is exactly what OBE advocates. They were optimistic about OBE, although they acknowledged the challenges in the classrooms. One (T12) mentioned that he finds OBE intriguing and reads a lot about its merits and failures in different parts of the world, especially the USA and Australia. He had been exposed to other systems outside South Africa, which allowed him to take a more reflective approach to the implementation of OBE in this country. He had heard from the teachers in Australia that there is no perfect system; we have to improve it as we go along. This additional information provided invaluable context for his understanding of the influences on his belief system.

Most of the teachers believed that OBE is about planning learner-centred activities with teachers taking on the role of guiding learners to perform basic operations as well as complex thinking operations.

Here is what one teacher had to say about their conception of learner-centredness:

T11 To me OBE means putting the learners' interest in the centre of everything that we do, and making sure that we build their potential to achieve the stated outcomes. The outcomes are reasonable and achievable, although some of them are stated vaguely and it becomes a challenge to measure them.

The need for teachers to become lifelong learners was also recognised. OBE was seen as having provided this opportunity for teachers to continually learn, thus leading to professional empowerment.

T16 If you chose to become a teacher, then you chose to become a life-long learner. The educational system has changes, we need to adapt to the new changes and make sure we keep ourselves updated all the time. OBE to me means flexibility and innovation and believing that every child has the potential to succeed, doing everything to make sure that the child succeeds. Success is not getting high grades only, it is also about making sure that the child is well rounded and takes responsibility for his/her actions. Therefore OBE means empowerment actually, everybody wins, teachers, learners, and the nation.

These teachers provided reasoned conclusions about their role, and the necessity and inevitability of change. This reflects expanded and sophisticated beliefs about learners. They seem to believe in the holistic development of the learner. This certainty translated into this teacher using socio-constructivist approaches in her classroom.

Teachers categorised as transformative also agreed that OBE is not without challenges, but there is a need to be positive and to concentrate on what works and to find solutions to challenges. It was suggested that OBE will work with good planning to ensure successful implementation.

As one teacher states:

T19 I believe that OBE has brought a new way at looking at things, yes, there are serious challenges, but people tend to focus on negatives and forget to count what works and what is good about OBE. I believe that I have the capability to implement OBE whether the resources are adequate or not. OBE requires innovation and positive attitude, there is too much work especially paperwork involved but as a pedagogical system, it is promising, if only it could be implemented with care.

These teachers viewed OBE as a change that is both necessary and inevitable. They accepted the responsibilities brought about by the change. To them OBE meant learning new ways of teaching and learning, and recognising their role as innovators and creators of an enabling classroom climate that is conducive to positive learner outcomes. They acknowledged that challenges are inherent in any system that is undergoing major transformation; hence some believe that the change should be gradual and not rushed. This will enable all teachers to build confidence and to unleash creativity.

T12 Change was necessary for example, changing the number of learning outcomes was a huge relief, and the introduction of National Curriculum Statements improved the wording of outcomes.

Another teacher added:

T3 OBE helps/empower teachers because I am also a learner, when learners reason, I gain from them. I am a co-learner.

She emphasised the active role of learners and felt that OBE has created a good relationship between teachers and learners, adding that learners relish this new active role and they always share new information. She viewed herself as a life-long learner. This was a mature teacher with many years of teaching experience, but just a few weeks of teaching mathematics. It appeared that she derived her beliefs from her own teaching experience. However, she also noted some good aspects of the traditional approach. She mentioned that she often draws insights from both systems:

T11 I believe in OBE fully, it allows one to explore new avenues, such as integration of subjects. You get the bigger picture of what the learners need to know and you can work toward helping them achieve those outcomes. I also feel that not everything in the old system was bad, the change was too radical and ambitious, I use some of the good old practices such as provide learners with structured daily tasks.

Another teacher felt that OBE provided new dimensions of knowing; it brought new theories and skills they never knew such as criterion-referenced assessments, designing rubrics and lesson plans. Outcomes were described as achievable:

T8 The outcomes are practical and realistic; learners understand better, they explore issues, because they know how they are going to be assessed.

She appreciated the new system because it is not abstract; the mathematics content is related to real life and well integrated with other learning areas. She also mentioned that OBE is more practical in teaching fractions and decimals. For example, when she taught area/volume, she let learners work out how much paint they will need for a room, etc. This appeared to make mathematics easier for the learners.

Her understanding and definition of OBE was based on valid theoretical premises. She seemed quite comfortable with the system, even though she did mention its challenges, but she did not think they were '*insurmountable*'.

One teacher felt that OBE is open to different interpretations and this interpretive framework guided decision taken in the classroom. She argued that

T11 A new system can have different meanings to different people, the subject advisers sometime have their own interpretation which is not shared by teachers on the ground.

Her descriptions seemed to imply that teachers use their own lenses to interpret what is required and plan the learning activities accordingly. This might suggest that teachers are taking on the roles of transformative intellectuals.

4.4 BELIEFS ABOUT OBE TEACHING AND LEARNING

The responses in this category overlap with teachers' definitions and beliefs about knowledge and experiences of OBE. It became evident early on in the study that experience and beliefs are intertwined. Teachers described several aspects related to teaching OBE mathematics. Their views in some cases were illustrative of a developmental view, in other cases of a transformational view. Teachers who had direct training on OBE had different views on OBE than those who relied on second-hand training.

4.4.1 Traditional views

Themes that emerged from these teachers supported the traditional models of teaching and learning. They believed that they had a moral duty to explain material to the learners. These teachers expressed reservations about the facilitation role as espoused in OBE, and they perceived learners' needs and background in mathematics knowledge as important factors in influencing teaching decisions.

T13 It is good to be a facilitator, but learners won't know the maths until you show them how to work out problems and provide them with multiple drills. There's a fixed sequence of teaching maths, for me facilitation means enabling learners to master the basic rules and procedures.

T7 OBE assumes that learners can reason out maths problems, that is not possible, our learners do not have the language needed to formulate correct equations.

T18 There is no time to teach problem solving; OBE has shortcomings when it comes to maths, topics such as gradient inclination needs to be taught.

T4 Maths is a well defined subject and I believe the only way to teach learners is to make them do the exercises every day. The kind of student we have right now would not benefit from facilitation.

Teachers seemed to prefer the old way of teaching and learning; this was apparent among those who had many years of experience and only a basic teacher's diploma as a qualification. They shared the belief that teaching is about making the subject interesting and providing learners with basic skills to solve mathematical problems and to use this knowledge in daily life. One teacher explained that:

T14 Learners need good algebraic skills to solve linear equations, I need to provide them with the necessary skills, good teaching is showing learners short cuts to solving problems.

Facilitation was described as giving learners problems to solve, writing procedures on the board and letting them work on their own. One said:

T7 There is no way you can teach maths without writing on the board; you have to write to show learners the shortest and quickest way of arriving at a solution.

Like I said earlier teachers have to provide a rich environment for learners to be sophisticated in maths reasoning, engage learners in regular problem solving drills, homework every day.

One supported this view and argued that:

T4 Facilitation is good but has limitations, you can do that when you have learners who are willing to learn and take responsibility, our learners are not ready for that, they need the basics.

These teachers showed reluctance to move away from teacher-centred approaches; they seemed to imply that they hold more authority in the subject. Therefore they needed to impart knowledge to the learners. In this context learners are given some degree of independence and control over learning; however, the teacher still appeared to be the dominant figure and mathematical knowledge viewed as fixed and absolute. This is an example of procedural knowledge that is characterised by rules and procedures. Mathematics is viewed as a set of logical concepts that exist in abstract and concrete forms (Archer 2000:8). Therefore, teachers needed to provide ample exercises for learners to memorise these rules to enable them to think mathematically.

Collaborative teaching and integration of content was defined as good and positive for professional growth and development; however, there were voices of concern regarding the different interpretations of OBE and the impact of this on teaching practice and learning.

T13 Collaboration is excellent in situations where we are all on the same level, we are doing different things based on our own understanding of what is expected and what we think is realistic and practical. But we are implementing OBE differently and I suppose this is difficult for learners to adapt to the realities of OBE or even to know what it is all about.

- **Linking mathematics to real-life situations**

All teachers believed that learners need to understand the connections between mathematical knowledge and real-life situations. They believed that relating mathematics to real-life problems is a useful tool in teaching and learning; for example, when dealing with costs and expenditure they used landline and cell phone costs and let learners compare the usage versus convenience and cost.

Teachers articulated a variety of approaches to linking mathematics to everyday problems. One explained that it is good to use examples such as asking learners ‘*why is roofing always in triangles?*’ There was general agreement that learners need to understand mathematics and be able to translate it into a usable tool. They felt that

OBE approaches make learning interesting for learners by providing examples related to real-life experiences.

- **Prior knowledge**

All teachers believed that prior knowledge is critical to understanding higher-order or complex mathematics later. Most admitted that their learners had knowledge gaps and felt that these gaps needed to be ‘filled’ by the teacher.

- **Role of learners**

All teachers described their role as facilitators, coaches or guides. Learners were defined as active participants. T3, T16 and T8 in particular embraced this new role and described it as empowering; however, some perceived OBE as having created poorly defined roles for teachers. These teachers felt that previously they could clearly articulate their role in the teaching and learning process, but now they are told that they should be facilitators, yet they still view their role as dispensers of knowledge. According to these teachers, nothing actually changed to justify the changed role. Here is how one summarised this view:

T18 OBE demands a change in our role and become facilitators, creators, all rounders, but, how do we become facilitators in this situation where everybody does what he thinks is correct? We are still using directives from the DOE, how do I become a creative being when everything else is ‘prescribed’, for example, timelines, outcomes, assessment approaches?

This teacher argued that for teachers to become facilitators and the system to truly work, there should be flexibility and an enabling environment for teachers to demonstrate their creativity. OBE was viewed as restrictive in terms of time; hence some teachers thought the system is unrealistic. They all agreed that OBE enhances learner-centred education. However, some had a different understanding of this notion, namely that the responsibility for learning was put squarely on the learners’ shoulders without teacher involvement.

Here are comments from some teachers:

T4 OBE involves critical outcomes that learners need to achieve, this will make them responsible citizens, I cannot teach them to be responsible, it has to come from within, at least that's one good thing about it.

I understand the role of the teacher as being a facilitator, and the learner taking full responsibility for their learning. This is good because it will help change some of the negative attitudes we experience in our learners.

Teachers who emphasised the rigidity of the system were found to favour the teacher-based approaches to teaching and learning; they did not believe that there was time to provide learners with different learning opportunities to enhance the achievement of outcomes. They held traditional views about teachings and felt that covering all outcomes was most important.

Some teachers blamed OBE for 'creating' unruly learners; here is how one of the teachers summarised learners' role:

T4 OBE emphasises other skills, for example, arguing and debate, but these learners argue without a basic knowledge, they are brave, bold, argue a lot, but their arguments are superficial.

This was supported by another teacher: who said that *high school is difficult, learners have an attitude.* Another teacher supported this view: *it has made them assertive, but they argue without content.* Further support came from yet another teacher:

T17 The new system has created illusions among learners; they seem to think active learning means arguing and making noise.

T10 OBE has given a voice to learners, it is good because they can debate issues in class; however, they tend to misuse this opportunity.

This view was supported by another teacher:

T4 OBE learners have no sense of commitment. How do I make them want to be active learners when they hardly have a purpose of being

in the classroom? How do I motivate them when I need somebody to say to me 'It's gonna be alright, you doing good'?

Male teachers in particular had a problem with this new attitude that OBE has 'created'. Mostly it seemed they associated active participation with negative attitudes. T7 and T4 in particular had problems with learners, who according to them displayed superficial knowledge yet they had a lot to say. The alternative viewpoints presented by learners seemed to be treated as less important. These teachers appeared to believe that the teacher's quick and easy method is the best and can be used to override the learners' interpretations.

Female teachers seemed to take this attitude in their stride; they viewed 'noise' in a positive light. As the words of one teacher illustrates:

T9 Classrooms are noisy, but, it is interesting to have them debate about how they arrived at a conclusion, it makes the atmosphere jovial, after all learning should be fun, especially when we use manipulatives, such as measuring the room diameters etc.'

What emerged from the data is that the learners are generally active in classrooms – OBE classes are regarded as more noisy, there are active discussions, but some teacher felt that these discussions were lacking in substance. The findings supported the view that beliefs are multidimensional and that one person can hold different views as demonstrated by teachers who held both traditional and evolving views.

4.4.2 Evolving views

Teachers with evolving views believed in a healthy mix of the old and the new. They articulated OBE premises, but seemed reluctant to let go of their traditional beliefs about teaching mathematics. Most were of the opinion that the learners are not yet ready for a system that demands creation of knowledge.

They believed that the suggested OBE teaching/learning methods are not sufficient to enhance achievement of outcomes. One teacher noted:

T1 OBE has brought about new methods, we support that, however, there are certain topics in maths that benefit from traditional approaches such as factorisation.

Another said:

T5 Teachers are facilitators, they provide guidance to learners, but like I said there are certain topics that learners cannot discover for themselves such as 'Algebraic skills to solve linear equations'.

These teachers believed that the teacher's role is to facilitate the acquisition of knowledge, but seemed to hold onto the position of authority in the process of knowledge creation. They asserted that mathematics required mediation and that the teacher is responsible for making sure that the learners become familiar with the rules and procedures.

This view was supported by one of the teachers who argued that:

T10 The role of teachers has changed and learners need to take more active role in learning... OBE recognises the knowledge that learners have, in the previous systems – teachers knew it all, but now we recognise the fact that when kids come to school they already know something in maths, all what you do is to guide them, we need to show them how to interpret the numbers and that numbers can be presented in other ways.

Although this view is consistent with OBE, especially in relation to the role of learners, the teacher is viewed as an authority figure who has more knowledge.

T1, Algebra is about a mix of rules and procedures that are used to solve problems, therefore I need to make sure that learners grasp the basic rules, and they need to learn them quickly to understand complex maths issues later.

This view suggested mixed beliefs about mathematics knowledge and how it should be acquired by learners. The view is that learners bring views to the classroom, but these often reflect limited understandings of mathematics that teachers need to guide learners in the right direction and provide them with the necessary support/scaffolding.

4.4.3 Transformative beliefs

Teachers in this category believed that both teachers' and learners' roles needed to change in OBE practices; both were believed to carry responsibility for teaching and learning. As one teacher notes:

T8 Learners need to be engaged cognitively with content, we need to help them think mathematically, they have to reason things out, relate their knowledge to the real world. Learners have the capacity to achieve OBE outcomes, the syllabus is straight forward, and we need to use methods that support achievement of outcomes.

Active learning in this view depends on the teacher creating a meaningful learning climate that will allow learners to engage with content and use their interpretive skills.

T8 For me learners are at the centre of everything I do in class, the way I present content, assess, interact with them is critical. I need to have a good relationship with them because my aim is to develop a whole being not just a maths guru.

She also believed that most learners have the capacity to achieve the outcomes, but she had problems with the belief that 'all learners can succeed'; this is what she said:

T8 The success for all fails to recognise the multiple factors involved in learning. It is not only the school environment, teaching, and curriculum that determines success, human beings are faced with a myriad of challenges at home, in the community and at school, personal, and social. However, in theory, I believe that the human mind, with the right attitude, can achieve anything.

Flores (2000:234) argues that the belief that all learners have the capacity to learn encourages teachers to react to learners needs and these teachers develop high expectations of their learners. The notion of learners creating knowledge as espoused in OBE was described by one teacher as follows:

T16 OBE practice requires facilitation, and that means leading learners to some outcome, help them reach the 'aha' point. Then they can discover certain knowledge themselves, these are challenges, but nothing is impossible.

All teachers believed that in order for them to be able to provide expanded learning opportunities for learners to achieve the outcomes, they have to be knowledgeable about mathematics and be authorities in the field; however, they do not have to be dominant figures in class, because learners need to be encouraged to be active participants.

Here is what one said:

T3 Teachers need to learn OBE teaching methods, you cannot respond to learners' need if you do not have adequate maths knowledge. Some of these learners are quite smart, you have to be ready to work out solutions with them and be well grounded in maths.

Another comment:

T19 We have fast learners who get easily bored, we try make the whole subject interesting and challenging, but the majority struggle, you have to come up with creative ideas to maintain the enthusiasm of above average learners. This is where I find OBE a bit frustrating – dealing with gifted learners whilst giving hundred percent support to the rest of the class.

T8 and T16 were among those who benefited from OBE training and workshops. Their conceptualisation of educational transformation and OBE was consistent with DOE aims. They both expressed the need for teachers to be creative and innovative, and indicated that lack of resources should not be a problem.

T16 Teaching in OBE brings its own joy and challenges, it is a new system, but as teachers we have to learn new ways of doing things all the time; teachers taking control of learning doesn't work, we have to allow learners the opportunity to bring to class what they know already, and OBE allows that.

This view was supported by another teacher who mentioned that:

T19 There is no end to creativity, you can do a lot with nothing, the learners bring in their experiences to class, we need to tap into that pool, and that provides a learning curve for us.

OBE provides opportunities for teachers to try out new systems and become innovative, collaborative learning provides a good opportunity to figure out things together.

OBE curriculum and teaching practice is the best, South Africa needed this change to improve the quality of learning, all the paperwork we have to do is tedious, but we need to be accountable and provide evidence of the teaching strategies employed.

These teachers held a more receptive view of OBE and their conception of teaching was more aligned to constructivist approaches.

4.5 GENERAL BELIEFS ABOUT MATHEMATICS KNOWLEDGE

Mathematics knowledge was included in the research so as to assist in understanding what informed the beliefs systems of teachers. This study assumed that the teachers' personal narratives about the nature of mathematics knowledge would in some way influence their belief systems and their practices. There are different views on knowledge; some people may view knowledge as dualistic, absolute and handed down by authority, while other individuals may hold the view that objective knowledge is not possible and that knowledge development is an ongoing process of inquiry (Berthelsen, Brownlee and Boulton-Lewis, 2002: 505). The literature has shown that individuals who believe in absolute knowledge tend to favour transmission methods of teaching, and people who believe in simple knowledge may be less inclined to explore more solutions and alternatives.

Teacher had various interpretations of what mathematics entails, from the ability to study mathematics to the qualifications of those who teach mathematics. In general the subject was viewed as an elitist area; most teachers believed that it is for a chosen few.

4.5.1 Traditional views

Teachers in this category viewed mathematics as a collection of rules and skills that are to be used to solve problems; therefore, the emphasis is placed on the curriculum guidelines such as the National Curriculum Statements or teachers' own experience.

T13 Maths has certain rules that we need to follow, and this is what I tell my learners every day, just know the rules you are fine with math.

Some had a content-focused view of mathematics; they highlighted conceptual understanding of content with an emphasis on performance. These teachers viewed performance as a key goal, whose attainment depended on the mastery of rules and procedures. One could infer from this explanation that their task was to deliver authorised content:

T4 Math is a problem-solving subject, it has its own language that learners need to know and use, the symbols, rules, they have to memorise these rules in order to solve problems.

T7 Our learners are afraid of solving problems; hence we give them daily exercises to practice problem solving.

These responses were illustrative of a transmission model of teaching and learning. These teachers believed that their task is to cover the content and that academic attainment depended on the mastery of rules and procedures.

Mathematics knowledge was viewed as fixed; some teachers suggested that it comprised a set of fixed rules and they cannot change the formulae.

T7 Maths is maths it will never change, and OBE is just a method of teaching maths, learners need to learn these rules to solve daily problems.

In math you have to show numerical relationships for learners to be able to formulate the correct equations

They all seemed to believe that mathematics problems have one answer, and teachers are better equipped to know what learners need.

T15 Maths follows definite steps, you can never go wrong if you use the correct procedure, and learners need to be taught these steps.

Knowledge is understanding basic and central concepts in any discipline; one needs to be a master in a particular field to add new knowledge to the discipline.

T14 Knowledge building to me means being well grounded in something before you build on it. Math, for example, demands knowledge of rules and procedures, in order to solve problems. Therefore, I do not believe any system or OBE can make learners suddenly have the ability to come up with new knowledge.

They appeared to be protective of the domain of mathematics knowledge and regretted the uncertainty created by OBE. They wanted to hold onto what they do best, which is ‘teaching’ mathematics; much as they articulated their role as facilitators in the previous discussion about the role of teachers, their statements contradicted this view. As stated in the words of one teacher:

T9 Teachers have to provide a rich environment for learners to be sophisticated in maths reasoning, engage learners in regular problem solving drills, that is, homework every day.

The discussion of traditional views illustrates an emphasis on procedural knowledge that is characterised by rules and procedures. Mathematics is viewed as a set of logical concepts that exist in abstract and concrete forms (Archer, 2000: 8). Therefore, teachers needed to provide ample exercises for learners to memorise these rules to enable them to think mathematically. The alternative viewpoint of mathematics, especially of including what learners know, appeared to be treated as less important. Teachers seemed to believe that the quick and easy method is the best and can be used to override learners’ knowledge.

4.5.2 Evolving views

Mathematics is regarded as an elite learning area; the subject knowledge is superior and open doors to sophisticated careers such as engineering, finance and physics. Also, they believed that the teacher with rich mathematics knowledge will be able to pass this over to his/her learners. They seemed to take pride in the fact that they were mathematics teachers.

T17 In order to teach maths effectively, you need to be good in it, and it is not many who are good in teaching maths. You need a specialisation in maths or natural sciences.

T5 The reality is maths teachers carry an important responsibility, making learners think in a logical way, I mean maths requires a certain skill in teaching.

T1 Maths is for the chosen few, both teachers and learners; some people just don't have the maths brain.

They shared similar views with the traditionalists and mentioned that the nature of mathematics forces them to emphasise the rules and procedures of solving problems. However, they did not hold absolutist views of knowledge, as illustrated in the words of one teacher:

T1 OBE clashes with maths, for example, algebra is about a mix of rules and procedures that are used to solve problems, therefore I need to make sure that learners interpret and give meaning to the solution. At the same time they have to learn the rules quickly to understand complex problems later.

For these teachers mathematics knowledge is simple for someone who is an expert in the field; learners bring simplistic views and understandings that need to be guided in the right direction by the teacher.

T2 Knowledge is evolving hence it is important for teacher to make sure that learners have the basics so that they can contribute to the knowledge base tomorrow.

T14 OBE is good in most aspects especially in art, but in maths really we need a mix of the old and the new to make it happen, otherwise we will have learners who do not have enough knowledge.

The content component of math knowledge was over-emphasised.

4.5.3 Transformative views

Other teachers provided a much more flexible stance that suggested an evolving understanding of the nature of mathematical knowledge. Learners' knowledge was embraced and accepted as legitimate. To them teaching and learning mathematics involved learners bringing their previously learned knowledge to create new meanings. Teaching was described as observing how learners develop these new meanings. One teacher in particular indicated that she learns everyday from her learners:

T3 My learners bring such rich experience to the classroom, I learn a lot from them, I even modify the marking guide to incorporate the new things they bring to class.

Learners bring their basic knowledge to class, and a different way of solving problems, new knowledge emerges everyday.

Learners argue quite a lot, they bring valid points that one never thought of.

These teachers supported debate and mentioned that they use learners' new-found assertiveness to bring out the 'hidden knowledge', as one put it. One said:

T19 You have to constantly make maths stimulating by allowing learners to be imaginative especially when you teach Pythagoras – let them find the right angles, keep on changing geometrical positions.

They believed that OBE has brought new ways of acquiring mathematical knowledge, and that classrooms are open to various interpretations and management. Teachers also admitted that OBE is demanding; they have to be creative and bring fun to the classes, use boxes, move things around to enable learners to apply reasoning.

T12 Teaching and learning maths comes through trying out new ideas and evaluating learners' responses.

T11 Maths give structure to thinking, for example, making sense of weather reports, making financial decisions, this is what I call knowledge.

Most teachers regarded mathematics as problem solving discipline that provides learners with essential survival skills that will open many opportunities; T16 provided a view of mathematics as dynamic and evolving:

T8 Maths is non-routine, it is translated into other facets of life, its learners can use it to manage time and other resources as they continually make sense of data.

He emphasised the need to make mathematics real to learners and remove the myth that it is for the elite. The knowledge of mathematics was mostly described as useful in the development of mental abilities such as reasoning, analysis and problem solving.

T8 Algebra increases reasoning and learners begin to see patterns emerging, teachers who have the love for the subject will always makes it interesting to learners.

4.6 EXPERIENCE OF OBE CURRICULUM

OBE demands a new mindset and way of doing things. Teachers are expected to be agents of inquiry and to create expanded opportunities for learners to engage with content in a meaningful way. OBE demands that the teaching and learning processes should change. The question is: how do teachers experience these changes? The findings show that their feelings were mixed, ranging from being confident and willing to know/learn more to feeling uncertain. Teachers felt that they were trying their best in the face of all challenges.

Their experiences of OBE curriculum will be discussed in more detail below.

4.6.1 Teaching and learning

The responses showed how teachers interpreted the teaching experience in OBE practice. Some teachers complained a lot without making an effort to get to know the basics, whilst others simply accepted the challenges and worked to the best of their ability. Teaching within OBE environment was described as full of challenges by some.

This particular teacher argued that it will be difficult to truly measure the success of OBE:

T7 Work schedule is not workable. In the past we would follow a set rule, now you run around trying to find out what opportunities are available to make maths meaningful to learners.

T5 OBE emphasises student-centredness, but, how can you reach 45 learners in 30 minutes? We cannot change it because other teachers feel these learners don't have high concentration, they get bored easily. I don't think I can handle them for longer than 30 minutes.

We have to finish the syllabus within a certain time frame, our classes are big, it is not possible to practice student-centredness.

Others thought it provided teachers with an invaluable window of opportunity to enrich themselves. As one teacher notes:

T16 OBE empowers teachers, but again, it is up to us to develop the right attitude and curiosity to want to know more, why should we wait for the department to show us what to do, we have been trained, we have the experience, with the right mind, we can make it work. Teaching in OBE has its merits and challenges, systems around the world are faced with challenges too.

OBE was viewed as good, because now the learners have a voice, they are assertive, they argue their points and seem to be comfortable with collaborative learning. As one teacher asserts:

T3 Integration of learning areas works out well especially in math literacy, we provide scenarios that help learners to think out of the box such as calculation of costs and expenditure using statements, invoices, etc.

The integration of learning areas opened up other possibilities for teachers to learn and support each other, although one teacher feels that there is still much to be done in this area and that the responsibility for doing so rests on the shoulders of teachers:

T8 OBE opened a new chapter of collaboration for teachers, previously maths teachers formed a distinct group and were viewed as 'experts', however, OBE has changed all that we are forced to speak to others and plan how best outcomes could be achieved. I mean what opportunities we can create for learners to achieve these outcomes.

T1 Some teachers do not apply OBE, therefore learners move from one teacher to another and find application of the new ways of learning confusing.

4.6.2 Collaborative teaching and learning

Group work was viewed differently by the teachers. Some described it useful, whilst others viewed it as detrimental to above-average learners. A teacher who views group work negatively says:

T4 One problem I have with OBE is group work, at times some learners won't do much but they will benefit from the group score.

Co-teaching was perceived to be beneficial and empowering, especially when those who had formal training are able to train others and allow them to observe their classes, as one teacher puts it:

T16 I consult with team leaders and benefit from co-teaching, the maths head is helpful, he supports us and provides good leadership, but he admits too that there are unanswered questions. How do you give your own view of something you are not sure of?

T5 I have mixed feeling about collaborative teaching and learning, asking assistance from other teachers does not reflect well on your integrity, most learners don't benefit from group learning, only weak learners do.

Most teachers admitted that meetings with mathematics teachers in the region had helped clarify certain problematic areas. Others felt collaborative teaching has problems, because some teachers are merely conformists in that they wait for others to create new methods of teaching and assessment and they just follow the trend.

Others acknowledged the challenges but did, however, show a willingness to try out the approach. As one teacher notes:

T15 It would be naïve to think that everything is smooth, there are challenges such as slow and fast learners, I usually pair them because it is not possible to cater for their individual needs. The department develops external assessments, learners have to be ready for that, no matter how you look at it you still have to cover sufficient content, it is difficult to cater for all learning needs.

Others believed that the new teaching and learning approaches support the acquisition of high-level knowledge for motivated learners. However, the other learners who depend on teachers and are not willing to take on an active role in learning will be disadvantaged. As a teacher explains:

T14 OBE has the capacity to provide motivated learners with rich knowledge – but learners who are not willing to take an active role in learning will have problems, we are doing our best to cater for all.

We consult each other ask 'how do you do this'? We are not so bad, there is something small that we need to discover.

4.6.3 Assessment

Assessment was viewed as very tedious, consisting of lots of paperwork and compromising content coverage. One teacher felt that OBE places huge demands on both learners and teachers; learners who are motivated experience no difficulties and teachers who are willing to learn the new ways of assessing and try to be creative

have no problems. The biggest concern is the time it takes to assess, give feedback, write progress reports and present new content. When this is done, the cycle starts again. Big classes pose a serious challenge as well as creating uncertainty in some instances. The following comments are illustrative:

T7 The assessment is tedious; that's all we do, assess and assess. That takes time off planning quality lessons; sometimes we end up teaching what we think is important to know.

T4 We follow the guidelines provided by DoE, the rubrics are confusing sometimes, and we don't know how to develop good ones, we ask from colleagues, I mean everybody does as he/she understands; the outcomes are good and achievable, all what we need is time.

The attitude of learners was also found to be a challenge to teachers. Teachers complained that learners do not have a sense of responsibility, because they are aware of the opportunities they get to re-do assessments. As a teacher elucidates:

T2 What is bothersome about OBE assessment is the repeated chances we are expected to provide learners. They are aware of this and they deliberately skip classes because they know they will be given another chance.

T5 You can never plan effective assessments that are integrated with learning because we are chasing time all the time, there are time frames, there are external exams and learners need to be ready for them.

At the same time most found the criterion-referenced assessment appropriate and it is used to make the purpose of the assessment clear to learners. As noted by a teacher:

T3 Continuous assessment helps weak learners and develops potential, for example, learners who are good in oral presentations get the benefit of multiple ways of assessment.

Some teachers felt that completing the content was not as important as the depth one needs to give in the subject; they felt that it is useless to rush over content without giving learners a chance to grasp the fundamentals that are so important. A teacher notes:

T17 I know that assessment involves a lot of paperwork, however, some of us are rushing to finish the content, I believe it is important to make sure that the learners understood the basics.

This teacher believed that learners need to understand mathematics and utilise this knowledge in real life, but outcomes-based assessment (OBA) seemed to be forcing learners to memorise rules and reproduce them, because teachers are expected to prepare learners adequately for external assessment; this may lead to teachers teaching for the exams. Most teachers stated that there is no time to try various methods of assessment and to cater for slow learners as well.

T13 How do you use different approaches of assessment with big classes? By the time you mark the work the period is over and you have to re-schedule your lesson plan.

T7 We spend most of our time marking and giving feedback, we are chasing the golden number 'four' for different assessments.

Most teachers felt the timeframe for implementation was not realistic and they did not understand the need to rush such a historical change. The number of assessed tasks was viewed as unrealistic. As one teacher contends:

T13 The department should have planned the implementation phases steadily and made sure that teachers were well trained to give them confidence. The number of times each learner has to be assessed is unrealistic, and there is the external component also that forces us to rush over content.

Another teacher supported this and said:

T6 The only problem I have about the new system is the way it is rushed through, we don't even get quality time to evaluate our work and improve on it, and we are doing everything from teaching to assessment in such a rush.

However, some teachers acknowledged the challenges and were willing to confront them and create new meanings from the experience. As one teacher expressed this:

T14 OBE requires innovation and positive attitude, there is too much work especially paperwork involved but as a pedagogical system, it is promising.

Rubrics are good in a sense that learners know beforehand how they will be assessed and this serves as a motivation. Continuous assessment caters for different learning preferences.

This teacher showed evidence of a cognitive understanding of the relationship between continuous assessment and the provision of expanded opportunities to enable learners to achieve outcomes. Critical outcomes posed some challenges to some teachers, who felt that innovation and critical thinking could not be scored reliably. These are teachers who put more emphasis on performance.

T15 Some of the outcomes are simply difficult to measure, how do I know the learners is creative, there will be a problems with inter-rater reliability.

I will never say with conviction that I know they know math, some aspects of math, yes, but not all. The problem is some outcomes are not very clear; it is difficult to measure them.

Perceptions of learners' ability appeared to influence views on the OBE assessment approaches. Some teachers felt that the learners are not yet ready and are lacking in many basic mathematical skills, especially in algebra; they seemed to imply that the best way to assess the subject would be to use the traditional methods because they were more reliable.

4.6.4 Content

OBE requires teachers to move out of routine work as it demands creativity and multiple forms of inquiry. Teachers' beliefs and principles are significant in the implementation of an innovation (Wadmany and Levin, 2006: 158). If teachers' beliefs do not match the goals and assumptions of educational innovation, then resistance is likely (Wadmany and Levin, 2006: 160). Data obtained from interviews and observations revealed that teachers are faced with many challenges in the classroom; they have to constantly make decisions regarding what is important to know and what is not. The need to empower learners to think mathematically was predominant. Some felt the outcomes were clear and gave direction to the development of appropriate learning activities; however, the majority of teachers felt that they knew what is best for learners and seemed to emphasise content-based teaching.

The following comment revealed apprehension and doubt. Yet this teacher is experienced and has taught the subject for years. He seemed to struggle with the discrepancy between what he thought constituted mathematical knowledge and the outcomes as required by the DoE:

T10 Math gives structure to thinking, for example, making sense of weather reports, making financial decisions, this is what I call knowledge, sometimes outcomes are vague, I taught maths for years, I never ask any teacher how to teach, now I find myself in a situation where I need colleagues to help me understand outcomes.

Others felt that mathematical knowledge is fixed and cannot be reduced to outcomes; this indicated that teachers focused more on content rather than on outcomes. As one teacher notes:

T18 Math is math, we have to teach the basic operations, and the learners need to acquire the skills. Some outcomes are good, but others are vague, not related to math knowledge.

In some instances mathematical knowledge was viewed as static and expected to remain the same; however, OBE was perceived as having changed that, as the following comments show:

T13 I am not against outcomes, but I think you cannot change maths from what it is now that we have OBE. The knowledge of maths remains the same whether it is OBE or not. Some of the outcomes are not content-based and difficult to measure.

T17 Many fields of knowledge rely on maths. We need real maths not all these outcomes that are confusing and some are even difficult to assess. I think that OBE ignores content.

T4 We need to teach maths, some outcomes are just a waste of time, how do you teach a child to appreciate something? Some outcomes need to be reviewed, others are quite good.

The conceptualisation of ideal mathematics teaching was content and performance focused, hence the teachers felt that they had an obligation to make learners develop good mathematical skills and that learning cannot be left to learners to simply discover knowledge. Mathematical knowledge was viewed as complex and not capable of being understood without the direct intervention of teachers. As one teacher contends:

T17 I understand fully what we need to do, however, I just feel that some maths aspects cannot be left to learners to explore and discover, I need to give direction. Hence, the content should be clear. At the moment some parts of it are clear but in some instances you simply guess what you supposed to do.

Other teachers thought the new NCS made outcomes clearer. They understand what is involved in the process of making learners understand mathematics, as illustrated below:

T5 In the beginning there were many outcomes, it was so confusing, now, with the introduction of NCS, the outcomes have become clearer, at least there is direction, you can move on with confidence.

T10 The NCS provides the best guidance, even if you did not specialise in math, you will be able to create good learning activities for learners. I mean everything is straightforward. We have to do a little bit of thinking also to make it usable for learners. For example, there are good scenarios for factorisation using facto theorem, in statistics, the examples provided for calculating probability are quite good.

As mentioned before, most stated that the changes in Grade 9 resulted in difficulties for teachers in Grade 10. The subject was viewed as being hierarchical in nature, meaning that the understanding of the higher concepts depended on proper understanding of lower-order concepts:

T9 Maths requires building up of concepts in a logical fashion. However, Grade 9 does not prepare learners adequately for Grade 10 Maths, there has been too many changes in the syllabus, gradient inclination and equation of straight line are now taught in Grade 11, previously analytical geometry was

taught in Grade 12 only. We are now faced with learners with poor math background.

The introduction of new chapters such as statistics was viewed as problematic, especially to teachers who do not have a statistical background. As a teacher notes:

T3 If you did not do stats in college, it would be difficult for example, mean, mode, median, probability, and they are not well explained, you need to have background knowledge, to make it meaningful to learners.

Other teachers did not seem to put too much emphasis on content, but on the process of learning. They were of the opinion that whatever the DoE has developed was good enough; it was up to them to make content meaningful to learners and give them the analytical, reasoning and problem-solving skills to confront any situation that requires mathematical reasoning. One of these teachers notes:

T8 OBE demands innovation and creativity, as a teacher I need to constantly respond to the learning needs and develop learning activities that are appropriate. I believe that outcomes are mere guidelines; I have to make sure that learners are exposed to a variety of experiences to achieve outcomes.

Mathematics was viewed as not being the only route to enhance the achievement of outcomes. As one teacher states:

T19 Collaborative teaching and integrated teaching provide the opportunity for learners to achieve the stated outcomes. This is not something that maths alone can achieve. This is the strength of OBE.

4.6.5 Real-life context

It was found that teachers with strong mathematical pedagogical beliefs believed that mathematics is a formal, structured guide for solving problems; therefore, real-life problems provided an avenue for providing concrete mathematical drills. On the other hand, those who leaned towards constructivist approaches believed that a real-life context provided learners the opportunity to think and reflect about the concepts so as to get a deeper understanding. All teachers mentioned that they often use real-life experiences to make content interesting and to stimulate critical thinking. This

dimension of OBE seemed to enable integration of mathematics with other subjects.

As a teacher notes:

T3 I use examples such as area, building and raw materials, painting – how many 5L paint do you need, and then, if there is a window what happens?

This teacher felt that the learners responded well to this kind of teaching and their reasoning improved considerably. She said that in other instances she used budgeting, for example, eating out and buying groceries. Learners were given time for the application of knowledge such as giving them a project requiring them to obtain information from local supermarkets, for example, pricing.

The tasks provided by the Department of Education were seen as helpful and challenging; for example, one teacher used financial management to apply and integrate exponents, and used disease profiles to demonstrate trends and graphs, histograms etc. Most appeared to be highly independent and tried different approaches. As one teacher notes:

T12 Teachers are expected to be creative and I try new methods for each unit, in that way I can cater for different learning preferences.

4.6.6 Resources

The lack of basic resources was a major concern for most teachers, especially in the townships. Most expressed doubts regarding the successful implementation of OBE. This in some instances led to despair and a sense of inadequacy. This is what some teachers said:

T10 Resources pose a serious issue, kids don't have calculators, there is this new one, it gives you answers, on the touch of a button, it can join and shape the graph. If the kid doesn't have it and sees it first time in the exam, it will not be beneficial.

T7 I know that they meant well by introducing OBE, but, they ignored fundamental issues in teaching in a township school that has no resources. We are trying to be creative as the system demands but your energy gets depleted

because you have to fight against odds all the time, in the classroom, preparation time, assessment. It really drains our spirit.

T14 The issue of resources was big previously, but now it has become bigger because we are expected to be creative, provide expanded opportunities for these learners to achieve the outcomes, how do we do that, what do we use to cater for different learning needs? How does one begin when you are faced with 50 learners in a class?

T6 Outcomes require going beyond and looking for ways of making opportunities for achieving outcomes. Even if textbooks are not available, it is not a major problem.

4.6.7 Learner

Mathematics teaching was described as challenging. As one teacher states:

T9 Learners comes from Grade 9 unprepared, the syllabus has changed and Grade 9 does not seem to provide them with adequate background to work through Grade 10 content, especially advanced maths.

Most teachers stressed that personal responsibility for learning was still lacking; learners were described as non-committed and very forgetful. OBE methods were perceived as too advanced for most learners by some teachers. However, others thought OBE empowered both teachers and learners. The following comments illustrate the different viewpoints:

T4 Learners are not disciplined, and corporal punishment has been abolished, this has weakened the authority of teachers.

T2 Sometimes it get very difficult and we are powerless to reprimand them, especially boys.

T5 I would not blame OBE for the lack of discipline in our schools; it all depends on the social circumstances, upbringing, and most importantly

leadership from the school management. Often teachers are not in a position to discipline learners.

One teacher in particular seemed to be aggrieved by this apparent lack of discipline in learners and appeared helpless to change the status quo: T2 *The head of instruction, the principal, everybody complains about these children, they don't have respect for authority anymore.* During class observations it was noted that some learners did not seem to listen to the teachers, were non-responsive and did not participate in class activities. Teachers simply ignored them.

On the other hand, other teachers enjoyed this new-found responsibility in learners and expressed appreciation and mentioned that OBE has created lively classrooms.

T8 I enjoy the new kind of responsibility observed in our learners, however, I cannot speak for all, I hear that in the township, it is different.

T5 OBE has given a voice to learners, while it is good because they can debate issues in class; however, they tend to misuse this opportunity.

T19 OBE is good because now learners participate in learning and assessment activities, self- and peer assessment gives us an idea of what they think about their knowledge of maths; however, we hardly agree with their scores.

One teacher seemed to need motivation and encouragement from superiors. This is a teacher who often expressed uncertainty and a sense of helplessness regarding OBE:

T7 How do I make them want to be active learners when they hardly have a purpose of being in the classroom? How do I motivate them when I need somebody to say to me 'it's gonna be alright, you doing good'?

Self-paced learning was been described as difficult to implement; most cited big classes and time constraints as challenges. Most were of the opinion that OBE was for fast and motivated learners.

One teacher T6 stated that he accommodates fast and slow learners by allowing fast learners to work at their own pace: *I have one girl who is four sessions ahead of the class and I allow her to solve problems on her own and ask questions when the need arises.* The slow learners are provided with interactive activities and supported; activities for slow learners suit their pace. He gives homework prior to lessons and reinforces work during lessons. He says:

OBE emphasises student-centredness, but how can you reach 45 learners in 30 minutes? We cannot change it because other teachers feel these learners don't have high concentration, they get bored easily. I don't think I can handle them for longer than 30 minutes.

4.6.8 Support from Department Of Education

The support from the Department of Education (DoE) is not adequate and teachers are left to fend for themselves. Training is viewed as lacking and not adequate. The department emphasised the high expectations of teachers, yet the training is not enabling.

Teachers indicated that they have had their successes and challenges with the new system; they thought few people could claim to have a full understanding of the system, hence it is imperative for the DoE to develop a well-coordinated in-service programme. Some felt that OBE should have been delayed until teacher education had been improved and teachers well prepared, because the new system demands highly qualified, innovative and flexible teachers.

This is illustrated in the following comments:

T10 To be honest, we are just doing what we think is right, for the sake of these children, the feedback from the department is scanty, we are expected to implement OBE in high school with very little support from the officials.

T17 There is too much paperwork; we are improvising, not sure if what we are doing is right or not. The officials should come frequently to provide support. It's not that we do not want to work – we do not know what to do.

T7 How do you deliver a system as sophisticated as OBE in a place like this, look around, what do you see? Broken chairs, broken windows, no calculators, no textbooks, how do you suddenly become this highly innovative educator when there is nothing to work on to get started?

T4 Most teachers are under-qualified, maths is another story altogether, the majority do not have the minimum qualifications to teach maths, without adequate support from the department, there is no way that they will become comfortable with OBE.

4.6.9. Training

All teachers indicated that the training was not adequate. What prevailed was a sense of helplessness, uncertainty and sometimes anger at the rate of change without adequate preparation.

T6 said *Teachers were taught in the traditional way, a major shift is needed to implement OBE successfully.* The language was found to be difficult and overwhelming, as noted by teachers:

T17 Training was not enough, people who trained us were unsure of certain aspects, they should have trained teachers for a year at least to build up confidence.

T10 There are no resources, educators not trained adequately; teachers need to take a full course of OBE to empower them, workshops not enough.

One teacher said that the Department of Education was seen as not doing enough in training teachers and that he expected more from the department as well as teachers:

T5 The guidance from the department needs to be improved, but still one needs to read, ask and collaborate with other teachers so that we learn from each other.

Others expressed similar views:

T7 We need support, we use to have in-service training for teachers – now we are being evaluated without much training. Need examples of lesson plans.

T18 OBE will work in developed countries; the reality is that most of us are under-qualified. There is merit to this system; however, it needs a complete retraining of educators.

4.7 CLASSROOM OBSERVATION

The data presented in the following section provide an overview of classroom observations of nineteen teachers who participated in the study. Inferences were made from data categorised as follows:

Teaching descriptors

1. Structure of content – lesson plan
2. Dominant teaching method: constructivist = **C**; Traditional = **T**; mixed = **M**
3. Linking to real-life events
4. Use of teaching aids
5. Questioning. Content-based questioning **CB**; Process-based questioning **PB**; A mix of both = **B**

Teacher/learner relationship

6. Teacher – learner interaction
7. Content authority

Assessment

8. Assessment strategies
 9. Creativity
- Teacher descriptors 3 and 4 were further classified as achieved = **A**; not achieved = **NA**; Partially achieved = **PA**

Table: 4.2 SUMMARY OF ANALYSIS - CLASSROOM OBSERVATIONS.

	Teaching descriptors					Teacher-learner relationship		Assessment	
	1	2	3	4	5	6	7	8	9
T1	M	M	PA	A	B	M	M	M	M
T2	M	M	PA	A	B	M	M	M	M
T3	C	C	A	A	PB	C	C	C	C
T4	T	T	A	A	CB	T	T	T	T
T5	M	M	PA	A	B	M	M	M	M
T6	C	C	PA	A	B	C	C	C	C
T7	T	T	A	A	CB	T	T	T	T
T8	C	C	A	A	PB	C	C	C	C
T9	T	T	A	A	CB	T	T	T	T
T10	T	T	A	A	CB	T	T	T	T
T11	T	T	A	A	CB	T	T	T	T
T12	M	M	A	A	B	M	M	M	M
T13	M	M	A	PA	B	M	M	M	M
T14	T	T	A	A	CB	T	T	T	T
T15	T	T	A	A	CB	T	T	T	T
T16	C	C	PA	A	B	C	C	C	C
T17	T	T	A	A	CB	T	T	T	T
T18	M	M	A	A	PB	M	M	M	M
T19	C	C	A	A	PB	C	C	C	C

The observed teacher behaviour was categorised as traditional transmission instruction, constructivist-compatible instruction and mixed practices. The traditional transmission instruction is defined as predominantly teacher-centred, where the teacher directs learners' actions, transmits information and relies mainly on textbooks as a resource. Learners are required to record and memorise formulae and information, follow the teacher's directions and complete worksheets. Constructivist approaches are defined as predominantly learner-centred, teachers facilitate learners' thinking, textbooks are used flexibly, learners design their own activities and the emphasis is on student reasoning. The mixed approach is a combination of the two approaches, with teachers showing various tendencies towards traditional and constructivist.

4.7.1 Traditional transmission teaching practices

Most teachers in township schools displayed almost similar teaching practices with slight variations. Their classrooms had similar features in terms of seating arrangements, teacher/learner interactions, start and end of lessons.

- **Teaching approaches**

The following teachers (T14, T15, T17, T10, T18, T9, T7, T4) displayed traditional transmission approaches that will be discussed below.

T4 The teacher introduced the lesson by asking learners questions about the ratio between boys and girls in the classroom. T4 wrote tasks on the board and learners solved mathematics problems individually and in groups. The subject appeared to be presented as a set of knowledge with rules to be used to solve problems. T4 continuously reminded learners to use thinking skills and recall the steps.

T4 walked around checking answers and giving feedback. The class was relatively quiet and learners seemed to be engaged in problem solving. In both observations there was little debate or dialogues in class. The teacher was in control and gave the

answers to problems most of the time. Learners occasionally went to the board to write down the solutions. No variety in teaching style was observed. Learners were also not asked to explain how they arrived at an answer. When interviewed after the lesson T4 said:

It is important to reinforce correct procedures, math requires them to be at ease with the basics, I am aware that we are expected to be facilitators, but you could see for yourself that they have very little maths background.

When not walking around checking answers, the teacher was marking notebooks and giving feedback on previous work. The blackboard was the main teaching aid. He justified his approach as follows:

The ideal math instruction involves learners getting involved, figuring things out, but our learners are not ready for that just yet, they find maths very difficult especially algebra.

Once they get the basics, they move faster, and I show them shortcuts, to cut down time of trying to figure things out.

He had previously mentioned that the system does not provide time for reflection and that teachers are expected to cover the learning material and finish within a stipulated time. He said:

There is a lot we need to cover, the outcomes are reasonable , but how can I be sure they will achieve them if I let them take control of something they have no knowledge of?

His conception of learners:

Learners have very little understanding of maths knowledge, they argue a lot but they are empty, I need to use the maths language, symbols and notations, which they cannot do on their own.

His perception that the learners are ‘empty’ (lacking in mathematics skills) seemed to legitimise his use of problem-oriented tasks. He also believed that he knew what was best for learners.

T7 used a native language most of the time, and the same applied to learners. He also demonstrated a high level of control and was talking most of the time, demonstrating how to use distance formulae. One student demonstrated the steps on the board

(repeated what the teacher did). T7 asked questions in between and learners responded in a chorus fashion. Document analysis revealed that the learning outcome for this lesson was: Use grids and maps in order to determine locations and plan tips. The mathematical skills development in this lesson was to determine distance and speed (Teacher Guide Mathematical Literacy 2006). He gave the following data to learners:

The Cape Town-bound train leaves Johannesburg station at 1pm and travels at 100km per hour, it arrives in Cape town at 12pm the following day. Calculate the distance between Johannesburg and Cape Town. He used more examples that allowed learners to estimate and measure lengths and distances.

In the classroom less time was spent on inquiry activities or interactive discussions. T7 used an uneven mix of traditional and OBE approaches; however, more time was spent on teacher-directed activities and problem practices. For example, in the second lesson, to a different group of learners, he asked questions that encouraged some form of thinking:

What is the equation of the straight line? What does C stand for in the equation?

What is gradient? Why is the graph shaped like this? Why is the parabola upside down?

Application: a train starts at 200 m per second, travels at what x speed for 15 seconds, the last 11 seconds of its journey; it travels at 177 m per second. Show the gradient of the acceleration.

These are good questions; however, the teacher was too quick to give answers and very little time was given to learners to process the questions. Learners responded well to teacher-led instruction (it was obvious that this was the daily pattern). The types of questions encouraged reproduction of knowledge fed earlier by the teacher.

One can infer from this teaching approach that the teacher believed that he is the authority concerning mathematics content, and his obligation was to drill the rules and procedures into learners. He explained his instructional practices in terms of his perceptions of mathematics:

Best way to teach math is to show learners how to work out solutions and let them practice.

He believed that mathematical knowledge is certain and straightforward. Most of the teaching seemed to be based on the traditional view and learners were not given the opportunity to explore and discover. He also mentioned that in order for learners to solve linear equations, they need to be able to use previously acquired knowledge in algebra and in his view the learners tend to forget everything taught previously and thought that OBE had aggravated the situation.

Maths is a build up on previous knowledge; it demands learners to be well grounded in basic algebraic manipulations.

OBE learners are less motivated, lazy and argumentative, they are so forgetful, you can never get anything out of them.

This view of learners seemed to influence his traditional teaching approach. In his view he needed to make sure that the outcomes are achieved, especially content-based outcomes.

In class he was the authority and seemed comfortable with mathematics content. However, he expressed uncertainty about how to write the OBE lesson plan and remarked that teachers needed guidance regarding the structure of the 'new' lesson plans. However, the structure of his lesson indicated a particular form; the sequence of activities showed that this was a planned lesson. The uncertainty about the OBE lesson plan would possibly be ascribed to 'fear' – as most teachers indicated that they were not sure whether or not they were on the right track.

He believed that OBE is a good policy but not well presented and lamented insufficient training teachers received prior to implementation:

It's not that we do not want to learn the new methods – we do not know, we need support, we need examples of lesson plans, given ample time to develop rubrics, to learn new things. I have been teaching math over years and respond to needs of my learners. OBE makes us look inadequate.

He cited the following challenges militating against making OBE work: big classes, time constraints, tedious assessment, not sure of what they are doing, less support from DOE officials. He also found OBE language too intimidating. However, he repeated that he was willing to learn new innovations if well supported.

I want to believe that my method works, because learners respond well and they pass the external assessment.

He did not support the view that OBE does not encourage mastering of rules as stated in the NCS.

It's all on paper; the reality is your performance is evaluated in terms of your subject pass rate.

It could be inferred from the data that there were contradictions in the system, especially between the DoE and the teachers. It appeared that teacher's belief were not consistent with the goals of the reforms.

T9, 10, 17, 15, 11 and 14 are grouped together because they used traditional approaches in class, but articulated OBE approaches very well. Their approaches were time bound and appeared to be driven by external examinations. They valued some of the goals of OBE, but had reservations regarding the success of OBE.

Here are the comments of two on their teaching approaches:

T17 OBE is not a bad system, we understand what needs to be done, but, how can you create different learning opportunities in 45 or 30 minutes? I am aware that I teach too much instead of allowing learners to discover new things, but, what can I do? The reality is that we have big classes, we need to finish the required content.

T14 My approach to teaching is influenced by learner needs, yes, I know what is expected of us, but, our learners come to us with limited maths background, what do you do in that case? – you kind of 'fill up' the gap by taking control of learning to enable them to understand new content.

T9's lesson plan reflected a deliberate attempt to 'cover' content and also incorporate aspects of critical thinking, problems solving and personal interpretation. He most often asked learners to explain how they arrived at an answer. He asked many process questions that allowed learners a good deal of opportunity to think. The ideal form of mathematical instruction, according to him, is a good mix of the

old and the new. He was very articulate about OBE goals and acknowledged the limitations posed by environmental factors.

I plan my lesson in such that content is covered adequately and at the same time give them a chance to think about issues and relate content as much as possible to real life situations. Maths literacy allows us to apply math knowledge, however, advance math tends to be abstract, but I try make to it practical.

T10 leaned towards traditional approaches more and demonstrated an almost similar approach to T7. During teaching her comments confirmed that she viewed math as a system of rules and procedures. In both her lessons she stressed the need to learn the steps by heart.

I stress to them to develop the number sense and properties of operations, this will help them do the computation quicker.

The issue of self-paced learning appeared to be problematic for these teachers. They felt that there is no time to cater for individual needs and the curriculum itself is time bound. The outcomes have been prescribed by the department of education; timeframes were given to cover content and that is exactly what teachers are doing... *working within time frames*. This contradicts the issue of expanded opportunities and self-paced learning.

T17 used group work most of the time and encouraged learners to discuss their ideas freely among themselves; much of his teaching seemed to be based on collaborative learning. He explained that:

Group work is very useful for these learners, they come from different backgrounds and bring very little to class, grouping them is beneficial for less capable ones.

Most of the NCS exercises served as foundation for his discussions. He used real-life references and asked learners to generate ideas. This was a lively class and learners appeared to enjoy his approach. He made content fun; however, he tended to dominate the discussions. He asked different types of questions and learners

responded; he appeared to be pressed for time. He moved rapidly over many aspects of his lesson; his lesson plan was a bit tight for a given time available. He stated:

I know that learners struggle a lot with maths, hence I group them. I cannot wait for each of them to process much without compromising content.

External assessment seemed to be the driving factor behind his teaching approaches. He said:

I have to facilitate in class, I try to do it, but our learners are not ready for this kind of teaching. OBE was introduced quickly and the DoE has unreasonable expectations. We can make it work we are qualified but it is utterly impossible to just facilitate.

In almost all the observations, teachers were facilitating learning and at the same time marking learners' previous work. Concerning this, T17 notes:

It is a vicious cycle, the assessment is tedious; that's all we do assess and assess. That takes time off planning quality lessons; sometimes we end up teaching what we think is important to know. I would like to do thing differently, however, I am bound by policies and rules.

Teachers are used to traditional methods of assessing mathematics knowledge; learners were expected to reproduce what they were 'fed' by the teacher most of the time. As a consequence, less new knowledge emerged from learners.

Data from T14's assessment showed she uses rubrics a great deal, especially with group work. Assessment data were not available for the rest of teachers. She mentioned that she found continuous assessment appropriate and always tried to vary assessment methods as far as she could.

Continuous assessment helps weak learners and develops potential, e.g. learners who are good in oral presentations get the benefit of multiple ways of assessment.

For all teachers who favoured transmission methods, mathematics drills and learners writing on the board seemed to be the essence of their teaching. Aside from working on the board, learners spent most of their time doing NCS exercises on worksheets.

Learners were given tasks with specific instructions, which appeared to limit learners' creativity; however, some teachers allowed learners an opportunity to apply knowledge.

The following explanations were given for the teaching approaches:

T11 Having them write the steps on the board assist those who got it wrong, that gives them the opportunity to learn from each other.

T15 I use the NCS exercises a lot, in that way I am sure that I am on the right track, I have no time to create my own because we only have one hour free time, we are teaching the whole day.

T7 I always tell learners that in order to pass Maths they should do exercises every day, that's why I give them homework daily.

Covering all the content was found to be important for these teachers. They used outcomes most of the time; however, their emphasis was on making sure that learners acquired the basics in mathematics. These are the teachers who held traditional beliefs about OBE, teaching and mathematics knowledge.

4.7.2 Summary of findings for mixed teaching approaches (T1, T2, T5, T12, T18).

The teachers in this category demonstrated mixed beliefs about OBE and approaches to teaching and learning. They also articulated positive beliefs about OBE and its practicability; however, some revealed an inclination towards a mixed model of traditional and constructivist teaching methods. Levin and Wadmay (2006: 178) assert that there are multiple conceptions of teaching and learning. Therefore, flexibility is required in learning and teaching. Co-existence of contrasting views in an individual may reflect differences in the strength and location of beliefs; and these should be seen as complementary.

Teachers seemed to believe strongly in the approaches they used in class. They viewed OBE as a system that needed to be infused with the old principles and seemed to hold very strong opinions about the nature of mathematics. Mathematics was perceived as an elite discipline which was exclusively available to the ‘chosen few’. As reflected in the views of T1:

Math is math, it is not for everybody only those who have the brain for it, you have to provide facts, and make sure learners practice it daily, many don't have a head for math.

Two of the lesson plans reviewed had the topic and content. The mode of instruction was described as teacher-led combined with class discussion. Content was sequenced according to the teacher guide from the Department of Education. No document analysis data were available for the other three teachers.

Teachers used various methods to present and assess knowledge. Some used DoE guidelines extensively; others designed their own activities and assessment tools, including rubrics. Few teachers discussed the assessment criteria with the learners and emphasised the most important aspects.

Teachers believed that OBE is good because learners know beforehand what they will be tested on and how they will be tested. As T5 notes:

OBE rubrics give learners a fair chance to excel, for example, if learners wanted to do better in examinations, they would know the specific parts they need to focus on.

○ **Observed teaching behaviours**

The typical behaviours observed included:

- Prior knowledge assessed in the process of questioning;
- Wrote the topic on the board and read out the learning outcomes;
- All problems were written on the board and learners worked on tasks;
- T1 explained that ‘*OBE is not against using the blackboard*’;
- Teachers demonstrated the procedures step by step;

- Learners were given the opportunity to reason out the answers;
- The blackboard was not the main resource; learners were given alternative sources and lack of resources did not seem to be a problem;
- Questioning covered a mix of content and process (reasoning out answers);
- Reference to real-life situations was moderate;
- Some degree of creativity observed – teachers designed their own rubrics for assessment and developed specific lesson plans;
- Not all teachers had lesson plans for both classes observed.

Most teachers used a mix of methods; this mixed methods approach allowed learners the freedom to explore issues, but at the same also took control of the situation by directing activities; most of the teaching appeared to be time bound and time appeared to be a major constraint. In both instances lessons were not ‘completed’ according to the lesson plan. In T5’s class learners arrived 10 minutes late in the first observed lesson. The second observed lesson they arrived 8 minutes late. T5 said:

We always complain about the 30 minutes classes, but nobody seems to notice, learners come late and it is difficult to finish content. We are somewhat managing and break the lesson into manageable chunks.

T12 and T1 taught by facilitating thinking process and mixing that with teacher-led instruction. T1 mentioned that:

OBE recognises the knowledge that learners have, in the previous systems – teachers knew it all, when kids come to school they already know something in maths, all what you do is to guide them.

However, the guidance in this instance seemed to be a teacher-based approach and their views of the nature of mathematics knowledge appeared to be more influential. This is what T1 mentioned in the initial interview:

Math is all about strict rules and learners need to be guided towards finding the shortest and most convenient way of solving problems.

This is somewhat contradictory to what OBE advocates, that there are multiple ways of looking at or solving a phenomenon. T1 seemed to believe that the teacher is still

the dominant figure who has to shape the thinking of learners and guide them to the right path of understanding mathematics. He noted:

You can use maths for exponents, learner's can come up with a pattern, at the end of the day you still have to show them that exponent is always expressed as a base.

The best way to teach maths is to show learners the steps and rules, then they will be able to reach the point where they can discover certain knowledge themselves, how can they discover something that is as rigid as maths without some background.

There are other concepts that you that cannot contextualise like factorisation, you can do linear graphic looking at trends, in real life for example - where do you work with x and y ? We use x and y as a starting point towards achieving unknown factor.

This seemed to imply that he believed it was important to provide learners with a concrete content basis in mathematics; previously during the interview he mentioned that *OBE clashed with math*.

Some form of collaborative learning was observed in the class of T12. Learners sat in groups and were working on worksheets. Occasionally they would ask questions and the teacher would give answers. Learners had their own chairs and tables, sat close together however and were working independently. There were tasks on the board and learners were working on the tasks. A few learners did not appear to be working on tasks; they were chatting and playing around. The teacher constantly reprimanded them, but they seemed to ignore him.

T5 grouped her learners and frequently demonstrated to the learners how to solve problems on the board. She explained this practice in terms of the nature of mathematics.

Maths follows a set procedures, it is a problem-solving process and therefore requires building up of concepts in a logical fashion.

Knowing math involves practising the skills.

She engaged learners and asked questions such as:

Can someone tell how you came to the conclusion?

As this example illustrates, the teacher used methods consistent with OBE – activating prior knowledge and eliciting creativity by asking process questions. Learners were actively involved and healthy debates were encouraged. The teacher seemed to be confident in asking learners to explore the answers and elaborate on other factors that influenced their decisions. However, she controlled the class activities to cover as much content as she could.

When asked whether covering content was more important, this is what she said:

In a normal situation you would do things differently, for instance give them time to process new content and integrate it with existing knowledge. But we have specific outcomes to work on and make sure learners achieve those in preparation for the external exams.

T5 was not able to reach all learners, as some were not participating in classroom activities; she tried to draw everybody into the classroom discussions. It was not possible to achieve this in the time that was available. She explained:

Our classes are too big to make OBE really work as it should, I am aware of what need to do, but it is not possible under the circumstances.

Not all her beliefs were translated into classroom practice. She had ideas on what needed to happen in her classroom, but could not implement those approaches because of contextual factors.

T12 and T18 constantly used repetition to reinforce facts and basic rules/steps of solving mathematical problems. Some of the classes had active learners, who showed good insight into mathematics and participated actively in seeking solutions. In this context learners are given some degree of independence and control over learning; however the teacher appears to be still the dominant figure and knowledge viewed as fixed and absolute. As T18 elaborates:

Like I said earlier teachers have to provide a rich environment for learners to be sophisticated in maths reasoning, engage learners in regular problem solving drills, homework every day.

This is an example of procedural knowledge that is characterised by rules and procedures. Mathematics is viewed as a set of logical concepts that exist in abstract and concrete forms (Archer, 2000: 8). Therefore, teachers needed to provide ample exercises for learners to memorise these rules to enable them to think mathematically. The alternative viewpoint of mathematics, especially of learners constructing their own knowledge, appeared to be treated as less important. T18 seemed to believe that the teacher's quick and easy method is the best and can be used to override the learners' approaches. In some instances she mentioned that meaning and understanding of mathematics concepts was more important than formulas. Several patterns emerged, but what transpired in his class suggests that he struggled to balance the two approaches. T18 believed that all learners have the capability to achieve the outcomes, provided the environment is conducive, that there are adequate resources, and that there is support for teachers and a more favourable teaching load.

The dominance of the teacher was expressed in subtle ways and tended to be positioned in different places on a continuum between learner-centred and teacher-centred approaches. These variations appeared to stem from personal practical knowledge rather than theoretical knowledge about learning as espoused by OBE. As T1 elaborates:

I need to make sure that learners grasp the basic rules, and they need to learn them quickly to understand complex math issues later.

In the classes of teachers classified as using mixed approaches there was minimal involvement of learners in bringing other methods of solving the problems. As mentioned earlier, the teachers showed mixed beliefs about knowledge and seemed to know what was best for learners. For them mathematics knowledge is simple for someone who is an expert in the field, whereas learners bring simplistic views and understandings that needs to be guided in the right direction by the teacher.

Teachers seemed to think that the new teaching and learning approaches support the acquisition of knowledge for motivated learners. Other learners, however, depend on the teachers and are not willing to take an active role in learning. This view explained the traditional approaches they used in class.

- **Reference to real-life contexts and integration**

All these teachers viewed mathematics as involving problem solving and related to real-life contexts. There was a structured attempt to make references to real-life situations, but it was minimal. T1 explained the approach he used in class by asking learners: *Why is roofing always in triangles? - To balance the beams with triangles, you cannot balance beams with squares.*

T12 discussed the functional design of an umbrella in a geometry class; the core of the discussion was on the geometry of an umbrella and how it influenced the design. He elaborated:

I use real life examples to allow learners to understand that maths needs to be used and applied for it to make sense, it should be something that you constantly refer to for things such as budgeting, estimating distance.

T2 also believed that relating content to life problems was a useful tool in teaching and learning. For example, when dealing with costs and expenditure, he used landline and cell phone costs and let learners compare the usage compared to the convenience and cost.

Blackboard, textbook and DoE examples appeared to be one of the main sources for the examples teachers used in the classroom.

T18 provided the following explanation:

I use the blackboard extensively because there are no other resources, ideally maths should be taught in the computer lab, and learners would have a chance to use technology to solve problems, this will enable them to discover many ways of arriving at solutions.

T2, however, did not believe in writing problems on the board because there is lots of content and one cannot write all of it on the board; he encouraged learners to go to the board and interact with peers and work at finding solutions. In this way he has a chance to observe the thinking patterns of learners, which is important in planning the next lesson. He stated:

It is important to know how they think, that gives direction to the next lesson, because the most important thing is to move from what they know and how they understand to the complex.

Learners were made to calculate the cost of telephone calls and compared landline and cell phone calls. Answers came mostly from learners and the teacher occasionally asked learners to give reasons for their answers. Learners developed a graph to show the relationship between cell phone and landline rates.

He believed that engaging learners was important as much as leading them to discover. He notes:

We need to promote reasoning skills and encourage learners to take responsibility and control of learning.

He asked learners the importance of maintaining good personal finances and to describe how they would get started. He mentioned that:

Learners learn best through direct reference to existing knowledge.

He was very strict with time. Learners who arrived late were reprimanded and marked 'late'. The integration of subjects opened other possibilities for teachers; they supported each other, although they felt there is still much to be done in this regard. T12 and T18 made regular references to other subjects such as chemistry and physics. T12 elaborates:

OBE opened a new chapter of collaboration for teachers, now we are forced to speak to others and plan how best outcomes could be achieved. I mean what opportunities we can create for learners to achieve these outcomes.

T5 integrated content with other subjects such as geography. She used examples of travel and calculating the distance between Pretoria and Cape Town. During the

second observation she used teacher-led instructions and explained this in terms of providing expanded opportunities for all. She notes:

Learners learn in different ways, I group them although that is a big challenge, I change the pattern according to their needs. Other times I give serious lectures.

She used symbolic representations most of the time; for example, learners used pricing and profit by creating a list of goods, put prices to them and calculated profit.

- **Assessment**

No new data emerged; assessment seemed to be factual, based on the rules of the subject. Some teachers used DoE rubrics, while T1 and T2 developed their own. Memorisation seemed to be encouraged; learners were assessed on their ability to identify patterns of relationships, reading and interpreting symbolic forms of equations. T12 remarked:

We use the guidelines from NCS, we cannot deviate from that. Everything is straightforward, but, sometimes, we create our own. It is a closed system.

4.7.3 Constructivist-related teaching approaches

Teachers who seemed to fall into this category were T6, T3, T8, T16 and T19. The teachers were grouped according to the patterns that emerged during teaching. These teachers were from different backgrounds. Some taught in townships schools with fewer facilities, others were in the former Model C schools and had better resources. Some of the teachers in this category had formal training in OBE, while others attended most of the workshops and they were the trainers in their respective schools. However, there were some who demonstrated a personal teaching and learning philosophy that was consistent with OBE; they were trained by the local trainers. Most demonstrated a high degree of creativity, such as creating expanded opportunities to cater for various learning preferences and they designed their own learning activities and assessment tools. T19 mentioned:

I never attended the formal workshops organised by the DoE, what I am using is my personal philosophy of what teaching and learning. This has been my teaching style for years long before OBE was introduced.

Although their teaching was consistent with OBE and constructivist principles, there were clear differences in the way teachers managed their classrooms.

Patterns that emerged from the observations

- **Collaborative learning**

There appeared to be a deliberate effort to group learners according to specific criteria. Learners worked independently and in groups writing answers on the worksheets or the chalk board. Teachers gave feedback, but at the same time asked learners to reason out the solutions. During the interview these teachers reflected on several parts of their lessons that involved group activities and they made the following comments.

T3 said her greatest challenge is grouping learners.

My biggest challenge is how to match my learners; I have very able and average learners in my class. I do not want to delay fast learners, at the same time I want slow learners to benefit from the fast learners.

Other teachers explained the grouping as follows:

T8 They produce their best when they are free to discuss and debate among themselves.

T16 It would be naïve to think that everything is smooth, there are challenges such as slow and fast learners, and I usually pair them because it is not possible to cater for their individual needs.

- **Collaborative teaching and activation of previous knowledge**

T8, T16 and T19 taught in the same school (former Model C), where they practise collaborative teaching and had almost identical presentations styles, which are described below. The classrooms had about 23 learners seated in groups. The periods were 45 minutes long. They started the lesson by checking the prior knowledge of

learners. T8 did this by asking learners to give a summary of what was done previously and let the other learners repeat the same, but giving his/her own interpretation of the outcomes of the previous sessions. He stated:

It is important to get their view points on the previous lesson.

T16 introduced the topic by having the learners review the work done previously by asking process questions that led to the discussions, thus engaging the whole class in some form of reasoning.

T19 began the class with clear expectations for the lesson, communicated it to the learners and gave learners the chance to ask questions. For example, this is what she said:

Today we are going to start a new chapter and I want you to pay close attention to the following concepts. I want you to think about each and how it fits into what we did yesterday.

- **Learner-centred approaches**

During the lesson T16 walked around the class to ensure that everybody participated and identified quiet learners. T8 did not walk around as such, but did ensure that all learners were engaged with content by occasionally calling volunteers to write on the board to show other how they came to the conclusion.

He repeatedly asked the question: *Can someone tell me how we came to this conclusion?* Learners responded with all kinds of explanations, correct and incorrect. Here is how he addressed the incorrect answers: *Tell me why you think that way, or give reasons for your answer?* and *Do you all agree with the answer?*

T8 used *what do you think* quite often as a way of engaging learners in some thinking processes. Learners used the board extensively in T8's class and almost all learners were actively participating in class activities.

T16 described how she constantly changed her approaches to offer expanded opportunities: *I always reflect on what happened in my classroom and try to correct what I think did not work with the learners, teaching is about that, isn't it?*

According to T3, mathematics is a formal way of representing the real world; it is practical and structured. Her teaching approach represented a practical view – she provided symbols and concrete material. The board appeared not to be the main resource; there were no other resources however, and the teacher drew on the learners' existing knowledge to make up for lack of resources.

- **Content not over-emphasised**

During teaching T8 seemed to change the speed and coverage of content to allow learners with varying learning abilities to understand the material. He believed that the subject's content is a formal way of representing the world and said he tends to offer his learners expanded opportunities to view content from different angles and to offer a different perspectives. He elaborates:

OBE has given learners the control of learning, I believe in making maths fun for them, what we are doing is not new really, it is just the language that they use to describe what we have been doing, I mean in our school mainly.

- **Teacher is in control of the learning situation but not dominating**

One of the teachers (T19) used a facilitative approach and recognised the knowledge learners bring to the classroom by incorporating their ideas. She taught by having learners work on the exercises provided and allowed them enough time to process the new information. This was followed by relevant questions; this is how she explained her approach:

We are also lifelong learners, we do not come to the classroom with an attitude of all knowing and just be ready to deliver the formula to learners and expect them to reproduce them. I learn a lot from my learners.

This teacher used process and content questioning most of the time and learners were given time to reflect on questions and to seek clarification. In cases of disagreements,

she probed and asked other learners' inputs. Her style seemed to be relaxed and not time bound. She explained:

They need to be able to form concepts, the previous method encouraged learners to memorise facts without any understanding, and there was content overload.

T8 engaged the learners fully; he would occasionally stop to ask if learners understood the content or solicited volunteers to suggest the correct answer. T8 notes:

Learners are independent, we merely facilitate, they have to be active in building this knowledge, it cannot come from me. My learners bring a very rich experience to class, we have to start there and activate it.

Teachers provide conceptual maps to allow learners to figure out the connections, they are able to work at their own level of understanding.

What sort of underlying conceptual system formed the basis of this teaching? Making connections to the existing knowledge was the essence of T8's approach, and he explained that *It is important to observe their learning processes by asking process questions, in that way you identify the shortfalls and take them through the process till they "discover" the truth or correct answer.*

One can infer from this explanation that T8's practice was informed by constructivist teaching methods which emphasise learner-centredness and self-discovery. Here is what he said earlier: *I believe that I have the capability to implement OBE whether the resources are adequate or not. OBE requires innovation and positive attitude.*

He did not believe in absolute drills, but used them to emphasise the patterns in algebra. He explained that his purpose was to make mathematics meaningful to learners and allow them to generate ideas. Whilst teaching, T8 used a variety of teaching strategies including guided inquiry. He was very confident and frequently encouraged learners to question his solutions.

When they get recognition and they are affirmed, they tend to excel, we are qualified, but it does not mean we have all the knowledge, I really enjoy their critique.

These teachers displayed confidence with content pedagogy; they felt affirmed by OBE principles. This finding corresponds with that of Koency and Swanson (2000:45), who stated that teachers who possess a deep and broad understanding of fundamentals of mathematics provide more rigorous instruction for their learners, which in turn leads to increased learners' achievement.

Learners in T6's class were noisy but clearly engaged with their tasks; some were downright playful. The teacher did very little to control the noise. This was a large class of 44 learners. There were few chairs; learners shared what was supposed to be a chair for one person. Some learners were writing solutions on the board and mostly engaged in some debate about the correct formula. Occasionally the teacher would provide feedback to the solutions. His school lacked most resources; however, he believed that a teacher can still be creative even in the absence of supporting material.

He mixed high- and low-ability learners together and believed that the brighter ones provides scaffolding for the slow learners. He started his lesson with questions on the previous work to activate prior knowledge to lead them in the day's lesson. One of the questions was: 'A bottle of fruit juice concentrate gives the mixing ratio of concentrate to water as 1: 5. How much concentrate must be mixed with 12 cups of water? How much concentrate and how much water must be mixed together to make 6 litres of juice?' Learners struggled with fractions, but he did not intervene directly; he asked groups to find the solution and used a question and answer method until they got the solution.

Also, his feedback was not merely 'telling' them the right answer; he constantly asked learners to explain the relationships between concepts. He used the teacher guides extensively; however, he also demonstrated a lot of initiative in the way in which he developed his lessons. There were no formal teaching aids; for example, he used cool drink bottles to enable learners to conceptualise the fractions and ratios.

- **Creativity - use of resources**

Much of their approach seemed to support their earlier statements about their beliefs of what OBE, knowledge, and mathematics teaching and learning were about. It appeared that they made sense of their teaching in terms of what they perceived as the expectations of the system. They also displayed innovation such as the way in which T16 used her class as a sample of the school community so as to reinforce sampling methods and used colourful diagrams on the white board; she also gave learners tasks to learn how to select a sample from a population.

She also believed that learners can achieve outcomes even when resources are lacking:

Textbook just a reference, I do not follow the textbook as is, because the focus is on outcomes; you will need many resources to get material for the lesson. Outcomes define what the learners need to know, not textbook can provide that, teachers have to design lessons that provide the opportunity for learners to achieve the outcomes

I have the capability to implement OBE whether the resources are adequate or not. OBE requires innovation and positive attitude.

Most teachers in this category acknowledged that inadequate resources posed a challenge; nevertheless, they did not allow the challenge to stop them from being innovative. As mentioned previously, time was regarded as the biggest constraint, but it did not prevent teachers from using various resources to make the content real and stimulating.

- **Teacher-learners interaction**

Teachers did not appear to be all-knowing figures of authority; most were willing to accept learners' reasoning and some even changed the rubric to accommodate new insights from learners (T3). T16 and T8 explained that their practice or approach was mostly informed by responses of their learners to content. The emphasis was on engaging learners cognitively and allowing them the opportunity to 'create

knowledge'. T8 said *Learners respond favourably to my approach because it makes them active participants.*

The following selections from field notes provide some insights into some of T19's beliefs:

To me OBE means putting the learners' interest in the centre of everything that we do, and making sure that we build their potential to achieve the stated outcomes.

Learners bring a rich experience to the classroom, it is up to us to tap into that and provide an enabling environment, OBE empower us to do just that.

I believe in my teaching methods, this is how I have been teaching anyways, OBE merely made my approach formal.

OBE teaching approaches are both liberating and empowering if you develop the right attitude to it, I enjoy my classes very much and I believe that knowledge is not static therefore, I am not going to bore my learners with endless drills like we used to do.

Both teachers (T8 and T19) did not seem to be unduly concerned with 'covering content', but focused more on making the classroom a memorable experience for learners. Learners were active, either writing on the board, or asking questions, finding solutions or figuring out how they arrived at solutions. They explained that the purpose of their approach was to make mathematics interesting to learners. Their aim was to allow learners to explore and discover the 'truths'. The OBE curriculum was perceived as having provided inquiry activities with the necessary content support, and teachers felt comfortable with the content knowledge.

- **Constant reference to real context and integration with other learning areas**

Teachers connected subject content to daily life situations and allowed learners to do the same by sharing their own understanding of the mathematics problems and the application of this knowledge in real life. However, some of them partially made references to life events. Learners were asked, for example: *How do you draw or create parking lots, what information do you need?*

In the case of T6 content was presented in small chunks (mathematical literacy). He focused on a question and answer method to ensure understanding. He elaborated:

Learners are afraid to problem solve, I break the work to make it manageable for them, the 30 minute period doesn't give us time to accomplish much.

During teaching he stressed that learners needed to think creatively to find meanings and patterns in the content. He also reminded learners that the subject was not difficult and that they just needed to pay attention to detail.

- **Assessment used as integral part of teaching**

Questioning was mainly process based – encouraged reasoning. Concerning assessment, T6 was driven mostly by achievement of outcomes:

My classes are not very big, it is not very difficult to measure the outcomes, the assessment criteria are quite explicit and I design my own often.

The question and answer methods was used to evaluate understanding as well as a teaching method by T6; he believed that learners had a gap in their understanding; the content was not well understood and therefore they will want to learn if they know and feel that they are successful. He thought learners got bored easily and were not yet adjusted to the demands of high school; therefore, giving daily tasks and feedback seems to work for them.

I know there is a lot of paperwork, but, continuous assessments give me an idea of their level of understanding, classes are big, it is difficult to reach all in 30 minutes.

Most teachers in this category displayed practices that were consistent with the objectives of OBE. Several patterns emerged that suggested creativity and innovation.

4.8 CONCLUSION

This chapter discussed the findings in relation to teachers' conceptualisation and beliefs regarding OBE. Inferences concerning the role of beliefs in teaching practice were made on the basis of a comprehensive data set, which included both interviews and observations. Teachers presented strong mathematical pedagogical beliefs; some believed that mathematics emphasised basic computational skills, whilst others had more open views that demonstrated receptiveness to various forms of knowledge. OBE and its various dimensions were conceptualised differently by teachers; a range of beliefs emerged indicating that, as in any educational system, there will always be tensions between accounts and alternative perspectives will continue to emerge.

This study also found that OBE is a system that consists of subsystems such as assessments, student-centred learning, collaboration, expanded opportunities, etc. Beliefs are also construed as a system. The interplay between the subsets of these systems presents research challenges.

Data from teachers reflected the need to understand their worldview, experiences and definitions of knowledge and meanings of education. Chapter 5 elaborates on the relationship between beliefs, conceptualisations and experiences of OBE, and teaching practice; it briefly discusses the conclusions reached and makes recommendations for practice and further research.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This study intended to explore and describe the beliefs, conceptualisations and experiences of teachers regarding OBE, and the possible relationship between their perceptions of OBE and their pedagogical practices. The aim was to examine the strategies that teachers employ in their classrooms in response to their beliefs about OBE. Teachers' epistemological beliefs were explored and linked to OBE pedagogical frameworks and classroom management practices. Their belief systems were divided into three components: the teachers' views about OBE, mathematics knowledge, and the teaching and learning of mathematics. This study was based on the premise that conceptions are specific meanings given to phenomena, derived from different experiences involved in helping individuals to make sense of their world. Furthermore, those worldviews in turn influence how new information is perceived. This study concluded that it is important to understand that any one belief exists in relation to other beliefs that form part of a belief system – beliefs are contextually bound (Beswick, 2007:116). Therefore, making inferences about a person's beliefs requires one to draw on a variety of (re)sources. In this study teachers' beliefs and conceptions of OBE were linked to their knowledge and experiences of teaching of school mathematics. Teachers were offered multiple interpretation points through asking them different questions regarding OBE, knowledge, education, teaching and learning.

Hofer and Pintrich (1997:89) assert that teachers have implicit theories of teaching, learning and knowing, and that their beliefs are formulated from experiences and mediated by socio-cultural factors in a given society. Therefore, interpretations of new experiences such as OBE would be mediated by those beliefs. Beliefs are seen to constitute professional guidelines for teaching; for some it is a blueprint for what is or is not possible. Linking teachers' beliefs on OBE with their epistemological and

pedagogical beliefs therefore made sense. It is necessary to understand that each individual views the world through his or her own conceptual and experiential lenses. As intellectuals, teachers have their own unique interpretation of what works and what doesn't work in the classroom. OBE may be a new phenomenon to teachers, but they have a wealth of experience to interpret their life world as professionals in particular ways.

5.2 DISCUSSION OF THE RESEARCH FINDINGS

The researcher derived various conclusions from the research findings. Beliefs were organised around fifteen themes which are discussed below. OBE principles were used as framework for the themes.

5.2.1 Teachers' conceptualisation of OBE

The focus of this study was not on teachers' knowledge of OBE; however, during the course of the data collection process it became evident that their knowledge was closely intertwined with their views, attitudes and personal opinions of education as a system. Teachers revealed a variety of beliefs of OBE. The teachers subjectively shared their own narratives regarding what OBE was all about and what it demanded of them as educators. They shared their opinions, views and understandings of the basic principles or assumptions of OBE; they were also clear on what they believed to be the best educational system for South Africa. Their descriptions generated important data which could serve as valuable information for policy makers on what is experienced first-hand at the "chalk-face".

The first impression gained from the data was that teachers responded to the challenges presented by the introduction of a new curriculum as professionals who drew on accumulated experience over the years, and that these experiences, their beliefs and contextual factors influenced their conceptualisation of OBE. Furthermore, teachers were caught up in a challenging situation in that they were expected to take on new professional identities – to be theorist, facilitators of the new system, and expected to design, deliver and evaluate the new curriculum with little information, support and training available to them. The government had high

expectations of teachers; they were expected to be all-knowing and competent in delivering a new system which used new and sophisticated terminology, widely regarded as incomprehensible by most of them.

According to Pajares (1992:309), when a person is confronted by novel situations in which they lack structures and cognitive strategies, they fall back on their beliefs to guide decisions they make. Nespor (1987:314) adds that, given the unpredictability and uniqueness of classroom events, teachers have to resort to their own beliefs, particularly in pedagogical situations when formal knowledge is not available or is disconnected.

Teachers were often required to make decisions in the absence of certainty about learning outcomes, assessments, facilitation, integration, collaboration, and evidence-based practice. They drew on their experiences, especially with regard to mathematics pedagogy or what they believed to be good teaching. Their beliefs about good teaching reflected their understanding about how learners learn and subsequently what facilitation meant. It could also be argued that there are no wrong and right beliefs; measuring teachers' beliefs meant asking questions that offered multiple interpretation points.

5.2.1.1 Beliefs consistent with the objectives of OBE

The results of the study showed a varied pattern. Teachers displayed diverse interpretations of OBE; consistencies and inconsistencies were found in their explanations of what OBE meant. Some teachers conceptualised OBE as rigid, complex and inaccessible, while others viewed it as a challenge that demanded they change their way of thinking. Despite the hasty introduction of OBE, some teachers articulated views that were highly consistent with the aims of OBE; this was also demonstrated in their classroom management and instructional methods (T8, T16). Some of them had formal OBE training and were also district trainers and therefore, they were in a better position to make sense of OBE. They embraced the principles of OBE, but had some reservations about whether it could be implemented successfully. All teachers seemed to think that it was not necessary to overhaul the entire system and believed that policy makers could have retained some of the elements of the old

system. This view is supported by Cross *et al.* (2002:180), who view the introduction of OBE as the process of ‘cleansing’ the old oppressive system by introducing narrowly expressed competencies.

However, there were also teachers who did not receive direct training, yet they were able to convey extreme confidence in their views of OBE and were well versed in the intentions of the new system. It was interesting to note that all suitably and highly qualified teachers – for example, those with a degree qualification plus a postgraduate qualification – showed higher understanding of pedagogical theories and forwarded sophisticated arguments for and against certain aspects of OBE. Studies have shown that an individual’s progress through tertiary studies is likely to be strongly influenced by exposure to a variety of educational perspectives (Schommer, 1998:554). The location of the school and the resources did not appear to have a major influence on the level of sophistication demonstrated by teachers; teachers from well-resourced and under-resourced schools were able to articulate the philosophical tenants of OBE with ease. They embraced the change, albeit with some reservations about certain aspects of the system.

These were the teachers who took a more proactive stance and believed that all educational systems have basic flaws; they also believed that it was up to the teacher to familiarise her/himself with the guidelines provided and to draw on their knowledge and experience to navigate the new territory. They were positive and believed that given a fair and appropriate chance, OBE could work. They reflected deeper views about OBE, mathematics knowledge and education, and demonstrated an awareness of the central role that new ways of teaching and learning can play in changing educational practices. OBE was viewed by these teachers as evolving and not as an answer to all educational problems, as many might perceive it to be. They saw opportunities to be creative and focused more on innovative teaching strategies that involved analysis and problem solving, and putting the learner in the centre of an educational encounter. They also capitalised on opportunities for collaborative teaching; they shared teaching materials and some even went as far as to co-teach with their colleagues. This provided mutual support and enabled the professional growth of teachers. The teachers who seemed to benefit most from cooperative teaching were those in former Model C schools, such as T8, T16 and T19.

The study found that collaborative/core teaching only happened in former Model C schools. Teachers in townships schools were asked if this was a possibility in their school; although they acknowledged the merit in doing so, they did not see it as working in similar ways. The core time that teachers had with learners per encounter was less than 25 minutes as their classes are large and they have a teaching overload. It became evident that soon the Department would lose these dedicated teachers who were willing to face all the challenges and make OBE work. The constant, uncoordinated instructions and demands from the government officials seemed to be a barrier for effective implementation on the ground.

The teaching approaches adopted by these teachers were also consistent with the fallibilist views that claim that mathematics knowledge is a social construct with the focus on the dynamics of the classroom. Their actions were driven by learner's needs and interests, and they did not seem perturbed by 'lack of guidance' from the Department of Education. To maximise *engagement in the critical mathematical processes* (Delaney *et al.*, 2010:178), they utilised collaborative learning, applied different questioning strategies that encouraged reflection, and drew on their experience and beliefs regarding learning processes to guide their actions. This was interpreted as evidence of pedagogical content knowledge. They also seemed to know a great deal about knowledge outside the realm of mathematics that could be used as modelling to enrich the learners' applications of mathematical processes.

OBE intends to empower teachers to find innovative teaching strategies, to be life-long learners. Consistent with this intention, teachers endeavoured to make sense of the policy changes and adapted their teaching practices. However, when they perceive incessant demands, they tend to become discouraged and join the stream of those who have given up trying to understand the workings of OBE/NCS. Nevertheless, empowered teachers are more likely to challenge and question their beliefs, and relate to the new identity generated by OBE and this is what most of the teachers in this study did. They were self-aware, reflective, innovative and willing to try the new system. For example, this is what one of the teachers (T19) said: *OBE teaching approaches are both liberating and empowering if you develop the right attitude to it.*

We are also lifelong learners, we do not come to the classroom with an attitude of all knowing and just be ready to deliver the formula to learners and expect them to reproduce them. I learn a lot from my learners.

5.2.1.2 Beliefs not consistent with the aims and objectives of OBE

As mentioned in the previous chapter, beliefs and knowledge are intertwined; the term ‘conception’ has been defined to encompass knowledge, beliefs and attitudes. Although the two concepts are intertwined, knowledge assumes certain evidence that beliefs do not. Beliefs inherently carry the possibility that they may be disputed, i.e. the believer is aware that others may think differently (Agudelo-Valderrama, Clarke and Bishop, 2007: 72).

Central concepts of OBE were used to allow teachers to articulate their own understandings/meanings of the changing South African educational system. These ranged from an emphasis on the teacher’s role as a facilitator, active participation of learners, continuous assessment and several other elements. The majority of teachers provided explanations which were indicative of the traditional, teacher-based philosophy, which is inconsistent with OBE aims. They demonstrated limited or improper understanding of OBE as an educational system or instructional strategy. They showed a general understanding of single concepts as mentioned above, but had challenges in synthesising a complete big picture of the direction and vision articulated in OBE curriculum policy documents. Some could articulate these concepts very well, but seemed to find difficulty in, or were reluctant to, translate these into concrete action. Also, there was some form of resistance to the new system.

The teachers’ general definitions of OBE were in line with various components of OBE, they included most core issues. Further probing revealed that they held strong central beliefs which seemed to support certain aspects of OBE, such as collaboration and references to real-life situations; however, they had problems with other aspects of OBE such as expanded opportunities and learning outcomes. For example:

T18 *Outcomes education sounds good on paper but with mathematics you need substance to teach, you cannot be focusing on outcomes all the time, there must be some form of concrete content.*

Some of these teachers had a single structure of beliefs, that is, they believed that there are absolute truths about OBE, teaching and learning of mathematics. They were not open to alternatives, but tended to focus on what they believed worked better; some of their opinions were not supported with evidence or any teaching theory.

They created their own truths about OBE and displayed resistance to certain facets of OBE.

T13 *OBE demands a change in our role and we become facilitators, creators, all-rounders, but how do we become facilitators in this situation where everybody does what he thinks is correct?*

T7 used a native language most of the time. He also demonstrated high control and was talking most of the time demonstrating how to use distance formulae. Learners participated in the learning process by answering questions; they did not ask any questions or requested clarification of concepts. T4 said: *Learners have very little understanding of maths knowledge, they argue a lot but they are empty.* These teachers put greater emphasis on the syllabus, curriculum and acquisition of knowledge. They were sceptical about OBE and had strong views about its practicality – they expressed the view that the old system was better suited to teach mathematics. OBE was described as an unworkable system used to initiate change in the educational system, for example:

T1 *OBE clashes with maths, for example algebra is about a mix of rules and procedures that are used to solve problems, therefore I need to make sure that learners grasp the basic rules, and they need to learn them quickly to understand complex math issues later.*

This position was supported by T5 who mentioned that *Our classes are too big to make OBE really work as it should, I am aware of what I need to do, but it is not possible under the circumstances.*

These teachers viewed their role as authorities in directing mathematics learning; therefore OBE was viewed as an ill-defined system making unrealistic demands. Teachers appeared reluctant to depart from traditional teaching approaches for fear

that learners will miss out on critical content. These reactions to OBE seemed to be influenced by a lack of basic knowledge about OBE, ostensibly caused by inadequate training and preparation. The data seemed to corroborate the point made by Hammer and Elby (2002:4) that teachers who are realists believe that there is a fixed core body of knowledge that is best acquired through transmission and reconstruction by experts. They teach actively to learners who are viewed as passive recipients of pre-established knowledge. This platonic perspective puts the emphasis on content, for example, concepts, algorithmic operations, relationships among different algorithmic procedures, the number system, etc. This is normally viewed as 'specialised' knowledge and its significance acknowledged. The structure of the subject matters as learning is described in the light of the structure and scope of mathematics to be learned (Ernest, 1989:14).

Mathematics was portrayed by these teachers as a practical activity that is carried out in a procedural way and mathematical competence was directly related to what learners knew – facts, procedures and conceptual understanding. They believed that mathematical knowledge accumulates with study and practice. The problem-solving aspect of mathematics was understood to be learners memorising the necessary steps to arrive at a solution. They also envisioned mathematics as a fixed subject of absolute truths (absolutist view). The teachers in this approach need to use variety of approaches to develop topics that enhance content. Most teachers, however, did not vary their instructional strategies; they were all inclined to use one approach which was *students solving problems on the board*, and seemed to believe that there are unquestionable criteria for differentiating right from wrong.

These findings do not assume that beliefs are static, but that they could be open to change and growth after exposure to certain experiences, such as sustained and effective training programmes. The low-level of training was found to be the main source of frustration and anxiety over the new reforms among teachers. It has been widely documented that the DoE and provincial education departments neglected this vital component. The consequences of such neglect were demonstrated in the reactions of some teachers to being interviewed. Some teachers assumed the researcher was from the DoE and it took a lot of persuasion to gain access to the participants. This initial response to the researcher may be suggestive of the poor relationship between the department of education and teachers. Handal and

Harrington (2003: 62) argue that failure of implementation of educational reform can be the result of teachers' instructional beliefs not matching the original goals of a particular innovation; if teachers' beliefs do not match those goals, it is likely that anxiety will be generated, in turn resulting in high levels of resistance. Conversely, if teachers' beliefs are more compatible with educational reform, it is probable that new ideas will be accepted and adopted in the classroom. Teachers therefore can be either obstacles to, or transmitters of, change (Prawat, 1992:358).

Over the years the experienced teachers were able to build their own narratives regarding knowing, learning, teaching, education and the purpose of schooling. They were quite articulate about the teaching and learning of mathematics, but two of them (T3 and T17) appeared not so confident in the subject matter, as they only had few months' experience of mathematics teaching, as the school apparently did not have enough qualified mathematics teachers. However, their definitions of OBE were varied.

OBE was mainly viewed as too complex and not suited to the teaching of mathematics. Consequently the teachers appeared to do what they knew best; they tended to adhere to teacher-based ideas in the absence of some concrete OBE knowledge structure to relate to. Teachers insisted that they were not against OBE, but they felt that training was not adequate to allow them to perceive, analyse and interpret the concepts of OBE satisfactorily. This was evident in the uncertainty about making connections between outcomes and learning activities as mentioned by one teacher:

T7 OBE is not balanced or maybe it is the way it was brought to us, we were not ready. The introduction could have been enhanced if we had been given courses before it was launched so that we could have a thorough knowledge, now it's like training while doing the job, and it is frustrating. For me OBE is a frustrating system.

It could be argued that a limited or an inadequate understanding of OBE would lead to conflict with OBE methodology. Naidoo and Parker (2005, cited in Monash and Mwakapenda, 2007:88) found that teachers who had absolutist pedagogies rejected the new discourse outright; they were resistant to OBE or showed superficial

compliance with its principles. Jansen (1999:60) observed that teachers were expected to move out of their comfort zones as transmitters of knowledge to facilitators of the educational experience; the change was enormous and bound to create anxieties and confusion. The main question was whether teachers could implement practices consistent with OBE, while maintaining core traditional views of education, teaching and learning? The teachers appeared to be more preoccupied with the threat of OBE than taking a more positive stance to interpret its philosophical framework and identify components that were more practical and to create opportunities for improving their practices from a seemingly complex situation. It can be argued that with proper interventions from DoE, teachers might begin to feel comfortable and progress in making instruction more meaningful for learners.

Teachers may have chosen to continue with the traditional teaching approaches because their beliefs about the importance of mathematics knowledge were psychologically stronger than their beliefs about active learner participation or demonstration of particular learning outcomes. Their beliefs about mathematics appeared to be the core belief influencing their teaching than a new OBE discourse. Fang (1996, cited in Murphy, 2008:4) agrees that studies of teachers' beliefs must address the personal experiences of teachers and their influences on shaping these beliefs using approaches such as narratives, autobiography and history. The main aim of such studies is to bring teachers' implicit beliefs to the explicit realm by providing them with opportunities to delve deeply into their inner selves. OBE seemed to invoke strong emotional responses, which made the attempt to bring their own interpretations of OBE to the fore a very complex task. However, the data showed that with other subsets of beliefs, for example, beliefs about mathematics knowledge, teaching and learning, teachers had adequate access to their inner world and they could bring those beliefs to the fore effortlessly.

There was a dire need to remove the fear factor from teachers in order for the study to achieve its purpose. Teachers tended to overly criticise the system instead of interrogating its philosophical assumptions. However, the multiple interpretation points provided a better understanding of their belief systems. Much has been said in the literature about the need for change in teaching methodologies; whilst acknowledging this, the study also argues that teachers' decision to teach in particular

ways are influenced by a myriad of factors, including contextual factors, teacher training, personal development, and relations between educational leadership and teachers. These experiences shape the teachers' conception of phenomena such as OBE. Findings on teachers' beliefs regarding the core elements of OBE according to Spady (1994) are discussed below.

5.2.1.3 Educational outcomes

The introduction of OBE paved a way to diminish subject boundaries and encourage integration of learning materials to enable learners to see a bigger picture and develop skills to use knowledge in future. The emphasis of OBE is on the utilisation of knowledge, not merely the acquisition of facts. Outcomes were developed to empower learners to think mathematically via teacher facilitation. There were varied responses; the majority of teachers found the outcomes vocabulary cumbersome and would have preferred simple content-based language. This would in turn have given them some cognitive structure to work towards. A small number of teachers were optimistic about OBE even though they had some misgivings regarding certain aspects of the system; they believed that the outcomes were clear and that they had a clear knowledge component attached for teachers to develop learning activities. They felt that learning outcomes were achievable and were the perfect way of developing a holistic person; and that is exactly what OBE advocates.

The majority of teachers expressed reservations about certain outcomes which they deemed to be vague; however, they admitted that others were achievable, especially those that emphasised application. Others indicated that generalised outcomes for the whole country were not practical, and seem to prefer that school mathematics use content language instead of outcomes. This argument is supported by several scholars (Allais, 2007; Jansen, 1999; Cross *et al.*, 2002); they argued that outcomes do not involve references to specific inputs; for any educational system there must be a clear definition of what should be taught. The outcomes-based system assumes that outcomes have clear meaning independent of content. Education is about acquisition of knowledge. Outcomes cannot provide the basis for designing learning programmes for disciplinary knowledge. Knowledge areas/disciplines have their own structures and cannot be condensed into outcomes.

Most teachers viewed outcomes as being too rigid and felt that they stifle the creativity of both teachers and learners; the general view was that learning generates different and unintended outcomes and there can never be predetermined outcomes. A few teachers mentioned that the outcomes were curriculum-based and were similar to competence, and that seems to put performance at the centre stage of OBE. They mentioned that they did not see the difference between previous objectives and present outcomes. Whilst outcomes are recognised as indicators used in education systems, teachers felt that the practicality of enabling learners to achieve these outcomes in a time-based system makes their achievement impossible. Outcomes were also seen as guidelines to what should be learned, acting as a compass for the teacher to know in advance what to include in the lesson and how to present the content.

There were those who felt that OBE looks good on paper, but that in reality school mathematics requires concrete content that is not necessarily captured in outcomes. As one teacher notes:

T18 Outcomes education sounds good on paper but with mathematics you need substance to teach, you cannot be focusing on outcomes all the time, there must be some form of concrete content.

The analysis of these responses indicated that teachers believed that mathematics needs to retain its boundaries and identity. They agreed that learner-centredness demands focusing on what learners know and what they can do and that therefore outcomes-focused education becomes inevitable. It should be noted that although teachers differed in their interpretations of learning outcomes, their core understanding demonstrated similarities. According to the proponents of OBE, outcomes were seen as demanding a new outlook for education, redefining the role of teachers. Reformists felt that learning outcomes are the perfect way of developing a holistic person; they were optimistic about OBE, although they acknowledged the challenges in the classrooms.

Most teachers agreed that they had a good understanding of what was needed to be taught; however, they had problems with the critical cross-field outcomes. This seemed to be a challenge mainly to pure mathematics teachers, who seemed to over-emphasise content and drills. The general view was that if an outcome is not clear, or is open to different interpretations, then different teachers may design different or even contradictory learning activities.

5.2.1.4 Expanded opportunities

Results showed that all teachers understood the need to adapt teaching to the needs of learners. They believed, however, that it is not possible to provide extended opportunities for all learners. They presented different understandings and interpretations of this concept. To some it meant giving different assessments until the learner demonstrates achievement of outcomes. To others, it meant nobody fails in OBE. For most, this concept was viewed as good on paper but difficult to implement. The duration of teacher-learner encounters, big classrooms and heavy teaching loads were cited as factors that prevented teachers from providing expanded learning opportunities.

T12 How do you deliver a system as sophisticated as OBE in a place like this, look around, what do you see? Broken chairs, broken windows, no calculators, no textbooks, how do you suddenly become this highly innovative educator when there is nothing to work on to get started?

However, this concept seemed to be clearly understood and well articulated in schools where teachers co-teach and had fewer learners. The teachers applied different approaches such as structured group work, problem-solving tasks, projects and portfolios. It should be noted that some were selective in how they applied this concept; they demonstrated an implicit belief that learners who are committed to learning are the ones who should be given several chances to enhance achievement of outcomes, as one teacher put it:

T13 You can only do so much for them, it is up to them to be curious, explore and most importantly want to know.

Male teachers in particular thought that learners abused the chances OBE afforded them. To them, giving learners many chances 'to pass' negated the purpose of education, i.e. to support those who are willing to learn. Two in particular indicated that learners skip assessments deliberately because they know they will be given a second and third chance to do an assessment. It would appear that expanded opportunity was associated with assessment by teachers, as opposed to catering for the various learning needs of learners through varying their teaching approaches.

The main challenge seemed to be the preoccupation with external assessments. Teachers also indicated that giving more learning opportunities would benefit learners who are struggling with the core principles of mathematics such as algebra and algorithms. It was apparent that some seemed to think that expanded opportunities meant drilling content into learners until they understood the procedures. Some teachers in township schools switched to the learners' mother tongue as a way of fostering greater comprehension; they viewed using a comprehensible language as an 'opportunity' to enable learners to better achieve the learning outcomes. This was done with the understanding that learners will improve their existing knowledge and as a consequence would assimilate new content without any difficulty. One teacher (T7) mainly used an African language during the lessons observed. In under-resourced schools it is virtually impossible to expect teachers to offer expanded opportunities when basic commodities such as desks, chairs, calculators, paper for photocopier, textbooks, different colour chalks are lacking and teachers are faced with 45 learners in a classroom with periods of only 30 minute in duration.

Most teachers questioned the validity of self-paced learning in a time-bound syllabus governed by fixed dates for external examination, while faced with poor instructional settings, poor support from the Department of Education and learners who are not motivated. Much as they all agreed that giving multiple opportunities is desirable, they did not believe this was possible given the large classes and teaching overload.

Within an OBE framework time is viewed as a flexible resource for both learners and teachers. In other words duration, frequency and precise timing when learning opportunities occur can be reorganised and adjusted before it becomes time to demonstrate mastery (Spady, 1994:30). Consistent with high expectation is the notion

of quality that is embedded in OBE. It is presumed that high expectations will lead to better prepared teachers, who are committed to bringing about change to improve the quality of education. High expectations of learners encourage teachers to use methods that develop higher-order thinking and provide several opportunities to enhance learner outcomes. Teachers agreed in principle with the concept *Success breeds success*, but seemed to put the blame on the system and learners for their low motivation and lack of prerequisite knowledge.

5.2.1.5 Learner-centredness

Most of the teachers believed that OBE is about planning activities with learners, where the teacher guides them from basic through to complex thinking operations. They all shared similar understandings and supported efforts that attempted to build learners' potential. However, there were basic differences in the way teachers interpreted and enacted learner-centredness. For some (T8, T16, T3) it meant flexibility and innovation in the belief that every child has the potential to succeed, and structuring activities in such a way that all the learners have an equal chance to succeed. Success was not defined in terms of getting high grades only; it was also seen as making sure that the learners are well rounded and that they take responsibility for their actions. These teachers seemed to believe in the holistic development of the learner.

The majority of teachers in the township schools had a completely different view; they seemed to equate learner-centredness with learners actively solving problems and writing on the board, taking active responsibility for learning such as coming to class on time, participating actively in the class and submitting homework on time. Some teachers appeared to blame OBE for 'misleading' learners regarding learner-centredness; they were of the opinion that OBE has created unruly learners who were present in class but not necessary learning. The classes were more noisy than usual and this was interpreted by some teachers as the consequence of learner-centredness. Male teachers in particular had a problem with the attitude of learners and this seemed to influence the choices and decisions these teachers made in terms of what to teach and how to teach it.

5.1.2.6 New identity/role and empowerment of teachers

OBE promises new and diverse possibilities, and empowerment for both learners and teachers. Teachers are defined as mediators of knowledge (Mason, 1999:141) and are expected to be innovative, creative and able to develop challenging and interactive tasks to enhance learners' outcomes. Most teachers tended to think that OBE provided ample opportunities to show this creativity; however, there were some who believed that OBE principles were too complex and not easy to implement. The majority did not view OBE as empowering; they heard or read about the intentions of the new systems, but thought it was incorrect to assume that OBE will suddenly bring about the necessary changes without first addressing the pressing issues of lack of resources, adequate training and general support. Teachers were not against OBE; however, a good number of them did not think it could achieve this emancipating role.

They seemed to approach their new role based on their experiences and with great expectations of the Department of Education. They used this experience to assimilate the new identity and responded to the new demands with scepticism. They were aware of what the Department of Education demanded of them, but described the expectations as unrealistic. Some recognised the need for teachers to become lifelong learners and to take time to reflect on their practice in order to appraise and align them with new teaching methods. OBE was seen by others as having provided this opportunity for teachers to continually learn, thus leading to professional empowerment.

All teachers described their role as facilitators, coaches or guides. Learners were defined as active participants. Some embraced this new role and described it as empowering; however, others perceived OBE as having created poorly defined roles for teachers. These teachers felt that previously they could clearly articulate their role in the teaching and learning process, but now they are told that they should be facilitators. The data suggest that the facilitator role did not sit well with some teachers or they were not adequately prepared to be facilitators. They viewed their role as authorities in mathematics. This understanding easily yields to transmission practices. According to these teachers, nothing has actually changed to justify the

changed role. They tended to think that the guidelines from the DoE were too confusing to allow for creativity.

For most, facilitation meant allowing learners the opportunity to have a voice, to allow them to take an active role in learning. Others described facilitation as facilitating the acquisition of basic mathematics skills; they seemed to take pride in their ability to show learners the quickest way of solving mathematical problems. They made comments such as '*providing a rich environment for learners to reach their potential and achieve learning outcomes*'; however, this definition incorporated drills. They appeared to integrate both traditional and reform-based views of the delivery of content, this is what T5 said:

Learners learn in different ways, I group them although that is a big challenge; I change the pattern according to their needs. Other times I give serious lectures.

She understood that she needed to put learners in the centre of teaching and learning, but also acknowledged that she had to give 'serious' lectures as well. It was apparent that the number of serious lectures was slightly more than learner-centred strategies. Also, some did not think the current learners are ready for the kind of facilitation envisaged by the DoE.

These teachers showed reluctance to move away from teacher-centred approaches; this finding seemed to imply that they felt comfortable holding onto more authority in the classroom. In this context learners are given some degree of independence and control over learning; however, the teacher is still the dominant figure in the classroom. They tended to think that facilitation involved providing ample exercises for learners to memorise the rules to enable them to think mathematically and believed that they were doing everything possible to enhance learner outcomes.

OBE advocates alternative modes that must be used by teachers to teach in order to assist learners achieve the critical and developmental outcomes by emphasising themes such as problem solving, team work, critical thinking, communication and appreciation of the impact of knowledge on the world, reflection, collaboration and citizenship (Department of Education, 2003). However, some teachers viewed OBE

with apprehension and anxiety, and as a consequence the intended aims of empowerment were not implemented as planned.

5.1.2.7 View of learners

OBE encourages good teacher-learner relationships based on mutual respect and healthy dialogue, where both teacher and learner engage in a learning discourse to create new meanings. Flores (2000:234) supports this view and adds that all learners have the capacity to learn; this in turn encourages teachers to react to learners' needs and such teachers develop high expectations of their learners. Rigid views of the student or of the curriculum, if given credence by a teacher, constrain teacher action in the classroom (Prawat and Jennings, 1997: 252). However, in this study some teachers viewed learners as being passive and thought about student learning only in terms of student ability. Older male teachers in township schools had low expectations of learners; they believed that the current learners had a negative attitude and were not ready for the learning model OBE envisages. These teachers found learners' negative attitudes and the poor learning culture quite challenging. They complained that learners do not have a sense of responsibility and that they purposely skip classes and assessments because they are aware of the opportunities for resubmission. These teachers also had a rigid outlook on educational transformation and had very few good things to say about OBE. Female teachers in the townships did not have complaints about the attitude of learners, probably because of the more nurturing side of these teachers.

These beliefs could be attributed to several factors, one of them being traditional beliefs about parent/child relations, their role as mathematics 'experts', beliefs about how education should evolve, their educational level, professional development and perceived support from the Department of Education. At certain points/stages their beliefs seemed to evolve into a fixed ideology. Younger, highly qualified male teachers did not perceive the learner attitudes as detrimental to learning. However, one younger teacher had serious issues with that and seemed to think that learners were not respectful as he believed that the teacher should maintain control of the learning environment. There may have been other factors involved in this particular matter. The teacher was African and teaching in a former Model C school. Learners

were from mixed ethnic groups, with white learners in the majority. The playfulness of learners (especially from white ethnic background) was apparent during the observed lessons. He was new in the school and obviously learners will always take a chance until he asserts himself.

Teachers who presented transformative beliefs acknowledged the changing role of learners and believed that within a good, disciplined environment classes tend to be noisy but they accepted this as a sign of great activity. Their classes were noisy but disciplined. Female township teachers share a similar view of learner attitude and, as mentioned previously, they did not display any adverse feelings about the ‘annoying’ attitude.

These teachers had high expectations of learners and acknowledged student-centred learning as a strength of OBE. Teachers are encouraged to set the expectation that OBE is for all learners by providing encouragement for them to engage deeply with the issues they are learning about so as to achieve the high challenging standards. It is believed that learners’ level of motivation increases as they gain success (Killen, 2000:6). OBE is seen to be developmental and emphasises achievement – if teachers have high expectations of their learners, they will be motivated to create multiple opportunities for learners to achieve the outcomes. When teachers feel uncertain about what is expected of them, and they have little understanding of the new educational model, they will either intentionally or unintentionally put the blame on somebody – in this case the learners.

Teachers who held evolving and transformative beliefs described the NCS outcomes as realistic and practical, and also believed the learners were capable of achieving these outcomes. They recognised the partnership between themselves and learners, and acknowledged that they were not the authorities of knowledge but are lifelong learners as well. OBE gives learners the power to teach themselves; it holds that learners can adapt and have the ability to develop freely especially when their minds are not controlled by adults who may limit the learner’s ‘inner workings’. However, some teachers seemed to have problems with this new *emancipatory role* of learners.

T4 said:

OBE emphasises other skills, for example, arguing and debate, but these learners are noisy and argue a lot, mostly without a basic knowledge, they are brave, bold, but their arguments are superficial.

It should be noted that if teachers believe that learners are not disciplined, or they do not have the capacity to maintain discipline as mentioned by some teachers, especially in the township schools and one in former Model C school, it will be difficult for teachers to create any meaningful relationship with learners. Teachers are expected to create a series of activities that inspire learners to develop their communicative skills, reasoning capacity and creativity without a need to direct instruction.

These teachers believed that it was not their role to foster a culture of learning. They seemed to expect other social institutions such as the family to take the responsibility for self-regulation and discipline. It is acknowledged that in 30 minutes per contact session there might be very little a teacher can do. However, if positive behaviour is reinforced in small units, it could eventually culminate in desired behaviour.

5.1.2.8 OBE assessment

The NCS aimed to redefine outcomes and provide more guidance on progression and content; consequently assessment standards were developed for each level and each outcome. The entire curriculum in OBE is driven by assessments that focus on well-defined learning outcomes and not primarily by factors such as what is taught, how long the student takes to achieve the outcomes or which path the student should take to achieve the target. However, Vandeyar and Killen (2006:8) argue that assessment needs to be developmental and integrated into learning. OBE assessment is continuous and embraces diversity in learning preferences. All teachers viewed assessment as good on paper, but tedious to implement. The 75% weighting of the external examination was described as a method of imposing a high level of control by the DoE. They indicated that OBE is bound by time and tightly scheduled; there are prescribed outcomes to be achieved by specified times; therefore giving the external examination a 75% weighting was contrary to the very basic principle of outcomes-based assessment, which emphasises continuous assessment. For example, all teachers believed that it is difficult to implement alternative assessments in a skills-based unit

such as algebra; however, their main argument was that learners lacked the prerequisite content and skills.

Data showed that much focus was placed on the tediousness of the assessment rather than on its pedagogical aspects. Those who were found to be confused by the language of OBE assessment were mainly older teachers, who had very basic qualifications. They seemed to be confused by the concepts such as rubrics, portfolio, validity and reliability tests, and assessment criteria/standards. This language of assessment was new to them and they struggled to understand it and it seemed to create misunderstandings, for example, by insisting that assessment should be content based. They recognised that the revised statements made provision for content and that it made outcomes clearer; however, they still felt that assessments involved too much paperwork and time was the major constraint. However, they all agreed that portfolio assessment was a good method that represents learners' best work and demonstrates the degree of outcomes achieved.

Younger and more qualified teachers thought some assessment standards lacked clarity and shared the view that OBE assessment takes up much of the teacher's work and involves a lot of recording. One teacher did not see any differences between the present standardised tests and previous testing approaches. She indicated that outcomes are not necessarily helpful in preparing learners for external examinations; external tests measure specific, factual knowledge, and all agreed that OBE emphasises exploration, problem solving and creativity as opposed to factual knowledge.

It should be noted that the concept of continuous assessment was understood and explained as testing learners' knowledge and skills continuously – this meant giving feedback to learners all the time. It also became clear that the change to standardised assessment had not been well communicated to the teachers as most of them still spoke of the criterion-referenced tests instead of standardised tests. Analysis of assessment documents such as question papers and learners' homework books indicated continuous testing that mostly utilised DoE guidelines. There was no evidence of small tasks leading to bigger assessments that required critical thinking and high-level reasoning. There were few projects and a great number of homework

exercises. Tests and examinations were the main assessment strategies and teachers believed that continuous assessment takes up so much of the teaching time that content acquisition was compromised. There seemed to be less understanding of how formative assessment fitted into the framework of OBE. Feedback was mainly based on 'right and wrong' answers; it did not fit into the 'feedback-review-new meanings loop' as envisaged in OBE.

In the OBE framework teachers are to identify the small, context-specific outcomes they want learners to achieve, and then assess learners' performance against these outcomes using agreed standards. What is important is consideration of evidence of achievement (Vandeyar and Killen, 2006:8). One of the most qualified in the reformist group of teachers felt that OBE introduced new dimensions of knowing; it brought new theories they never knew such as those on standardisation, designing rubrics and integration. He indicated a sound understanding of OBA principles and seemed to have a good grasp of the relationship between expanded learning opportunities, specific outcomes and assessments. Certain factors might have influenced his thinking and subsequent beliefs, as he was suitably qualified, worked in an environment that appeared to be supportive and also showed special interest in the subject.

It was mentioned previously that teachers who demonstrated traditional beliefs believed that OBE has lowered standards; they compared the previous with new pass requirements and concluded that the 30% required for learners to pass a grade is too low. These teachers understood the notion that all children can succeed as meaning that all the learners should not repeat a grade and the tendency was for them to teach at the level they thought it was possible for learners to attain the minimum requirements. Those with evolving beliefs demonstrated mixed feelings and opinions about the assessment models. While they accepted the validity and objectivity of standardised tests, they also lamented the time taken to document learners' progress. Furthermore, they did not believe that self and peer assessments were effective as there is always a huge discrepancy between the learners' and teachers assessments, as mentioned by one teacher:

T17 They overrate themselves, meanwhile they are aware that they still need to work hard and provide sound solutions for problems or tasks given.

What was evident in the perceptions of OBE assessment was that the concept of continuous assessment was misconstrued; most teachers did not seem to understand the relationship between expanded opportunities, specific outcomes and informative assessment. The challenge of the time constraint is confirmed by Cross *et al.* (2002: 184), who noted that '*education is time based, defined by, organised around, focused on, and managed by time schedules not outcomes*'. It is therefore reasonable to assume that introducing OBE which requires self-pacing and provisions for expanded opportunities into a time-based system will pose implementation challenges to educators. It is acknowledged that writing appropriate material and measurable outcomes can be a challenge to the course writers – learners are expected to demonstrate the specified outcomes and they cannot progress until the standards are met. Teachers could be under pressure to prepare learners for examinations and experience conflict or inconsistency between the beliefs and making sure that learners achieve the outcomes. In a way it could be argued that teachers are expected to teach and focus on external examinations, and in such an environment even progressive educational beliefs are compromised.

5.1.2.9 Integration of content and real-life experiences

Teachers in this system are expected to fulfil various roles as outlined in the Norms and Standards for Educators, for example, mediators of learning, designers, leaders, scholars, lifelong learners, pastors and subject specialists (Howie, 2003:6). Most teachers described themselves as specialists in mathematics teaching; they demonstrated a sense of authority with regard to mathematics and seemed reluctant to let go of this feeling and were hesitant to allow 'others' into what they thought to be their territory. The analysis of these responses indicated that teachers believed that mathematics needed to retain its boundaries and identity. Furthermore, exploration revealed that this view was influenced by their beliefs about the nature of mathematics knowledge.

The 'pure' mathematics teachers in particular displayed this attitude, with the mathematical literacy group showing greater acceptance of knowledge integration. T3 taught mathematical literacy; she was older and very experienced but had only a few

weeks' experience as a mathematics teacher. She indicated her appreciation of the need for integration of content, and felt that mathematics content is related to real life and integrates well with other learning areas. For example, when she taught area/volume, she let learners work out how much paint they would need for a room, etc. This made mathematics learning fun. She demonstrated an attitude of being a co-learner and appreciated the knowledge learners brought to the classroom. This was a highly experienced teacher who at times indicated that she did not understand OBE very well. For example, she found the language overwhelming; however, data from her interviews and classroom observations indicated that her practice was strongly aligned with constructivist/OBE principles. She utilised collaborative learning and gave real-life references in many instances. She presented fractions, area and volume lessons using tiling as an example. T5 incorporated geography into her lessons on the measurement of distances and indicated that integration was good as it made mathematics real to the learner. Both these teachers were females; this might suggest some relationship between gender and beliefs regarding this particular component of OBE.

T1, a male teacher, advocated subject identity and strove to maintain strong boundaries and hence attempts to de-centre subject identity were met with resistance and were perceived as a threat to his own professional identity. Subject loyalty was found to be stronger than the influence of OBE principles. Subject identity is understood as the characteristics that the subject has with respect to how it relates to other subjects and everyday life; a subject that has strong boundaries is strongly insulated with respect to others (Naidoo and Parker, 2005, cited in Mason and Mwakapenda, 2007:89).

Some teachers believed they owned certain knowledge and that their role was to build on what learners already knew. It is well known in secondary schools that mathematics and science teachers always felt that they were 'special' in that they were teaching 'difficult/hard' sciences. It was therefore not surprising to identify this kind of attitude.

5.1.2.10 Role of contextual factors

Context in this study is defined as the environment in which OBE was unfolding; this context included the OBE policy, the expected support from the Department of Education and the resources available to deliver the curriculum. At local level it refers to the school and all subsystems that form the school culture. There was a clear interplay of various factors that seemed to influence teachers' conceptualisation of OBE. All teachers indicated that OBE was a rushed system and that they were never given a chance to reflect on the new system, their instructional methods, their new role and the environments in which they worked. This inadequate preparation of teachers seemed to be the major factor in their limited or improper understanding of both the theory and practice of OBE. They were never afforded the opportunity to perceive, analyse and integrate the concept satisfactorily and this led to feelings of alienation. Most teachers expressed frustration with the DoE's lack of support, yet expected to see the new identity of teachers evolving. The findings resonate with the findings of Cross *et al.* (2002:174; see also Jansen 1999:62) that OBE was poorly planned, hastily introduced and failed to consider the number of teachers available to implement OBE, and also that policy makers did not give teachers sufficient time to plan their new roles, and they ignored the resource disparities in South African schools. There were few teachers, notably from the under-resourced schools, who did not seem to be perturbed by the lack of resources; they claimed that the absence of textbooks did not make them less creative in making mathematics meaningful to learners. They did acknowledge that any educational system will thrive best in an adequately resourced environment, but they accepted a lack of resources as a challenge to make them more creative.

It has been widely documented that teachers were not well prepared for the implementation of OBE; training was limited to five-day workshops for the few who were then expected to train others. There was a lack of alignment between curriculum development and professional development (Cross *et al.*, 2002:176). There were also complaints about the government's knowledge and understanding of OBE; teachers seemed to think that the very trainers brought inadequate knowledge and were not able to articulate the philosophical principles of OBE adequately. This was perceived as 'the blind leading the blind'. Success of any educational system hinges on well-

trained teachers and professional development programmes that go beyond workshops, incorporating role modelling, and basic skills in innovative practices. Furthermore, in-service teacher education should aim at challenging and assisting teachers in understanding the basic premises of OBE and it should be left to them to use their innovative skills to design classroom activities that encourage discovery and the creation of knowledge by learners. More time should be spent in courses that promote content knowledge and classroom support.

The language of OBE appeared to be frustrating to most teachers; it was said to be impenetrable and obscure, and too much emphasis on outcomes seemed to frustrate most teacher, especially those who put too much emphasis on content knowledge. Teachers thought that policy makers should have made a considerable effort to prepare learners also for their new role and not expect teachers to grapple with their new identities as well as fostering the culture of learning among learners. Most felt that learners were poorly prepared to undertake the role of inquiry, exploration and creation of knowledge. Learners' attitude can affect teacher's attitude; mutual respect creates effective social arrangements for teaching and learning.

Content coverage and the examination system appeared to challenge most teachers. They reported that they had timelines to consider and were under pressure to cover a certain amount of content to prepare learners for examinations. They felt that the OBE system did not allow them to spend time engaging learners in explorative activities. Many mentioned that they have to compromise ideal instructional practices to meet the expectations of the DoE.

Teachers are expected to create ideal classroom situations that enable learners to be creators of knowledge; however, teachers felt that this was 'wishful thinking'. They did not see how they could be expected to translate OBE ideals when faced with over 40 learners in a cramped classroom. They believed that it is not possible to reach out to individual learners, and teaching the old traditional way seemed to be the best way out of the dilemma. In order for them to create an enabling learning environment, they were expected to create multiple opportunities, and spend considerable time with learners to enhance learner outcomes. However, that became almost impossible to achieve.

Much as it is acknowledged that resources play an important role in an educational environment, it was noted that some township teachers simply gave up and allowed their anger at the policy makers to take precedence over 'doing something about the situation'. The former Model C schools were well resourced; the only challenge they verbalised was the time constraint and the unreasonable expectations of the DoE. They rose to the challenge, however, and utilised the opportunity to build their knowledge base and handled complex class dynamics with ease. In any educational system undergoing change the teachers may develop various coping strategies that are either aligned, or in conflict, with the educational system. In this case the majority of teachers were left to navigate through an uncertain terrain. Some found this profoundly challenging.

5.1.2.11 Teachers' emotional reaction to educational transformation/OBE

The discussion of OBE seemed to invoke strong emotional reactions among teachers; they expressed uncertainty, anger, frustration and powerlessness to influence the policy outcomes. Some demonstrated outright anger, combined with anxiety that led to a sense of hopelessness, as they felt inadequately prepared to comply with the OBE curriculum. There were several factors that appeared to influence this reaction: school setting, lack of resources and high expectations by the DOE. One could sense a feeling of despair among other teachers; meanwhile others seemed to simply flow with the stream by giving up on trying to understand what was required of them. A small number felt confident to accept the challenges and these were mostly from former Model C schools and only four from township schools.

Transformation to OBE appeared to evoke a sense of despair in those who seemed to want to know more about it but found the system too overwhelming; they were confronted with new terminology and new roles, as mentioned previously. OBE appeared overpowering and eroded some of the confidence that they had built up over the years as masters of mathematics knowledge. This statement testifies to some of the strong emotions:

T13 I cannot say OBE is bad but I cannot say it is good either, it is just one system that was imported from overseas and forced onto us and we are

learning the ropes at the same time we are expected to implement it, the learners are even aware that teachers do things differently, we not sure about the whole thing.

Further questioning revealed that they wanted to do what was right, yet frustration set in when they had to shift from what they perceived as the best way of teaching mathematics to a fluid system that, according to one teacher, was flawed. Venturing into the unknown seemed to lead to feelings of insecurity and sometimes anger. One teacher said that sometimes he feels unsure if what he was doing was right; there was a lot of uncertainty around certain aspects of OBE.

T16 It is left to the individual teacher to interpret, and prepare himself to guide learners in the right direction, but sometimes this direction seems blurred and it can be very frustrating. We are fortunate here because the head of instruction has personal interest in OBE and he makes sure that we get support as needed, but he cannot be everywhere every time. We have to struggle and try to understand the meaning of rubrics, and certain outcomes.

Meanwhile others demonstrated a willingness to use the knowledge and experience they had and infused it with what they believed was expected of them. This appeared to give them a sense of hope and motivated them to seek new ways of delivery and assessment. The speed at which OBE was introduced seemed to be the main source of frustration rather than lack of confidence in the philosophical underpinnings of system. This feeling of helplessness appeared to influence responses to OBE demands. There is a significant body of scholarship that found that change is a complex process and often leads to uncertainty during large-scale changes. It has been reported that curriculum change gives rise to immense anxiety and that educational reforms never work when teachers do not understand or do not have a commitment to them; even when teachers support education change, successful implementation is unlikely if they are given little time to talk to colleagues, think the changes through and experiment with them. Speedy reforms with no time to understand them properly offer educational and professional alternatives that are unacceptable (King 2006:6).

The results supported the view by Fineman (1995, cited in King, 2006:6) that the human side of the change process is often ignored; little recognition is given to the

way feelings are produced, reproduced, communicated and acted upon in organisations. This is further supported by Hargreaves (2005:279) that educational and organisational change are treated as rational, cognitive processes in pursuit of rational curriculum ends, and in the process the emotional dimension of educational change is neglected. He found that teachers' emotions influence responses to all other aspects of educational change such as curriculum planning teaching and learning.

A major educational change such as OBE in South Africa was bound to evoke intense reactions, given the ideological nature of policy review and critique. Teachers who place more value on power, authority and control will probably experience strong feelings of resistance, especially when the principles of the new system are not aligned with their beliefs regarding what constitutes knowledge, teaching and learning.

5.3 BELIEFS REGARDING MATHEMATICS KNOWLEDGE, TEACHING AND LEARNING MATHEMATICS

Questions have been raised in the previous chapters concerning what constitutes adequate knowledge and the function of content in the curriculum; various debates were presented in Chapter Two. Jansen (2002:204) stated that in the process of educational transformation there is a need to address questions such as what is education and what are schools are. This argument can be extended to include questions such as: What does it mean to know something? What is involved in the process of knowledge making? How do teachers define mathematics knowledge?

5.3.1 Beliefs about mathematics knowledge

Teachers presented various interpretations of what constituted mathematics knowledge; their understanding appeared to be influenced by their general view and understanding of knowledge. Some presented a more traditional belief, while others were somewhat in the middle, showing a mixed type that included both traditional and reformed beliefs, referred to here as evolving beliefs. A few presented more reformed beliefs.

- **Traditional and evolving beliefs**

All teachers who revealed traditional and evolving beliefs viewed mathematics knowledge as a discipline based on rules and procedures and that there is usually one best way to arrive at an answer. They appeared to endorse the principles of absolutism, meanwhile teachers with evolving beliefs demonstrated a dialectical relationship between beliefs based on traditional/absolutist and control and emerging beliefs based on learner autonomy. They also believed that mathematics was for the chosen few, i.e. for those who have the ‘brain for mathematics’. These are the teachers who viewed knowledge as fixed and delimited by the discipline; they put more emphasis on the subject boundary and seemed to think that mathematics is a well-defined territory. They believed that they were experts and their role was to enable learners to learn mathematics concepts quickly; they viewed OBE approaches as irrelevant and not useful in achieving this goal. They did not buy into the view that mathematics could be socially constructed and may change; for them mathematics represented fixed knowledge.

‘Pure’ mathematics teachers seemed to view the subject as more self-contained and expressed little consideration for real-life references. They appeared more comfortable with traditional teaching and believed that learners learn best when they are given problems and shown procedures and steps. OBE was seen as an attempt to change the status quo as confirmed by T1:

Math is about following definite steps, I need to make sure that learners interpret and give meaning to the solutions.

He acknowledged the existing knowledge of learners and believed that everyone has the capacity to learn mathematics; however, he believed that topics such as exponents cannot be ‘discovered independently.’ These teachers seemed to focus on the conceptual understanding of content with an emphasis on performance. They viewed performance as a key goal whose attainment depends on the mastery of rules and procedures. Most believed that mathematics had to be learned as factual information and endorsed the fact that mathematics can be memorised.

These teachers believed that learners have to master basic skills and procedures in mathematics and seemed to be rigid about their beliefs of the need to learn in a fixed

sequence. For most teachers, learners had insufficient background knowledge from Grade 9 and because of that skill lack that they had trouble handling abstract information. It is this low expectation that teachers held of learners that led them to emphasise mastery of rules and procedures as the best tools for learning mathematics.

It is also known that attitudes to mathematics and its teaching are important contributors to a teacher's make up and approach because of effects they can have on learners' attitudes to mathematics. This understanding expressed by teachers is not something new; in a paper presented at the Association of Educational Assessment in Africa, Howie (2003:1) indicated that South African learners fared poorly in the Third International Mathematics & Science Study-Repeat. The report portrayed a bleak situation that needed urgent attention, all aspects of mathematics education, teaching methods, teachers' qualifications and language of instruction were found to be below acceptable quality.

These international studies seem to endorse the traditional approach that uses achievement tests in a form of multiple choice to measure knowledge and skills in sets, regulations and functions, number systems, finite mathematics, algebra and geometry (Burton, 1993:11). This format of closed questions encourages reproduction of learned knowledge. The same could be said about the external assessment that carries 75% weighting in South African OBE. One is tempted to imagine a final OBE assessment that measures quality of student activity, creativity and problem solving, and free from time limits. To address the challenges of poor performance in mathematics, perhaps it is time that researchers focused on the learners' discourse practices in mathematics classrooms, especially among diverse populations, and examine the influences of socio-cultural practices on learners' mathematical understandings.

- **Transformative beliefs**

Teachers who held transformative beliefs were more reflective in their descriptions of OBE and mathematics knowledge; those with traditional beliefs did not demonstrate the same degree of reflective ability. The former group provided a much more flexible stance that suggested an evolving understanding of mathematics knowledge. For these

teachers there were no absolute truths and questions about correctness were replaced with human activities such as collaborative construction, reasoning, enquiry, creativity and problem solving. Learners' knowledge was embraced and accepted as legitimate. To them teaching and learning mathematics involved learners bringing their previously learned knowledge to create new meanings. Teaching mathematics was described as observing how learners develop these new meanings. Data showed that teachers who are transformative in their approach had the opportunity to create a new social order that incorporates innovations. It was interesting to note that neither resources nor the type of school environment had any relationship with the thinking of these teachers. Whilst most were from well-resourced schools and the formerly more privileged social groups, there were also teachers from other sectors of the population who articulated sophisticated beliefs.

5.3.2 Beliefs regarding teaching and learning mathematics

Teachers hold assumptions about knowledge and how it is gained and also about teaching. Their views on teaching were inter-connected with beliefs about mathematics knowledge and ranged from imparting knowledge to allowing learners the opportunity to make sense of mathematics and to figure out how they arrived at answers. The potential of alternative teaching strategies to provide a meaningful environment for learners to construct their own knowledge hinges around the teachers' and learners' ideas and beliefs about teaching and learning (Ofori, 2008:24). Those with teacher-centered views conceived of learning as a process of memorising and reproducing learned material; the conceptualisation of ideal mathematics teaching was mostly content and performance focused, and hence these teachers felt that they had an obligation to make learners develop good mathematical skills and that learning mathematics cannot be left to learners to discover knowledge. Mathematics knowledge was viewed as a complex entity to be understood only with the direct intervention of teachers.

Other teachers did not seem to put so much emphasis on content, but on the process of learning. They were of the opinion that whatever the DoE has developed was not perfect, but it was a good starting point; it was up to them to make the learning material meaningful to learners and to give them the analytical, reasoning and

problem-solving skills to confront any situation that requires mathematical reasoning. The need to empower learners to think mathematically was predominant among all teachers. Many seemed to assume that the subject matter has its own built-in logic and the study of mathematics transfers that logic. The transformation-orientated teachers felt the outcomes were clear and gave direction to the development of appropriate learning activities; however, the traditionally oriented teachers felt that they knew what was best for learners and believed that teaching mathematics is transmitting knowledge of rules and procedures and that learning involves getting the steps correct.

For the traditionally inclined teachers, it was not apparent whether these were centrally held beliefs or the result of their limited understanding of OBE that influenced them to gravitate towards teacher-centred teaching and learning. Handal (1995:49) argues that teaching places great demand on teaching decisions, and these demands often put teachers in the position of resorting to practicability and intuition.

The belief that learners are incapable of making informed choices about learning mathematics appeared to be the major influence on teachers' beliefs about mathematics pedagogy. As mentioned previously, most debates about the nature of mathematics centre on the role of learners and whether mathematical objects such as numbers and points exist naturally or are human creations. Elevating the role of learners as creators of mathematical knowledge would be a challenge to content-oriented teachers. The teachers emphasised the view of mathematics as too abstract and unchanging for learners to independently create new meanings. They viewed themselves as sources of knowledge. Most township teachers seemed to endorse the idea that learners would not actively learn mathematics content if they were not given tasks to practice, an approach that negates the independent learning and self-regulation advocated by OBE. It is known that learning in such an environment becomes passive. Teachers seemed to endorse a belief that they had a responsibility to maintain control of the classroom discourse, to facilitate and guide learners' construction of mathematics knowledge. They viewed learning as the mastery of discrete knowledge and skills, and seemed to hold strong beliefs regarding teacher-directed learning activities that put the teacher in absolute control.

Absolutist philosophies dictated educational solutions such as ‘unchanging truths’. Mathematics knowledge was described as ‘unquestionable’. This line of thinking conveyed ‘fixed truths’ held by teachers who were more traditional in their outlook. OBE shifts from this line of thinking to an understanding that values enquiry and discovery. Mathematics learning is a complex interaction between existing knowledge, experiences and opportunities for resolution, and teachers are expected to build opportunities that enable learners to interpret and negotiate open meanings that are not static. However, as teachers struggle to find a balance between the old and the new, they need not lose their identities; much can be learned from what they know and do, how they do it and the new roles demanded by OBE, as demonstrated by the following statement from Wilen, Ishler, Hutchinson and Kindsvatter (2000: 4): *‘Teachers will be more effective if they maintain their own personal identity and integrity while being guided by the tenets of the new pedagogy’*.

Teachers who revealed reformist beliefs had a learner-focused view of teaching. Learning was defined as construction of mathematics knowledge through social interaction, and their focus seemed to be on the process of learning mathematics rather than on getting the right answers from the learners. They demonstrated awareness of the central role of ideas in the process of learning. They did not believe in absolutes; they perceived of OBE as evolving. Collaboration and sharing of information about student learning appeared to be central in their beliefs. There was a group of teachers who perceived themselves as learners and embraced the need to learn new methods every day.

It should be noted that knowledge about what works and what doesn’t in teaching comes from practice through trial and error. Some teachers may believe that good teaching is related to content knowledge and an ability to convey that knowledge to others. Teachers are expected to manage the classroom situations where effective learning becomes the core mission of the educational process. In case of OBE teachers are required to make decisions in the absence of certainty about outcomes; judgments about what is worth knowing will be guided by notions of what is worthwhile and relevant; the degree of openness to new innovations such as OBE will influence what is seen as possible or appropriate within the light of other held beliefs. Different ways of teaching can be expected to be appropriate in different contexts and

that mathematics should, therefore, be taught in whatever way holds promise for meaningful learning (Tobin, 1999 cited in Ofori, 2008:9). Mathematics teaching and learning should enable learners to establish an authentic connection between mathematics as a discipline and the application of mathematics in real-world contexts.

5.4 TEACHERS' BELIEFS AND RELATIONS TO TEACHING PRACTICE

Descriptions of what took place in the classroom together with the explanations of the incidents in the observed lessons provided insightful evidence of teachers' conception of OBE. In this section an attempt is made to relate conceptions of teachers' role, their understanding of OBE in relation to what they do in their teaching and their explanation of why they teach the way they do. Teachers had personally constructed beliefs about OBE, teaching and learning. These beliefs revealed how they viewed knowledge and suggested how they may enact their classroom practices. Matured and experienced teachers demonstrated well-established beliefs that appeared to be central. Younger and more qualified teachers appeared to have peripheral beliefs that were likely to change. The results support the view expressed by Schommer-Aikins (2004:21), who found that beliefs are often interlinked; data showed that teachers don't compartmentalise beliefs, and the interplay between beliefs demonstrated that they are embedded within each other and are not always discrete entities. For example, when teachers discussed teaching and learning, they often made connections to mathematics knowledge and the purpose of education.

This observation is consistent with the literature that teaching strategies can convey an objective or constructivist way of knowing, and that individuals have both general and domain-specific beliefs which are part of an interconnected network of assumptions about knowledge and knowing (Hofer and Pintrich, 2002:14).

The introduction of OBE increased the complexity and unpredictability of instruction and learning situations and often required teachers to change their old methods and to adopt learner-centred instructional practices. However, when trying to implement the new approaches, teachers often found themselves resorting to traditional approaches. Nespor (1987:325) described teaching as an entangled domain because of the various

situations teachers encounter which have overlapping but not completely comparable or related characteristics with other situations, thereby requiring teachers to make difficult decisions. The differences between traditional and reformists conceptions were on how learners came to know mathematics and the means of achieving this level of knowing. Instructional practices demonstrated by teachers fitted into two categories: practices related to beliefs and those that were not related to beliefs.

5.4.1 Practices related to beliefs

The data from the classroom observation indicated strong links between these teachers' beliefs and teaching practice. Teachers who held traditional beliefs about teaching manifested more traditional practices and emphasised performance-based behaviours. Teachers' practices regarding the design of lesson plans, presentation of content and questioning seemed generally consistent with their professed beliefs. As observed from the lessons, teachers who favoured the traditional approach seldom created a learning environment characterised by exploration, induction and deduction. This practice concurred with their belief that learners learn best when teachers demonstrate the steps for a mathematics problem and show them the 'shortcuts' to arrive at solutions. Their stated preference for drills was also reflected in the actual type of activities they designed for learners, as illustrated from the lesson observations.

T14 mentioned that *maths requires building of concepts in a logical fashion*. Their approach could suggest that they believed that daily tasks would enhance this logic/understanding. The strategy that teachers used most frequently was having learners reproduce these rules and procedures on the board or answer together in a chorus; for example, T7 would ask a question, then start the answer for them and the learners would complete it. He used the vernacular most of the time and he appeared anxious to maintain control; he said to the learners *Le se ka mphoqa (Do not disappoint me)*. He was one of the teachers who demonstrated intense emotions ranging from anger to uncertainty about the principles of OBE. In both lessons observed he did not have a lesson plan; during the post-observation interview he mentioned that he needed assistance with lesson plans and assessment techniques. This reflected someone wanting to do what was right, but frustrated by uncertainty.

He used the only tools available to him at that time and delivered what he thought would give learners a sense of the essence of mathematics at least.

Interview data showed evidence that teachers' beliefs about mathematics teaching and learning were influenced by what they believed constituted mathematics knowledge, more than their beliefs about OBE. A synthesis of all lessons revealed that on the whole there was little facilitation and teaching was primarily didactic; some parts of the lessons reflected some form of learner-centredness, with traces of exploration. Teacher-dominant styles remained consistent throughout and tended to follow the guidelines provided by DoE without adding any creativity. Teachers emphasised drills and demonstrated authority in classroom management. They were in absolute control, lessons were time bound, there was no evidence of self-pacing, there was little debate or dialogue in class and minimal activation of prior knowledge. There was no evidence of learner-centredness in activities such as process questioning or responses to learner answers: the type of questioning was mainly content based and learners' responses were mainly reproductions of formulae.

T4 Facilitation is good but has limitations, you can do that when you have learners who are willing to learn and take responsibility, our learners are not ready for that, they need the basics.

The learners' deficient prerequisite mathematics knowledge was cited as one of the reasons for the transmission model of teaching.

This view demonstrated that teachers thought they knew what was best for their learners. It also indicated the influence of contextual factors on decision making. OBE gave the teacher the power and authority to select appropriate teaching designs and assessment techniques; however, their tight schedule, teaching overload and short periods appeared to limit the opportunity for teachers to continuously reflect on their practices in relation to their new role and identity as facilitators of knowledge acquisition. At the same time it also became evident that when teachers view themselves as authorities in mathematics knowledge, there is little chance that they will (re)consider other alternatives.

These teachers viewed mathematics as unique and believed it was their role to guide the learners through orderly steps to attain mastery of content. T9, T7 and T4 were particularly sceptical about OBE's ability to achieve this goal.

T9 There is no time to teach problem solving; OBE has shortcomings when it comes to maths, topics such as gradient inclination need to be taught.

It was interesting to note that out of fourteen teachers in township schools, only two had a different delivery style; the rest demonstrated similar teaching patterns, with teachers starting the lessons with writing tasks on the board and learners occasionally going to the board to write the solutions; there was no variety in what was done. The blackboard was the main resource; there was minimal reference to real-world contexts and very few hands on activities:

T7 There is no way you can teach maths without writing on the board, there are no other resources available.

Learners were not asked to explain how they arrived at an answer and in some instances English was not the main language of instruction, especially in the case of T7 and T4. Post-observation interview data revealed that teachers wanted to do more, but were limited by lack of resources. In some instances there was only one piece of white chalk, no computers, no calculators and no textbooks. Learners shared whatever was available. The data also revealed that some teachers were reluctant to engage meaningfully with the new language of OBE.

The data appeared to suggest a 'fixed ideology'. A view that defines mathematics as an objective, certain and unchallengeable truth would endorse the transmission approaches to teaching, and the teachers as experts would be encouraged to convey the *sacred truth*.

Data showed that certain sets of beliefs do influence teacher behaviour. This finding extends the understanding that when teachers engage in a particular behaviour, they do so because of an underlying belief (Pajares,1992:311). This belief is justified mostly through their professional experiences and sometimes through their teaching preparation background. It was concluded that professional experience and personal efficacy seemed to influence teachers' decisions and attitudes towards OBE. Teachers' beliefs appeared to be contextually based and drawn from personal experiences as they reflected on OBE requirements and what was expected of them.

Data from observation of their classroom practices also confirmed their claim about the misconception of OBE that all learners have the capability to succeed. Most had low expectations of learners; success was mostly defined as passing external examinations. This finding suggests that teachers focused on the content; in fact, they appeared to ignore the outcomes completely and concentrated on the 'content' component, i.e. not developing the 'whole' person. Their behaviour seemed to be driven by external examinations.

Like the traditionalists, teachers who had evolving beliefs about OBE and mathematics knowledge demonstrated classroom practices which were also generally consistent with their stated beliefs. They believed in teachers taking the centre role in mathematics teaching, and their teaching was mostly didactic; however, it is interesting to note that although all expressed the belief that teachers should be responsible for teaching mathematics rules and procedures, the frequency of allowing learners to be 'creative' varied. Two of the teachers, T12 and T16, had lessons that were mainly constructivist in one section and mainly traditional in another. They explained this behaviour as rising from a need to respond to specific learning needs. This might suggest that the teachers' consideration of their learners' ability to understand and use mathematics concepts had some degree of influence on the teachers' final instructional decision to create enabling learning environments.

Some of these teachers made attempts to support the concept of collaborative learning; however, they occasionally stepped in and led the lesson procedurally. Three teachers in particular (T1, T5 and T2) incorporated real-life contexts in most of their lessons, with examples such as using triangles for roofing and asking learners about the exchange rate, and they used a variety of teaching methods such as projects, e.g. learning pricing by going to the supermarket, and group work. They mentioned that they believed in problem solving and collaborative learning, but maintained strict control of classroom activities and seemed to be overly concerned with content. It appeared that their teaching approach was influenced or driven by contextual factors such as the type of learners, school, ethnicity and external examinations.

Reformists, on the other hand, envisioned learners' interactions as a dialectical relationship and demonstrated more learner-centred practices. Teachers seemed to be

in control of the learning situation; they showed confidence in what they were doing and were clearly in control, but not dominating. Learners were encouraged to think by frequently asking process questions. Their teaching approaches differed; however, they all displayed methods consistent with learner-centered strategies such as activation of prior learning, giving mathematics a real-life context by constantly making references to what learners already know in the real world. They emphasised application of knowledge; for example; T19 used parking slots and size of vehicles to encourage learners to think about parameters and area. In many instances during the lessons learners were given the opportunity to think through solutions and asked to offer explanations as to how they arrived at a solution.

Collaborative learning was encouraged, especially with T8, T16 and T19. In one observed lesson the learners were grouped and worked on tasks; it was apparent that the grouping was a structured form of learning; the learners seemed comfortable in their groups, indicating that it was a frequently applied practice. T3 and T18 used activation of prior knowledge extensively; one of the lessons were mainly giving feedback on previous tasks and used the question and answer method. All these teachers provided reasonable opportunities to enhance student outcomes. Most of their practices were fundamentally connected to their beliefs about the nature of mathematics knowledge and student-centred learning as espoused in OBE. T3 had little experience of teaching mathematics, but indicated strong beliefs in using manipulatives. She used real-life contexts in most of her lessons, such as calculating area/painting the house and personal budgeting. She believed that understanding is enhanced when mathematics is presented as a real-life problem. She also believed in being a co-learner, saying that '*OBE helps/empower teachers because I am also a learner, when learners reason, I gain from them. I am a co-learner*'. She acknowledged existing knowledge by being flexible with her assessment rubric – and incorporated new information from learners.

The issue of resources formed a basis for T16's and T19's conceptualisation of OBE. Both articulated their position regarding OBE with interesting clarity and T19 was reflective and emphasised her own views on what education in South Africa needs:

What we need right now is a mix of OBE assessment techniques, collaborative teaching, integration and districts to determine what is good for the region and move away from the rigid outcomes. Teachers should be trained well and given the freedom to make informed choices regarding their learners.

These teachers were well prepared and understood the core principles of OBE, articulated them very well and demonstrated in-depth understanding of the philosophical framework and basic principles. They believed that OBE had potential if well understood and supported. Much as they demonstrated learner-centred learning and teaching practices, they integrated these practices with some forms of traditional teaching methods; this was in line with their beliefs that they have to make sure that learners understand the relevant content and are able to demonstrate achievement of learning outcomes.

From what these teachers professed during interviews, it appeared they believed that it was important to maintain a good balance between the authority/control of teachers and the freedom of learners to be active and creative. Given their beliefs, it might be inferred that construction of a constructivist classroom environment can be underpinned by differing, although not contradictory sets of beliefs.

5.4.2 Practices not related to beliefs

Certain observed practices represented teachers' struggle to negotiate the location of their beliefs and instructional practices. Teachers who held traditional beliefs and described mathematics as a problem-solving subject articulated their roles as facilitators; however, they believed learners should learn basic rules. T1 (evolving beliefs) was highly articulate about OBE, demonstrating his strong belief in most of its core concepts such as self-pacing, moving from unknown to known, the need to contextualise mathematics, for example, factorisation. However, his practice was completely didactic. His manner of interacting with learners did not reflect the idea of 'learner-centredness' in the ways one might have expected; like many others, he used a teacher-centred style. When learners had difficulties with problems, he did not ask leading questions, but merely showed them how to go about the steps. Yet he believed his role to be that of a facilitator.

Most teachers believed that outcomes were achievable and believed that NCS has made the outcomes clearer and that content has been taken care of. However, the concept of outcomes appeared to be confusing as teaching mainly involved telling learners to follow the steps given. The outcomes were treated as traditional objectives, the teacher leading learners to what they needed to achieve. There were two teachers (T11, T17) who professed beliefs that were not consistent with OBE; however, they were found to use practices more aligned with some constructivist methods. The interview data with T17 is indicative of this:

T17 OBE sounds good, especially the outcomes, sample lesson plans from DOE, and rubric, but, I am not yet sure that what I am doing is right or not. Our biggest problem is we see people doing different things and that adds to my anxiety because I want to do the right things.

It is a vicious cycle, the assessment is tedious; that's all we do assess and assess. That takes time off planning quality lessons; sometimes we end up teaching what we think is important to know.

He provided strong evidence of well-structured collaborative learning and seemed to understand the learning needs of his learners; in some instances he provided the scaffolding during group work, moved around in his classroom to monitor progress without being dominant. This is his view of collaborative learning:

Group work is very useful for these learners, they come from different backgrounds and bring very little to class, grouping them is beneficial for less capable ones.

In the case of T11 the data indicate a professional with only one year experience of teaching mathematics, but doing the right thing in terms of OBE principles, yet uncertain whether he was on the right track or not. This is reflective of the theory that this study holds of teachers being reflective practitioners and transformative intellectuals. Minimal experience of mathematics teaching and limited understanding of OBE did not prevent this teacher from using his intuition to deliver authentic pedagogy. However, his professed beliefs were somewhat contrary to his classroom management.

On the other hand, T19 from the reformist group believed that *OBE means putting the learners' interest in the centre of everything that we do, and making sure that we build their potential to achieve the stated outcomes*. And also believed that she has been practising 'OBE' all along her teaching career: *I believe in my teaching methods, this is how I have been teaching anyways, OBE merely made my approach formal*. Her teaching practice did not illuminate all the OBE approaches she professed to value. She had learners work on problems, but she did not provide scaffolding to learners whilst they were problem solving. She continued to maintain a somewhat teacher-centred approach, although some of her instructional practice was learner-centred. Her questioning also indicated a focus on learners getting the right answers, not on their thinking processes. Her professed beliefs would lead one to expect a questioning style that drew out student ideas and helped them build on their existing understanding of the material. Although she asked process questions, she did not probe for learners' understanding. During the interview she mentioned that she needed to give clear explanations of procedures to follow.

This dilemma was further enhanced by the tension these teachers felt between the fundamental principles of OBE which they understood and believed in, and the pressures of learning contexts to produce learners who are active participants, and who can use this mathematics knowledge 'beyond school'. The findings indicate that her beliefs and practice were not completely consistent. Rather, her practice was more closely related to her own self-efficacy rather than her beliefs about OBE.

The perceived inconsistencies may have been due to teachers' intentionally or unintentionally stating beliefs they did not practise. Contextual factors or teachers' priorities may have prevented teachers from behaving in accordance with their beliefs; alternatively, the explanation might lie in the structure, strength, location and direction of the beliefs in question, or other beliefs might have had an influence on their understanding and descriptions of OBE. As reported in the literature, this study also acknowledges that beliefs are situated in particular contexts and may change from context to context. The results of this study also seem to confirm previous research (Pajares, 1992:309) that teachers' beliefs can be *a messy process* as focusing on what happens inside teachers' heads presents certain obvious research challenges. From an interactionist framework, beliefs are described as entities that may be

transformed or even emerge as a result of teacher's interaction with learners (Speer 2005:374). Research based on this model may question the role of such beliefs in shaping teacher's practices, saying that typical characterisation of teachers' beliefs may or may not match what is observed at that particular moment, not that there are inconsistencies. From this perspective, it is deemed inappropriate to describe the teachers' beliefs as inconsistent; *inconsistency is an observer's perspective that does not do justice to the complexity of the teacher's work* (Skott, 2001, cited in Speer, 2005:374).

The complexity of belief research is documented in other studies that showed inconsistencies between professed beliefs and observed practices. Karaagac and Threlfall (2004), Chen (2008), Levin and Wadmany (2006), and Barkatsas and Malone (2005) concluded that classrooms were complex environments and found a widespread contrast between teachers' expressed beliefs and observed practice. Other factors such as perceived support, availability of resources, attitude of learners and the teachers' personality were found to influence beliefs. It is also assumed that beliefs are multidimensional and consist of semi-independent units that correspond to different behaviours (Nespor, 1987:307). In the case of OBE, the study identified various units of beliefs and attempted to correlate those with particular teaching behaviours. Co-existence of contrasting views about OBE in an individual may reflect differences in the dimensions of beliefs which one recognises and focuses upon, and they could be seen as complementary.

5.4.3 Synthesis

This need to learn about teachers' thinking and beliefs stems from an image of the teacher as reflective practitioner. The study examined the relationship between teachers' beliefs, conceptualisation and experiences of OBE and instructional practices; the findings are discussed below.

- **Age**

Teachers who were more mature were able to articulate their views and showed some understanding of certain dimensions of OBE, yet they clearly also had limitations. The younger teachers had a clear picture of the tenets of OBE and seemed more confident. The reasons for this could be the type of initial teacher education they had. However, one of them demonstrated learner-centred thinking and teaching styles even though she mentioned that OBE was a foreign language to her.

- **Level of education**

Teachers who participated in this study were adequately qualified, with a few who had no university qualification. Those who had degrees and postgraduate qualifications provided more sophisticated views of OBE and pedagogy. These findings are consistent with other studies that support the view that teachers who have had higher preparation for teaching are more confident and successful with curriculum issues and classroom management than those who have had none (Darling-Hammond, 2000:52). Jansen (1997) also indicated that South African teachers may not be capable of handling the conceptual demands of an OBE system. However, this study also acknowledges that teachers are transformative intellectuals who constantly strive to make meaning of their situation; therefore, to assume that all under-qualified teachers have poor thinking capabilities would be an inappropriate generalisation.

- **Location of school**

The study was conducted in two distinct school settings: township schools and urban schools. This classification is merely used to indicate the differences between patterns that emerged in instructional practices, not to make inferences about the capabilities of teachers. Twelve out of fourteen township school teachers displayed similar teaching patterns, which were mostly teacher-based with little variations in delivery style. The most striking feature of their practice was that the individual approaches followed similar patterns from the beginning to the end of the lesson. The lack of significant differences could be attributed to several factors: the OBE training they

received in that region, the length of the lesson, the rush to cover content and prepare learners for examinations, and their beliefs.

Three of the teachers in urban areas showed variations in their teaching styles and seemed also to hold views leaning towards constructivism; they had a richer repertoire of teaching styles and used potentially more effective teaching practices. Two teachers had evolving types of beliefs which seemed to favour a blended teaching approach – including both aspects of traditional and constructivism. The reason for these variations between township and urban schools could be the climate of learning: most township schools experience challenges, burnout syndrome and a poor culture of learning.

- **Resources**

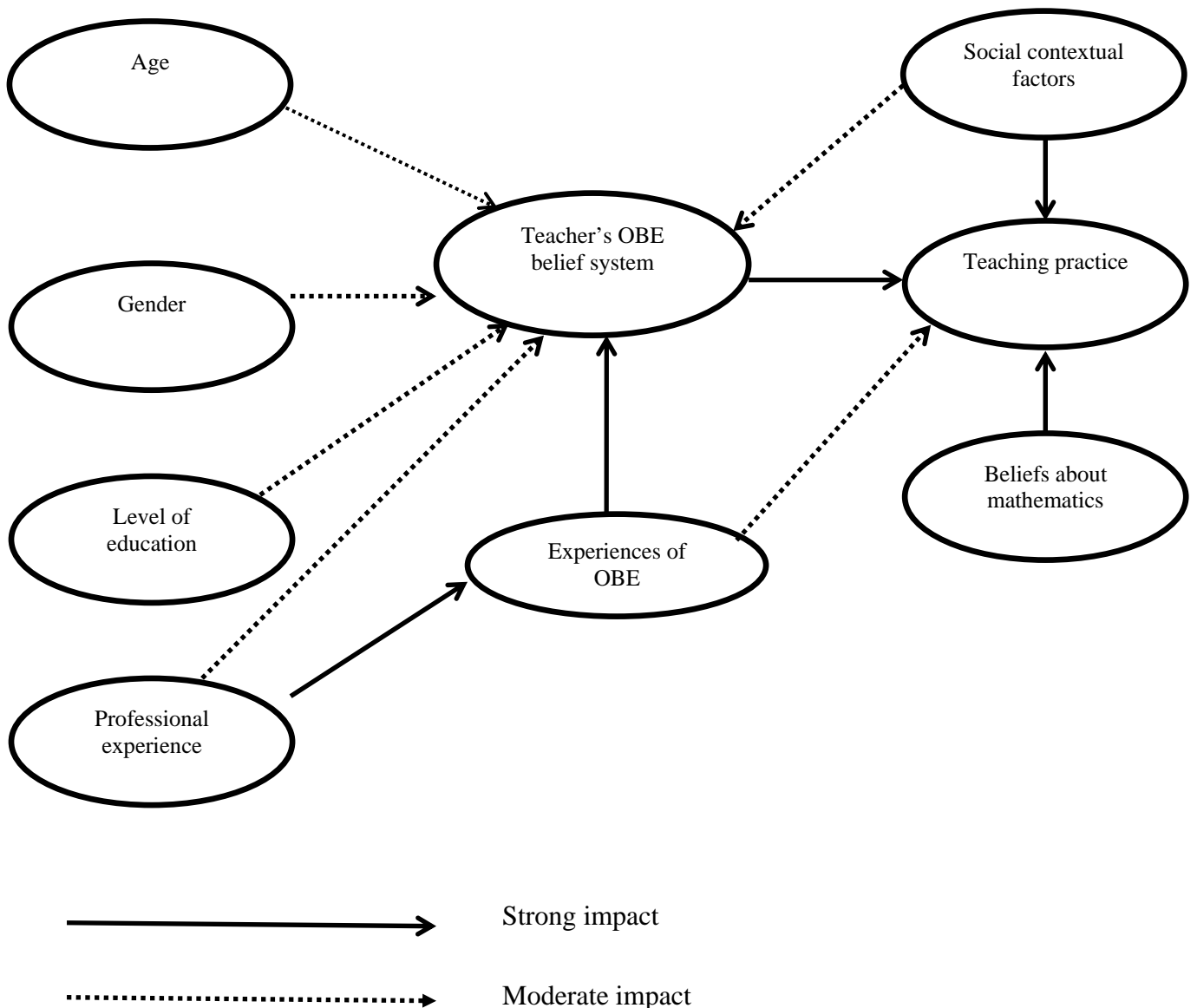
Township schools were grossly under-resourced compared to the urban schools. This appeared to influence the general implementation of OBE. Teachers in township schools in particular operate under extreme and challenging environments. What this study found was that teachers' experience of OBE implementation was the dominant influence on how teachers conceptualised OBE. Only one teacher displayed different views; he believed that lack of resources cannot prevent a teacher from being innovative and creating environments that facilitate problem solving. This finding seemed to resonate with the view expressed by Prickel (2000:14), who argued that if the teacher believes learners can maximise their chances of learning regardless of environmental conditions or background of learners, she/he will apply all possible strategies to achieve student outcomes.

- **Gender and new identities**

Female teachers appeared more accommodating of the change than their male counterparts; they also endorsed the new role of learners without any major shift in their identities. Male teachers (with the exception of two in urban schools) had considerable problems with the perceived *unruly behaviour created by OBE*. Mature teachers seemed to struggle more than the younger ones. It is not known how the learners perceive this new role; what is known is that the poor culture of learning may be the most influential factor in poor teacher-learner relationship. In most observed

classes, learners were found to be noisy and paid little attention to the classroom proceedings. Teachers who believe in maintaining absolute authority may experience tension in such environments. Cultural orientations would also have some degree of influence on perceptions of identities and the new roles. In most African societies being male is equated with having power and authority, and the mismatch between this perception and the goals of the educational system may give rise to anxieties and anger. Handal and Herrington (2003:63) explained that innovation represents an encounter of two cultures in which the conflict of values and goals needs to be minimised and blended to avoid tensions and scepticism.

Figure 5.1 Factors that influence teacher’s beliefs and teaching practice



5.5 CONCLUSIONS

This study highlighted that OBE is viewed as an externally imposed innovation and its implementation was beset with challenges. Policy makers failed to implement what the system advocates, that is, that teachers' knowledge and understanding is constantly being constructed as they interact with their environment. The very principles of constructivism they were trying to implement via OBE were undermined. There was a sense of urgency among teachers to cover content; their content knowledge in many instances was good, but not all teachers could provide expanded opportunities and real-life contexts to enable learners to explore mathematical concepts meaningfully. OBE is a complex system which was introduced in South Africa in haste. This left teachers confused, angry and frustrated, and during the transformation of education the pedagogical integrity of education was somewhat lost in all the jargon that was presented, making South African OBE inaccessible to the people charged with its implementation.

Teachers often approached systemic reforms with little background knowledge of the type of instruction that was necessary for change to occur, as most teachers learned to teach in a traditional manner. In the absence of certainty about OBE and faced with a myriad of classroom challenges, teachers relied on their experience to make decisions regarding what was important to know; they drew on their own personal teaching theories more than what they thought about OBE to make judgments about learning processes. Teachers created ideal images of teaching mathematics and themselves as masters of the subject; hence they perceived their role as experts in control of the knowledge. Their experience, reasoning processes and judgment of learning processes provided the opportunities to seek answers and make pedagogical decisions; these provided them with a sense of strength and the convictions about what should be taught and how it should be taught as this statement reveals: *Teachers ground their professional practices within analysis of their ontological values, live their professional practice in terms of how they realise these values as lived practices* (McNiff and Whitehead, 2005: 6).

This study concludes that the link between their beliefs, conceptualisation of OBE and teaching practice is weak. Their experience of the implementation of OBE and their beliefs about the nature of mathematics knowledge had stronger connections with their preferred teaching practice and represented the basis for their pedagogical purpose. Teachers may value the concepts of OBE, but fail to understand how to put these concepts into practice and will implement OBE on the basis of their own interpretation and understanding. Teachers' beliefs about mathematics appeared to fit closely with the major perspectives of the nature of mathematics reviewed from literature.

The magnitude of change and the uncertainty and anxiety seemed to be the major influences on the intensely emotional reactions that teachers displayed. It was difficult at times to separate the strength of the beliefs in a particular aspect of OBE and the emotional reactions informed by it, and the emotional reactions not informed by any beliefs. However, the researcher probed deeply to bring to the fore those implicitly held beliefs. The findings of this study demonstrate that many complex beliefs held by teachers are sometimes in conflict with each other and these differing beliefs exert different degrees of power and influence on the teachers' classroom practices. Teachers' beliefs are also not always aligned with their classroom practices. Brogan (1994:6) states that education is not a destination but a journey, and therefore OBE should be viewed as a process and not a product.

This study views OBE as a place of departure not a destination, assuming that educators and policy makers will remain open to new ways of thinking based on the discovery of new ideas, including those that this study might produce. The unique contribution of this study was to explore and describe the relationship between implementation of policy and teachers' own epistemological and personal beliefs and understandings. Prickel (2000:12) contends that teachers are continually contributing to new knowledge and insights to the science of teaching and learning, and that their teaching strategies are adapted and applied from tested and non-scientific theories, and their personal beliefs.

5.6 RECOMMENDATIONS

5.6.1 Recommendations with regard to educational policy

The findings of this study have some potential implications for training of teachers and for research. It is recommended that teachers' personal theories be taken seriously and integrated into policy frameworks. The teachers should be given opportunities to develop self-awareness to identify their own beliefs and examine how they relate to the proposed reforms. It should be recognised that these teachers may have to deal with their own implicitly held beliefs and it is through well-planned orientation and induction programmes that the teachers would be able to assimilate the difference among their beliefs, teaching practices and the educational policy. Educational reformers might need to focus first on developing teachers' knowledge and skills before they focus on changing the structure. In addition, teachers need the opportunity to develop shared goals, expectations and beliefs about what good teaching is, and to create instructional practices that coincided with those goals. DoE must recognise that there are variations within educational settings, that township schools are grossly, under-resourced, and that the culture of teaching and learning needs to be reactivated and supported through well-structured programmes. Some of the former Model C schools are not at the generally acceptable status. Therefore, when addressing issues of quality teaching, variations on the ground need to be recognised. There must be mutual trust and understanding between teachers, learners and the national and provincial Departments of Education.

The study also acknowledges that OBE has a lot of potential, if it is introduced in phases and adequate opportunities are created to assess its outcomes and make the necessary changes. There must be a built-in mechanism for continual evaluation; it should not be presented as the final truth that is non-negotiable. Teachers and educators should be at the forefront of the evaluation movement. The credibility of several changes is questionable in the eyes of some teachers, who felt sidelined during the planning process. Teachers did their best to make meaning of OBE amidst much confusion and anxiety.

5.6.2 Recommendations with regard to teaching practice

In order to gain insight into the possibilities of changing teachers' practice, it is recommended that the teachers receive continuous information about the current and research-supported methodologies. The teachers should be guided by sound educational theories of learning that are shared with them by experienced and knowledgeable individuals. Universities could take a leading role in this field by creating models that provide information on the theoretical premises of OBE and other reforms, how learners learn, facilitation processes and authentic assessment models.

The workload of teachers should be distributed equitably to allow them to foster good teacher-learner relationships. Experienced teachers should be allowed to take innovative decisions; management should provide an enabling environment with opportunities for professional growth and development. Giving such teachers, the opportunity to grow would greatly enhance their sense of accomplishment and subsequently lead to high-quality teaching practice. Most of these teachers are skilled to take effective decisions; they are responsible practitioners and do not need rigid routines and unrealistic expectations to guide their practice.

With adequate support, it is believed that all teachers will develop more transformative ideologies, become true transformative intellectuals and enhance the success of OBE. In-service trainers can provide opportunities that challenge teachers' conceptions of OBE and their models for teaching and learning, and explore activities that move teachers to higher levels of evidenced-based practice. The major implication is for teachers to understand new theories and new ways of doing things, and various forms of knowledge.

5.6.3 Recommendations with regard to further research

It is recommended that a model for high-quality practice in South Africa be developed through theory-generating research. It is recommended that an in-depth investigation is done on the direction and intensity of belief systems, and the impact of contextual

factors on belief systems. The research could specifically address mathematics content and effective teaching strategies.

5.7 LIMITATIONS

As with all forms of research, limitations are inherent in this present study. Because of the nature of the study, it is limited in its scope as it investigated the beliefs, conceptualisation and experiences of a small purposive sample of mathematics teachers in Gauteng schools. This study did not intend to elaborate on mathematics content teaching per se. The small sample size and focus on only Grade 10 mathematics teachers also implies that any generalisation based on the results of the study may not be as reliable as they could have been. In addition, the teachers were asked about their beliefs regarding OBE and there seemed to be an overlap between beliefs about OBE and knowledge of theoretical assumptions of OBE.

One final word related to limitations is that when teachers attempt to articulate their beliefs and classroom practices, they may not be able to verbalise why they have made a particular decision, partly because these beliefs could be implicit, and even when these beliefs have been articulated, they may be an unreliable guide to the reality of their classroom actions (Pajares, 1992:309). That said, all attempts have been made to minimise the effects of the limitations of the study to increase the trustworthiness and integrity of the study.

This study also acknowledges that all pedagogical competencies are based on teachers having a deep, vast, and thorough understanding of mathematical content (Piccolo 2008:47), some informants may not have had the form of knowledge necessary to unpack mathematical ideas.

The researcher enhanced the dependability and transferability of the research findings by providing thick descriptions of the research setting and what she had heard and seen in relation to OBE during data collection and data analysis. The depth of emic knowledge gained from this study regarding the influence of the contextual structures, such as resources and culture of learning, might help policy makers in other parts of

the country who may encounter teachers who hold a similar worldviews about the value or otherwise of OBE.

5.8 CONTRIBUTIONS OF THE STUDY

This research study generated in-depth contextualised knowledge on OBE beliefs and teaching practice in Gauteng. It could contribute to the literature on educational transformation by providing evidence regarding relations among beliefs and teaching practice. It also reveals the need for the Department of Education to make teachers' personal theories about educational systems an integral part of the transformation agenda so as to improve the quality of teaching. The study's theoretical importance lies in the finding that real change in educational practice can be effected if teachers' beliefs are acknowledged and addressed. The present results may also mean that during a transformation period caution must be taken against enforcing an ideology on teachers; the recent announcement by the Minister of Basic Education confirms that teachers need not discard their old 'proven' beliefs. The teachers were consistent throughout all investigations on the non-credibility of OBE; their views were eventually acknowledged when the Minister announced *we have signed OBE's death certificate*.

The study also generated several questions that could be utilised as hypotheses for further research, for example, the relationship between the cognitive and affective dimensions of teacher beliefs, the question of the multidimensionality of beliefs, and the interplay between the units of the belief system and their impact on choice of instructional approaches.

5.9 A FINAL WORD

As this dissertation is being finalised the Department of Basic Education is working feverishly on developing new frameworks for a Revised General Education and Training Curriculum. These changes might mark the end of OBE in South Africa. This study provides empirical evidence in support of some of the suggested changes, that is, to streamline the curriculum, to reduce the time spent on assessment-related

work, to reintroduce school textbooks for all subjects/learning areas so as to strengthen content knowledge in pedagogical interactions, and so on. However, it also cautions against any hasty implementation of changes that could lead to further confusion, anxiety and frustration on the part of teachers. Moreover, the effect of teachers' epistemological and personal beliefs on their teaching practices should not be underestimated and should be taken into account in ongoing in-service education programmes for teachers. Policy makers need to provide sufficient time for teachers to reflect on their existing assumptions about several pedagogical issues and to compare those beliefs with the proposed new educational system. This could be the beginning of a more committed and reflective teaching fraternity.

Even if OBE is entirely effaced from South African curriculum frameworks, the insights that this study provides have relevance to any curriculum reform that might be introduced in South Africa.

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ANNEXURE A

INTERVIEW GUIDE

PERSONAL NARRATIVES

BIOGRAPHIC DATA

1. Highest Educational qualifications: _____

2. Professional experience: _____ 3. Years teaching Math:

4. Age: _____ 5. Gender: _____

QUESTIONS:

1. Can you describe what you think education is?
2. What does OBE mean to you personally?
3. What are your views regarding OBE curriculum, teaching/facilitation, collaboration, expanded opportunities, and learning?
4. How would you describe your ideas/opinions of teaching/learning – in general?

5. How would you describe your approach to teaching? What type of activities do you plan for your class?
6. How do your ideas influence your teaching style?
7. What is the students' role in learning?
8. What are your views or beliefs about Math?/what is the purpose of teaching maths?
9. What have been the most important sources of knowledge that have influenced your practice? What is mathematics knowledge? Please elaborate.
10. How would you describe your approach to teaching mathematics? Please elaborate.
11. In your view, how would you describe effective teaching?
12. How would you describe your experiences of teaching mathematics within OBE environment?
13. Are the mathematics outcomes reasonable/achievable? What challenges do you face teaching OBE mathematics?
14. What opportunities does OBE offer? What do you expect from the department of education?
15. How do learners respond to the OBE math delivery? How do you know they know/understand mathematics?
16. In your opinion - What methods are appropriate to assess math knowledge?

ANNEXURE B

OBSERVATIONAL GUIDE: CODE _____

1. TEACHING METHOD

- Testing previous knowledge

- Presentation of new content

2. FACILITATION

- a) integration – creativity

- b) application – problem solving

- c) fast/slow learners

3. QUESTIONING

- a. Types of questions

- b. Time provided to process question

4. ENGAGING STUDENTS WITH CONTENT

- a. Allowing students to process new knowledge with existing knowledge framework

- b. Application of knowledge

5. OUTCOME

- a. What is the observed outcome of the teaching/learning encounter?

- b. What are the main characteristics of the observed teaching/learning process?

Notes:

- The degree to which the teacher focused on rules, procedures vs. learners' interpretation and meaning making?
- What does this behaviour tell about T beliefs?
- What was the T narrative? How does it influence teaching practice?

CLASSROOM OBSERVATIONS

The data presented in the following section provide an overview of classroom observations of nineteen teachers who participated in the study. Inferences were made from data categorized as follows:

Teaching descriptors

1. Structure of content – lesson plan
2. Dominant teaching method : constructivist = **C**. Traditional = **T**.
mixed =
3. Linking to real life events
4. Use of teaching aids
5. Questioning. Content based questioning **CB**. Process based questioning **PB**. A mix of both = **B**

Teacher/learner relationship

6. Teacher –learner interaction
7. Content authority

Assessment

8. Assessment strategies
 9. Creativity
- Teacher descriptors 3 and 4 were further classified as achieved = **A**. not achieved = **NA**. Partially achieved = **PA**.

○ **SUMMARY OF ANALYSIS**

	Teaching descriptors					Teacher-learner relationship		Assessment	
	1	2	3	4	5	6	7	8	9
T1									
T2									
T3									
T4									
T5									
T6									
T7									
T8									
T9									
T10									
T11									
T12									
T13									
T14									
T15									
T16									
T17									
T18									
T19									

ANNEXURE C

FOCUS GROUP INTERVIEW GUIDE

CHANGE TO OBE. GENERAL QUESTIONS.

- a) What has changed in terms of education, knowledge?
- b) What do they think of the new changes?
- c) How do they experience the changes/transition?
- d) How has the change affected teaching of Math?
- e) Are teachers ready and prepared for the change?
- f) How confident are they in teaching math following OBE principles?
- g) What are the challenges?
- h) Has the change brought about the desired outcomes?
- i) What are the outcomes they emphasize most in teaching math?
- j) How do they know that the children know math?
- k) What should be done? And rationale?

ANNEXURE D

CODING SYSTEM

Category	Node	Node definition	Teachers
Conceptualization		Forming a concept of what OBE is, or interpretation of OBE that is based on a range of interrelated factors including experience, observation and reading	
Beliefs		Beliefs are involved in helping teachers make sense of OBE, they also influence how information is perceived and whether it is accepted or rejected	
OBE		Theory of education used to transform education and to change the way in which teaching and learning takes place	
	Traditional beliefs	The traditional responses are those that reflect some degree of awareness about OBE as a philosophical and practical approach to teaching. The views were not generally consistent with premises of OBE; however, there was some acknowledgement of	

		certain aspects of OBE.	
	Evolving	Belief system described as evolving/transitional are somewhat mixed beliefs about OBE Views that are consistent with the premises of OBE to a large extent, but expressed reservations and some degree of apprehension and uncertainty about the success of OBE	
	Transformative	Reflect advanced views and understanding of the complexity of the philosophical framework and practice of OBE.	
Experience		A totality of mentally processed teaching and learning events that construct a reality for teachers.	
Knowledge		It is incomplete and constantly being constructed and reconstructed, it develops via integration of a range of learning activities and one's construction of meaning. Knowledge is adaptive and evolves through dialogues with socio-cultural factors influencing the final product of meaning	

Teaching practice		This study defines teaching practice as a multidimensional process, in which teachers constantly respond to learning needs by providing opportunities for active, deep learning using multiple approaches	
	Transmissionist/traditional	Defined as predominantly teacher-centred, where the teacher directs learners' actions, transmits information and relies mainly on textbooks as a resource. Learners are required to record and memorize formulae and information, follow teacher directions and complete worksheets.	
	Mixed	Mixed, is a combination of the two approaches with teachers showing various tendencies towards traditional and constructivist.	
	Constructivist oriented	Defined as predominantly learner-centred, teachers facilitate learners' thinking, textbooks are used flexibly, they design their own activities and emphasize student reasoning.	

ANNEXURE E

RELATIONSHIP BETWEEN BELIEFS AND TEACHING PRACTICE

- Each category of OBE was used to make inferences about beliefs and teaching practice
- Data from interviews and class observations plotted in the table
- Example given of T4, T7 and T3

Category	Belief	View of OBE	Degree of evidence
Learners	<p>Learners are less motivated, lazy and forgetful. They are so argumentative.</p> <p>Learners need good algebraic skills to solve linear equations, I need to provide them with the necessary skills, good teaching is showing learners short cuts to solving problems.</p>	<p>It is good and it has more bad issues. It can never work with the type of learners we have.</p> <p>It's not that we do not want to learn the new methods – we do not know, we need support, we need examples of lesson plans, given ample time to develop rubrics, to learn new things. I have been teaching math over years and respond to needs of my learners. OBE makes us look</p>	<p>T7Teacher used mainly transmission approaches, maintained control and there was little evidence of student-centredness</p> <p>(he believes he is an authority in math)</p> <p>(uncertainty leads to using what you know best in this case – transmission approaches)</p> <p>Strong evidence</p>

	<p>Beliefs about his teaching:</p> <p>I want to believe that my method works, because learners respond well and they pass the external assessment.</p>	inadequate.	
Questioning			<p>Good questions, however, the teacher was quick to give answers, very little time was given to learners to process the questions. Learners responded well to teacher led instruction – (it was obvious that this was the daily pattern). The type of questions encouraged reproduction of knowledge fed earlier by the teacher.</p>
Facilitation	<p>There is a lot that we need to cover, how can I be sure they will achieve the outcomes if I do not take control?</p> <p>T4 Facilitation is good but has</p>	OBE is not practical	

	<p>limitations, you can do that when you have learners who are willing to learn and take responsibility, our learners are not ready for that, they need the basics.</p>		
<p>Collaborative learning</p>	<p>Collaboration is excellent in situations where we are all on the same level, we are doing different things based on our own understanding of what is expected and what we think is realistic and practical. But we are implementing OBE differently and I suppose this is difficult for learners to adapt to the realities of OBE or even to know what it is all about.</p>		
<p>Real life context</p>	<p>Manipulations are good they make the abstract concrete</p>	<p>It has the potential to deliver if it is explained to teachers properly</p>	<p>Strong evidence</p>
<p>Resources</p>	<p>We do not have adequate resources. However, I believe that we can still make this happen by creating learning</p>	<p>OBE is a good system with some basic flaws, it needs to be ‘polished ‘and teachers need to be given time to be</p>	<p>Strong evidence Teacher used good examples in her lessons about painting the room, quantity of paint, size of</p>

	tasks that enhance understanding	creative	windows.
Traditional	My role is to show learners the procedures and process for finding solutions to math problems	OBE created noisy and assertive learners who are empty, they have no knowledge or good background of math'	<p>T7 Teacher used mainly transmission approaches, maintained control and there was little evidence of student-centredness.</p> <p>T4 The teacher introduced the lesson by asking learners questions about the ratio between boys and girls in the classroom. T4 wrote tasks on the board and learners solved mathematics problems individually and in groups. The subject appeared to be presented as a set of knowledge with rules to be used to solve problems. T4 continuously reminded learners to use thinking skills and recall the steps.</p>

ANNEXURE F

PERMISSION TO CONDUCT THE STUDY



UMnyango WezeMfundo
Department of Education

Lefapha la Thuto
Departement van Onderwys

Enquiries : Shadrack Phele MIRMSA
Tel. no. : (011) 355 0285

14 November 2007

Mrs Ramukumba Mokholelana Margaret
PO Box 911-2154
Rosslyn
0200

Dear Mrs Ramukumba Mokholelana Margaret

PERMISSION TO CONDUCT RESEARCH

The Gauteng Department of Education hereby grants permission to conduct research in its institutions as per application.

Topic of research : "The role of beliefs, conceptualization and experiences of outcomes-based education on teaching practice".

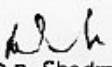
Degree : PhD (Education)

Name of university : Stellenbosch University

Upon completion of the research project the researcher is obliged to furnish the Department with copy of the research report (electronic or hard copy).

Wish you success in your academic pursuit.

Sincerely yours,


p.p. Shadrack Phele MIRMSA

TOM WASPE
CHIEF INFORMATION OFFICER
Gauteng Department of Education



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ANNEXURE G

PERMISSION LETTER TO PARTICIPANTS

Dear Potential Participant,

I am Margaret Ramukumba a student in the department at the University of Stellenbosch undertaking PhD in curriculum studies. I am conducting a research study titled ‘The role of beliefs, conceptualizations, and experience of OBE in teaching practice.’

You are invited to take part in this research project, which examines the meaning and experience of OBE by Grade 10 Mathematics teachers in Gauteng Province.

The study intends to explore and describe the teachers’ conceptualisation of the philosophical and theoretical assumptions in the development of OBE, to determine the challenges and possibilities in the implementation of OBE in institutions servicing different communities.

If you consent to participate in this study, this will involve:

- Class Observations
- Interviews before and after class observations
- In-depth interview which will take about 45minutes
- Focus group meeting (all grade 10 teachers mathematics teachers)

To protect your privacy and confidentiality, you will not be asked to disclose your name.

Participation is **entirely voluntary**. You can withdraw at any time and there will be no disadvantage if you decide not to complete the survey. All information collected will be confidential. All information gathered from the survey will be **stored securely** and once the information has been analysed the interview guides and responses will be destroyed, no individual will be identified in any reports resulting from this study.

Thank you for your interest,

MM Ramukumba