Influence of new curriculum policies on mathematics teachers' work

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Declaration

I, Safura Meeran, declare that:

The research in this thesis, except where otherwise indicated, is my original work.

This thesis has not been submitted for any degree or examination, except where otherwise indicated, and is my original work.

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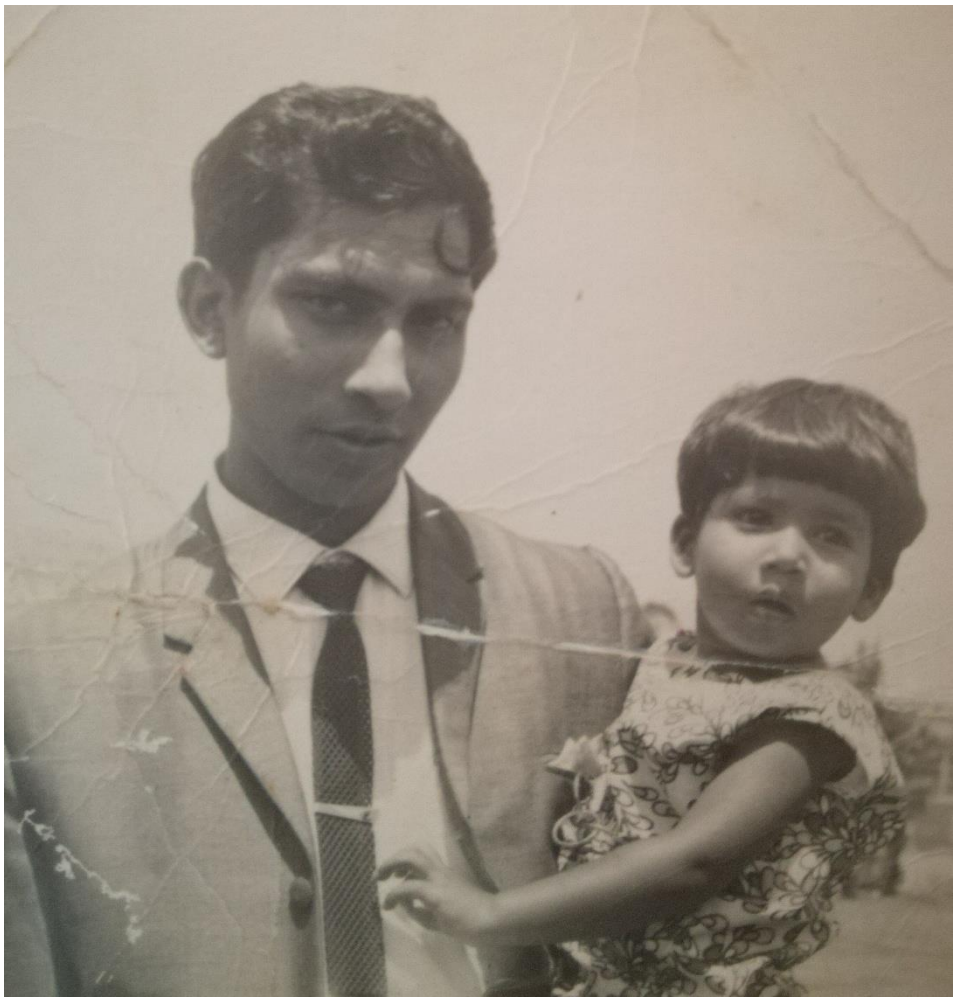
Acknowledgement

I would firstly, like to give gratitude to God, as with constant prayer through the many upheavals I have had during this period, I have managed to complete this thesis. My supervisor has been a source of strength throughout this study. She has guided and developed me both academically and emotionally and I find myself a stronger person because of this development. My husband, Nizaam, has been the force who has pushed me through with constant encouragement and motivation. His belief in me has steered me in believing that I am capable of achieving my goals. I also thank him for the many meals he has prepared so that I could make time to dedicate towards my thesis. My children, Daanish and Jauhara, have given me support and were never demanding of my time. I know I have neglected them and will strive to make up for that. Remember, I am so proud of your achievements and I have done this for you. To my mum, Momeen Meeran, who has had so much faith in me, thank you. I will not forget my sister, Fareenaz Meeran and my little brother Aktar Meeran. Both have been inspiring me through their constant phone calls and their presence. I would especially like to thank Nomkosi Nzimande, Nessa Reddy, Deva Poovan, Barbs Naidoo and Suren Naidoo. They worked with me in this project of Teachers' Work. I have depended on them for constant reassurances, upliftment, as well as academic support. I am really thankful that we had each other through this lonely journey. I offer my gratitude to Professor Bert Olivier, my critical reader, who has been a source of intense knowledge that has broadened my thinking. My gratitude also goes out to the principal, Mr. A. Narrandes, and staff of Sandfields Primary, for their input and motivation, Lastly, I would like to place on record my sincere gratitude and appreciation to the participants of this study, the mathematics teachers. They have given me their precious time and were always willing to give additional information whenever it was needed. I have made firm friends for life and fellow colleagues who aspire to the betterment of teachers and their work.

Dedication

This special dedication goes to my late dad, Essop Meeran, who passed away on the 4th of April 2016 through a short illness of lung cancer. A quieter, more humble person is impossible to find. His few, precious words were always positive. I know he was always so pleased with me. I miss him so much and as I put the finishing touches to this thesis, he is constantly on my mind. I feel sorrow but I also feel that sense of achievement because I know how proud he would have been of me. This is for you, my precious father. Life has not been the same without you.



List of appendices

Acronyms and abbreviations

C2005	Curriculum 2005
OBE	Outcomes Based Education
NCS	National Curriculum Statement
DoE	Department of Education
RNCS	Revised National Curriculum Statement
GET	General Education and Training
FET	Further Education and Training
CAPS	Curriculum Assessment Policy Statement
TIMSS	Trends in International Mathematics and Science Studies
CPD	Continuing Professional Development
HSRC	Human Sciences Research Council
NATED 550	National Assembly Training and Education Department
COLTS	Culture of Learning and Teaching
IQMS	Integrated Quality Management Systems
DAS	Developmental Appraisal Systems
ANA	Annual National Assessments
MLMMS	Mathematics Literacy, Mathematics and Mathematics Sciences
DiMe	Diversity in Mathematics Education
HOD	Head of Department
ISA	Ideological State Apparatus
SADTU	South African Democratic Teacher Union
COSATU	Congress of South African Trade Unions
CoP	Communities of Practice
TRC	Truth and Reconciliation Commission
SGB	School Governing Body
VDM	Visual Drawing Mala
VDK	Visual Drawing Khan
VDC	Visual Drawing Charles
JSEd	Junior Secondary Education
FDE	Further Diploma in Education

List of figures and tables

Abstract

The focus of this study is teachers' work and in particular the work of mathematics teachers as they orientate themselves to each curriculum policy change. Since 1994, with the eradication of apartheid and the change to democracy, there have been several changes in education through curriculum policies. This study, therefore, sought to explore the influence of new curriculum policies on mathematics teachers' work. Through literature it has been established that teachers' work is indeed complex, so there was a need to understand and critically analyse how each curriculum change has influenced their work.

This study drew on Lèvi Strauss' (1967) 'bricolage' to theorise the phenomenon of how new curriculum policies influences mathematics teachers' work and to find out the reasons for it being influenced in that way. The concepts of state ideology, experience, social influence, context, 'governmentality' and cultural capital were used separately and integrated with each other through the theory of 'bricolage' to pursue an in-depth understanding of reasons why curriculum polices influence the work of mathematics' teachers in the way they do.

Five mathematics teachers with 20 or more years of service, teaching grades 10 to 12, were sampled for this study. A case study methodology was used, using a single case, being mathematics teachers, to research this thesis. The methods chosen for the study were: visual drawings, semi-structured interviews and a focus group interview. Participants were first asked to do a visual drawing to show their work encumbrances with each policy change. These drawings were discussed during the first semi-structured, individual interview. Secondly, semi-structured individual interviews were conducted with each participant. Finally, the data collection culminated with the focus group interview with all participants.

The data was analysed within themes using content analysis. The first data analysis chapter discusses how new curriculum policies have influenced mathematics teachers' work and a critical analysis was done to determine why policies influence mathematics teachers' work in the way it does. The next data analysis chapter sought to find the differences, contradictions,

inconsistencies and ambiguities that arose from the data from the first data analysis chapter. This gave a deeper insight into the work of teachers when they implement curriculum changes.

The main finding was that policies contradict their principle of equity for all. New curriculum policies advocate equitable education for students, yet the curriculum prescription defies the possibility for this. Participants have articulated that the policies limited them to time frames which do not allow them to meet the needs of all students in their classroom. They feel de-professionalised as their agency is removed by the prescription of the curriculum and participants have to follow curriculum policy dictates. The mathematics teachers in this study have admitted to becoming exam-driven in terms of their work, because of the many challenges they faced when implementing new curriculum policies, as well as, because of their own past experiences. Trying to cope with the new content areas required in new curriculum policies, the added burdens of administration tasks inherent in each policy change, challenges of context and working with diverse students, have overburdened these participants. Many are stressed and feel that the issues they experience are not heard. In some ways these participants have endeavoured to use their agency to help them cope with content area challenges. They complete the syllabus by seeking professional assistance; some make decisions of integrating methods even with the challenges of limited time frames in using new curriculum policies and one participant uses technology to ease his work burdens. However, the context was different for each participant and the work challenges differed according to the context. What is also apparent is that participants do implement new curriculum policies in the way they assume it should be implemented and show no resistance to doing so.

Teachers' work is indeed burdensome, challenging and complex. Each curriculum change brings more burdens and teachers have to start all over again with more work challenges. While change is inevitable, and has been accepted by many of the participants, contextual issues, lack of pedagogical, context and content knowledge, teachers' own cultural capital and centralisation of new curriculum policies have added to the burdens of the already over-worked teachers.

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Chapter One

Exploring the influences of curriculum change on mathematics teachers' work

The Greek story of Sisyphus is described as follows: Sisyphus was punished by the Roman Gods and his sentence entailed pushing a huge boulder up a hill and rolling it down again for all eternity (Schrijver & Herman, 2005). I use this analogy of the boulder to represent the 'burdens' of the teacher, which gets bigger and heavier as curriculum policies of the Department of Education (DoE) are altered or changed on an on-going basis. Furthermore, as Sisyphus is ordered by the ultimate authority (the Gods) to push the boulder, he cannot desist from his punishment but he does not have to like what he is doing. He can show resistance by taking his time to carry out his punishment and also by not carrying out his duties conscientiously. This Greek myth can be equated to the burdens of teachers as they bear the agony of work intensification each time new curriculum policies are introduced by the Department of Education. Just when the burden becomes lighter, as teachers acclimatise to current policies, their journey starts all over again as a new curriculum policy is introduced and new work burdens arise.

Rationale for the study

There is a general understanding that teachers' work is to teach. Teachers' work can be looked at from a variety of perspectives; such as the social, professional, political, curricular and administrative perspectives. In this study, however, the focus is on the influences of curriculum policies on teachers' work because it is not clear how the advent of curriculum policies influences the work they actually do. There is abundant change involved with each policy renewal such as change of learning areas, assessments, texts and content. Additionally, since 1994, morale in the profession has dropped. Some teachers talk about increased workloads, others about the nature of today's children and further still, others blame the change of policies. This has been the catalyst that prompted me to look deeper into the influence of policies on mathematics teachers' work. As a mathematics teacher myself, I have encountered significant work intensification with each new change in policy. Similar frustrations have been expressed by other mathematics teachers that I have interacted with during department workshops.

Moreover, mathematics is regarded as a gateway to most careers and is under constant scrutiny by the media, parents and government officials. This places additional burdens on mathematics teachers to work significantly harder and to produce outstanding successes because attainment in mathematics is intimately associated with national development (Amin, 2012). This study focuses on various policies implemented since 1994, to explore how and in what ways they have influenced teachers' work. It has the potential to make a contribution to the scholarship on teachers' work.

Broad overview of curriculum policy changes in South Africa

Mathematics polices have undergone a major overhaul after the advent of democracy in 1994 especially with the introduction of Curriculum 2005 (C2005) and Outcomes Based Education (OBE) as a teaching methodology. OBE brought about de-specification of content in mathematics and promoted student centred education (Vithal, 2003). The teaching of mathematics was previously based on the behaviouristic view, *"as a fixed and static body of knowledge consisting of logical and meaningful networks of inter-related truths, facts, rules and meanings"* (Thomson, 1992, p. 132). The teachers' role was to impart this knowledge to the students. However, the National Curriculum Statement (NCS) emphasised a student-centred approach to the teaching of Mathematics with a view to achieving the critical and developmental outcomes advocated in this model (Department of Education, 2003). The key principles of C2005 remain the same even with the changes in curriculum. These key principles are integration, holistic development, relevance, participation and ownership, accountability, student-centred, flexibility, creative and critical thinking, quality standards and international competiveness (Department of Education, 1997).

With the advent of democracy, the mathematics syllabus remained largely intact in 1994 (Vithal & Volmink, 2005). Teachers trained in the traditional, behaviourist way of teaching saw the change to an outcomes based system in C2005 as a shift from the use of objectives to that of outcomes even though the specific and critical outcomes did not specify any mathematical content (Vithal & Volmink, 2005). The second democratic election precipitated via the Minister of Education and in the curriculum as there was concern about the mathematical literacy achievement of students (Vithal & Volmink, 2005). The new curriculum was called the Revised National Curriculum Statement (RNCS) and was introduced in 2002.

Teachers were faced once again with another change in curriculum. Although RNCS used the basic elements of OBE, it placed higher demands on the teacher to teach critical skills and apply assessment standards rather than just coach students as OBE recommended (Lekgoathi, 2010). The RNCS was introduced with related standards in the General Education and Training (GET) phase curriculum for Grades R to 9 and in the new Further Education and Training (FET) phase for Grades 10 to 12. All students were compelled to take mathematics as a subject. In the FET phase, if students did not choose mathematics, they were required to take mathematical literacy (Vithal & Volmink, 2005). A further curriculum change occurred in 2007 and was referred to as the National Curriculum Statement (NCS). The aim of this curriculum was to develop the democratic principles of society in young people so that they would act in the interest of a society underpinned by respect, equality and social justice (Weldon, 2010). The most recent change is the introduction of Curriculum Assessment Policy Statement (CAPS). This curriculum is more specific in terms of content knowledge (Department of Education, 2011) but retains the general trend of the NCS curriculum. Mathematics and mathematical literacy as subjects remain in this new curriculum introduced to the FET phase in 2012, with the first group of matriculants (Grade 12, exit level students) writing mathematics using the CAPS curriculum in 2014 (Dennis & Murray, 2012)**.** Thus far this is the extent to which curriculum policies have changed and these are too many for the teachers to contend with. If the process of curriculum development continues on this trajectory, there will be more changes envisaged in the near future.

Finding the gap and focus of the study

Benchmark tests of numeracy and literacy in South African schools reveal poor achievement levels (Beets, 2012). Therefore, the question arises as to whether the plethora of curriculum policies aimed at improving the quality of education since 1994 has achieved its desired goal. Further, it raises questions about the reason for this plethora of curriculum policies. One of the reasons could be that curriculum developers ignore the central role that teachers play in curriculum implementation (Bantwini, 2010; Remillard, 2005). After 1994, in South Africa, we have witnessed many curriculum policies aimed at providing quality, democratic and equal education for all. Despite this, my study reveals that little investigation has been undertaken into how it influences teachers' work in the classroom. Although research about teachers' work has been carried out internationally, in my investigation there appears to be very little evidence

of studies of teachers' work in South Africa. Weber (2007) reviewed literature in this field and found studies being done on teaching methods, teaching defined in terms of academic achievement, accountability and standardized testing, macro-policy changes affecting teachers, the managerial control of teaching and the conditions, contexts and politics of the job; but very little is based on what teachers' work actually entails.

Policies are studied in terms of how they are formulated, enacted, received, interpreted, implemented, realised and whether there are gaps between policy and practice (Banoobhai, 2012; Bantwini, 2010; Valli & Buese, 2007). However, there are not many studies on how they influence teachers' work, especially mathematics teachers' work. It is for this primary reason that the focus of this study honed in on how new curriculum policies influence the work of mathematics teachers in the classroom.

Key research question of the study

1. How do new curriculum policies influence mathematics teachers' work?
2. Why do new curriculum policies influence mathematics teachers' work in the way it does?

Research methodology

I used a case study methodology within the qualitative approach. Researchers who use the qualitative approach believe that knowledge is socially constructed through *"language, consciousness and shared meanings"* (Maree & Pietersen, 2007, p. 56). This, according to Invankova, Creswell and Clark (2007), allows the researcher to understand and explore a phenomenon. Subjectivity or bias is involved since social construction deals with human interaction. The case study approach was used to study the influences of policy changes on mathematics teachers' work. Stake (2005, p.449) interprets a case study as a *"complex entity located in a situation embedded in a number of contexts"*. The specificity and boundedness of the case defines its singularity (Denzin & Lincoln, 2005). The study allowed for an in-depth understanding of the case without the need to generalise the findings to the greater population

(Denzin & Lincoln, 2005). Yin (2003) describes a case study as an in-depth understanding of the case relying on multiple data sources.

A single case was used in this study, comprising the mathematics teachers who provided data on the particular phenomenon (the influence of policy changes on mathematics teachers' work). The multiple data providers were five mathematics teachers who were the participants in this study.

A brief glimpse of data analysis

Content analysis was used to analyse data where large chunks of information were coded into themes (Cohen, Manion & Morrison, 2007). The visual method, semi-structured interviews and focus group discussions were used to analyse how teachers' work was influenced by policies. Questions about curriculum policy and work were explicitly explored. The first part of the research question which was "How do new curriculum policies influence mathematics teachers' work?" was addressed by asking questions on the role of the educators as determined by the Norms and Standards for an educator and on the concepts based on the conceptual framework used for this study. The second research question which was, "Why do new curriculum policies influence mathematics teachers' work in the way it does?" critically analysed the reasons for the influences of new curriculum policies on mathematics teachers' work. The large chunks of data that were derived from the participants were arranged into themes and discussed.

Validity, reliability and rigour

The following was undertaken to ensure trustworthiness and credibility:

a) Multiple data-collection instruments were used so data saturation is ensured (Cohen *et al*., 2007, Patton, 1990).
b) Participants were requested to read the transcript of responses during focus group discussions to ensure authenticity (Cohen *et al*., 2007).
c) Focus group interviews were audio and video-recorded to ensure trustworthiness and credibility.

Ethical considerations

The informed consent of all participants was obtained. Using focus groups did not guarantee complete confidentiality however all participants were asked to respect the confidentiality of other participants. Anonymity was established by using pseudonyms in this thesis. Consent from participants was sought and obtained for audio-taping and video-taping. The reasons for the research, and how results would be used, were clarified with participants before data collection was done. Participants were reassured that they were free to withdraw at any time.

Delimitations

The problem of the withdrawal of participants can occur. Although four participants would be sufficient but I had opted to work with six participants and thus had more participants than was required. One participant withdrew from the study so I had five participants. The intrusive impact of audio-taping can inhibit data (Kleiber, 2004) and indeed the voice recorder did prove to be intrusive, so it was left in an area which was not easily noticeable by participants. Ethically, power issues between participant and researcher can arise (Kleiber, 2004) and this can be avoided by making participants as comfortable as possible in a neutral location that is beneficial to all. I did inform participants that I was a primary school teacher; since they were secondary school teachers and perceived to be of higher status in the eyes of society, the power issues were minimised.

Structure of chapters

Chapter Two – Literature Review – Influences of curriculum policies on the work of mathematics teachers.

This chapter reviews literature based on mathematics teachers' work and the influences of curriculum policies on their work. It reviews the roles of teachers in the Norms and Standards document in order to understand mathematics teachers' work burdens during curriculum change (Department of Education, 2011). These roles dealt with mathematics teachers' work in mediating learning, student assessment and achievement, developing content knowledge, teachers developing themselves professionally, communicating democratic values to students

to uphold community values, as well as with the role of a teacher as a leader, manager and administrator. Finally, there was a discussion on challenges that teachers faced such as student diversity, language barriers and stress and negativity towards mathematics.

Chapter Three – Theoretical/Conceptual Framework - Theorising mathematics teachers' implementation of new curriculum policies.

A theoretical/conceptual framework was used to understand why curriculum policies influence mathematics teachers' work in the way it does. The concepts for this study can be understood by referring to Levi- Strauss's (1967) theory of *bricolage*. *Bricolage* is discussed as a *"system ruled by internal cohesiveness, that this cohesiveness is inaccessible to observation in an isolated system be revealed in the study of transformations through which similar properties in apparently different systems are brought to light"* (Levi-Strauss, 1967, p. 27). Therefore, concepts used in isolation will not be cohesive and understood as a system but, when similar properties are brought together they can form a cohesiveness to be understood as a system, enabling one to understand why teachers implement new curriculum policies the way they do. A variety of different tasks, and in this case, concepts, are used to unify and to get a holistic picture of the study (Hatton, 1989).

The concepts used in this study are: state ideology, social influence and experience, context, cultural capital and power in relation to teachers' work. To understand how this can be cohesive, in a society there are individuals (teachers) that interact (having social influence) with students and other teachers. These individuals (teachers) have their own ideologies and cultural capitals because of the influences they have had in their lives due to their prior experiences; these influences determine why they interpret policies in the way they do. Power relations exist due to state policies and amongst the individuals who interact because of the policies that govern them, revealing dominant ideologies, in this case those that pursue an agenda of improvement in mathematics. All these concepts form a system because they cohesively allow the researcher to develop an argument as to why curriculum policy changes influence mathematics teachers' work in the way they do. Although these concepts are discussed separately, they do work together to determine how teachers interpret policy change. Below is the list of concepts and how they are unified using Levi-Strauss' (1967) 'bricolage'.

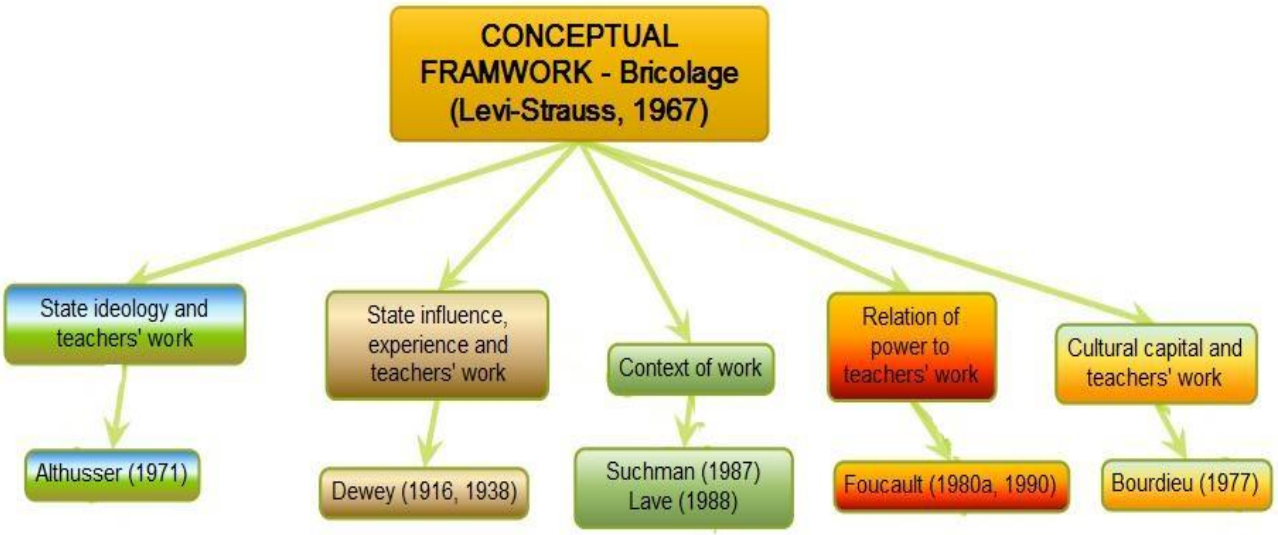


Figure 1 – Concepts and authors used within the theory of Bricolage

Chapter Four – Research Methodology - Researching the influences of new curriculum policies on mathematics teachers' work.

This chapter started with the paradigm that was used, which is the critical interpretivist paradigm. The paradigm allowed for a critical analysis of the influences of new curriculum policies on mathematics teachers' work and also allowed a deeper understanding of what teachers' work entailed. The data collection methods used in this study included visual drawings, individual semi-structured interviews and finally a focus group interview. The participants selected were five mathematics teachers each of whom had more than 20 years of experience in order to gauge their transition through the numerous curriculum policies that have been introduced since 1994. Finally, the process of content analysis and how it was used to analyse the data, was discussed.

Chapter Five – Data Analysis Part 1 – Analysing curriculum influences.

This chapter was broken up into themes formulated from data collected during interviews on the visual drawings, individual, semi-structured interviews and the focus group interview. The themes formulated were used to analyse how new curriculum policies have influenced mathematics teachers' work. A deeper understanding and critical analysis is invoked by the "Why?" question. Each theme was reviewed using literature and concepts from the conceptual framework.

Chapter Six – Data Analysis Part 2 – Finding the contradiction, inconsistencies, differences and ambiguities in mathematics teachers' work.

The contents of this chapter included themes drawn from a re-examination of data from Chapter Five to find the contradictions, inconsistencies, differences as well as ambiguities that had arisen. After the critical analysis, each theme was scrutinised using the literature review and concepts within the conceptual framework.

Chapter Seven – Conclusion - Teachers' work is marked by policy contradictions.

This chapter concludes this thesis by outlining the summary of the findings found in Chapter Five and six. Findings were linked and summarised under broad headings. The summary of findings was followed by the implications for this study; delimitations of this study and the concluding remarks.

Chapter Two

Influences of curriculum policies on the work of mathematics teachers

Chapter orientation

This chapter reviews the influences of new curriculum policies on mathematics teachers' work. The review of literature discusses teachers' work in general. Thereafter, the themes that follow explore mathematics teachers' work with the advent of new curriculum policies by exploring some of the roles that teachers have to enact according to the **Norms and Standards** for educators (Department of Education, 2011) in South Africa. The roles of teachers in the Norms and Standards will be used as a framework to discuss the manner in which teachers' work has evolved and intensified with each curriculum change since 1994. These themes deal with mathematics teachers' work in mediating learning, student assessment and achievement, developing content knowledge, teachers developing themselves professionally, with communicating democratic values to students to uphold community values as well as with the role of a teacher as a leader, manager and administrator. The final theme for discussion is the challenges that mathematics teachers face with regard to student diversity, language barriers and stress and negativity towards mathematics.

What is teachers' work?

Wally Morrow (2007, p. 1), was an eminent South African educationist involved in the drawing up of the first democratic education model. In his contribution to The National Framework for Teacher Education in South Africa, he posed a profound question with regard to teachers' work in South Africa, '*What is teachers' work?*' Having started out his career in teaching, Morrow (2007) claimed that he was unaware himself what his job really entailed. He pointed out a key problem that there is a "*failure to recognize the distinction between the formal and the material elements of teaching as laid out in the Norms and Standards*" (Morrow, 2007, p1). The formal element that he speaks about is the actual classroom teaching while the material elements are all the other roles teachers have to enact within the educational environment that has been prescribed to them. Morrow's (2007) supporting claims are: Firstly, that the implementation of outcomes-based education is failing as the accompanying administrative burdens have led to

an increase of teachers' workloads and pull them away from their core function of teaching. Secondly, the Norms and Standards are prescribed for all South African schools but ignore the contextual differences of the schools within which teachers work that magnify their work exponentially. Thirdly, the recommendations in The National Framework for Teacher Education are not specific to teachers and recommendations concerning teaching are found at different points, therefore confusing the work of teachers. Fourthly, the role of care-giving and teaching is not clearly defined leading to elevated care-giving and nurturing being undertaken rather than actual teaching. Finally, teacher education programmes fail to sufficiently prepare future teachers for the formal and the material elements of schools. Using Morrow's (2007) argument, it is fair to assume that there is a possible misunderstanding of what actually constitutes teachers' work.

The prescribed seven roles of teachers in the Norms and Standards describe a teacher as a learning mediator with a sensitivity to the diversity of students, an interpreter and designer of learning programmes, a leader, manager and administrator, one who continuously engages in professional development, who upholds the community by promoting democratic values to support students, who assesses and gives appropriate feedback to students and who is theoretically knowledgeable to carry out his or her duties (Department of Education, 2000). With these seven roles of teachers being so broadly defined, one is left with numerous interpretations without clarity of how teachers should interpret and implement curriculum policies in the classroom. Put succinctly, Soudien, Jacklin and Hoadley (2001, p. 82) refer to the Norms and Standards as *"the ideal version of the teacher as the state would like them to be"*. The Norms and Standards are stated so clinically in terms of responsibilities of the teacher that it may be impossible to achieve them in terms of the work involved. One could conclude that the situation is stressful as teachers try to establish their roles in implementing new curriculum policies in the classroom keeping in mind their prescribed roles in the Norms and Standards policy document (Department of Education, 2000). The Minimum Requirements for Teacher Education Qualifications document (Department of Education, 2011) replaced the Norms and Standards for Educators (Department of Education, 2000). This policy (Department of Education, 2011) prescribed the seven roles as the collective task of all educators at the school and roles will be carried out according to teachers' position in the school, however there is no stipulation regarding who should do what, when, where and how in a school.

Mathematics teachers' work in mediating learning

Since the change to Outcomes Based Education (OBE) teachers have to now develop different ways of teaching mathematics in the classroom. They have to plan and centre their lessons as facilitators so that students can have more input in the lesson. The question to ask would be: Do the curriculum policies assist teachers adequately in adopting the key principles to make their work manageable in the classroom? In the case of C2005, if the Department of Education showed concern that students had not developed the required problem solving skills and critical reasoning ability that were required for them during the learning process (Engelbrecht, Harding & Phiri, 2010), this highlighted that there was difficulty in incorporating the key principles of C2005 in teachers' work. The key principles were integration, holistic development, relevance, participation and ownership, accountability, student-centred, flexibility, creative and critical thinking, quality standards and international competiveness, all of which would remain the same with each curriculum change (Department of Education, 1997).

With the NCS the constructivist approach to teaching and learning is based on a problem solving view of mathematics (Benade & Froneman, 2010). Knowledge in mathematics is used to solve real life problems (Van de Walle, 2007). Teachers have to find ways and means to make content knowledge useful in solving everyday life problems. They have to be innovative and creative and require sufficient time and knowledge to be able to do this. Do policies prepare teachers to do this? Teachers still hold on to the platonistic[1] view of teaching mathematics, according to Webb & Webb (2004). This shows that teachers are finding the changes in policies a burden to their work as they revert to the traditional method of teaching mathematics that they are familiar with.

One of the norms for teachers is to be a learning mediator with a sensitivity to the diversity of students. Whilst curriculum change via curriculum policies was an endeavour to replace the apartheid curriculum, the change to mediated learning provided little support for teachers. It did not specify any particular method (Lekgoathi, 2010) yet it embraced many progressive pedagogical methods (Lekgoathi, 2010; Vithal & Volmink, 2005). The problem-centred

[1] Platonistic – Hierarchical form of teaching such as those prevalent in teacher centred methods.

approach was such a method, which involved students finding solutions to problems using techniques of constructivism that involved mediating learning through developing knowledge structures that allow for conceptual understanding and higher order thinking (Bansilal, 2011; Vithal & Volmink, 2005). Constructivism is concerned with constructing knowledge to make sense of the complexity of one's own thinking and the outside world (Brodie, 2010). This meant transforming students' previous knowledge into new knowledge and so doing means that teachers have to work on students' previous knowledge to develop new knowledge (Brodie, 2010). Consequently, teachers have to correct misconceptions that students have before gaining new knowledge (Brodie, 2010) and that involves working with individual students to find their misconceptions in mathematics and correcting them. This is indeed a burdensome task for the already overworked teacher. Many teachers had little experience with such a method and according to Vithal and Volmink (2005, p. 7) it has come across as "*a prescriptive methodology, a new orthodoxy which replaced any existing set of ideas about the teaching of the subject*". Teachers did not, therefore, see this change as worthwhile transformation but rather as an intensification of work as they would have to get used to these new methods of teaching mathematics (Brodie, 2010; Vithal & Volmink, 2005). The fact that teachers have had to also cope with larger class sizes and poor resources in public schools made these progressive methods unreachable in many South African classrooms. The use of 'objectives' in the apartheid curriculum was just replaced by 'outcomes' yet the initial outcomes did not indicate any mathematics content (Vithal & Volmink, 2005).

Social-constructivism theory, developed by Vygotsky (1978), prompted learning through development and collaboration with a more capable other, peer or teacher. This theory is relevant in current curriculum policies as it promotes student centred teaching. This seems to be sufficient for policy makers who did not foresee the challenges of implementation. The demands on teachers to carry out constructivism are termed by Brodie and Pournara (2005, p. 58) as being enormous, as they involve *"co-ordinating participation of students, mediate mathematical meanings that are offered, maintaining the attention and the participation of the whole class in the ensuing discussion and having to deal with language difficulties as students can't express themselves*". Furthermore, the week-long and one-day workshops were not sufficient to prepare teachers to use such a method (Lekgoathi, 2010). The everyday implementation of such a method requires on-going, strenuous, intellectual and emotional work by teachers (Brodie & Pournara, 2005). Furthermore, such a pedagogy relies on the everyday

experiences of students (Laridon, Mosimege & Mogari, 2005) and for the teacher to co-ordinate these different experiences, is difficult and time consuming.

To implement constructivism requires rich opportunities for students to understand mathematical discourses (Drageset, 2014) and this requires resources, meaningful student interaction and sufficient training for teachers to pursue such a method. Researchers find value in such a method as it allows students to explain their thinking and to reach consensus about mathematical knowledge (Franke, Kazemi & Bathey, 2007). Furthermore, it allows for inquiry and justification that will help students develop mathematical arguments and reasoning (Wood, Williams & McNeal, 2006), as well as allowing for scaffolding and facilitating discourse (Franke *et al*., 2007). Finally, it encourages and assists students towards interactions that they feel are valued (Stein, Engle, Smith & Hughes, 2008). However, Stein *et al*. (2008) posit that, if policies do not guide teachers towards using such a method, teachers would have the impression that guidance should be avoided, which will, according to Brendefur and Frykholm (2000), result in conversations that assist and share ideas but preclude deep thought. To try to carry out such a method can be rather overwhelming for the already overworked mathematics teacher where guidance is inadequate in the new curriculum policies and where policies dictate *what* should be done rather than *how* it should be done. Teachers will therefore resort to teaching mathematics in the ways they were taught and this means resorting to traditional mathematics procedures such as memorization and finding one right answer (Abramovich & Connell, 2014). Furthermore, constructivist methods such as student centred, group work and discussion require more time rather than direct teaching activities (Leong & Chick, 2011). Leong and Chick (2011) point out that the work of teachers includes having to complete the syllabus, to teach mathematical reasoning and encourage participating in discourse within limited timeframes, although policies do not cater for such activities in the timeframes given, while prescribing these activities. Most teachers would be driven to revert to procedural methods that are dominated by teacher centred methods, calculating answers and memorizing procedures (Abramovich & Connell, 2014; Drageset, 2014).

The student centred, critical-thinking and problem solving approach which is propagated by the new curriculum policies (Department of Education, 1997; Department of Education, 1995) has its roots in Freirian (1971) philosophy. Freire (1971) rejected the behaviourist form of

learning that the traditional mathematics curriculum was composed of where the teacher gave out knowledge and expected students to follow suit. Instead the critical pedagogy proposed by Freire (1971) was designed to encourage critical thinking and democratic values. Teachers are motivated to create a critical pedagogy in their classrooms so students could understand the forces that shaped their lives and to make decisions using a critical outlook (Freire, 1971). Critical mathematics is further recommended by Skovsmose (2011) for its ability to detect the technical and hidden uses of mathematics by powerful institutions in capitalistic societies. The argument is that mathematics is used to disadvantage the lower echelons of society by promoting middle and higher class values that limit access to mathematics (Brantlinger, 2014; Buckley, 2010; Vithal, 2003). Consequently, education in the schooling context promotes middle class values thereby not catering for students from the lower socio-economic groups. It is understandable in South Africa that a critical pedagogy that caters for diverse students would instead be encouraged via curriculum policies to be implemented in the classroom. With the past inequalities and injustices a mathematics curriculum that is called people's mathematics would be encouraged as the mathematics knowledge would be used to create critical awareness and to transform that awareness into social and political action (Vithal, 2003). However, the transformation envisaged by curriculum policy designers, although having value, was not informed by the challenges of implementation. It was introduced without taking into account the limitations of resources, time and curriculum frameworks (Vithal, 2003).

Mediating learning using new curriculum policies involves using students' previous knowledge and everyday knowledge to make mathematics understandable rather than abstract. This once again is the philosophy of critical pedagogy in which ethnomathematics is a critical constituent. Tulak, Bondy and Adams (2011) argue that ethnomathematics reconstructs mathematics education to empower different cultures by using authentic mathematics from their lives. Hence, students' cultural and everyday knowledge is incorporated in the mathematics curriculum to make mathematics relevant and understandable (Abramovich & Connell, 2014; Tulak, Bondy & Adams, 2011; Laridon, Mosimege & Mogari, 2005; Vithal, 2003). Many authors argue for the use of mathematics in real life situations as they feel that this will improve performance in mathematics (Bautista, Wilkerson-Jerde, Tobin & Brizuela, 2014; Julie, 2013). Yet others challenge this viewpoint as grasping what these real world experiences are requires a lot of reading and preparation by the teachers because of the diversity of students (Hansson, 2012). Teachers may not find the context driven mathematics personally relevant and will fail

to impart this form of knowledge to students (Julie, 2013). (Leong & Chick, 2011) found that there is not enough time to create real-world experiences for students in the classroom (Leong & Chick, 2011). Further to this, the diverse groups of students in diverse contexts, makes ethnomathematics a challenge, as this type of mathematics includes encompassing the everyday cultural activities and values of students who may find it embarrassing to share these activities with other students (Vithal, 2003). Teachers sit with the dilemma of not only completing content but having to create critical thinkers in the classroom as well as to ensure that students feel safe to share their cultural backgrounds to understand the content, This is indeed a mammoth task especially when teachers themselves are not free of ideology, An example used by Vithal (2003) is that of white teachers having to teach multiracial students about political mathematics education under the legacy of apartheid. This will take a lot of planning on the part of the teacher to bring across such a curriculum as to not offend anyone, thus work extends beyond school hours. A study conducted by Reddy (2006) study which aimed to understand the poor performance of South African students in the Trends in International Mathematics and Science Studies (TIMSS) found that South Africa, in their transformation endeavours, placed significantly greater emphasis on real-life situations and multicultural approaches than other countries who placed more emphasis on understanding and mastering mathematical concepts and skills. So what exactly should teachers do to implement changes in curriculum policies and still meet the achievement requirements for students?

The intellectual work involved in mediating learning by a mathematics teacher is to make abstract mathematical knowledge understandable in everyday language (Ball, 2000). Dewey (1904) believed that an exceptional teacher should be able to tap into students' intellectual abilities and provide opportunities for students to reach their full potential through methods aimed at recognizing and creating this intellectual activity. Ball (2000) shows the amount of intellectual work involved in just using an example of analysing and preparing a single mathematics problem requiring effort on the part of the teacher to surmise a number of issues: whether it is suitable for all students; whether the problem is contextually situated; what methods to use to bring the problem to the level of the student and so on. Teachers are supposed to reach students that come from different cultural backgrounds who are sitting in one classroom, work in difficult teaching and learning situations and are restricted in using an abstract discipline, in everyday language, to be understood by all students.

Researchers have professed the used of using technology to ease the burden of mediating new curriculum policies in the classroom (Abramovich & Connell; Bragg, 2014; Eyyam & Yaratan, 2014; Mallik, 2014; Mardis, 2014; Clarke, Clarke & Sullivan, 2012; Lee & McDougall, 2010). Bragg (2014) claims that teacher should source resources that will engage students in meaningful learning. Mallik (2014) concurs that the use of technology will further progressive methods such as constructivism as it allows students to visualise abstractions as well as to formulate and solve problems. Resources in the form of cultural tools such as geoboards and manipulative, such as calculators and mathematics sets, symbols and representations as well as software modelling geometric and numeric patterns will help students visualize and work with real life problems (Abramovich & Connell, 2014). However, Eyyam and Yaratan (2014) as well as Mardis (2014) have found that schools do not have the necessary resources to enhance their teaching and the teachers lack the expertise and time to use such technology in the classroom. Nonetheless, technology itself can be of benefit for the reduction of teachers' administration work, allowing them to extend beyond the written curriculum to web sources and other educational technologies (Clarke, Clarke & Sullivan, 2012). Bragg (2014) claims that although the benefits of technology for assisting teachings cannot be denied; access, time and skills are needed to use these technologies. While mediating learning is the major role of mathematics teachers, to gauge the learning done is also a major aspect of teachers' work. This is the next aspect to be discussed.

Mathematics teachers' work in students' assessment and achievement

Student assessment and achievement is one of the norms that is indicated in the Minimum Requirements for Teacher Education Qualifications document (Department of Education, 2011). Conversely, student assessment and achievement come with their own set of challenges and lead to work intensification for the mathematics teacher. Since the advent of democracy in 1994, the concept of quality education has been used in South African policy documents which exist alongside policies that foster democracy in schools (Department of Education, 2011). Student assessment has also changed tremendously. Whereas pre-1994 student assessment consisted of tests in mathematics, now it is used to foster democracy, based on student-centred activities that include group assessment, formative assessment such as peer- and self - assessment, projects, investigations and assignments as well as tests and exams (Department

of Education, 2011). However, instructional policies on assessment seem to be vague and allow for multiple interpretations rather than being clear and detailed, specifying how assessment should be carried out (Fleisch & Schöer, 2014). Teachers are now required to incorporate all these aspects in assessing students although they were not adequately trained to do so and may not even know what is expected of them. Still, student assessment is prescribed by policies and teachers are mandated to carry them out (Department of Education, 2011).

South Africa has obtained poor results in the Trends in International Mathematics and Science Studies (TIMSS) (Drent, Meelissen & van der Kleij, 2013). South Africa was one of 50 in the 1995, 1999 and 2003 TIMSS and one of 69 countries in the 2011 TIMSS assessment (Drent, Meelissen & van der Kleij, 2013) and South Africa had the lowest performance in mathematics and science (Reddy, 2006). TIMSS was carried out to provide data on student achievement and learning contexts with students of different age groups and across nations with the purpose of informing educational policies (Nixon & Barth, 2014; Reddy, 2006). However that is not how it was viewed. It was used instead to compare the mathematics and science skills of different nations (Nixon & Barth, 2014) and with the poor performance of South African students, to add pressure to teachers to improve mathematics results to meet such global standards. The misinterpretation of international assessments by policy makers led to these assessments being used as a focus of ranking rather than to improve educational systems (Nixon & Barth, 2014; Drent, Meelissen & van der Kleij, 2013) as seems to be the case in South Africa; this puts added burdens on teachers as policies have been aimed to increase ranking by ensuring achievement. Reddy (2006) through her research via the Human Sciences Research Council (HSRC) found valid reasons for such poor performance. One reason is the language of instruction. The majority of South African students are English second language students and these students fared worse than English first language students (Reddy, 2006). Secondly, South African students scored the lowest in geometry (Reddy, 2006) and the reason for this is that geometry was removed from the curriculum when C2005 and RNCS (Revised National Curriculum Statement) was introduced. Reddy (2006) further stresses that TIMSS was carried during curriculum change and restructuring and teachers had to contend with curricular change from NATED 550 to C2005 then RNCS. It seems to be that with each curricular change teachers are being overwhelmed by such drastic changes, resulting in poor student achievement. Furthermore, it was found that mathematics and science teachers were the least qualified compared to other countries and yet with the transformative educational policies,

qualified teachers are needed to organise and implement the activities that these policies envisage (Reddy, 2006). Moreover, South Africa had the second largest class sizes from all TIMSS participating nations, having also economic disadvantages as most schools are under-resourced and contexts were not conducive for mathematics and science studies (Reddy, 2006). Reddy (2006) also found that that the frequent restructuring of the policies over a short period of time caused stress and anxiety amongst teachers who were not prepared for such policy changes and combined with the other factors such as contextual issues, large class sizes, lack of resources and insufficient knowledge to adopt these policies, put the majority of South African teachers at a serious disadvantage.

South Africa's need to meet global standards by participating in TIMSS reflects the need for economic advantage to improve mathematics results. South Africa has made its claim to globalisation within policy documents by stressing that the worldwide social, economic and cultural relations will be used to serve economic growth and enhance international competiveness (Weber, 2011; Department of Education, 1997; Department of Education, 1995). Reddy, van der Berg, Janse van Rensburg and Taylor (2012) as well as Reddy (2006) declare that South Africa has committed itself to a science and technology pathway for the economic and social development of the country. Nevertheless, it was found that the mathematics score profile of students graduating from school show achievement that is inadequate to pursue careers in the science and engineering fields (Pitoniak & Yeld, 2013; Reddy *et al*., 2012; Reddy, 2006). Even the National Senior Certificate, the big test in South Africa, that is the school exiting examination, conforms to acceptable standards and masks the educational challenge of high levels of failure (Pitoniak & Yeld, 2013), hence, the constant curriculum revision to improve student achievement in mathematics. Not only must mathematics teachers work hard to implement each curriculum change, they have added pressure to improve the performance of students in mathematics. Accountability pressures are placed on the mathematics teachers to accomplish this burden. Thereafter, follows the contradictions, as the need to improve performance of students and policy ideals of democracy, clash.

The way student assessment and achievement in mathematics are used opposes the policy ideals of democracy. By being prescriptive, policies are thought to improve the performance

of students in mathematics but in so doing, they contradict the critical outcomes that are present in all the transformative education policies. Apple (2003) refers to these contradictions as the conflict between decentralising and centralising policy descriptors. Decentralising principles give greater autonomy to the teacher and are based on the principles of democracy while centralising policies involve the state being prescriptive and giving little or no autonomy to the teacher in implementing curriculum policies. The centralising pressure on policy documents, according to Beets (2012) and Mncube and Harber (2010), is as a result of the global concern with quality education especially in developing countries such as South Africa. By centralising policies the state has a greater control in attaining global standards for the country. The centralising principle now comes into effect, whereby teachers are forced to become robotic as they simply deliver lessons that are based on excessive specificity in the curriculum policies, because of state control through curriculum policies. This argument has significance as the many accountability issues that teachers are subjected to allow them little or no autonomy.

Through COLTS (Culture of Learning and Teaching), IQMS (Integrated Quality Management Systems, DAS (Developmental Appraisal Systems), WSE (Whole School Evaluations) and systemic evaluations such as ANA (Annual National Assessments), increased pressure has been put on teachers to follow curriculum policies religiously. External assessments such as Annual National Assessments (ANA) are being used from the primary schools to high schools to gauge the performance of students in mathematics and English (Fleisch & Schöer, 2014). Mathematics teachers and policy makers are under pressure to improve achievement results, particularly the matriculation (National Senior Certificate) results, and this puts continuous intellectual and emotional stress on the teacher who has to cater to these demands (Brodie & Pournara, 2005). According to Beets (2012, p. 15) policies are *"linked to powerful global discourses of performativity, efficiency, quality assurance and accountability"*. Therefore, mathematics is not used for its utility value in problem solving and its cultural possibilities but rather in its socio-political value because of its economic importance (Pais, 2013). The empowerment enabled by mathematics, because the knowledge is considered economically viable, seems to be hidden in the policies (Pais, 2013) which stress democratic principles and mask the hidden agenda of political and economic enhancement. Tulak, Bondy and Adams (2011) assert that achievement of equity in mathematics should not be used to increase the workforce and to support economic growth but rather to achieve social justice and democracy for all the people in the country. So claiming equity for all through education policies and then

subscribing to global standards (Long, 2013; Weber, 2011) of economic growth creates a paradox that burdens teachers. There is a need to ask, therefore, what happens to the majority of the previously disadvantaged students who are still being disadvantaged because of inadequate resources, large class sizes and over-burdened teachers, and who are unable to gain access to the higher echelons of society by achieving good results in mathematics? This creates additional stress and burden on the teacher who has to follow the policy prescriptions, thereby providing reasons for their frustration as he or she does not have time to meet the diverse needs of the students. At the same time, one of the roles of an educator prescribed in the Norms and Standards for teachers is to cater for the diverse needs of students (Department of Education, 2000). Too many inconsistencies exist which lead to confusion.

Mathematics teachers' work in developing content knowledge

The Norms and Standards for teachers stipulate that teachers have to be theoretically knowledgeable. That may seem obvious for mathematics teachers who have to be conversant with the mathematics content to be able to teach it to students. However, the multiple changes in the mathematics curriculum have had an adverse effect on content knowledge that teachers have. When C2005, using the underlying principles of OBE, was introduced even the name, mathematics, that teachers were familiar with, changed. The name changed to Mathematical Literacy, Mathematics and Mathematical Sciences (MLMMS) and this curriculum was extended from grade 4 to grade 9 as a compulsory subject (Reddy, 2006). Although this study looks at the Further Education and Training Phase (FET) from grades 10 to 12, it should be noted that students from the lower grades feed into grades 10 to 12. OBE came with an under-specification of content (Reddy, 2006) and even the name MLMMS would have caused confusion for the teachers as to what to teach and what the subject area required (Vithal & Volmink, 2005). Reddy (2006) consequently maintains that South African policy makers created a curriculum that placed emphasis on real-life situation at the expense of understanding of mathematical concepts and principles. The South African high school curriculum, grades 10 to 12, remained unchanged at this stage and could be regarded as being academic and suited to a small minority of students. Even with a transformational policy such as C2005, teachers were still driven by a content-based curriculum to prepare students for the matriculation examinations. Even though the mathematics curriculum in the FET phase remained unchanged until the RNCS was introduced, teachers still had to battle to guide students from an OBE

background in the earlier grades to one that still incorporated NATED 550 principles of a content driven curriculum in the FET phase.

With the introduction of RNCS the changes in the mathematics curriculum created uncertainty and confusion for mathematics teachers as to what was required of them. It became compulsory for all students to do mathematics and if students could not cope with the mathematics curriculum they were required to take mathematical literacy (Vithal & Volmink, 2005). Teachers once again were faced with the challenge of becoming theoretically knowledgeable in mathematical literacy and learn the concepts therein, without understanding the subject requirements. Vithal and Volmink (2005) refer to mathematical literacy as a watered down version of the abstract mathematics curriculum. The division between mathematics and mathematical literacy seems to separate students even further because those that can cope with the abstract mathematics curriculum will be in line for the high status careers (Vithal & Volmink, 2005). Furthermore, *"All students will be required to take mathematics or mathematical literacy which are nationally examined and used for the determining right of access to jobs and further education"* (Vithal & Volmink, 2005, p. 17). Additionally, the section of geometry was removed from the RNCS syllabus (Department of Education, 2003). Reddy (2006) established through her research, that South African students had the lowest ranking in Geometry in the TIMSS assessments. Then, with the introduction of Curriculum Assessment Policy Statement (CAPS), yet another curriculum change, geometry was reintroduced together with content areas such as probability and transformational geometry (Department of Education, 2011), hence, it stands to reason that few teachers will have knowledge of the new content added on. It can be noted that with each curriculum change there have been changes in the content area which has had an effect on teachers' theoretical knowledge.

The question to ask is, how would teachers acquire the necessary content knowledge that they are required to have in the new curriculum policies? Reddy (2006) discovered that South African mathematics and science teachers were the least qualified as compared to other teachers that participated in the TIMSS assessment. Teachers used three curriculum documents, C2005 and RNCS, together with textbooks, to understand what and how to teach in the classroom (Reddy, 2006). With many teachers being under-qualified or unqualified to teach

mathematics, having to manoeuvre a new curriculum can be an impossible task. In addition, teachers who are struggling with having theoretical knowledge to teach mathematics are now faced with new curricula and unfamiliar teaching materials (Reddy, 2006). Teachers' confidence to carry out curriculum change is affected by their knowledge of the content area (Brodie, 2010). In the new curriculum teachers are required to find out how students think and to find their misconceptions and errors (Brodie, 2010) but they will not be able to do so if they are lacking in content knowledge. This could be a major contributor to the low performance of students in mathematics. Policies are ideally placed for transformation without considering other factors such as teachers themselves and whether they are able to implement the requirement of policies. Teachers are also faced with other challenges such as time (Leong & Chick, 2011); context (Brodie, 2010) and resources (Reddy, 2006; Vithal & Volmink, 2005). All of these impact on teachers' work and policy implementation. Taylor and Vinjevold (1999) contend that South African teachers' difficulties in the new curriculum are due to their not having enough conceptual mathematics. The new curriculum refers to the curriculum that had been just introduced at that time. The reason given for this, according to Chisholm, Volmink, Ndhlovu, Potenza, Mahomed and Muller (2000) as well as Taylor and Vinjevold (1999) is that teacher development around the new curriculum has been inadequate with insufficient resources to make adequate curriculum change and conceptual change. Moreover, curriculum innovations require teachers to co-ordinate contextual and knowledge structures which take a long time to develop (Slonimsky & Brodie, 2006). The relevance for the South African context is that most teachers have to work in under-resourced contexts to develop content knowledge for students. This is taking a long time because most teachers are inadequately qualified to teach the new content knowledge. Teachers have to work very hard to understand the content knowledge so as to implement it to students even though they may have misconceptions due to their inadequate theoretical knowledge, to carry out this task,

Teachers' conceptual and content knowledge of mathematics is acknowledged as a worldwide problem (Ball, Lubenski & Mewborn, 2001). Here in South Africa it is more of a problem; Brodie (2010) argues that teachers in South Africa were disadvantaged by the apartheid curriculum and therefore have a weak conception of mathematical knowledge and how to teach it. She further stresses that there is a limited number of students who graduate with strong mathematical knowledge and many of those who do choose to work in industries with better salaries and job conditions (Brodie, 2010). Teaching is therefore a poor alternative. Schools

are short of qualified mathematics teachers (Chetty, 2014; Reddy, 2006). This is a strong indication that teachers should continually strive to improve their education in keeping with current research in mathematics education (Sriraman & Tőrner, 2014; Department of Education, 2011) and this will have implications for the improvement of policy implementation and to improve the learning process and student achievement in mathematics (Shabanifar, 2014; Sriraman & Tőrner, 2014). Teachers' theoretical knowledge should allow teachers to detect student errors in order to shape pedagogical content knowledge (Shabanifar, 2014; Brodie, 2010). Conversely, if teachers are over-worked by making sense of and implementing new curricular content knowledge, many would not have the time or the inclination to pursue studies that will develop their content knowledge. Furthermore, if the content keeps changing in each curriculum policy, it may be difficult to keep up.

Teachers' curricular and theoretical knowledge may improve if there is an investment in the education of teachers who are within the school system. The state should, therefore, provide opportunities to develop teachers' curricular knowledge and expertise (Clarke, Clarke & Sullivan, 2012) and having day long workshops is insufficient to do so. Findings show that teachers' content knowledge is inactive in the class unless the content knowledge is directly related to curriculum instruction and student learning (Baumert, Kunter, Blum, Brunner, Voss, Jordan & Tsai, 2010). Teachers are consequently orientated to unpacking the curriculum in the classroom (Davis & Renert, 2013). Davis and Renert (2013), hence, argue that teachers' shared practices will have implications for their content knowledge. Therefore, if the Department of Education arrange courses that develop teachers' understanding of content changes in the new curriculum policies, teachers can collaborate with each other to share their expertise and challenges which will have a positive impact on their work conditions in the classroom. Even experienced teachers who are confronted with constant curriculum changes and new content areas will find it a challenge to deliver lessons in these new areas. They will then resort to familiar content knowledge which reverts to what they were taught (Abramovich & Connell, 2014). Closely linked to improving content knowledge is the participation of teachers in professional development activities which will serve to develop teachers' content knowledge.

Mathematics teachers' work in professional development

One of the requirements of the Norms and Standards for South African teachers is that they should participate in on-going professional development. This on-going professional development has been given priority in many other countries (Jita & Mokhele, 2014). With the introduction of new curriculum policies the continuing professional development (CPD) is said to promote student learning (Jita & Mokhele, 2014) if teachers achieve the purpose of altering their knowledge, beliefs and practices (Borko, 2004; Guskey, 2002). Researchers stress the importance of professional development for teachers to achieve better pedagogical understanding and improvement in teaching strategies (Gunnarsdóttir, 2014; Jita & Mokhele, 2014; Sriraman & Tőrner, 2014; Hill, Sleep, Lewis & Ball, 2007). It has also been noted that improvement in classroom teaching and student achievement is recognised by policy makers (Hill *et al*., 2007). With continual curriculum reforms in mathematics as well as in other subjects in South Africa, it would seem that professional development is vital for South African teachers to improve classroom practice and ensure student achievement, yet results in mathematics are poor (Reddy, 2006). Thus it would make sense to understand the reasons for such a situation.

With continuous mathematics policy changes, professional development would be a necessity for mathematics teachers to participate in, in order to adopt curriculum changes. However, Reddy (2006) found that not many teachers participated in professional development activities related to mathematics and science pedagogy, even though C2005 introduced new methodologies in classroom practice (Reddy, 2006; Vithal, 2003). It was also found that professional development courses offered in South Africa were not continual and Reddy (2006) suggested that for professional development to be effective it should take place over a long period of time. Similarly, in the United States, Sowder (2007) found that educational reformers have realised the importance of providing quality education to students depended on providing an on-going professional development programme for teachers. However, both Sowder (2007) and Reddy (2006) are in agreement that the quality of professional development provided needed to be assessed in order for it to be beneficial to the teachers. Ball and Cohen (1996) declare that professional development sessions were not substantial and intellectually stimulating to teachers. Besides, it is as if the teachers needed updating rather than finding opportunities in professional development for continuous learning of the curriculum, students and learning (Ball & Cohen, 1996). Hence, as was established by Reddy (2006), a low

percentage of teachers participate in professional development activities in South Africa because it could seem a burden to the teachers as it would entail more work for them. There is so much more that is required than simply attending these workshops.

For professional development workshops to be beneficial teachers need to be committed to making the changes that these workshops advocate. A case study done by Cohen (1990) showed that even if a teacher willingly participates in the professional development courses and believes that she has made major changes to her practice, her understanding of mathematics is still superficial as she had just adapted the new curriculum materials to her traditional style of teaching. What she needs to do is to unlearn her old ways and adopt rather than adapt the new methods but to do this she needs sustained guidance and support and help from others to do the unlearning (Cohen, 1990). So just attending these workshops will not bring about the required changes. Opportunities in these workshops should be provided not for a shift to content knowledge but rather a shift of content that is related to experiences of the student in the classroom (Dewey, 1992). Professional development should also allow for the teacher to become theoretically knowledgeable in mathematics even if the focus is on curriculum changes and student achievement (Easton, 2008; Sowder, 2007). If it is related to students' understanding and achievement then teachers will be able to uncover mistakes in students' understanding and their teaching practice as well as to make them re-evaluate the curriculum in order to effectively refocus students (Sriraman & Tőrner, 2014). Referring to the case study done by Cohen (1990), for such intensity in professional development workshops to be effective, on-going support and individual or small group work are needed to assist the teacher to work effectively in a context of curriculum changes.

Teachers' needs and beliefs are important aspects to be considered if professional development is to be successful. Richardson (1996, p. 103) defines beliefs as *"psychologically held understandings, premises or propositions about the world that are felt to be true"*. To change behaviour one must first change one's beliefs (Pajares, 1992) so changes in beliefs could change instructional practices (Randolf & Philipp, 2007). If teachers' beliefs conflict with the curricular reforms advocated in professional development workshops then teachers may not change their thinking or practices (Randolf & Philipp, 2007). Gunnarsdóttir (2014, p. 159) posits that teachers need to feel a *"coherence between their beliefs and knowledge and their*

experiences in professional development reforms and policies at all levels". They would need time to work on the new ideas and to reflect on them (Desimone, 2009). Jarry-Shore and McNeil (2014) argue that if large-scale professional development workshops are aimed at showing teachers' their faults in their current practices then teachers will take this personally as a criticism of their work and may ignore these workshops. Additionally, in developing countries such as South Africa, using the 'one size fits all perspective' by not taking into account the context that teachers work in can be devastating as professional development workshops discuss resources and materials that is needed to teach the mathematics content and these resources are not readily available in all schools (Boger, Yule & Sparrow, 2013). Weldon (2010) claims that teachers are not a homogenous group of people that share similar beliefs and knowledge but belong to different communities and had different experiences during conflict years so using a 'one size fits all' curriculum training will not benefit all teachers. Teachers have to be convinced that new teaching practices work before they can adopt them (Sowder, 2007). Change brings about anxiety especially when teachers are not sure how to bring about change and are worried about the work involved and these issues can be addressed in professional development workshops if these workshops are carried out well (Sowder, 2007). However, in developing countries where resources for quality professional development workshops are reduced then the needs, knowledge and beliefs of teachers are not adequately addressed (Jarry-Shore & McNeil, 2014). Furthermore, if the Department of Education wants teachers to change their practice according to policy changes, teachers need to be given more opportunities through professional development workshops to make these changes, or curriculum policies will not be adhered to (Spillane, 2000). The state should also make a financial commitment to provide professional development (Spillane, 2000).

While it is recognised that quality professional development workshops are conducive to ensuring curriculum change and student achievement, however big scale workshops may not achieve what it was set out to do. Jita and Mokhele (2014) report that teacher cluster teams typify a recent and popular experiment of professional development and are used to improve teachers' classroom practice and student achievement. The effectiveness of such clusters is as yet still unclear (De Lima, 2010). South Africa was subjected to the cascade method but using teacher clusters will be more beneficial as teacher clusters are smaller and such interventions are closer to the teachers and the classrooms (Jita & Mokhele, 2014). Teachers form clusters in context in which they work and with teachers that generally have the same issues (Sowder,

2007). Professional communities, as introduced by Wenger (1998), are similar to teacher clusters. Their advantage is that they provide an on-going venue for teacher learning. The teachers in these clusters or communities share a purpose of achieving goals, sharing responsibility for decision making and co-ordinating their efforts to ensure student learning (Sowder, 2007). Communities of practice or teacher clusters are closer to home and can be formed within schools or include neighbouring schools but the aim is professional development. It was found that when teachers became part of a cluster community they were able to shed their anxieties about their teaching and content knowledge, thereby gaining a sense of empowerment and confidence in their abilities in mathematics by addressing their specific needs and concerns (Sowder, 2007). Research done by Muijs (2008) revealed that teachers from mutual clusters experienced less stress and difficulty when implementing a new curriculum. In any cluster, however, there has to be access to an expert who can help the teachers with the issues they are experiencing (Sriraman & Tőrner, 2014). That may be the difficult part if subject advisors or any other expert in the mathematics field are not readily available to cluster teams. It has been recognized that in South Africa the Department of Education has not provided adequate support for teachers at the local and district levels (Lekgoathi, 2010) and this type of support with expert knowledge would be beneficial to cluster teams. There is also a possibility that teachers will develop trust and be more open with their ideas if they are part of a professional development team (Jarry-Shore & McNeil, 2014). Changes in practice require time and support which can be adequately provided by such teams. Working towards change where there is support may make it easier for teachers to cope with curriculum change and work pressures.

Professional development is used to orientate the teacher towards a new curriculum but it also intensifies work. It requires commitment and participation in professional development workshops to make effective curriculum changes (Sriraman & Tőrner, 2014). Teachers have to find time with all the other work issues that they have to attend these workshops. It also takes work and effort for teachers to find out fallacies in their students' understanding and to change their practice, and that is the requirement for professional development workshops to be successful (Sriraman & Tőrner, 2014). Teachers need to take responsibility to be aware of current research in mathematics education so that they can give their inputs in workshops (Sriraman & Tőrner, 2014). Teachers who are already burdened with so many other issues in their practice have to now take on a further burden, There are some teachers who want to create

a mathematical community in his or her classroom where debating, discovering, probing and problem solving occur. To achieve this, help thorough professional development is required (Boger, Yule & Sparrow, 2013). However, a mathematical classroom needs time to be administered and with pressures on teachers to complete the curriculum, they do not have time for such endeavours (Leong & Chick, 2011). Teachers' work is complex and diverse.

Mathematics teachers' work in relation to community values

One of the duties that a teacher has to perform enshrined in the Norms and Standards is that they must uphold the community by promoting democratic values to support students. This is a very broad statement as it is vague as to whose values are needed to be upheld. Is it the democratic values of the state, the democratic values relevant to the community or is it the democratic values that the teacher feels are relevant? Furthermore, what values are considered to be democratic? For mathematics education, Brodie (2010) finds that justification and meaning-making are important values to be instilled in students according to current reforms in mathematics education. So such values are compatible with reforms in policies to make learning student centred thereby catering for the individual needs of the student. The teacher has to uphold these values by listening to students' contributions and transforming these contributions to mathematical knowledge thereby creating meaning making and justification for individual students (Brodie, 2010). There is the value of equity coming through strongly as in this way although groups of diverse students are worked with there is the support and development of individual students (Brodie, 2010). Vithal (2003) postulates that the task of the mathematics teacher is to apply the thinking tools of the curriculum incorporating the democratic values inherent in the curriculum policies in such a way that it will make students critically aware and able to take social and political action. Teachers can use indigenous knowledge in mathematics to make learning relevant and concepts more meaningful to students' everyday lives (Maxwell & Chahine 2013). The value of equity means that teachers have to move beyond their own expectations and knowledge in order to gain maximum participation with contributions from all students on their ideas (Brodie, 2010). Brodie (2010) states that it is not always easy for the teacher owing to the time limits in the curricular goals they have to achieve. Moreover, many South African teachers have received a general training on curriculum policy change rather than a subject related one (Chisholm, 1999; Taylor & Vinjevold, 1999). Consequently, the democratic value of equity which South Africa, as a post-

apartheid, developing and democratic country, holds valuable may be difficult to bring about in the South African classroom because of work-related issues.

With the value of equity still under discussion, there are contradictions to what the community may hold valuable. Oehrle (2010) found that South Africa, on its pathway to equity as a result of economic, social, political and cultural changes, has experienced the problem of breakdown in family and tribal values. This rhetoric is echoed by DiME (2007) in arguing that mathematics education needs to attend to issues of culture, race and power. The issue of whose values are more valuable comes into focus, more so, as mathematics is seen as a subject that is independent of cultural influences (Ladson-Billings, 1997). Foote and Bartell (2011) add that valuing and using previously marginalized students' cultural values and experiences will make our understanding of mathematics a socially constructed one inclusive of many, thereby providing some equity. South Africa, as an economically unequal country, has prioritised access to education to improve educational outcomes in key areas such as mathematics and science, as part of the human development strategy (Reddy *et al*., 2012). Reddy *et al*. (2012) suggest that in so doing, giving access to all students to educational outcomes, the hope for any parent, society or government is to ensure that if the youth receive a good education, that will translate into monetary gain and the development of capabilities and skills that will lead to personal development, citizenship and readiness for economically viable careers. Yet South Africa in its quest for equity by treating all races as equal and striving to eliminate gross inequalities in allocation of resources, still experiences poor quality in education with progress in their ensuring equitable outcomes (Timæus, Simekane & Letsoato, 2013; Taylor, Fleisch & Shinder, 2008). Thus the teacher who has to instil and promote these values is now facing a mammoth task to manoeuvre through the various contradictions while at the same time finding values beneficial for all and providing an equitable and quality education. This leads to even good teachers in South Africa becoming despondent and considering leaving the profession because of the extremely difficult conditions they work in (Oehrle, 2010).

The personally held values that teachers and students have can have a contradictory effect on education. Oehrle (2010) believes that shared spiritual values that work with personal values can help, inspire and create a greater sense of self by respecting the dignity of all, by listening to others, by allowing everyone to make their own decisions, by being caring of others and by

believing that given an opportunity anyone can succeed. These values are indeed laudable but the teachers' ability and commitment to instil and use these values adequately may be in contradiction to their curricular goals, time and their own personal values. In addition, teachers may not be free of their own ideologies and values that may be in conflict with that of the students (Vithal, 2003). This may also be, as Maistry and Thakrar (2012) discuss, because of the contradiction of the students' own values in relationship with others, which is critical to a students' social responsibility. Weldon (2010) contends that the beliefs that teachers have do not only influence filtering of curriculum knowledge in the classroom but impact on the democratic values taught through classroom interactions. Further, Rengifo-Herrera & Branco (2014) contend that broader principles of ethics and morals can have an impact on politics and the economy and create better ways to develop the future of our society.

While educational policies have changed the democratic values, this is typically done with a 'one size fits all' perspective. Maile (2011) argues that the national curriculum attempts to address the local context of students by introducing critical outcomes restricted to learning areas and methodologies but not to the context of the individual student. The National Curriculum Statement emphasised a student-centred, OBE approach to the teaching of mathematics to achieve the critical and developmental outcomes (Department of Education, 2003). The key principles of C2005 remain the same even with the changes in curriculum. Luthuli (2006) advocates that these outcomes do not adequately free the blacks from an inferiority complex and liberate them to become human beings. To do this the curriculum needs to be integrated and inclusive with respect for the rights of all, with an emphasis on diversity (Luthuli, 2006). The conflicts of cultural, social, economic and political differences that aggravate the situation in the South African context and schools, still domesticate the education population to accept the power of the ruling minority and conform to such rules (Maile, 2011). Therefore, the values prevalent for those in power will be inculcated in students. While the curriculum fosters the values of human rights, anti-racism, critical thinking and problem solving particularly in mathematics, curriculum development spaces fostering such values are not accessible by teachers who are the implementers of the curriculum and who possess local knowledge of the context and values (Maile, 2011). Furthermore, Vithal (2003) questions whether the mathematics curriculum is moving towards the humanitarian values of democracy, justice, non-racism and non-sexism if as a society we are still struggling with inequalities and injustices. Owing to the use of global perspectives to inform its system of education, it has

allowed cultural imperialism and domination to result in inequalities in socio-economic situations and parental involvement (Maile, 2011). Visser, Juan and Feza (2015) and Maile (2011) argue that parents of students from poorer socio-economic backgrounds have inadequate knowledge and skills to assert their children's rights and their values are being ignored.

Cultural values do have a place in mathematics education. Maxwell and Chahine (2013, p.62) argue that *"cultural immersion not only builds a well-rounded individual but also provides teachers with the necessary tools to maintain relevance in the diverse and constantly evolving landscape that is the classroom"*. The individual need of the student are now prevalent as the teacher must keep in mind the unique and personal ways of solving mathematical problems (Maxwell & Chahine, 2013). This would mean that teachers need to make mathematics relevant to everyday lives by using students' cultural knowledge and values. Using everyday knowledge and values is one of the requirements of mathematics education (Department of Education, 2003). The use of community based values as a learning tool which reflects the knowledge of a particular community can be used by the teacher to work with diverse students (Foote & Bartell, 2011). This does however, put extra burden on the teachers to find out about different cultural values and use them to make the teaching of mathematics relevant to the student. With so many duties that the teacher has to carry out there are still more challenges that the teacher faces in the classroom.

Mathematics teachers' work as leaders, managers and administrators

Leadership can be understood in different ways. Can (2009, p. 43) defines leaders as those who *"take over voluntary responsibilities during the education processes and activities forming independent projects influencing his/her surroundings"*. Can (2009) extends this definition to give examples of such activities such as staff meetings, student club activities, celebration activities as well as parent meetings. Teachers take on leadership roles to co-ordinate and manage these activities. With regards to policy changes, such a teacher will organise and co-ordinate meetings with teachers and thereafter parents to collegially participate in discussion on how these policies can be implemented. Student club meetings can be organised by teachers to further mathematics interest and participation in competitions. However, this voluntary participation can be challenged depending on the power hierarchy in schools. Metcalfe and

Russell (1997) liken the way secondary schools function to that of a production line, in which students move on conveyor belts from one subject specialist classroom to another with the timetable as the alarm, shuffling students to their desks, regularly, throughout the day. Subject departments are divided in this way and provide teachers with a strong identity of belonging to a certain departmental team, thus perpetuating further divisions owing to the status of their subject (Downey, Byrne & Souza, 2013; Hargreaves & Macmillan, 1992). So, teachers teaching a subject such as mathematics, which is considered a high status subject (Apple, 1995; Apple, 1988), will see themselves as superior to other teachers and may not form a collegial relationships with other teachers in the school. This very strength of the division and rigidity of specialist departments may inhibit curriculum change because a more flexible structure is required to facilitate change (Downey *et al*., 2013). Furthermore, Head of Departments (HODs) lead such organisational structures and contribute to the strong identity of teachers belonging to specific subject teams. If they do not relinquish leadership roles to teachers in their teams then these teachers would not have the opportunities to participate in leadership roles (Downey *et al.,* 2013; Ball, Maguire, Braun & Hoskins, 2011). Therefore, teachers may not always have an opportunity to participate in such leadership roles or, if such roles are bequeathed to them, such as organising a parents meeting, they may find, according to Strong and Yoshida (2014) that it is increased work pressure rather than an opportunity for empowerment.

Teacher leadership can be discussed as teacher autonomy within and out of the classroom. Strong and Yoshida (2014); Saad (2012) as well as Pearson and Moomau (2005) deliberate over teacher autonomy, arguing that giving teachers autonomy in implementing and interpreting as well as being part of reform policy initiatives in the classroom will solve the issues in schools. So, if a teacher is given autonomy to use the curriculum in ways that will be meaningful to students, this will create teacher leaders in the classroom who can manage their own curriculum and planning. However, autonomy can seem to be far-fetched because the roles of teachers have become diversified and intensified and this poses a challenge to their autonomy (Hargreaves & Fullan, 1998). With the centralization of government policies where curriculum change is emphasised in terms of quality, teachers are measured by student performance through performance management systems, national teaching standards and external examinations (Gür, 2014; Gu & Day, 2013). Here, in South Africa, such management systems are the IQMS (Integrated Management systems) and the external exams are those that are given to each grade in the secondary school until the matriculation examinations. Hence,

Ball *et al*. (2011) posit that there is compliance to policy initiatives rather than autonomy to decide the best ways and valuable topics that need to be studied in the mathematics classroom. Thus, the diversity and number of curriculum policies are related to demands on the teacher to comply with policies within limited time frames (Ball *et al.*, 2011). Ball *et al.* (2011, p. 616) emphasise what policies do to teachers, *"teachers do not do policies, policies do them"*.

The teacher has to manage the classroom in which he or she implements the curriculum. That means managing the implementation of the curriculum as well as managing resources and students in the classroom. Classrooms form the organization structure of each specific school, so managing classrooms are context relevant; yet Ado (2013) points out that policies are decontextualized and topics and issues are often limited to a single workshop to bring about curriculum interpretation. Teachers therefore, find it difficult to manage the curriculum in the context they work in. In managing their classrooms teachers face challenges such as student centred reforms, changes in teaching methodologies, their increased social responsibility towards the diverse students in their classrooms, the workload involved in implementing new policies, and extra-curricular duties that they have to prepare and organise while monitoring of their performance creates extra workload as well (Gür, 2014).

Downey *et al.* (2013) stress that, considering the specialist subject divisions, teachers who head the subject specific teams are required to give pastoral care to students outside their subject divisions and this puts added pressures on them. There are diverse students in a classroom, from different socio-economic backgrounds, cultures and diverse ability groups. The teacher has to manage implementing reform initiatives in such a classroom. Depending on the context that students come from, there will be the added burden of the social responsibility towards the students (Darling-Hammond, 1999). One of the challenges that teachers find in their classroom management was found by Gu and Day (2013) to be student behaviour in the classroom. Of teachers interviewed in a study incorporating 1000 teachers in England, 40% considered leaving the teaching profession because of disruptive behaviour in the classroom, so it can be argued that the teacher in the classroom needs to develop a mode of survival rather than prioritise the giving of quality education (Gu & Day, 2013). With the diversity of students being taught, Roth and Maheux (2015), contend that curriculum specifications and planned lessons that do not take into account the diversity of students in the classroom can account for

students' attitudes. Students will exhibit such behaviours if their needs are not met in the classroom and they do not understand the mathematics content being taught. Govender and Sookrajh (2014) therefore argue that policy makers need to take into account the influence of classroom discipline in the context of changing curriculum policies as it has increased the workload of teachers and caused discipline problems in the classroom. It can thus be concluded that, with changing policies, managing the classroom in such an environment is indeed a burden for most teachers.

Administration tasks that teachers take on with the increasing changes in policies are numerous. According to Hongying (2007) administration burdens in the changing school climate are the reason that most secondary school teachers are disgruntled with their work. With each change in policy there are administration tasks that accompany such a reform. Moreover, Gür (2014) reports that because of curriculum prescription, teachers have less control and as a result of bureaucratic monitoring to ensure quality education they have increased administration tasks and they face busier schedules. This removal of autonomy or deskilling of teachers intensifies teachers' work, making them do more tasks in less time than before; with their involvement in administration tasks there is less attention to the needs of students (Apple, 1988). This is one factor that may explain discipline problems that arise in the classroom. Teachers' work in implementing new curriculum policies is indeed overwhelming, confusing, intensified and complex.

Challenges that mathematics teachers face when implementing new curriculum policies

1. Diversity in the mathematics classroom

Students come from different backgrounds. Teachers have a challenge in their classrooms to meet the demands of diverse students. This increases their work-load. Bernstein (1996) discusses the diversity of students when he made an argument based on class. This can be applied to South African schools as students come from different cultural and economic backgrounds. Therefore, tools for teachers to cater for diverse groups of students are not given when curriculum changes are made because context is not taken into account. Teachers have to therefore find ways and means to provide lessons to cater for all students

Apple (1992) discusses mathematics teachers' work from a political, economic and cultural perspective. A subject such as mathematics is seen as an economically useful subject to create a better workforce that is economically viable for the country (Apple, 1992). As such, more pressure is put on the mathematics teacher. In South Africa there was a move from an apartheid society to a democratic one and that meant a huge shift in education especially in providing equal education for all. However, Apple (1992) warns, an overemphasis on an egalitarian education system will lead to a crisis in the economy and culture. This means that equal distribution of resources to schools will lead to public schools having little resources and an unmanageable class size. The consequence of implementing new mathematics curriculum policies with their administration burdens may add to the stress of the already overworked teachers in South Africa. Furthermore, the once neoliberal philosophy that was intended when Curriculum 2005 was introduced to encourage a participatory classroom aimed at creating independent and critical thinkers with a democratic form of decision making (Mncube & Harber, 2010), has now moved more towards neoconservative principles where the state has more control through curriculum policies (Apple, 2003). Student diversities such as race, class and gender also extend to mathematics as it is seen as a high status subject and economically viable (Mhlolo, 2011; Apple, 2003). Mathematics is expected to lead to better job opportunities for students. This has intensified teachers' work in order to provide quality education in mathematics for all students. Furthermore, the prescription of a curriculum policy give more administration burdens and little time for mathematics teachers to be innovative in the classroom.

2. Language of instruction

The language of instruction in most South African schools is English (Maille, 2011). Maille (2011) proposes that the reason for this is that South Africa's current education system is Eurocentric due to succumbing to the dominant international forces of globalisation in order for South Africa to address its market needs. As English is an internationally recognised language, it has become the language of instruction in most schools in South Africa. The problem that many of the teachers have is that they have to teach mathematics in English to students, for many of whom English is not their mother tongue. This issue is exacerbated as Setati (2005) argues that mathematics is a language in its own right. Mathematics, therefore, requires profound knowledge of the language of instruction in order for students to understand and interpret the learning content (Abedi & Lord, 2001). So, students have to learn mathematics

in English and with mathematics having its own abstract vocabulary, it becomes a mammoth task for teachers to teach mathematics. This extends and deepens the frustrations teachers have to make mathematics literate to all students. Essien (2010, p. 34) states that, *''learning and teaching mathematics to multilingual students is complex and the teacher grapples with this complexity''*. With the constant curriculum changes in mathematics and with language issues, teachers have a difficult time in the classroom,

Literacy in education is a problem in many developing countries especially as language forms an important part of the learning process. South African teachers face the challenge of teaching students from multilingual backgrounds in a language that they may acquire only when they start their formal education (Visser, Juan & Feza, 2015). This is the reason that Reddy (2006) found during the research for reasons for underachievement in mathematics in TIMSS examinations, that African school students where English was not the mother tongue, performed poorly. Howie (2003) also revealed that students perform better if the language of instruction was the same as their home language. Thus, as South Africa is a multilingual country, language is an important aspect of education to be acknowledged. Teachers have to deal with the numerous tasks of teaching English using the ground rules for teaching the language of instruction in the educational setting and then teaching the subject content (Brodie, 2010; Essien, 2010). Moreover, teachers have the added task of making mathematics literate to students by incorporating their everyday language where students express what they know in their own language, incorporate this knowledge into English and then interact with the language in the textbooks. Halai (2004) recognizes that this is not a straight forward matter. Teachers have so much more to do in teaching mathematics as they have to negotiate through the language barriers to teach mathematics and with constant change in curriculum their workload increases.

3. Stress and negativity towards mathematics education

With the numerous challenges that teachers have to face with curriculum change and teaching mathematics, there will be anxiety and feelings of negativity towards mathematics and the teaching of mathematics. Sowder (2007) states that having to cope with change provide emotional challenges for the teacher. If teachers believe that mathematics is a set of rules and procedures and those beliefs are challenged by changes in a curriculum that promotes

democratic principles, this can lead to anxiety in the teacher (Collopy, 2003). This anxiety leads to negativity towards mathematics and the teaching of mathematics and these feelings are reciprocated to students who may get feelings of helplessness and dislike towards the subject matter (Ma, 1999). The resultant effect is that students who do not have a positive attitude towards mathematics will not be able to achieve in mathematics (Maree, Fletcher & Erasmus, 2013). If this is the case then students' poor achievement in mathematics adds more stress and work for the teacher as they are held accountable if students underachieve in mathematics (Beets, 2012).

Stress and anxiety may have detrimental effects on teachers. Louw, George and Esterhuyse (2011) posit that in developing countries such as South Africa, transformation aims to rectify the injustices of the past, therefore, if not enough preparations are made to adjust to the changes, that leads to difficulty for teachers in coping. Teachers then become disillusioned with educational practices and if they continue to stay in their profession they experience burnout (Louw *et al.,* 2011). Mathematics education is indeed complex especially with the numerous curriculum changes and challenges that teachers face in the classroom so there is little wonder that teachers experience these feelings of anxiety.

Conclusion

In this chapter a discussion was undertaken on what mathematics teachers' work actually entails and how new curriculum policies influences this work. From the literature referenced I have ascertained that teachers' work is complex and I have attempted to find out how teachers' work is intensified when they try to enact new curriculum policies in mathematics. Thereafter, the curriculum changes from C2005 (1997), RNCS (2002), NCS (2007) to the current CAPS (2012) curriculum were discussed. The themes that followed interrogated the roles of the teacher in the Norms and Standards document (2011, 2000) and related to discuss mathematics teachers' work when implementing new curriculum policies. The Minimum Requirements for Teacher Education Qualifications document (2011) prescribes the seven roles as the collective responsibility of all educators at the school; roles will be carried out according to teachers' positions in the school, however, all the roles seem to be prevalent for every educator and not as a collective. Teachers are leaders, managers and administrators. They have to mediate knowledge in the classroom which keeps changing with each curriculum policy change.

Assessment, according to changes in curriculum policies, has to be carried out to ensure student achievement. To mediate knowledge they have to be theoretically knowledgeable to do so adequately, as mathematics content has changed with each curriculum change. Furthermore, teachers have to be involved in professional development activities to understand and work with each new curriculum. Values are embedded within the key principles and have to be used within the teaching practice in the classroom. So whether the teacher knows the roles prescribed for them in the Norms and Standards document or not, they are using them. Finally, this chapter tries to show that mathematics teachers' work is complex, time-consuming and challenging and that curriculum policy changes require policymakers and practitioners to collaborate intimately before any changes can be rolled out, to obviate or minimise any serious challenges in the teaching and learning spaces. The next chapter will seek to understand why teachers implement new curriculum policies in the way they do. To do this, a theoretical framework drawing on Lèvi-Strauss's (1967) 'bricolage' will be used to understand and critically analyse diverse concepts that are linked to discuss the teachers' decisions in implementing new curriculum policies.

Chapter Three

Theorising mathematics teachers' implementation of new curriculum policies

Chapter orientation

Following on from Chapter Two, which sought to determine how new curriculum policies influence mathematics teachers' work, this chapter will seek to understand and critically analyse the influences of new curriculum policies on mathematics teachers' work. A theoretical framework using many varied concepts will seek to uncover the depths of curriculum policy change on teachers' work. The theoretical framework using the theory of 'bricolage', will be used to unite the concepts to be used; which are state ideology, social influence and experience, context, cultural capital and power in relation to teachers' work.

Theoretical Framework

The theoretical framework for this study can be understood by referring to Lèvi-Strauss's (1967) theory of 'bricolage'. 'Bricolage' is discussed as a *"system ruled by internal cohesiveness, that this cohesiveness is inaccessible to observation in an isolated system be revealed in the study of transformations through which similar properties in apparently different systems are brought to light"* (Lèvi-Strauss, 1967, p. 27). So, the elements of a 'bricolage' are heterogeneous, in that looking at the individual element will not enable one to view the current project (Johnson, 2012). The individual bundles of these elements put together combine to form meaning (Lèvi-Strausss, 1963). Therefore concepts used in isolation will not be cohesive and understood as a system but, when brought together, similar properties can be used to understand, for example, why teachers implement new curriculum policies the way they do, as they will form a cohesiveness to be understood as a system. A variety of different tasks, and in this case, concepts, is used to unify and to get a holistic picture of the study (Hatton, 1989). Mauro-Flude (2013) argues that people understand the world in many ways so using a tangled web of concepts would create a better understanding for teachers' work when implementing new curriculum policies.

The concepts used in this study are state ideology, social influence and experience, context, cultural capital and power in relation to teachers' work. To understand the cohesiveness of the chosen concepts, it should be noted that in a society there are individuals (teachers) that interact (**social influence** with students and other teachers). These individuals (teachers) have their own **ideologies and cultural capitals** because of the influences they have had in their lives due to their prior **experiences** and these influences determine why they interpret policies in the way they do. Their **ideologies** are formed through **dominant state ideologies** although they may not be aware of it. **Power relations** exist due to state policies and amongst the individuals who interact because of the policies that govern them, revealing **dominant ideologies** that pursue an agenda of improvement in mathematics. All these concepts form a system because they cohesively allow the researcher to develop an argument for why curriculum policy change influences mathematics teachers' work in the way it does. Although these concepts will be discussed separately they do work together to determine how teachers interpret policy change. The concepts will be used interchangeably when discussing each concept so as to discuss similarities and differences that may arise and to show how they relate to each other.

The researcher, in putting these heterogeneous concepts together, resembles either an engineer or *bricoleur* (Lèvi-Strauss, 1963). Derrida (1978) makes clearer the distinction between a *bricoleur* and an engineer. He notes that an engineer puts parts together precisely using greater exactitude because of the objects he or she deals with (Derrida, 1978). So, even though, like an engineer, one would endeavour to be as exact and clear when writing, one knows full well that with being subjected to the erosion of time one becomes a *bricoleur* (Derrida, 1978). So even though there is a wish to be perfectly coherent, it can be found that that cohesiveness is not entirely systematic because a *bricoleur* accepts that time erodes things and one cannot change time. What is cohesive now will change with time. I, therefore, chose to be a *bricoleur*. The bricoleur uses tools from his or her immediate environment and, through determining what each of these tools signify, would put them together to create meaning (Lèvi-Strauss, 1963). With teachers and education being the focus of this study, the *bricoleur* would choose concepts related to the teacher and education, each of which on its own has an influence on curriculum change and teachers' work. Put together they should give a cohesive and broader perspective for the influences of curriculum change on mathematics teachers' work. As the *bricoleur* it is my task to bring together the concepts of state ideology, contexts, the influence of social networks, experience, power (governmentality) as well as cultural capital to create a web of

understanding and to critically analyse the relationship these concepts have to teachers' work and curriculum change. The concepts will be used to delve into the background and the reasons for the decisions these mathematics teachers take when confronted with the burden of having to continuously make the transition to new practices in their classroom due to policy dictates.

The use of bricolage will perhaps make apparent the way in which state apparatus influences mathematics performance and teaching through its policies

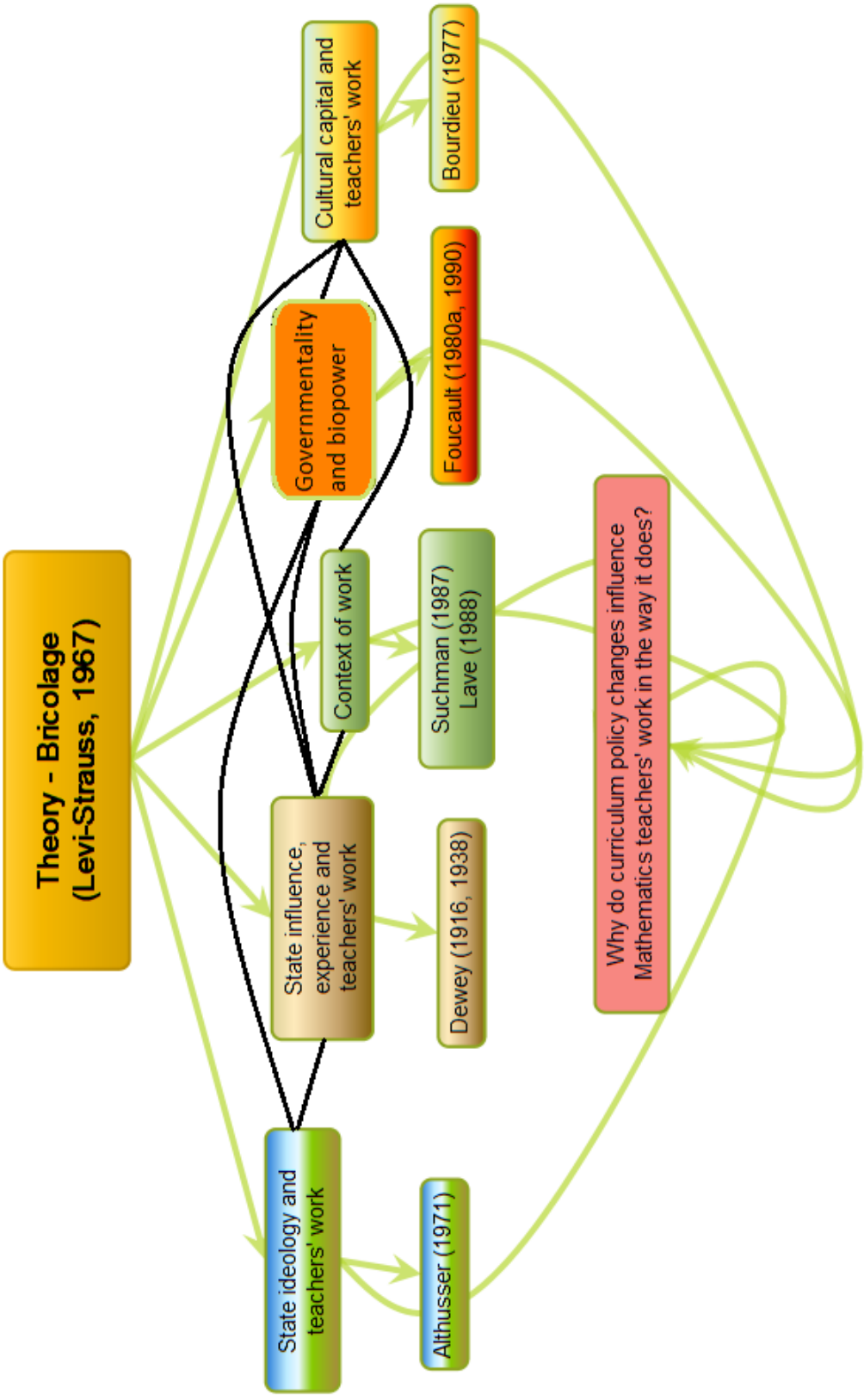


Figure 2 – Expanded diagram showing the connections between concepts

State ideology and mathematics teachers' work

Althusser (1971) uses the concept of Ideological State Apparatus (ISA) to discuss the dominant ideology of the state. Ideology can be understood as a belief system that induces action of a certain kind. Therefore one plays out these beliefs. According to Althusser (1971) everyone is subjected to ideology which means that one is subjected to something that expects a certain kind of behaviour from one. The state and school officials are potentially agents of such ideology. Hardt and Negri (2001) call the dominant ideology that exist today, 'Empire'. 'Empire' they see is the effect of globalisation, which they call a new form of sovereignty as it is the power of capitalism through globalisation that is believed to govern economic and social production and exchange. Apple (2011) refers to it as neoliberal capitalism that controls the world in favour of economic growth. The state in their quest to improve economic status through education uses this as the dominant ideology. Useful skills that can benefit the state is regarded as essential to increase effective governance and the state will therefore use this kind of ideology in apparatuses such as policies to convince the public to succumb to their dominant ideologies. The ideology becomes dominant as those that rule are now those in power and their governance determines what they require to be attained by the people of the country. However, as Althusser (1971) argues, force through policies can cause resistance so instead the state ideology spreads its pervasive wings through a subtlety that is regarded as everyday practice. The ideology of the state is captured in the curriculum policies as the policies are used to prescribe the dominant ideology of the state. The policy is accepted as what should be done in the class but the subtlety comes from the prescription and insistence to follow a set pattern and is portrayed as being a vehicle to provide a 'quality education for all students.' Teachers' work is now framed by quality. The state subscribes to global initiatives and it set the rules of following this path through the curriculum where mathematics is a high status subject and will increase economic performance for the country (Mhlolo, 2011; Apple, 1992). The state's agenda seems to be about improving mathematics education so that South Africa can compete in the global market. Mathematics is seen as a subject that will bring economic success to the country (Mhlolo, 2011). Policy makers equate volume and completing the syllabus as an indicator of meeting the standards, yet ignore the different needs of the students. This amplifies teachers' work as teachers are required to deliver curriculum policies and at the same time to meet the needs of the different students in the classroom. Additionally, the change in curriculum policies and the work teachers have to do to implement these changes are regarded

as what has to be done by the teachers because of the subtle, persuasive way the curriculum policies as the ISA are enforced.

Althusser (1971) suggests that individuals become subjects because of their subscription to dominant ideologies without them even being aware of it (Aydoğdu, 2014; Mills, 2014). A subject is someone who now obeys and follows the dictates of those who enforce these dominant ideologies. The subjects – in this study the teachers – believe that they are free thinking individuals whose task it is to bring about curriculum change in mathematics education. However, Althusser (1971) points out that just showing up at work and participating in the day's work is consistent with legal ideology. Mathematics teachers are led to believe that they have to work to implement curriculum changes as demanded by the state because they are being paid to do so and thus have a legal obligation to complete the allotted task. Furthermore, showing up on time to school and obeying the period changes in lessons and fulfilling their jobs as mathematics teachers with all the other obligations expected of a teacher, is considered to be the right thing to do, is termed a moral ideology by Althusser (1971).

Structural institutions such as schools are not the only venues where ISA is practiced. ISAs are practiced in all areas of a person/subject, primarily starting with the family (Ivanov & Sautkin, 2008). They are used to maintain the status quo. This can be explained adequately using as an example the value placed on mathematics. Families wish their children to get high status careers which are dependent on achieving in mathematics. Teachers want to prove that they are good mathematics teachers by wanting to achieve academic excellence in their students. These subjects are subscribing to the status quo because with better achievement in mathematics there will be better economic prosperity for the state as it is believed that mathematics would achieve such a goal. Lundin (2012) claims that it is believed that cohesion of man, nature and society is mediated through mathematical knowledge and therefore such knowledge is the precondition for reaching the higher echelons of society. Those that belong to the higher echelons of society are those who have access to careers and places in society that are not readily available to others.

Ideology exists through practices and rituals that are evident in all institutions. Myers (2005) describes three characteristics in the ISA. Firstly, the ISA takes the form of an institution which has practices and rituals embedded within its walls (Myers, 2005). We can use the school as an example of such an institution, with its many rules and regulation that teachers have to follow, as these rules are formulated by the state to exact control of all its subjects. One such rule deals with having to adapt a lesson within an allocated time frame called a lesson. Secondly, the ISA functions to interpellate subjects through a relationship between ordinary subjects and absolute subjects (Myers, 2005). The absolute subject refers to those who hold the highest position in the institutional hierarchy like the principal in the school. The interpellation[2] occurs when the ordinary subjects or the workers believe that they are lesser than the principal so they have to obey him or her (Myers, 2005). It could also be that they believe they are similar to the absolute subject or principal so by obeying him or her they are doing what they would have done if they were the absolute subject (Myers, 2005). So the principal, who has to follow what the state requires by reinforcing the curriculum and its changes, is obeyed by the teachers who carry out the curriculum and its changes as is ordered by the principal who is obeying the state. Accountability through assessment, internal and external, moderation of teachers' work and management systems such as IQMS (Integrated Quality Management Systems) are practices that make sure that there is control. Finally, the ISA serves to reproduce the relations of production within an already established, dominant mode of production (Myers, 2005). So, in a school, roles of production are already established and even with curriculum changes these roles are adapted within the dominant ideology that the schools exhibit, which is to produce educated citizens that will serve the state. However, as Althusser (1971) may not have envisaged, there may be resistance to the policies. Teachers do not always accept the changes in the policies and show their resistance through unions. Their resistance can end up in strike action that is prevalent in South Africa. This leads to the question of democracy and how it should be used to benefit all stakeholders in a collaborative way rather than the way policies are formulated and imposed on schools.

Ideological State Apparatuses, therefore, exist without their subjects even being aware of it. Changes in the curriculum are met without the teacher even being aware of doing it. The rules and regulations within an institution force compliance within subjects and even if there is

[2] Interpellation - interruption

resistance these rules bring recalcitrant subjects back to the fold. However, even though this has been said there is still the issue of unions and how they play their role to bring recalcitrant teachers back to the fold. Here in South Africa, the largest teacher union, SADTU (South African Democratic Teacher Union), has its alliance with the government through their membership with COSATU (Congress of South African Trade Unions) and at the same time they serve the teachers (Chisholm, 2015). So this type of paradox arises in how they do their job to support teachers in their resistance to some of the policy demands and at the same time agree with state governance. Are they therefore agreeing to state demands rather than protecting the interests of the teachers who are included in their membership?

Social influence and teachers' work

Dewey (1916, p. 2) stresses that *"education is the means of the social continuity of life"*. Teachers interact with each other and with students in a school context. There is therefore, this continuity through interaction that influences education. Dewey (1980) advocates that schools should encourage interaction to cultivate free discourse rather than submitting to enforced standards of practice: with this shared communication of discourse will be a greater liberation of personal capacity. In this way teachers share their concerns and find ways to benefit themselves and the students in the classroom. This may seem worthwhile as open discussion does lend a platform for freedom of speech but at the same time, this is an ideal that many schools fail to accomplish. Schools have to be recognised as institutions of hierarchical power that enforces such standards of practice so, even though Dewey (1980) gives worthwhile suggestions to enable free discourse, the issue of the types of contexts teachers work in, has to be discussed. Roofe (2015) argues that many school contexts are not the preference of teachers and parents because of large class sizes, lack of resources and discipline problems. So even if free discourse is vital the discourse may be about their disillusionments rather than finding means to improve practice in the school or when communicating with parents. Contexts differ, ranging from authoritarian structures to those that encourage free discourse. Kelchtermans (2005) posits that demands for transformation are interpreted by teachers through the social process of meaning making. As policies are the means of transformation, when policies are prescribed it lends itself to interpretation so the way teachers interpret the policies will probably influence the way they work. Furthermore, Allexsaht-Snider and Hart (2001) argue that teachers cannot work in isolation to implement curriculum change. They need the support of

colleagues, management staff, researchers and even the policy makers to help their transition to change (Allexsaht-Snider & Hart, 2001). So social networks within and out of school are useful in assisting teachers to implement changes in the curriculum.

Costea, Barreto and Burns (2008) have another take on the definition of social influence. They understand social influence as being social power as people are influenced to do things that they would not normally do (Costea *et al*., 2008). The four types of influence are firstly, *direct influence* which is evident through rules and regulations that govern school and classroom structure (Costea *et al*., 2008). These are used to influence teachers and students by using reinforcements such as rewards and punishments to direct schools to follow and abide by changes in curriculum policy. Social power using direct influence is similar to the Repressive State Ideology (Althussser, 1971). The next type is the *indirect influence* which is demonstrated through verbal strategies without a direct demand coercing others to do what is believed to be required of them (Costea *et al.,* 2008). Yet again this type is similar to Ideological State Apparatus (Althusser, 1971) as it is used to make others do one's bidding without them being aware that they are subscribing to the dominant will of others and in this way the demands of the state are introduced in schools through curriculum policies with subtlety. The final two types of social power are the *problem solving influence* used to assist others to manage difficult situations (Costea *et al.,* 2008) and guide them through policy changes and the *likeability influence* which is the use of charm and charisma to influence others to do one's bidding (Costea *et al.,* 2008). These two can also be likened to Althusser's (1971) Ideological State Apparatus. An example would be that of social media sites such as 'facebook' as through 'facebook' visits one puts one's best foot forward. One would display a likability influence by putting one's best foot forward and shaming others who do not fit in the expected image. It therefore becomes a way of marketing oneself and making you fit into a crowd that will make you acceptable and accepted. So even social media fits in with the dominant ideology of capitalism to be marketed and accepted.

Experience and teachers' work

The aspect of experience to be addressed in this thesis is that of being cumulative. Gadamer (1975) says that all cognition is really recognition. Therefore what one experiences is integrated with other experiences. Teachers have previous experiences and when using new curriculum

policies they rely on those previous experiences to interpret and integrate new experiences that are prevalent in these new policies. Therefore, experiences are circular in that one has to retrace one's steps to connect past experiences with new experiences (Gadamer, 1975). Apperception is a term coined by Kant (1992) which links past experiences with present experiences so that one has a sense of continuity. The structure of experiences is apperceptive in that past experiences, present experiences and future experiences are integrated and often revised. Teachers experience the impact of curriculum change on their lives at a sensory level as well as at an emotional level if they feel frustrated and anxious for various reasons such as not having enough resources, time and so on. Experience is therefore multifaceted and multidimensional. They also experience the influence of new curriculum changes at an intellectual level as they attempt to convey curriculum policy changes to students. Consequently, experience is never closed (Gadamer, 1975).

The principle of interaction proposes that individuals create meaning from an experience as they interact with their physical and social setting (Dewey, 1938). These experiences can be educative if interests are shared and there is a collective sense of responsibility which allows for debating, questioning and problematising new innovations (Dewey, 1997). More so, the principle of continuity states that the effect of the experience is shaped by prior experience and in turns shapes future experiences (Dewey, 1916). So it can be inferred that social influence and the context that teachers work in, shapes their experiences. The experiences teachers had when they were taught will influence the way they teach now. The platonistic method that was prevalent during apartheid times and in which many mathematics' teachers were taught in, will determine why it is so difficult for mathematics teachers to abide by the student centred, problem solving methods that are the pre-requisite of current curriculum policies. Consequently, the teachers' experiences through their individual beliefs, social networking and the context that they work in will determine why teachers' work is influenced by new curriculum polices in the way they are.

Experiences shape the way we think and do. Experiences are circular in that one has to retrace one's steps to connect past experiences with new experiences (Gadamer, 1975). Teaching and learning have been embedded in teachers from a young age because they have spent many hours in schools and they may be resistant to change because of such experiences (Bullock and Russell, 2010). The way school is arranged with its structures, rules and practices is termed

discursive practices according to Bourdieu's (1998) social field theory because contexts support and reproduce traditional practices, which is contradictory to the democratic values in the new curriculum policies. In South Africa, this is so because contexts have not changed much from apartheid days and hierarchy still exists through classroom isolation and hierarchical power structures that remain within schools. The field that Bourdieu (1988) refers to is the actual context (school) and the relations (social networks) within the school. The field influences an individual's decisions which are shaped by an individual's attitudes and beliefs which are formed through the individual's history (experience) (Nolan, 2012). Dede (2013) agrees the decisions that teachers make in the way they implement curriculum policies are shaped by their prior experiences. Hence, if experience plays a role in how teachers interpret and implement new curriculum policies then it is only fair that teachers should also experience curriculum changes in order to implement them adequately. Nicol (2002) posits that if teachers are to facilitate educational change to make mathematics relevant and meaningful to everyday life, then they need to extend their practice from just being subject based to include labour partnerships to make mathematics meaningful. However, schools do not give such opportunities to teachers so the discursive practices of traditionally based structures within school does not allow for meaningful curriculum change. It seems fit then that teachers rely on past experiences which are related to the traditional practices that schools exhibit. Teachers may then make superficial changes to curriculum innovations to please management structures.

The implication of contexts on teachers' work

Context refers to the *"environmental influence on person and process'* (Poulou, 2014, p. 987). So a particular environment that places a group of people together with a particular set of rules and regulations can vary substantially from environment to environment. Situated action theorists claim that although social interactions, knowledge and values are important, true inquiry occurs during the everyday activity and the environment or setting in which this activity takes place (Lave, 1988; Suchman, 1987). Context is therefore, important. Teaching and learning is an everyday activity and the setting is the context or school in which this activity takes place. Context is considered vital for teachers' work in a school setting especially to promote change that is demanded by policies. Policy makers make large scale changes within policies without taking into account the complex local ecologies of schools (Luke, 2010). Policies are framed without taking into account the context that a teacher is placed in. Policies

are made at a universal level and while one can recognise that policies cannot be made at individual level, there is a need for policies to be able to address multiple contexts. Policies are essential for proper and democratic governance with inputs from all stakeholders. Yet, there is a need for policies to understand teachers, their work burdens as well as the contexts that they teach in. Work for each teacher will differ from context to context depending on the socio-economic backgrounds of students, resources, class sizes and so on. Each school has its own social network of teachers and students and in each social network power relations exists with the hierarchies within the school such as the school managers, master teachers, senior teachers, teachers and students. Ideologies in each context differ and may not be in common and the above factors will determine the school challenges and the amount of work that a teacher has to carry out.

Context is termed *field* by Bourdieu (1983) and refers to network of structures and relations within a particular area. Schools are indicative of the structural component of the field but they are not the only component of the field. The field also contains the social networks and processes within the context. There has to be recognition that each context is unique and different from one another. Klusmann, Kunter, Trantwein, Lùdtke and Baumert (2008) argue that even though organizational structures and teachers' roles may be similar across schools, the style of leadership amongst colleagues and student population differs drastically between schools. So even though the way classrooms are set up, as well as, how the school day is organised may be similar, hereto there may be variations. The Minimum Requirements for Teacher Education Qualifications document (2011) define the roles for teachers in South Africa but yet again these roles are determined by social processes within the school, depending on the type of management and who does what, as well as, the diverse types of students within the classroom. Yet, with all these disparities within schools the teacher is supposed to create learning opportunities within a set curriculum that excludes the unique social situation of the class and school (Klusmann *et al*., 2008). There are wide -ranging demands on resources, as students come from different social backgrounds, have different achievement level and even the level of pastoral care varies from school to school (Klusmann *et al.,* 2008). An argument raised by Psycharis (2015) indicates that issues are raised within a teacher's contextual experience when they are experimenting with new pedagogical practices that the new curriculum requests; in addition the constraints of a national examination is exerted thereon. Teachers are now faced with such dilemmas and that causes difficulties as they have to, as

Psycharis (2015) discusses, negotiate their external and internal (own beliefs and attitudes) contextual factors. This makes teaching very demanding. In addition, the curriculum changes that have been evident since 1994 create confusion and place extra work demands on the already overworked teacher. This impact on the reasons teachers implement curriculum changes in the way they do.

Although we look at the schools being unique and different from one another as well as the networks within school being unique to that particular school, there are also differences amongst each teacher within a context. Crowther (1989) discusses the term "social sublime" which can be understood as the social interactions amongst people in a certain context. There is a classroom of students within a certain context, a staffroom of teachers in a context but if you understand those people as individuals who live at the moment in that time and space, and their individual experiences in their lives, it is almost impossible to be integrated with the present. The social sublime is an indication of the utter complexity of such a situation (Crowther, 1989). Livingston (2014) and Beswick (2007) highlight that, even though teachers work in different locales and school contexts with students of different needs, they themselves have their own beliefs and are the contributors to the choices of content and methodology to be used in their classrooms. Additionally, as Lee, Huang, Low and Wang (2013) found in Chinese schools, the actions of teachers were diverse during the daily implementation of the curriculum and in specific schools and classroom contexts. So although school contexts are different, even classroom contexts within a particular school differ because of the individual teacher as well as the diverse students within the classroom. Therefore, each teacher provides a unique experience in classroom practice and what each teacher encounters in trying to bring about curriculum reform can have different effects on teachers, according to Lee *et al*. (2013). If there is a negative reaction during curriculum change there will be a lesser possibility that policies will be implemented as required and if the teachers defer to stakeholders such as policy makers and social networks within schools then they will implement the required changes. Teachers encounter difficulties in bringing about curriculum change, not only because of contextual differences within a classroom but because of role conflicts within schools and the time and resources being insufficient to fulfil their teaching role as curriculum reformers (Kuntz, Näswell & Bockett, 2013; Lee *et al.,* 2013). There are many challenges in bringing about curriculum changes especially when there are different contexts that house teachers with their own beliefs and experiences.

Each context has different ways of bringing about curriculum change in mathematics. Demands placed on mathematics teachers to bring about curriculum reform include connecting mathematics content and application to reforms which can be contrary to the experiences teachers had as students (Sowder, 2007). If within a particular school such views are also held by the management who believe that mathematics should be taught in a traditional way then new curriculum policies will not be implemented as it was intended to (Price & Ball, 1997). Price and Ball (1997) argue that principals of schools influence the teaching approaches taken by mathematics teachers and yet they may have limited understanding of reforms in mathematics as a subject. The power wielded by the principal may influence the way teachers implement the curriculum in that particular context. Different schools therefore have very different expectations of mathematics instructions according to new curriculum policies (Hodges & Cady, 2012). Conflicting ideas can be held by teachers in each classroom, the school itself and even by district officials on how to bring about curriculum change (Hodges & Cady, 2012). So teachers who have their own beliefs on how mathematics should be taught are then challenged further by the way the school management thinks, the way mathematics curriculum reform should be implemented and then have to contend with district officials who outlay what the state demands.

Researchers believe that if policies are context responsive then meaningful learning can occur (Roofe, 2015; Hodges & Cady, 2012). If it is recognised that each context should be recognised for its uniqueness, there is therefore a need for policies to include contextual knowledge (Miller & Potter, 2011). The curriculum will therefore prepare teachers to teach in a particular context such as a rural context or an urban context. While the discussion is on bringing about contextual knowledge in teachers to prepare them for classroom practice in similar geographical contexts, it must be understood that each context is unique and different from another. However, if teachers are given some tools to work with using contextual similarities, it may assist them to some extent. These skills help teachers to localize policies when it reaches their context (Roofe, 2015). Jamaica and South Africa are countries where each school are given the same curriculum to implement regardless of contextual issues and circumstances (Roofe, 2015). So if new national curricula are introduced, at least with some differences according to geographical location, such as urban and rural differences, it may assist in bringing about curriculum changes envisaged by the state. Training of teachers to localise such policies will ease the burden even further, However, time and resources to bring about such endeavours are

limited (Roofe, 2015) and teachers are left to their own devices and the expectations of their schools.

Wenger (1998) proposed *communities of practice* (CoP) where particular communities such as a school or neighbouring schools that share similar contexts can work together. Therefore, teachers that teach in similar contexts have avenues to discuss ways to improve their classroom practice and even ease their work burdens. While this is a worthwhile idea and can assist teachers to localise national policies, Babione and Shea (2005) stress that there is very little time during the work day for teachers to be communicative and to collaborate on the context of their teaching. Sowder (2007) points out that sharing a shared vision of bringing about reform initiatives is a professional development initiative but also agrees that the demands are too much on the mathematics teachers' work for them to find time to partake in such initiatives, unless it is demanded by the state. Then it will be forced and teachers may not be willing to partake in such initiatives. More thought and preparation needs to carried out by the state to bring about curriculum reform and using one national policy for different contexts will not achieve reform education in mathematics.

School contexts are different from one another with some similarities structurally but differences in the social networks within schools, diverse students in the classroom as well as differences in beliefs that each teacher has. Context and its uniqueness is an essential factor to consider. There is sometimes an experience of mutual understanding between people which Gadamer (1975, p. 305) calls a *"fusion of horizon"*. In this thesis there will be a *"fusion of horizon"* (Gadamer, 1975, p. 305) between a teacher and the knowledge within the curriculum policy where the teacher understands the effect of the policy change on the curriculum and the implications it has for their teaching methods. However, once there is another change in policy the fusion breaks again.

The relation of 'governmentality' to teachers' work

The 'governmentality' that Foucault (1990, 1980a) discusses is a modern sort of power as it involves interpersonal relations involving some form of control or guidance within an institution and with exercises of control from political sovereignty. Perhaps an easier way to

understand it is to separate 'govern' from 'mentality'. One governs by invading another's mind and once that invasion is internalised the person becomes a subject. The interpersonal power relations will be explained using the following example. If a teacher works differently from the norm to do his/her work, his/her colleagues will let him/her know that she should follow the rules and regulation consistent with the rules and prescriptions of the school. If the teacher does follow what his/her colleagues are doing, this makes him/her a subject. In South Africa that political sovereignty would be the state with its policies prescribing what should be done in the classroom. Governmentality is defined by Dean (2010) as a governing of collectively held views through many discourses that guide individuals to act according to societal norms. Furthermore, schools are being put into the spotlight as various political groups vie for power (Journell, 2011). Hursh (2007) takes further this argument in claiming that those that have the most power such as the ruling state will therefore use their power to set regulations and rules via policies which can be monitored through standardised testing thereby making individuals accountable. Hence, these rules will therefore force individuals to obey. It would seem that these rules and prescriptions are not only to demonstrate power to the individual but as a means of control of opposition political parties. 'Governmentality' is therefore used to create governable subjects through the use of various techniques to control, normalize and shape the conduct of individuals (Fimyar, 2008). Even though there is this normalising behaviour there is always deviant behaviour which is called resistance by Foucault (1972).

'Governmentality' works on individuals to govern them. 'Governmentality', therefore, works as the self-governance of individuals as well as to govern (Dent, 2009). The discussion will begin at the level of the individual. It shapes and manages individuals who take an active part in the process as it constrains the free choices of individuals by demarcating legitimate choices from illegitimate choices in accordance with normality (Joronen, 2013; Ove, 2013; Dean, 2010; Bevir, 2004). This is done by encouraging people to regulate themselves for their own personal gain and for the benefit of all and is circulated through daily practices which individuals take part in as if by choice (Ove, 2013). Foucault (1978) says this type of power that the state exerts on individuals is through techniques of self-examination and confession. It can be explained quite simply by knowing that the interventions by the state through curriculum policies is said to promote democracy and equal education for all. Teachers will subscribe to such interventions especially those who have been marginalised by apartheid. In so doing they will make the legitimate choice of implementing new curriculum policies as required by the state

to promote democracy no matter the work and the confusion that is inherent with the multiplicity of curriculum policies.

Institutions such as schools with their procedures and practices all play a part in subjectifying the individual (Dent, 2009). Subjects are formed through the network of social relations that serve to homogenise populations through knowledge and separation (Dent, 2009). Using the same curriculum policies assists in homogenising knowledge, making the same knowledge available to all. All students in the secondary school, doing the FET (Further Education and Training, Grades 10 to 12) phase in South Africa, are required to take mathematics or mathematics literacy with no individual choice, thus homogenising mathematics education. Subsequently, subjects are the individuals (teachers in the school) who serve this task to bring about the same policy to all without recognizing the individual talents of the students. At the same time the separation that Dent (2009) refers to is the classrooms that are separated from one another and the desks that further separate students. Again this is about power and control; through separation there is little time for discussion. In a school day with the number of tasks teachers have, they have little time for discussion or resistance as that time is taken up with implementing the new curriculum and most of the discussion centres around ways to implement new curricula. There is now an assumption that it is the teachers' individual choice to implement the curriculum as required by the department as it is the right thing to do.

The term *subjects* are shared by both Althusser (1971), as related to ideology and power, and Foucault (1978), as related to power. Both discuss the power relations inherent in creating the subjects and give adequate reasoning for them. The difference is that Foucault (1978) dismisses the concept of ideology as he believes that subjects are able to know and express their exploitation and show resistance. For the purpose of this thesis both are relevant to understanding why teachers implement the new curricula in the way they do. Foucault (1978) advises that where there is power there is resistance. Challenging the system shows countering of domination and starts with self-resistance by recognizing and situating oneself in that system (Ettlinger, 2011; McWhorter, 2010; Cheah, 2007). Transformation can be achieved if the self, connects with empowerment via critical theory to make the place a better place by critiquing the existing system (Ettlinger, 2011). We all have the ability to show resistance, and resistance can be through mathematics teachers teaching the way they were taught at school rather than

adopting the new curriculum policies. Or resistance can be shown by challenging contradictions inherent in policies that demarcate an equitable education for all but then advocate uniformity in policies and external examinations that serve to separate students according to their abilities. Even with the democratic education foreseen by the state there still exist socio-economic divides (Journell, 2011), based on the backgrounds of students and resources that they have to bring about equitable education for all. However, Ettlinger (2011) does warn that resistance to a system is a continuous process and requires self-discipline and proactive reflexivity and very few people are able to keep up with this continuity, Therefore normalising behaviour in keeping with departmental and societal norms persists (Ettlinger, 2011). With the social structures within schools making sure one adheres to such norms, such resistance through resisting curriculum control and adherence to rules and regulations is usually curbed along the way.

Power relations are intrinsic to all spheres of an individual from the family to the school and through 'governmentality'. Foucault (1978) shows how people are governed through 'freedom of choice' to abide by and follow through with new curriculum policies. Resistance is also a viable option but, as discussed, resistance is infrequent and can be curbed. Teachers, therefore, find themselves implementing curriculum policies as they should be as it is the legitimate way to abide by societal norms.

The intricacies of teachers' cultural capital

Bourdieu's (1977) theory of cultural capital is defined by Deem and Lucas (2007, p. 118-119) as *"the educational qualifications and forms of cultural differentiation such as language, cultural dispositions and general proximity to and knowledge of cultural institution"*. Teachers, therefore, have their own cultural capital which is attributed to them primarily through the family (Zembylas, 2007) and is allocated a status based on what the dominant social class values (Giroux, 1983). More interestingly, Strickfaden and Heylighen (2010) liken cultural capital to a resource which can be used as wealth to increase social status. The cultural capital that people have is therefore an asset that gives them power and status. In South Africa, the dominant social class values are denoted by the cultural capital or the knowledge that the state values, which is improvement in mathematics to meet the demands of the global market. Thus mathematics knowledge is rewarded. One such example is that of Mr Marubini, a Grade

12 mathematics teacher from Thengwe Secondary School, who won the National Teaching Award as he produced a 96.8 % pass rate in matriculation with at least 20 distinctions in mathematics (Madonda, 2014). It is interesting to note that the context was outlined vividly as a building of mud structures with pit toilets denoting a poor school with students from lower economic backgrounds (Madonda, 2014). The ideology of the state is also clearly stated as the news broadcast (Madonda, 2014) outlines that the National awards was an initiative of the then education minister, Naledi Pandor, to encourage teachers and students to excel at mathematics. However, not all teachers may have the cultural capital needed to make schools a place of excellence by giving quality education to all students.

The marketable value of mathematics cannot be denied. It is practically useful to production and consumption and offers access to scarce resources as well (Williams, 2012). Mathematics as a cultural capital will allow access to those who have it and pass on those who do not. Policies are formulated to give access to equitable education for all but cultural capital makes further divisions in society. Chakaia, Andguladze, Janelidze and Pruidze (2014) as well as Williams (2012) stress that those that acquire mathematical knowledge will contribute to the higher echelons of society and those that do not have such competencies will be cast aside to find other opportunities. Furthermore, Milne & Aurini (2015) assert that it is the family that socially conditions children to the dominant values and practices that will advantage them in society. So parents that have the required cultural capital and pass these skills on to their children are now advantaging their children to advance themselves in the educational field to reach the higher echelons of career routes. Schools as institutions further this bias as this bias serves the economic, cultural and social elite of society (Des Forges, 2014; Gonzales, 2012). Teachers, administrators and others in the school system reward and praise this privileging of cultural capital (Winkle-Wagner, 2010). As Bourdieu (1973) posits, education converts social hierarchies into academic hierarchies thus perpetuating the social norms. Accordingly, teachers who have the cultural capital to advance students that have acquired such cultural capital from their homes, which is further extended by these teachers, will do well in mathematics. Boaler (2008) points out that although an equitable access to quality education in mathematics is prioritised in new education policies, mathematics scores are ranked higher than meaningful learning in mathematics. While meaningful learning is advocated in transformative education policies there are demands made for producing good results in the subject so that greater economic capital (relating to money and marketable commodities) (Bourdieu, 1990) can be

achieved. So teachers who have to produce the results may pay little attention to the new curriculum polices and instead focus on using traditional methods of teaching mathematics to ensure achievement.

Vithal and Volmink (2005) make the deduction that most teachers have not been exposed to student-centred approaches as well as the multi-assessment model that is required in South Africa. This was made obvious by the studies done to show factors that led to poor performance in mathematics (Adler, 1998; Arnott & Kubeka, 1997; Kahn, 1993; Monyana, 1996; Setati & Adler, 2000; Taylor & Vinjevold, 1999). Moreover, Bourdieu and Passeron (1977) argue that the disparity in society is apparent because students from higher social positions are already familiar with the knowledge that schools advocate. This is explained further by Anyon (1980) who discovered that students from the lower echelons of society were subjected to rote learning and teacher-centred education that made them obedient to power and authority. It therefore becomes evident that schools and even teachers cater for middle class values as they work to improve results in high status subjects, thereby keeping the status quo of subscribing to improve the economic wealth of the country. Williams (2012) argues further that tests and preparations for high stakes exams such as the matriculation exams are dominated by transmission and by teacher-dominated lessons and have a damaging effect on students' understanding of the subject. Hence, students who have the right sort of cultural capital will do well in tests and examinations and those who do not are disadvantaged. Many teachers were subjected to a similar type of education during the apartheid regime in South Africa. The experiences they had constituted their cultural capital. Therefore, the work they do in the classroom will be related to the cultural capital from their previous experiences.

It has been established that understanding context is essential for educational purposes and that context determines why new curriculum polices are implemented the way they are. Bourdieu (1977) calls the context the field, as it is external in nature and consists of social relations. Bourdieu's (1977) field is discussed in a compelling way by Winkle-Wagner (2010) as the place or space in which cultural competence or knowledge is produced and given a price. This argument is relevant to a school setting as the required status can be given formal recognition there. As mathematics is considered a privileged subject, since it allows for economically useful skills that benefit the country, then teachers, who use this cultural competence in the

school setting, produce academic excellence in mathematics. More so, with the price attached to the economic viability of mathematics, power is given to the mathematics teachers who seem to have the adequate cultural capital to produce worthwhile students who will benefit the state in terms of economic wealth they can bring to the state. There are power struggles within the field for resources and positions as agents or actors within the field either conserve or transform the field (Bourdieu, 1977). A school is a context with its unique set of individuals who work in hierarchical structures thus furthering the field. Chandler (2013) and France, Bottrell and Haddon (2013) contend that within a field there are power struggles over control over relevant capital. Mathematics teachers, who have the cultural capital of a subject/learning area that is considered dominant in reproducing economic power for the country, may have more power than other teachers and may be given preference in the social order within schools. Msila (2013) claims that this struggle may influence social behaviours and the way teachers interact with each other, those seemingly with power working in isolation from others as they see their knowledge and skills as more coveted than that of others. Subsequently new curriculum polices may not be discussed and knowledge shared as mathematics teachers will only work with those of similar calibre as themselves. Skills, preferences and abilities are considered high status if they are economically viable in a particular social setting (Winkle-Wagner, 2010) as it is with mathematics in a school setting.

Each person, teacher, actor or agent works within social relations in a field having their own attitudes and beliefs. Bourdieu (1977, p. 214) calls these internal attitudes and beliefs that an individual has, the habitus, and it is defined as *"a system of lasting and transportable dispositions which, integrating past experiences, functions at every moment as a matrix of perceptions, appreciations and actions and makes possible the achievement of infinitely diversified tasks"*. Individuals have their own habitus which is gained from their past experiences and which in turn shapes their future experiences. There is a dialectical relationship between the field and habitus as social relation, family, class, occupation and so on guide our attitudes, values, perceptions and dispositions (Bourdieu, 1984). So the field, such as the institution that an individual functions in, together with their habitus will inform their cultural capital. The cultural capital, being what they value, their knowledge, and even their behaviours, will be constituted by their actions. So, what a teacher deems important in the field that they function in will show in their classroom practice. Interestingly, Chandler (2013) points out that it is the past that is the essential element of the habitus. So, past experiences play a large part

on the perceptions and attitudes of mathematics teachers. Teachers are acclimatised and shaped in a particular environment and they enact these practices (Chopra, 2003). If they value the dominant class norms and have been inculcated into those ways then teachers will perpetuate these norms by praising test scores and working towards achieving high test scores in their students rather than obeying the demands of the new curriculum policies that want to make mathematics learning meaningful for all students. Bourdieu and Passeron (1977) posit that individuals possess a habitus that ensures the active presence of past experiences and have a tendency to secure a correctness of practice and reliability over time rather than any formal rules or specific norms. Hence, the curriculum policies with their prescriptions and policies may not be adhered to as most teachers have been indoctrinated into the transmission mode of mathematics teaching that they have learnt since childhood. Bourdieu (1990) describes habitus as operating below the level of consciousness and people are not aware of practices that alter their behaviours through their actions. Therefore, what teachers have experienced while they were in school and through interaction constitutes their dispositions and their inclinations. Their actions are shaped by their habitus without them even being aware that they acquired such perceptions.

Similar to Althusser's (1971) Ideological State Apparatus where practices by subjects are done unconsciously, so are the practices of individuals due to their habitus. The habits, attitudes and beliefs cause individuals to act without conscious plan and to adjust automatically to the situation (Kamphuis, Jansen, Mackenbach & van Lenthe, 2015; Chandler, 2013; Mills, 2013). Winkle-Wagner (2010) states that there is socialization towards a particular habitus from childhood which continues to adulthood, as these perceptions are internalized and practices are carried out without conscious knowledge. So teachers regress to their past experiences as they perceive that theirs is the only way to teach mathematics, using the traditional mode of teaching to ensure achievement. They will not change their classroom practices in accordance with new curriculum policies, although Boaler (2008) does argue that reform based mathematics classrooms should carry a different set of valued practices than traditional classes and therefore the habituses need to be adjusted to allow for interpreting and implementing reforms in mathematics education. Yet, a reform such as using group-work in the mathematics classroom can conflict with the habitus that a teacher has, taking their control away from them and giving it to the student by giving students the opportunity to discuss knowledge with each other (Doyle, 1983). Thus, it can be argued that individuals do have limited power to make decisions

because of certain environmental and psychological mechanisms causing them to take certain courses of action (Chakhaia *et al*., 2014). Teachers may then implement new curriculum practices superficially or not at all because it conflicts with their habituses.

Conclusion

There is a need to understand why teachers' work is influenced by curriculum policies in the way that it is. Concepts that may not be related if used in isolation are used in an organised way to form a system in order to study why curriculum policy change influences mathematics teachers' work in the way it does, using Levi-Strauss's (1967) 'bricolage' to link these concepts into a coherent understanding and to create awareness of why teachers implement curriculum policies the way they do. The concept of state ideology is useful in that it shows how prescription in curriculum policies is used in the classroom in a subtle, persuasive way of control. It formulates a type of power that is used by the state through curriculum policies to manage and control teachers that is known as 'governmenality'. 'Governmentality' can also be exerted on individuals by other individuals so the concept of social influence shows hierarchies within school contexts that serve to make teachers conform to policy changes. Furthermore, the concept of experience shows that the way teachers experience the curriculum previously can determine the way they interpret policies now. The concept of context is relevant here; for the purposes of this study the key context is the school environment in which teachers work to interpret and implement policy. Each context has its own challenges and will determine the way teachers are influenced by policy changes and what their work entails. Each teacher has their own cultural capital due to the fields that they teach in and the habitus that informs the way they implement new curriculum policies. The chapter that follows will review the methodology and methods used to capture data in order to be critically aware and to understand the perceptions and attitudes teachers have that determine why they implement new curriculum policies in the way they do and how new curriculum policies influence their work. The methodology chosen is a case study, using methods that entail visual drawings, individual semi-structured interviews and a focus group interview to collect data in order to understand and to bring into critical awareness the influences of new curriculum policies on mathematics teachers' work.

Chapter Four

Research methodology: Researching the influences of new curriculum policies on mathematics teachers' work

Chapter orientation

The previous chapter dealt with the theoretical/conceptual framework, using concepts to understand why teachers implement the curriculum in the way they do. This chapter deals with the research to be undertaken for this study, comprising four sections. The first section deals with the research design and elucidates the paradigm and the orientation towards a qualitative study and the arguments for it. The second section used the following headings: research question, data generation plan, sampling of participants and data collection methods. Section three incorporates validity issues and ethical issues. Finally, section four reports on the data analysis used in this study.

Section one: Research design

Paradigm

The paradigm that was applied to this study is the critical interpretivist paradigm. The interpretivist and the critical paradigms will be discussed separately to express why they have been put together in this study. The interpretivist paradigm seeks *"to understand the subjective world of human experience"* (Cohen, Manion & Morrison, 2007, p.21). This means that the interpretivist paradigm guides the understanding of human experiences as not having one truth but multiple truths as each person observes situations in a different way (Ponterotto, 2005). However, just comprehending human experiences is not sufficient as this study also debates the unequal distribution of power especially with the domination the state's power. Therefore, just understanding what the influences of curriculum change in mathematics teachers' work would have bypassed the critical aspect of the study. The critical paradigm focuses on realities that are mediated by power relations that are socially constructed (Ponterotto, 2005). If the two paradigms are combined into the critical interpretivist paradigm it reaches, as Deetz (1982) elaborates, a deeper understanding of what teachers' work entails but at the same time enables the researcher to be critical of policies and the effects they have on the work intensification of mathematics teachers.

Therefore critical research must not only be understood as descriptions and meanings attributed to them but to expose the hidden ideologies that are prevalent (Hesse-Biber & Leary, 2011; Kincheloe, McLaren & Steinberg, 2011). This research has also an agenda to create critical scholars that understood the power implications of state reforms via educational policies (Kincheloe, McLaren & Steinberg, 2011). The study also strives to understand and interrogate work intensification from the experiences of mathematics teachers when they implement new curriculum policies. In this way participants comprehend the forces shaping education that they may have not been aware of during their immediate experience and perception (Kincheloe, McLaren & Steinberg, 2011; Lather, 1986). They may become aware of the historical, cultural, economic, political and psychological contexts that shape them (Kincheloe, McLaren & Steinberg, 2011) and not take policies as face value but look for the hidden qualities that may not be evident, allowing for a critical analysis of policies. Furthermore, this research will encourage self-reflection and a deeper understanding (Lather, 1986) of policies and work.

Qualitative research

The choice to do qualitative research was much deliberated on. As a researcher, the issue of intensification of teachers' work when new curriculum policies are introduced was grappled with and had to be explored. There are many ways to do qualitative research and it is dependent on the way the researcher sees the world, his or her epistemological (nature of knowledge) outlook, the way the research is designed, the research participants themselves and more importantly the positioning of the researcher themselves (reflexivity) (Ritchie & Lewis, 2003). The way the researcher sees the world has determined the choice of the research approach. This study intends to discern the experience and actions of the participants, which may not be enough, but to also question and critically analyse the understandings and perceptions they have. This was to permit insightfulness into the phenomenon, the phenomenon being the influence of new curriculum policies on mathematics teachers' work. Teaching and schooling relate to social science as they deal with people who are subjective human beings as they make deliberations according to their individual needs. Where people are involved it becomes futile to be objective as thoughts and feelings are involved so qualitative research becomes the obvious choices. Qualitative research is *"a naturalistic, interpretative approach concerned with perceiving the meanings which people attach to phenomena (action, decision, beliefs, values) with their social worlds"* (Ritchie & Lewis, 2003, p. 3). Perhaps the choice and the

rationale for it will be better understood using a philosophical understanding of the debate between the quantitative and qualitative research approaches.

Philosophers sought to distinguish between the different orientations regarding research in the Social Sciences and their understandings have assisted the choice of using a qualitative approach. Descartes (1637) (a dualist) focussed on objectivity in search of the absolute truth. Objectivity involves factual and clearly observable information which determines right from wrong. This scientific knowledge through experiments and hypothesis testing is indicative of the quantitative approach. However, Hume (1711) believed knowledge about the world is determined by one's own experiences derived from our senses. As each participant's experiences are different from one another, this informed the development of the qualitative research approach. Unlike Hume (1711), Comte (1907) was a positivist who believed that the social world can be studied through laws just like the natural world. The positivist paradigm allows this as the belief is that anything observable is knowledge which can be derived from scientific theories to test facts and values which can be counted as objective enquiry (Comte, 1798). Hence, quantitative research falls within the positivist paradigm. But Kant (1781) believed that there are ways of knowing the world through perception through senses and understanding about what befalls them rather than only through direct observation. Qualitative research concerns itself with belief. The above reasoning is authentic for this research as participants were interviewed on their perceptions of what their work entailed. Dilthey (1860) took the qualitative outlook further by emphasising the importance of comprehending the lived experiences of peoples' lives through their historical and social contexts, emphasising that determination and creativity also play a role in guiding the actions people took (Dilthey, 1860). The social context in this study is schools. In understanding what is entailed in mathematics teachers' work when there is a curriculum change, teachers' perceptions are not to be ignored. The historical context pertaining to this study illustrates how curriculum change came about in South Africa since 1994 in order to combat the previous apartheid influences. A more detailed look into the historical context of curriculum change and its influences on teachers' work was done in the literature chapter.

Weber (1864) believed that both the positivist (quantitative) and interpretive (qualitative) approaches were important as research has to understand the meaning of social action

(qualitative) within the material conditions (quantitative) in which people live. By the 1970s positivism and the use of experimental variables involving human subjects were debated as concerns were raised on whether it was appropriate to ignore meanings and actions in controlled experimental studies (Creswell, 2003; Ritchie & Lewis, 2003). Post-positivism arose, referring to the thinking after positivism which challenged the absolute truth of knowledge (Lincoln & Guba, 2000; Mertens, 1998). It was recognized that there can be no positivity to the claims of knowledge using human beings and reduce ideas into small set of discrete ideas to test hypotheses (Phillips & Burbules, 2000). Knowledge through a post-postivist lens is based on careful observation and measurement of objective reality as absolute truth where knowledge is perfect and fallible can never be found (Creswell, 2003). Post-positivism uses the quantitative research approach to collect data.

Qualitative approach and socially constructed claims were developed by Luckmann and Guba (1985) and Berger and Luckmann (1967) who reasoned that humans seek knowledge of the world they live in and work and develop subjective meanings of their experiences. Their experiences are multiple and varied and complexity of meanings should be looked at. Yilmaz (2013, p. 312) defines it as *"an emergent, inductive, interpretive and naturalistic approach to the study of people, cases, phenomena, social situations and processes in their natural settings in order to reveal in descriptive terms the meanings that people attach to their experiences of the world rather than discrete ideas"*. Within the last decade of the twentieth century qualitative methods were accepted and widely used (Richardson, 1996; Nicholson, 1991). The goal, therefore, of qualitative research is to understand the social phenomena and the world we live in and to give emphasis to the meanings and experiences of participants rather than using experimental settings to specify objectivity (Denzin & Lincoln, 2011; Creswell, 2008; Pope & Mays, 1995). More so, the beauty of qualitative research is that it permits the reader to get a closer view to people and their ideas and what stimulates the researcher's curiosity (Rhynes, Bamberger & Pratt, 2011). Researchers who use the qualitative approach believe that knowledge is socially constructed through *"language, consciousness and shared meanings"* (Maree & Pietersen, 2007, p. 56). This, according to Invankova, Creswell and Clark (2007), allows the researcher to understand and explore a phenomenon. Subjectivity or bias is involved since social construction deals with human interaction. To take the reasons for the choice of a qualitative research methodology further, a deeper understanding of reflexivity, epistemology, ontology (nature of reality), nature of truth and the negotiated ethics will be discussed.

Epistemology

In this study, epistemology deals with interactions between participants and researcher in data production thereby producing knowledge that is subjective due to such interaction. According to Richie and Lewis (2003), epistemology is concerned with knowing and learning about the Social World. Epistemology is therefore the type of knowledge being produced and the argument concerning quantitative and qualitative knowledge prevails. Qualitative researchers believe that, *"the relationship between the research and the social phenomena is interactive. Researcher cannot be objective"* (Ritchie & Lewis, 2003, p.13). This statement is significant for this research as the data provided by the participants has to be analysed by the researcher who is a subjective being and may look at data provided differently from how it was intended. Through interaction with participants data can be clarified. Findings were determined through consensus and agreement by giving transcripts back to participants for them to determine if what was transcribed was the true reflection of what they have communicated. Epistemology in positivism, which is indicative of the quantitative approach, assumes that research produces unbiased and objective data without any personal interest of the researcher and the participant in the research itself (Willig, 2001). However, in this study the intention was rather that each participant would describe the phenomenon in individual ways as the emphasis was on individual perspectives. Furthermore, Blumer (1969) argues that we need to find out from people what meanings they attribute to phenomena rather than getting the researcher's own viewpoint through observation. Sourcing knowledge from the perceptions of the researcher only is dangerous as it risks bias. The implication of the work issues due to policy changes as suggested by participants, determined for me, a realisation of the complexities of their work, by interpretation of their social realities. This may not be enough as some researchers affirm that an action agenda needs to be incorporated into the process for a more critical analysis of the perceptions attributed to the phenomena (Creswell, 2003). Here is where the researcher's voice comes in to raise the consciousness of the participants and possibly to improve the lives of participants (Creswell, 2003). Therefore reflexivity plays a huge role in qualitative research and the nature of knowledge. Reflexivity in this study was exercised by being sensitive to participants' experiences and by not being judgemental or moralistic.

The researcher's personality such as the style of writing, powers of observation, sensitivity to participants, interpretation skills and relationship with participants will determine the outcome of the study (Flick, van Kardorff & Steinke, 2004). Therefore, knowledge will be based on the relationship between researcher and participant. Power relations were minimised by the researcher assuming an inferior role in the relationship with participants by revealing that the researcher taught at a primary school while participants taught in secondary schools. This gave a relatively higher status to participants in order to increase their confidence and make them comfortable to provide the meanings that participants had of their situations. Sensitivity to participants was shown by the researcher not showing any negative emotion to what participants revealed about their work stress due to curriculum change. The researcher used the knowledge provided by participants to show how policy change can affect teacher's lives, not by changing the meanings participants have of the phenomenon but by incorporating what they had said to show the possible agendas for their work stresses. It was essential for the researcher not to judge but to observe data through participants' eyes. Yet as a researcher, one has control in distinguishing between the important and the unimportant, relevant and irrelevant data (Luckmann, 1986). This enabled the researcher to find the relevant data that corresponded with the phenomenon by finding themes related to the research question and using data that matched those themes. Critical readers assisted by giving input on the relevance of data attached to the themes.

Truth

As a researcher using the qualitative approach**,** truth is seen as multiple, subjective and negotiated. Truth, however, according to quantitative research is objective, impartial and accurate (Winter, 2000). Perhaps the debate around truth can be perceived by understanding Posel and Simpson (2002) who researched the Truth and Reconciliation Commission (TRC) established in South Africa to provide *"reparations for victims of human rights violations, and for amnesty from prosecution for perpetrators*" (Stein, Seedat, Kaminer, Moomal, Herman, Sonnega & Williams, 2008, p. 462). Posel and Simpson (2002) discussed four types of truth. The first one is factual truth that is factual and relates to facts, the kind of truth that is appropriate for a quantitative approach. The second type of truth is personal or narrative truth that connects to personal experience and is subjective (Posel & Simpson, 2002). The third type of truth is social truth which displays the interaction between social beings and is again subjective (Posel & Simpson, 2002). Humans are individuals as well as social beings which

enable them to have their own viewpoints and opinions and observe situations in alternate perspectives from others so therefore, subjectivity prevails. The final truth is a healing truth that, in the case of apartheid, allows victims the opportunity to come to terms with the past (Posel & Simpson, 2002). With the nature of truth looked at as multiple, the question now arises as to who was to be looked at as perpetrators or victims according to the TRC and hence the paradox of truth is explained applicably here. Qualitative research is applicable to this study as it looks at truth as multiple, with participants who gave perspectives on what was regarded as their truth of the social realities they encountered every day in the classroom.

A philosophical understanding will shed more light on truth. Foucault (1972) looks at truth at diverse levels. The first type of truth he calls transubjective truth, which is the objective truth where the researcher maintains a neutral position (Winter, 2000). The second type of truth is the unisubjective truth and this is truth that concerns itself with the person itself and is personal and numerous (Winter, 2000). Posel and Simpson (2002) base the concept of personal and narrative truth on Foucault's (1972) unisubjective truth. Intersubjective truth requires a common positionality of subjects where truth is negotiated (Winter, 2000), which Posel and Simpson (2002) calls the social truth. Mixed method researchers who use both the qualitative and quantitative approaches assume that Foucault (1972) does not wholly reject the notion of objectivity (Seals, 1998) but for this research the concepts of multiple truths and negotiated truth will be beneficial. However, Foucault (1986) argues that truth is related to power and is produced by virtue of its multiple forms and is therefore regulated by each society's regime of truth. Thus views on what the curriculum should be, in post-apartheid South Africa, for example, are imposed on teachers via policies and come to be viewed as the truth. Yet people have their own versions of truths and view curriculum changes and the work it entails, in diverse ways, which may not be consistent with the Department of Education's view of the truth of what is needed for South African students.

A contrasting argument is made by Diefenbach (2009) who believes that each person interprets the world differently ,which has led researchers away from the notion of truth towards one of relativism where the researcher describes and interprets the individual perspective of the participant who perceives the world differently from another individual. Therefore participants' beliefs, world views and perceptions are the reality. This may be called relativism

by Diefenbach (2009) but it still sheds light about the multiple truths or realities that people have to make sense of the world. Research into the lives of people will involve contradictions and opposing truths (Winter, 2000) and that is the nature of subjectivity and the multiple realities people have. Therefore, what constitutes the truth is closely related to one's understanding of reality, or ontology.

Qualitative research is subjective and holds the notion that there are **multiple realities** experienced by people. This research sought to negotiate the different realities participants have on how work was influenced when curriculum policy change occurred. Therefore, reality in qualitative research is the negotiation of truths through subjective accounts from participants (Winter, 2000). *"There are multiple realities through which one can make sense of the world as reality is constructed from one's own experiences"* (Brown, 2008, p. 1). Brown's (2008) definition sums up what multiple realities are. Each person has their own experiences which will constitute their reality. This research discussed the different realities that mathematics teachers experienced in relation to their work when new curriculum policies were introduced.

There are numerous methodologies that use the qualitative approach, with case studies being one of them. Some authors see case studies as a qualitative research type (Flyvbjerg 2011; 2006; Simons 2009; Baxter & Jack 2008; Stake 2005) rather than just a methodology. Therefore, qualitative research is synonymous with case study research and will be used interchangeably. One is the same as the other.

Selection of Case Study Approach

The case study approach was selected for this study as it allowed for research into a case of mathematics teachers in order to study how new curriculum policies influenced their work and why it did so. A case allows for specificity and boundedness to allow the researcher to get an in- depth understanding of the case without having to generalise findings to the greater population (Denzin & Lincoln, 2005). This boundedness helped to keep the research focussed on the particular aspect to be researched which is the influences of new curriculum policies on mathematics teachers' work.

The case study approach was employed to study the influences of curriculum policy changes on mathematics teachers' work. Stake (2005, p.449) interprets a case study as a *"complex entity located in a situation embedded in a number of contexts"*, the complex entity being the case which is mathematics teachers working in the school context. The specificity and boundedness of the case defines its singularity (Denzin & Lincoln, 2005; Creswell, 1998). Yin (2009) and Stake (1995) in their definition of case studies point out, that case studies permit the use of a variety of data collection methods. This study applied the following methods: visual drawings, semi-structured interviews and focus group interviews, as a means of obtaining detailed information. Triangulation of data for depth that multi-method data collection permits will be discussed in more detail later in the chapter.

Yin (2009, p.18) defines a case study as an *"empirical inquiry that investigates a contemporary phenomenon in-depth and within real-life contexts"*. The contemporary phenomenon is new and recent as it is just developed and copes with the influence of curriculum policy change on mathematics teachers' work in South Africa. As also echoed by Denzin and Lincoln (2005) it enables the collection of in-depth data. Flyvbjerg (2011) and Meyer (2001) define a case study as an acute discernment of a type of issue relating to the environment. Again the type or case and context are being stressed in relation to the nature of truth. Yin (2003) and Stake (1995) base their approach to case studies on a constructivist viewpoint as they believe that truth is relative and dependent on the subject. Therefore case studies permit for subjectivity based on participants' viewpoints which this study was based on. Yin (2009; 2003) and Meyer (2001) stress that the key difference between a case study and other qualitative methods is that a case study enables the use of theory or a conceptual framework prior to the collection of data which will then guide the research. This has important implications for this study as the conceptual framework used is one that obliges an in-depth comprehension and a creation of awareness of historical and social factors that influences curriculum policy changes on teachers' work. This being said, the data collection was guided by the conceptual framework so as to specify the research, rather than the research becoming too broad and generalised.

The type of case study being used in this research was guided by Merriam (1998), Stake (1995) and Yin's (1993) descriptions of the special features of different case studies which assisted in the identification of this case study. Merriam (1998) calls it particularistic, descriptive and

heuristic. Being particularistic means that it focuses on a special event, situation or programme while descriptive looks at the end product, namely the finished product (in this case the completed thesis) including the many variables and interactions over time and finally heuristic, whereby the case study enhances the readers' understanding of the phenomenon and will thereby extend the readers' experience. This study incorporates the heuristic feature and led to a deeper insightfulness of what work is entailed in mathematics teachers' work when new curriculum policies are implemented. Furthermore, it permits teachers to critically analyse their view of the way curriculum policies were made, circulated and implemented and how it influenced their work. Yin (1993) introduced explanatory, exploratory and descriptive cases. Explanatory cases are used in causal relationships as those found in quantitative, scientific studies where the objective or hypothesis is tested to get a particular outcome (Yin, 1993). Exploratory cases are those which explore situations before the actual research (Yin, 1993). Descriptive studies are relevant to case studies where the theory is developed before the project is undertaken (Yin, 1993). The special feature in this case study is the descriptive one where a conceptual framework has been designed with theories used to describe the case before the data for the case was collected. Finally, Stake (1995) describes the special features of a case as intrinsic, instrumental and collective. Intrinsic is where the researcher has a special interest in the case, instrumental is when the case is used to understand more than what is obvious to the researcher and collective is a group of cases being studied. This case study used the instrumental feature as it was used to enlighten the participants as well as the reader to the implications of work involved in multilingual, multicultural, overcrowded classrooms when new curriculum policies were introduced. The reason why all of Merriam's (1998), Stake's (1995) and Yin's (1993) special features of a case study have been deliberated is to define the special features of this particular case study.

A single case is being studied as this study undertakes to research a particular phenomenon which is the influence of policy changes on mathematics teachers' work. The specificity and boundedness of the case defines its singularity (Denzin & Lincoln, 2011; 2005; Stake, 2005). The study would allow an in-depth understanding of the case without the need to generalise the findings to the greater population (Denzin & Lincoln, 2011; Denzin & Lincoln, 2005; Yin, 2009). Yin (2009; 2005; 2003) describes a case study as an in-depth understanding of the case relying on multiple data sources. The multiple data sources used for the study of the case (the phenomenon) that Yin (2009; 2005; 2003) refers to are the five mathematics teachers.

Section two: Data collection

Research question

1. How do new curriculum policies influence mathematics teachers' work?
2. Why do new curriculum policies influence mathematics teachers' work in the way it does?

Data generation plan

Why was the data being collected?	To explore the influence of policy change on mathematics teachers' work and to understand why new policies influence mathematics teachers' work in the way it does.
What were the research strategies?	Drawings Two individual, semi-structured interviews. A focus group interview.
Who or what were the sources of the data?	**Mathematics teachers** who have been trained to teach mathematics in the FET Phase and have at least twenty years of experience in the teaching of mathematics.
How many of the data sources were accessed?	**Five** mathematics teachers were the data sources.
Where was the data collected?	At venues convenient for the participants (not in their workplaces).
How often was data collected?	An initial meeting was held to discuss teachers' work and the influence of curriculum policies on teachers' work and to request a visual drawing. The drawings were followed by a semi-structured interview with each participant to discuss the drawings in November 2014. The next semi-structured interview was done in January 2015 when the new year and term began. The last interview was carried out in March 2015 when bench-mark testing took place and first term exams continued. The final data collection method was the focus group interview in June 2015 which tied in with all the interviews.
How was the data collected?	Pre-data collection meetings were held to advise participants on what was required and to request the visual drawings. Data was collected from the visual methods where participants showed the influences of curriculum policy changes on their work. This was followed by a semi-structured interview to discuss the visual drawings. All the semi-structured interviews were audio taped. A second semi-structured interview followed to discuss how curriculum policy changes influenced participants' work and why curriculum policy change influences

	teachers' work in the way it does. Finally a focus group discussion followed to discuss concerns and themes that have emerged during the semi-structured interviews. The focus group discussion was video-taped.

Table 1- Data generation plan

Selection of participants

Using five mathematics teachers with 20 or more years of experience enabled me to get in-depth information about the influence of policy change on the participants' work. Purposive sampling was employed to select participants as a deliberate choice of participants was needed (Cohen, Manion & Morrison, 2007) using the mentioned criteria (trained in mathematics and teaching mathematics in the FET Phase and having 20 years of experience teaching mathematics). All participants are mathematics specialists. Twenty years of service was used so the changes in curriculum policies since 1994 and how it has influenced their work could be researched. Furthermore, they had to be teaching in the FET phase (Grades 10 to 12). The choice of participants who taught grades 10 to 12 was relevant because this is the most critical part of a student's education. It allowed me to see what students have acquired over the longer period of immersion in schools. The policy changes also affected these grades the most. Teachers had to have been trained in mathematics to observe whether their training influenced how they taught mathematics now. Selecting five participants was adequate to gain the insightful information via in-depth interviews needed for the study rather than broad information. Having five participants allowed me to generate just sufficient data as this is a case study. Therefore, incorporating more participants was not necessary. At the same time it allowed for a large enough number of participants to engage in a focus group discussion.

Pseudonyms	Designation	Years of service	Grades teaching	Subjects being taught	Qualifications
1. Sagie	HOD	33	9 to 12	Pure Maths Maths Literacy	JSEd (Mathematic, Accountancy) FDE (Computer Science
2. Mala	Educator	31	10 to 12	Pure Maths	JSEd (Mathematics, Accountancy) FDE (Mathematics) B. Ed (Hons) M. Ed
3. Khan	Educator	32	8 to 12	Pure Maths Maths Literacy	JSEd (Mathematics), BSc, B. Ed (Hons), M. Ed, Ace – Mathematics Literacy
4. Patricia	Educator	32	8 to 12	Pure Maths	JSEd (Mathematics), FDE (Mathematics)[3]
5. Charles	HOD	33	10 to 12	Pure Maths	JSEd (Mathematics) FDE (Mathematics)

Table 2 - Participant information

Data collection methods

Pre-data collection meetings were done to explain the role and functions of the data collection methods. Using the **visual methods** provides a new language for curriculum work (Gough & Gough, 2004) and shows the perspectives participants have of policy changes. **Individual, semi-structured interviews** were done after the visual drawings were drawn in order to discuss the teachers' interpretations of the drawings, before they were influenced by the interview questions. All participants were asked the same questions but the questions in the semi-structured interview were open-ended to allow for probing. The second semi-structured interview followed at strategic times when there were examinations or tests in order to determine how the mathematics teachers fared with policy changes during these times. These interviews permitted the researcher to get data to present the holistic experiences of the

[3] JSEd – Junior Secondary Education
FDE – Further Diploma in Education

participants. A **focus group interview** enabled interaction that permitted participants to discuss issues and experiences they had with their colleagues (the other participants in the study).

a) Visual drawings

Prosser (2011) argues that qualitative research is now moving towards the visual as today's society is moving towards the visual rather than the verbal and textual culture. Furthermore, this type of data collection proved to be an interesting one as it was something new and added an interest value to learn more about it. The use of visual drawings to bring out meanings and perceptions (Prosser, 2011; Knowles & Cole, 2008; Banks, 2007) that might not have been elicited in interviews, held interest as it would permit hidden depths (Banks, 2007) of what participants really felt about the influence of new curriculum policies on their work. An informed exploration of visual methods and their benefits is needed to gain an understanding of the choice for such a method in this research.

The epistemology that informs positivist culture presents truth as objective. Art, being more emotive, was thus not regarded as being informative or objective in research (Eisner, 1993). Plato (1992), who regarded mathematics as the legacy of knowledge that inspired rationality, found that the arts led one away from the rationality that was regarded as truth. However, Aristotle believed that knowledge was multiple and not always reduced to language (McKean, 2001). Langer (1957; 1951) found the cognitive aspects of art led to serious inquiry. So using arts research with other data collection methods gave depth and creativity to understand human experience (McNiff, 2008). This led away from the truth value that positivists hold dear and more towards qualitative research that this study engages with. *"Art in research puts a premium on evocation even when it has sections or aspects of it that are descriptive in character"* (Eisner, 2008, p. 6). When dealing with humans one cannot separate emotion from language and this is where art comes in. Together with art, the language utilised to describe the drawings has brought greater meaning to this research. Even if science created meaning, it is believed by Dewey (1934) that art exposed the meaning. The hidden depths that art creates have been useful in critically analysing hidden perceptions exposed using the visual drawings.

Using this type of data collection method although interesting, was met with some trepidation. The reason was that using visual drawings was an unexplored experience for the researcher. When considering how it could be utilised, many challenges came up. Firstly, the question arose of whether mathematics teachers could draw. It was known that this will feature so plausible ways of representing visual drawings came up. At the same time there was a need not to put pressure on participants who were very busy mathematics teachers. So when meeting each of the participants to explain the research and describing the data collection methods used, the question did arise. Participants asked, 'What do I do here?' They were told to represent the influence of curriculum changes on their work in any way they wanted, even using flow diagrams. Eisner (2008) expresses the view that there is a requirement of skills and knowledge of techniques in the arts so that one can learn how to see as well as how to read the arts. The artists in this research were novices so the drawings would have been a source of stress to them. However, novices have been found to give a credibility and authenticity to research because their lack of artifice is more convincing and true to life (Weber, 2008). Furthermore, asking participants to reveal what they drew gave meanings to the visual drawings rather than the researcher having to learn to see and read the arts. More so, what an image means depends on who is doing the viewing and the context in which it is viewed (Weber, 2008) so having the participants to translate their own drawings gave an insight into the experiences of the participants.

Dewey (1934) found that human experience is both aesthetic and literal. One cannot separate ordinary experience from aesthetics. Therefore, vision is part of the aesthetic experience of both artist and participant as both see and feel something in the art (Janesick, 2008). According to Dewey (1934) art illuminates experience. This gave added depth to the study as it enabled true experience to surface. Art expands experiences (McNiff, 2008). This proved to be rather interesting as it granted the participants to give insight into their encounters with new curricula which then gave depth to this research. Furthermore, it permits the reader to empathise and comprehend the plight of the participants' experiences (Knowles & Cole, 2008). Teachers' work is rarely understood so using visual drawings might elicit appropriate responses from readers. Sometimes participants find it difficult to put their experiences into words (Knowles & Cole, 2008) so using drawings would help to draw out their experiences in the classroom. Banks (2007, p. 120) reiterates the depths visual drawings give to research and human

experience, *"visual methods leads research in new directions in a way that matches the fluidity and flux of human experience"*.

An important part of art is the transformative potential that it carries. Visual drawings can address readers in such a way that provokes awareness, arouses their intellect to higher levels and inspires greater response (Knowles & Cole, 2008). This was an essential quality for this research as the goal of the research was to have greater insight and to create awareness of the implications of new curriculum policies on mathematics teachers' work. It was hoped it would raise consciousness in the reader as well as the participants themselves as they came to the knowledge of the power issues involved. Finley (2008) points out that art can challenge prevailing authority structures and broaden access to power. It can therefore be used to unveil oppression and provoke dialogue (Finley, 2008). The interviews that followed did provoke dialogues on the visual drawings and gave information on the 'taken for granted' work involved when each curriculum policy was introduced. Through drawings of events in everyday life researchers can raise biases and worldviews that are denoted in drawings (Finley, 2008). The critical aspect of the critical interpretivist paradigm played out adequately as awareness was created in participants and hopefully in the reader as well.

The benefits of visual drawings are many. Weber (2008) offers six benefits. Firstly, images can be used to capture meanings that are hard to put into words. Participants could therefore communicate meanings via this method if they found it incomprehensible to use language to describe their experiences. Secondly, images help us discover what we never noticed. This was applicable to this study; most importantly it created awareness in participants of issues that they may have not realised. Thirdly, images can be memorable and get a wider audience. As mentioned earlier, society is drifting to a more visual culture so images would be more widely noticed than only words. Fourthly, images can be communicated holistically. This proved to be a vital aspect in this research as participants were able to answer substantially using the visual drawings rather than individual questions in the individual interviews. Fifthly, images encourage empathy and generalizability. Here one could compare participants' experiences with one's own experiences as the expansion of detail in the image proved to be trustworthy. Sixthly, images create embodied knowledge. Importantly, an image does not show just intellect but shows what a participants' experience was like and what they felt. Finally, images are social and encourage critical questions. Images would allow us to question ourselves and create awareness in the participant and reader as well. Gauntlett (2007) echoes Weber's (2008)

argument that images allow for a holistic interpretation of concepts, emotions and information. More so reiterates Literat (2013), if certain aspects of the research were previously overlooked, the drawings will help to identify and provide such information. Using visual drawings would perhaps give information that words may not have been able to do. Therefore, using visual drawings was a sound choice and enabled greater insight into the experiences of mathematics teachers when they implement new curriculum policies.

b) Individual semi-structured interviews

The individual semi-structured interviews followed the visual drawing. The first interview was a discussion of the visual drawings. This was followed by an interview comprising teachers' work and the interrogation of concepts in the conceptual framework. One of the integral sources of case study information is from interviews (Yin, 2009). *"An interview is a method of data collection in which one person asks questions of another person, face to face or telephonically"* (Whiting, 2008, p. 35). This is a simple definition that encompasses what an interview is. The format of the semi-structured interview is conversational using the same open ended questions with all participants (Cohen, Manion & Morrison, 2011; Yin, 2009).

Interviews are vital because they touch on areas of reality such as subjective experiences and attitudes of participants and they give accounts of areas in which the researchers have an interest in (Perakyla & Ruusuvuori, 2011; Harret & Bradley, 2009). The specificity of this type of interview allowed for certain areas of the research to be adequately addressed. Each of the participants taught at different contexts and their experience of the phenomenon was individually addressed. More so, the participants experienced alternative realities of work involved in implementing a new curriculum and an individual interview obtained the depth of such an experience. Teachers' work in delving into a new curriculum is not addressed just in the classroom but also involves attending workshops, working within teams in school, working through the curriculum (at home and at school), formulating assessments and so on. So observing lessons would not have helped to understand the work involved. An interview on the other hand gives detailed information (Creswell, 2008) that one may not have got from just observations. Furthermore, using open-ended questions allows for depth and detail (Perakyla & Ruusuvuori, 2011; Creswell, 2008).

Whiting (2008) gives pointers on how an interview should be carried out, one being that an interview should be held in a quiet place at a venue of the participant's choice. Participants made the choice of venue in this study, however there was an issue of noise in two of the interviews. Some participants chose the library as a neutral venue but it was not sufficiently private and there were disturbances from other patrons in the library and there was this fear of disturbing patrons as well. This issue was remedied by finding a quiet corner away from other people. Another suggestion that Whiting (2008) makes, is that participants would respond better to a researcher similar to themselves. This proved correct as the researcher is a teacher, teaching mathematics in a primary school. Participants communicated openly and confidently as they recognized that the challenges of teaching was reciprocated. Creswell (2008) and Whiting (2008) suggest audio-taping the interview as it will allow for a more comfortable, conversational stance as the researcher can chat to the participants rather than concentrating on writing down their experiences. Audio-taping was done for the interviews, however it was found that some of the participants showed wariness in their demeanour and kept looking at the voice recorder. Accordingly, the voice recorder was kept further away from sight so as not to detract from the conversation. Interviews can reveal ideas and make meaning where no other method could (Diefenbach, 2009). To get an individual perspective from each participant was necessary but each method used had its own special function that brought insight to this research. Furthermore, semi-structured interviews permitted probing that gave the researcher an opportunity to delve deeply into a phenomenon and to understand the responses of participants (Harret & Bradley, 2009; Yin, 2009). This is an essential aspect of the interview and brought clarity to the research as well as knowledge of challenges that participants face.

While there are many advantages to the individual, semi-structured interview, one must also note the disadvantages and be able to deal with them during the interview process. One disadvantage articulated by Creswell (2008) is that participants may provide data that the interviewee wants the researcher to hear. This kind of data is deceptive. Therefore the researcher had to be as neutral as possible and adopt a non-committal stance. In this way the participant may not have guessed the perspective of the researcher. Probing required careful handling in order not to make the participant decide that they needed to tell the researcher what the researcher wanted to hear. Another disadvantage is that the participant's response may not be articulate or clear enough (Creswell, 2008). One way to combat this is to have a pre-interview with a participant to clarify whether questions were clear and easy to understand. This was employed for this research. Furthermore, probing skills are used to determine what

the participant meant. The presence of the researcher will affect the responses of the participants (Creswell, 2008). This disadvantage was negated by introducing the researcher, as a primary school teacher. This changed the power dynamics so that participants could see themselves as being superior as they were secondary school mathematics teachers. They were able to converse confidently and without reserve. Finally, equipment issues could surface (Creswell, 2008). Therefore audio equipment was organised and tested in advanced. Furthermore, two sets of audio recording devices were used to allow for faultiness in any one of the devices.

One issue that has to be interrogated is the availability of participants to do the interviews. Three semi-structured interviews were initially decided on but participants were always too busy to meet the researcher. They were mathematics teachers who had huge syllabi to complete and were found to be working with students even during the weekends and holidays. Therefore, the interviews had to be restructured into two interviews. Time had to be allocated depending on the convenience and the availability of the participants for the interviews. At the same time interviews could not be conducted during school time to ensure that students would not be deprived of lesson time at the participants' schools as well as the school that the researcher taught in. This was the rule made by the Department of Education when granting permission and had to be abided by. The interviews therefore spanned eight months from November 2014, when university ethical clearance was obtained, till June 2015.

c) Focus group interview

The last data collection method scheduled for this research was the focus group interview. This interview was chosen to be done last as the researcher wanted to see the interaction between participants and see if realisation of how new curriculum policies influenced their work, emanated and how they were able to manoeuvre these huge syllabi into their daily routines. A focus group is a group interview allowing all the participants in the study to interact with each other (Hesse-Biber & Leavy, 2011; Kamberelis & Dimitriadis, 2011; Harret & Bradley, 2009; Creswell, 2008). The researcher also sought to get information of whether previous data collection methods created an awareness of the power issues at play with curriculum policy change.

Setting up such an interview proved to be a challenge, especially to get all the participants together, at a time and venue convenient for them all. This interview took a while to organise

and it was delayed as the researcher wanted to ascertain how all the participants would react and interact with each other. Literature on focus groups was read to prepare the researcher for such an interview.

Some suggestions by Harret and Bradley (2009) were adhered to. Firstly, Harret and Bradley (2009) suggest that a focus group needs someone who is able to direct the conversation to the research topic and to encourage participation of all members. The researcher had to hone in on those skills so that she could direct conversation in keeping with the phenomenon and to make sure that all participants had an equal opportunity to air their views. The researcher had no problem keeping attention on the phenomenon as participants wanted to share their challenges in their work situations with curriculum implementation. The researcher had to be diplomatic in giving all members an equal opportunity to proclaim their views as all wanted to talk at once. Another suggestion by Harret and Bradley (2009) is to keep the conversation moving and to take control from the dominant person in the group. Probes were used and opinions of other members in the group were asked so as to keep the conversation moving. It is essential to use a venue where furniture can be moved to form a circle (Harret & Bradley, 2009). Fortunately, a participant arranged the venue in his school library, after hours, when all participants were available. The researcher had the opportunity to rearrange the furniture and the venue was quiet and private with no disturbances. This also put the participants at ease as anonymity could be preserved. Members of the focus group were asked to respect each one's privacy and not to divulge what had transpired in the room.

Focus group interviews are a valuable data collection source. They allow one to get multiple views on key issues (Hesse-Biber & Leary, 2011). More so, they allow one to get depth and even breadth of data that is descriptive in nature (Hesse-Biber & Leary, 2011). The most important advantage is that the focus group interview permitted the researcher to get a large amount of data through interaction (Hesse-Biber & Leary, 2011). Also a valid point to bring up is that it was economical in that one could get this depth of data in a short time as the interview spanned an hour. Goltz (2009) found that focus groups were good for education as collaboration was important for educational issues. This was so in the focus group interview for this study as the participants were able to freely discuss the challenges to their work that they faced during curriculum change. The group was similar in that they were all mathematics teachers with twenty and more years of service, teaching mathematics in the FET phase. So they were able to share similar views, attitudes and life experiences (Hesse-Biber & Leary,

2011; Creswell, 2008; Tellis, 1997). This made the conversation dynamic and flowing. Participants were able to reflect on their experiences when implementing new curriculum policies and discuss it with the others. *"Participants may also change their minds, challenge previously held attitudes or beliefs or reconsider their own behaviours when they are reflected back to them by the mirror of the larger group"* (Hesse-Biber & Leary, 2011, p. 167). This became clear in my focus group interview and may have culminated in the awareness of the complications of work burdens that ensue with each curriculum change. The conversation between participants helped to create such awareness as well as to create a forum for participants to air their opinions and work burdens. This awareness was based on the views of the others in the group (Hesse-Biber & Leary, 2011; Kamberelis & Dimitriadis, 2011).

Although the advantages far out-weigh the disadvantages of a focus group, they have to be clarified. Creswell (2008), postulates that a focus group interview can prove to be challenging to the researcher who has to take control of the discussion. Being a novice in focus group interviews, the challenges were experienced by the researcher. The researcher had to therefore prepare by reading appropriate literature and practising with critical readers who were also teachers. This helped to direct the conversation and kept the conversation flowing. When focus groups are audiotaped there may be difficulty in distinguishing voices of participants (Creswell, 2008). The focus group was therefore video-taped as it allowed the researcher to observe gestures that may have been missed during the focus group interview. It allowed the researcher to also view facial expressions which may have been missed if just audio-taping the conversation was done. Video-taping also allowed the conversation to flow freely without the researcher having to concentrate on non-verbal gestures as these would be taken care of in the video.

Section three

This section discusses the validity and ethical issues that have been dealt with in this study.

Validity issues

Validity in quantitative studies focuses on how valid or true the data is, how reliable the data is by its replicability or generalisability to the greater population (Winter, 2000). The results can be replicated and the same results in another research can be reached so generalizability

can be guaranteed. However, this is a qualitative study and depth rather than generalizability is advocated. Instead of generalization, transferability can be used (Lincoln & Guba, 1985). Transferability refers to findings and conclusions that can be applied to other similar case studies (Houghton, Casey, Shaw, & Murphy, 2013; Polit & Beck, 2012; Lincoln & Guba, 1985). A qualitative study will do this if readers can associate the results with their own experiences (Cope, 2014). Sufficient information on the phenomenon and findings was provided in this thesis to enable the reader to assess whether the findings were transferable. Qualitative research instead concerns itself with the experiences and meanings individual people give to issues which will be different from one another (Winter, 2000). A smaller sample was used as generalizability was not an issue. Qualitative research recognizes that lives of people are being researched so contradictions and opposing truths are inevitable (Whittemore, Chase & Mandle, 2001; Winter, 2000). So, there will not be a single truth. Therefore applying validity factors of quantitative studies would not be applicable in qualitative studies.

Patton (1990) recognizes that qualitative data should be creative but at the same time it has to be rigorous and explicit. Therefore terms such as credibility and authenticity were coined by Lincoln and Guba (1985) to ensure there is an accurate interpretation of the meaning of the data. Credibility was guaranteed by giving the participants the transcriptions to read so as to verify the data. Credibility refers to the truth in the views of the participants and how truthful the interpretation and representation of them by the researcher (Polit & Beck, 2012). Credibility was enhanced by the researcher describing her experiences as a researcher with critical readers and verifying the research findings with the participants (Cope, 2014). This is called member checking (Cohen, Manion & Morrison, 2011; Whiting, 2008). Authenticity is the accurate portrayal of experiences and meanings as lived and perceived by participants (Cohen, Manion & Morrison, 2011; King, 1994; Sandelowki, 1986). The researcher had to make a conscious effort to keep her opinions and views separate from that of the participants so as not to cloud the data and to make it as authentic as possible. Furthermore, participants were asked to read the transcripts of their responses before interpretation of the results were done.

Integrity is also important in qualitative research. Integrity is the ability of the researcher to be self-critical at all levels of the research (Johnson, 1999; Lather, 1986). This was done by continuously checking interpretations so that they would be an accurate rendition of findings.

Vividness can be guaranteed by the thick descriptions of data to present the essence of the data (Ambert, Adler, Adler & Detzner, 1995). The researcher utilised thick descriptions so as to give an accurate rendition of the participant's view in each case. Thoroughness deals with making relevant themes and developing these ideas (Eisenhart & Howe, 1992). This will be brought out more fully in the data analysis chapter.

An essential factor to consider in research is triangulation, which is generally used in quantitative research. Triangulation is the use of multiple methods to verify data (Cohen, Manion & Morrison, 2011; Hesse-Biber & Leary, 2011; Yin, 2009; Brown, 2008; Creswell, 2008; Tellis, 1997). The verification would be applicable to a quantitative study and the aim of this research was not to verify data to guarantee validity but rather to get depth and something more from each of the data collection methods. Rather it would be called data saturation as it would allow the researcher to get depth in the data (Cohen, Manion & Morrison, 2007; Patton, 1990). Brown (2008) and Yin (2003) stress that using multiple sources of data enables the researcher to cover more issues but they also share the view that this approach leads to converging lines of enquiry as in triangulation. These converging lines of inquiry will not be relevant in this study, although noted, but the aim for this study is depth rather than verification. The use of triangulation is to check if different methods have the same findings, which will increase the validity of the results (Greene, 2007). That is not what this research aims to do and the statement above would work well within the quantitative perspective of objectivity and truth. Instead the methods will be used to *"capture alternative and multiple perspectives on social reality"* (Hesse-Biber, 2011, p. 52). The researcher wished to ascertain the contradictions and conflicting arguments that teachers have about their work and to discover how each teacher confronted the challenges about their work situations when implementing a new curriculum. There would be different realities for each of them so instead data saturation using multiple data methods, will be adhered to.

Different types of validity have been described by Cohen, Manion and Morrison (2011); Hesse-Biber and Leary (2011); Winter (2000) and Lather (1993; 1986). For this study, however, just three of these types of validity will be described as they are applicable to this study. This study gave detailed descriptions of participants' views to highlight experiences and contradictions. This is called voluptuous validity by Lather (1993) as the thick descriptions show interaction

with the data. Reflexivity is evident as there is engagement with the findings through interpretation and questioning of findings (Lather, 1993). This abundance of thick descriptions that is denoted by voluptuous validity, allowed for reduction of bias and at the same time the researcher's engagement with the findings related how interpretation took place. Therefore, the researcher's intentions were made clear as to how data was to be engaged with in Section four of this chapter.

The next type of validity is construct validity. Construct validity is the confrontation with the social realities of participants through methods used to show sufficient detail to ensure believable and credible accounts of their experiences and opinions (Yilmaz, 2013; Yin, 2009; Meyer, 2001; Tellis, 1997; Lather, 1993). These accounts are tested against theory by continuous interaction between the theories used and the data collected (Yin, 2009; Meyer, 2001; Tellis, 1997). This was performed by continuously checking with participants using the researcher's interpretations to see if she had their views correctly interpreted and then checking against theories for this study to find similarities and contradictions. These contradictions, Lenzo (1995) and Lather (1986) classify as theoretical impositions that a theoretically guided research has. These contradictions will, according to Lather (1993), actually illuminate and enhance social theories.

The third type of validity that was used in this study is catalytic validity. *"Catalytic validity is the degree the research process re-orients, focuses and energises participants in conscientisation"* (Lather, 1986, p. 67). This was the focus of this study. There was a need to create awareness in the participants of their job stresses and for them to come to a realisation of the causes for their work intensification. Knowing and realising the reality of their work situations would assist them to create a determination to overcome the odds through their participation in this research (Lather, 1986). In this way, the aim of this study was that the awareness that participants exhibit will empower them to change their oppressed situations (Cohen, Manion & Morrison, 2011; Lather, 1986; Lincoln & Guba, 1985). Therefore, each method and the choice of questions used in this study was orientated towards awareness of and thereby transformation as well as a deep understanding of the work stresses influenced by curriculum change in a South African classroom. Validity is therefore about political issues

rather than just about following the correct procedure (Moss, Phillips, Erickson, Floden, Lather & Schneider, 2009).

Case studies have their own rigour and validity. According to Flyvbjerg (2011) and Yin (2009) one criticism of case studies are that they are not generalisable to the greater population and do not enable scientific generalisations. Yin (2009) does give an adequate explanation for that as he argues that the goal of a case study is to expand and generalise theories and not to show frequencies by generalisations. Therefore the theories are to be better understood and expanded rather than to generalise the findings to the greater population. A case study helps to get an in-depth understanding of the phenomenon and the theory propositions rather than just explain the causal relationships that scientific research demands. Another deficiency discussed by Flyvbjerg (2011) is that case studies allow more for the researcher's subjectivity than any other qualitative method. Yet it has been found that case studies have their own rigour (Flyvbjerg, 2011) very similar to Popper's (1926) theory of falsification and verification. So the pre-conceived notions that researchers have will be tested by participants' views of the phenomenon. Case study researchers generally work within the context being studied and this, according to Flyvbjerg (2011), will show a greater bias towards falsification of pre-conceived notions rather than verification. Therefore, the falsification will actually lead to richness of the problem rather than a challenge that cannot be met. This conflict and diversity of opinions from the participants will therefore add different dimensions to the case. Another criticism made is that case studies result in massive, unreadable data (Yin, 2009). A rebuttal to that is that case studies do not rely on just one data collection method but uses a collection of data methods (Yin, 2009) which helps towards triangulation of data thus giving depth to the study. This will lead to overall trustworthiness of the data.

Visual methods have their own rigour. By providing details in the drawings, participants enhanced the comprehension of the data. The more explicit the visual drawings are about the phenomenon being investigated, the more trustworthy they are (Weber, 2008). Furthermore, using novice artists, as was done in the study, lent credibility to the study. Methods using novices provide authenticity and credibility that professional drawings cannot achieve (Weber, 2008). In the semi-structured interviews the researcher had to be as neutral as possible so no bias prevailed (Harret & Bradley, 2009). This would have influenced the data as participants

would have responded in the way that they felt the researcher would want them to. Furthermore, the researcher had to be wary of social cues such as excessive nodding (Harret & Bradley, 2009) so that participants would not deem that that was what was required of them. Also asking different participants the same questions improved the quality of the data as it allowed cross-checking and comparing data as well as to give a broader picture of the data (Diefenbach, 2009). Furthermore, interview transcripts were returned to participants to verify and validate participants' meanings. Biases were kept to a minimum by constructing good questions (Tellis, 1997) that were checked by critical readers. Audio-taping the semi-structured interviews and video-taping the focus group interviews allowed the researcher to get trustworthy data. Questions and possible probes were decided on before the focus group interview. This allowed the researcher to elicit information and clarify points in the participants' favour (Creswell, 2008).

A lot of thought and preparation was undertaken to ensure trustworthiness of the study.

Ethical issues

Using case studies to study current phenomena in real life contexts involve working with human subjects (Yin, 2009). As such, sensitivity and care had to be involved in conducting this research. Therefore, the informed consent of all participants was obtained prior to the participation in the study. The university's stringent rules and strict guidelines made sure that all ethical procedures were in place before data collection took place. Sanjari, Bahramnezhad, Fomani, Shoghi and Cheraghi (2014) advocate developing specific guidelines so that ethics are adhered to which will also ensure trustworthiness of data collected because there will be no evidence of deceit on the part of the researcher. Participants were guaranteed confidentiality by using pseudonyms in the thesis as well as in any other publications and conference proceedings resulting from this thesis. True anonymity cannot be guaranteed but every effort was made to ensure anonymise. True anonymity can only exist if a participant's identity cannot be linked by the data even by the researcher (Whiting, 2009). By using pseudonyms there was no linking of participants to data but pseudonyms were coined by the researcher with permission from the participants. Consequently, it was known to whom the pseudonyms belonged to. Using focus group interview will not guarantee complete confidentiality but all participants were asked to respect the confidentiality of other participants. Permission for visual

drawings to be used in the thesis was obtained from participants. The publication of such drawings that may identify the participant is not ethical (Banks, 2007). However, as the visual representations are non-professional drawings done by novices, it would be difficult to identify such drawings and the participant as well.

Participants were protected from any harm including deception in this study (Yin, 2009) by giving details of the study to them in the consent form. All possible risks were outlined in the informed consent form. Furthermore, participants were informed that their participation was voluntary and they could withdraw at any time before, during or even after the data had been collected and the data would not be used in the study. Originally there were six participants in the study. All had signed the informed consent form. However, when participants were contacted to enquire about possible times to meet, one participant felt that he would not have time to meet with the researcher and decided to drop out of the study. Therefore, this study consisted of five participants rather than six. This did not make a difference to the study as four to six participants were originally projected for the study and having five met the needs of the study.

Permission to audio-tape and videotape the interviews were obtained prior to the data collection. However, before data was collected the participants were informed about confidentiality, voluntary participation and opting out of the research as well as if they still felt comfortable with audio-taping the semi-structured interviews and video-taping the focus group interview. Reasons and results of the research were clarified with participants before data collection was done. Participants were assured via the letter of consent and during introduction to the interviews, that data would remain secure during the duration of the study and after the thesis was written, the data would be kept in a steel cupboard at the university for five years and then it would be incinerated.

Section four: Data analysis

Content analysis

Content analysis was used to analyse data where large chunks of information were coded into codes and then themes (Cohen, Manion & Morrison, 2011). The inductive method was used whereby detailed data was reduced into possible codes and themes. The visual method, semi-structured interviews and focus group interview were used to analyse teachers' work in relation to the ways in which it was influenced by policies. Questions were asked directly about the influence of curriculum policies on the intensification of teachers' work. The first research question, which deals with how curriculum policy change intensify mathematics teachers' work, was based on asking questions on the role of the educators as determined by the Norms and Standards for an educator. The second research question was based on the units of analysis (concepts) in the conceptual framework. Below represents the data analysis that took place for the visual drawings.

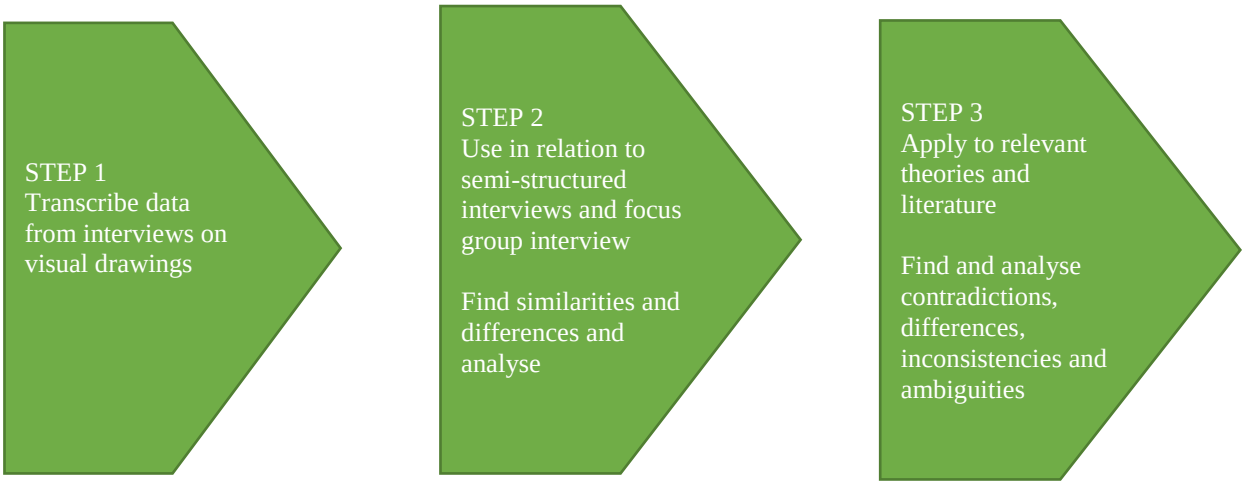


Figure 3 – Visual drawing analysis process

The following diagrammatic representations detail the analysis that was done on the semi-structured interviews and the focus group interview.

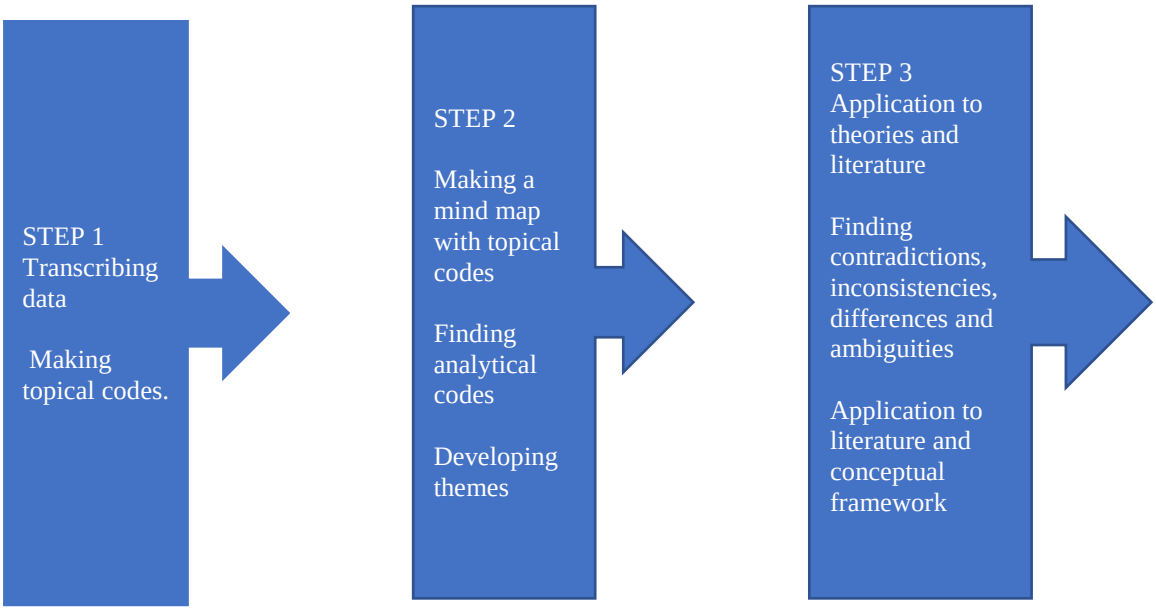


Figure 4 – Interview analysis process

Transcribing the relevant data was a thought provoking process. It dealt with careful listening, analysing as well as interpreting data. It was a long process and involved continuous interaction with participants to confirm details as well as to verify that what was described was an accurate representation of the participants' viewpoints. The researcher had to be self-critical at all times while transcribing the data so as not to impose on the data, her interpretations. There was an attempt to use data transcription devices but these were difficult to follow. Instead data was transcribed word for word. While transcribing data the researcher looked for possible codes and wrote them in in a column next to the transcriptions. This was the first part of the analysis process.

The data for the visual drawings was transcribed. This was followed by transcriptions of the individual, semi-structured interviews and the focus group interview. For the visual drawings, the semi-structured interviews and the focus group interview, the following was done: When the transcriptions were completed with the possible codes, then a focused coding was done

where the researcher then proceeded to building and clarifying codes and comparing data from all participants to form analytical codes. This was ensured by first setting up a mind map of the topical codes that had been utilised during transcriptions to formulate more analytical codes using theoretical suppositions and literature. However, when doing so the researcher had to also look for contradictions, differences, inconsistencies and ambiguities. Seven to ten codes were taken and grouped into themes by using more words to describe the code. The visual drawings, the first and second individual, semi-structured interviews and the focus group interview were used in Chapter Five to answer the critical research questions. Themes were formulated from the research questions. Chapter Six re-examined data presented in Chapter Five to look for contradictions, differences, inconsistencies and ambiguities. What had to be noted is the researcher's own involvement in the study; she could have influenced the research at all stages in the transcription as well as during analysis and interpretation. It was therefore vital to make contact with the participants at all times to verify findings and to keep the researcher's bias to a minimum. Fortunately that was not a problem as participants were always accessible via telephone and played a pivotal role in this research.

Conclusion

This chapter used four sections. In section one the researcher showed how the critical interpretivist paradigm is used to locate this study. Thereafter the qualitative approach used in the study was described. The argument for using a qualitative study instead of a quantitative study was done by comparing both these approaches. The case study was then broken down into its unit of analysis and described in detail to understand the specific case study being used. Section two dealt with the research question followed by the sampling of context and participants. Both were described with special note being made of why those particular participants were chosen. A data generation plan followed to show how data collection was done. Finally the methods of visual drawings, semi-structured interviews and focus group interview were described in detail with reference to the researcher's role in the data collection procedure. In section three an in-depth review was made of the trustworthiness and credibility of the data. A special review was done of voluptuous validity, construct validity and catalytic validity which analysed the trustworthiness of this thesis. This was followed by ethical issues which dealt with all the ways used to protect participants from any harm in this study. Finally

section four showed how analysis was done for the relevant data obtained from the visual drawings, and the interviews.

The next chapter is the first data analysis chapter that is based on themes from the research question.

Chapter Five

Data analysis part 1: An analysis and discussion of influences of new curriculum policies on mathematics teachers' work

Chapter orientation

The methodology chapter discussed how data was collected, transcribed and showed how content analysis was done to get the themes which will be analysed in this chapter. The findings in response to the critical research question will be divided into two chapters. This chapter will analyse, **'How do new curriculum policies influence mathematics teachers' work? And 'Why do new curriculum policies influence mathematics teachers' work in the way it does?''**, using the data from the individual semi-structured interviews, the visual drawings and the focus group interview. This chapter will be divided into two sections. In section one there will be a brief introduction of each participant with the context that each teaches in, described. Section two will follow with the themes used to analyse participants' responses to the above critical question. Pseudonyms were used for participants and the school contexts they worked in for the purposes of maintaining confidentiality and to prevent accidental identification. This chapter analyses the curriculum influences on mathematics teachers' work so themes were formulated around curriculum influences. Visual drawings (VD) have been matched to the first letter of their given name:

VDM – Visual Drawing Mala

VDK – Visual Drawing Khan

VDC – Visual Drawing Charles

Section one: A brief profile of each participant

Participant One: Sagie

Sagie has been teaching mathematics for 33 years. He teaches grades 9 to 12. The context he has been teaching in is government schools and he has been teaching students in these schools in apartheid times and through the transformation into the democratic education phase. He has been in the school that he is teaching presently in, for 27 years, and for four years of this time he has been Head of Department (HOD). The student enrolment at the time of data production

was 1000 students with a staff complement of 34. Many students come from disadvantaged socio-economic backgrounds with 70% of the student population being English second language students. Sagie shows great enthusiasm towards teaching. He enjoys interacting with others and he says that in all the years that he has been teaching, he has not experienced burn out. Sagie believes that the right attitude is everything and one should know that teaching helps to sustain oneself and one's family as well as to make a difference in the lives of children. He is quite vocal that South Africa needs dedicated teachers to turn our country around. He says he enjoys touching children's minds in mathematics and shows awe of the brilliance of some of the high achievers he has taught over the years.

Participant Two: Mala

Mala has been teaching mathematics for 31 years in government schools. This is the second school that she has been teaching at. She has spent 25 years at the past school and due to being in excess of the number of staff required at her previous school she has been placed in the current school and has been teaching there for 6 years. She teaches grades 10 to 12. Mala teaches in the same school as Sagie but as a level one educator. The student enrolment at the time of data production was 1000 students with a staff complement of 34. Many students come from disadvantaged socio-economic backgrounds with 70% of the student population being English second language students. She says teaching was not her first choice but due to financial circumstances she could not choose dentistry so instead settled for teaching. She said she elected to teach mathematics as it was the only subject that was challenging. This aspect makes her enjoy mathematics. Mala indicates that it is her passion for mathematics that allows her to manipulate a question beyond the textbook and the classroom.

Participant Three: Patricia

Patricia has been teaching mathematics at the same government school for 32 years. She teaches at a combined school having primary and secondary school students. The school enrolment at the time of data collection was 1300 with a staff complement of 35. Most of the students are from poor socio-economic backgrounds with many residing in the local squatter settlement. The school comprises 90% second language students. Patricia used to enjoy teaching mathematics but she does not now because of the discipline problems in school. She

says she is finding it difficult to cope with students' negative attitude to school and mathematics.

Participant Four: Charles

Charles has been teaching for 33 years of which he has spent 10 years as an HOD in the combined school that he presently teaches at. He taught for 25 years at two other government schools. He teaches grades 10 and 12. Charles spent about five years teaching in London amid his teaching career in South Africa. There is a student enrolment of 1200 with a staff complement of 50. There are 18 School Governing Body (SGB) teacher employees. Charles teaches in a context that has very few second language students. Most of the students come from middle class backgrounds and most of their parents occupy government jobs such as teaching and policing. There are a few students who come from the local informal homesteads that are fragile, temporary structures that are constructed of cardboard, iron and building waste materials retrieved from dumps. Charles enjoys teaching and he attributes his love for teaching mathematics to his colleagues who, from the past, helped guide him to be a competent teacher. He also attributes his love of teaching to the students in his school whom he says, are goal orientated and motivated to study.

Participant Five: Khan

Khan has been teaching for 32 years. He is a level one teacher at the same government, secondary school for 32 years. He teaches grades 10, 11 and 12. The school that he teaches at is in a predominantly Indian area. The student enrolment is 900-1000 students with 34 staff members. He teaches 75% Indian students and 25% African students. The African students occupy the local informal homesteads that are fragile, temporary structures that are constructed of cardboard, iron and building waste materials retrieved from dumps; they come from poor socio-economic backgrounds. Most of the Indian students also come from lower income groups with some living in the informal homesteads or in state rented flats. Few of the Indian students come from middle socio-economic backgrounds. He feels that one of the noblest professions is that of imparting knowledge. He chose to teach mathematics as he loved the subject in school. He says that when students achieve a level of success after his input, that is what he enjoys the most.

Section two: Themes

Increased administration demands on teachers

Participants have stressed that with each policy change there has been an increase of additional administration tasks attached to the curriculum changes.

> **Mala:** ***Necessary administration we have to do. During curriculum change there was more time taken up during the afterhours of school then before C2005. Just when we got settled in accepting all the new sections of C2005, and now we have CAPS, and we have to learn new sections. Preparation takes up most of the time so that will be administration. Marking too. I spend more time on administration than actual teaching. Then, the idea of students maintaining a portfolio. I found at the beginning that they were not mature enough to file and to put things in order but over the years they managed to get that in order. But it is also the responsibility of the teacher.***

Administration is a ritual of teachers' work and has always been there but Mala now emphasises that there is an intensification of such work. Mala understands administration work as preparation of lessons and keeping student portfolios. The keeping of portfolios is new work that has been introduced with curricular change and introduces a new responsibility on teachers, thereby increasing work demands. She explains that her work extends to after school hours, which puts stress on her work burden. She also indicates that she spends more time on administration than actual teaching. It would seem that Mala is using her teaching time to do administration tasks. Preparation for lessons as indicated by Mala, takes up a lot of time and she has to work in her own time, in order to implement the new curriculum. Mala's frustration is also evident when she states that when she gets settled using one curriculum, there is a change to the next, which warrants more administration work for her and the other participants in the study. The way she expresses herself shows that having to relearn and prepare for new sections is burdensome to her. It is important to ask at this stage, 'What is teacher's work?' Mala confirms that she does more administration work than actual teaching in the classroom. Administration burdens also extend to keeping learning portfolios, which was not done previously. Mala has to make sure that these portfolios are up to date herself, and not according to expectations of curriculum policies that students have to do so. If students cannot perform such tasks then it is left to the teacher to do so. However, as Mala states, students do finally learn how to maintain a portfolio. It would therefore seem that the new curriculum has introduced additional administration tasks which Mala complains about but as she finally

manages to cope, she envisages more changes in the curriculum which will add to her administration woes. With all the administration burdens put on teachers with each curriculum change a lot of work demands are evident as relayed by some of the other participants. It would seem that participants show symptoms of being de-professionalised as the rituals of new administration tasks arising from new curriculum policies are taking away these teachers' ability to cope with the work burdens.

> **Patricia:** ***Well, marking is done most of the time at home because we cannot do it at school. We cannot even mark students' books because when marking one book the other students cause a problem in the class. So you have to basically sit and watch them work.***
>
> **Khan*****: With regards to admin, it means keeping up to date with your books, your marking of books, test records and now with continuous assessment we have to make sure assessments are completed by students and entered. A lot of time is taken to do all of this, even more so when compared to the days before the implementation of the new curriculum. I do most of my administration work at home.***

Like Mala, Khan and Patricia express discontent at the amount of administration tasks they are burdened with and state that most of their administration work is done at home. Patricia is unable to do any administration work such as marking students' books with students, which can have benefits as it will show students where they went wrong, because of the discipline problems she experiences in the classroom. There is also a perception that Patricia is not checking on students' work as she has to sit and watch them work. It seems that context plays a role in increasing administration burdens. When new curricula are introduced there are enough administration burdens but depending on the context the teacher teachers in, these burdens are amplified and these participants have to do most of the work at home. These participants allude to there being more assessments with C2005 than there were before. Therefore, with more assessments there seems to be greater record keeping incumbent on the participants. It does appear that with the new curriculum, assessment is valued over learning as it is not diagnosing and judging learning but seems to be a measure of the teachers' record keeping abilities.

Sagie shows another dimension to administration burdens:

As a teacher, we have more to do as compared to the earlier days. It was the syllabus and the curriculum which was much higher powered. NATED 550 was at its peak in terms of its difficulty and complexity. This was pre 1994. But as technology came in, our workload seemed to have decreased drastically. Previously you will find us typing on those stencils and running them out. Now it is cut and paste on the computer. You can get a worksheet in 5 minutes. Those days you had to work overnight to make sure everything was ready. Now, within an hour, you can do an entire day's preparation.

Sagie has found that even though there are administration burdens with each curriculum change, these burdens have been eased with the introduction of technology. The technology that is present in recent times has assisted Sagie to ease his work burdens but it does not take away from the administration burdens that come with each curriculum change. Sagie seems to have the skills and technological resources to ease his administration burdens which are not mentioned by the other participants. One can assume that their administration encumbrances are increased as they have to do most of the administration tasks without the assistance of technological aids. It is therefore evident that curriculum policies have increased administration burdens for teachers who do not use technology. This has caused discontent in most of the participants.

Discussion of theme

It is therefore evident that curriculum policies have increased administration burdens for most of the participants in the study, resulting in feelings of discontent. Hongying (2008) posits that administration burdens in the changing school climate are the major reason that most secondary school teachers are disgruntled with their work. Teachers are submitted to constant curriculum changes and they have to work within the allocated curriculum, thereby enforcing them to subscribe to the administration burdens of each curriculum change. In addition they have to assimilate the implications of the new curricula for their teaching methods and approaches too. This removal of autonomy or deskilling of teachers intensifies teachers' work, making them do more tasks in less time than before and with their involvement in administration tasks there is less attention to the needs of students (Apple, 1988). Gür (2014) ascertains that because of curriculum prescription, teachers have less control and because of bureaucratic monitoring to ensure quality education they have increased administration tasks and they face busier

schedules. Hence, there is a sense of being de-professionalised, which is what has been alluded to by the participants. However, as Sagie has argued, technology has eased some of his burdens therefore technology itself can be a benefit for reducing teacher's administration work and can allow them to extend beyond the written curriculum to web sources and other educational technologies (Clarke, Clarke & Sullivan, 2012). That is, of course, if teachers have access to such devices or they choose to use them.

What does one make of the information gained from the teachers in relation to the increased demands in administrative tasks that invariably result from changes in the curriculum? Using Bourdieu's (1984) concepts of field, cultural capital and habitus, one can state that such curriculum changes have the effect of repeatedly disrupting the character of these teachers' way of teaching, that is, their didactic habitus within the teaching field, deriving from their cultural capital. These include their tried and tested teaching methods, for example, reinforced by years of experience, which display a circular structure (Gadamer, 1975) – where earlier experience is either confirmed as being right, or negated as being wrong, and therefore corrected. It also includes the teaching habits shaped by the way they were trained as teachers, and either strengthened or modified in the light of their many-layered experience through the years. Unavoidably this would also include the kind of teacher-centred (and hierarchical) teaching approach that characterised apartheid approaches to teaching. With regard to Dewey's (1916, p.2) view that *"education is the means of the social continuity of life"*, with its emphasis on open dialogue and discussion to further education in a non-hierarchical manner, it is clear from the teachers' discourses that what is experienced as excessive demands placed on them by the introduction of new curricula does not leave any time for such discussion – except of course the discussion of these administrative demands among themselves, which is hardly a means of addressing the demands creatively, with a positive effect on getting the work done. Nor do the increased demands on their time promote constructive discussion of the work itself (mathematics) with the students. Foucault's (1978) concept of 'governmentality', as the process through which people 'govern' themselves 'mentally' according to the discourses that they assimilate (those of the state, pre-eminently in this context, in other words what Althusser (1971) called dominant state ideology, further helps one understand the difficulty for teachers to extricate themselves from the demands of new curricula. After all, they come from the Department of Education, and 'must' be carried out, despite the fact that Foucault's (1978) concept of 'resistance' makes room for just that: resistance. The question is what form

'legitimate' resistance can take in this situation, even when it is possible to pick up signs of such an inclination on the part of the teachers.

New curriculum policies did not change teaching approaches

Curriculum policies introduced in democratic South Africa have introduced student centred methods to meet the needs of student diversity in the classroom. However, some of the participants have acknowledged that they resort to traditional teacher centred methods more often.

> **Sagie:** ***We do a little bit of group work but because of curriculum and time constraints become time consuming and we have to take a second period because of overflow. We do a little bit of that if the sections warrant that like sections using discovery like a section on congruency. Students can work together and identify, bring it out and everybody share and bring out the principles and then move on. Other sections, you know maths being abstract, it is little bit difficult to do that.***

Sagie does state that he does a little bit of group work. This would indicate that Sagie shows strategic use of group work. The curriculum does prescribe student centred activities such as group work so Sagie decides when he needs it and uses it then. Sagie does want to introduce student centred methods but he says some sections lend themselves to group work, whilst abstract sections need direct teaching. It would seem that Sagie is exercising his professional knowledge of student learning and matching it in a way that makes pedagogical sense. So despite policy recommendations, he demonstrates that there are opportunities to exercise your agency as a teacher and to make curriculum decisions. It would appear that, although curriculum policies prescribe student centred approaches, the teacher in the class uses his discretion to decide when to use it, as Sagie does say these methods become time consuming. He also refers us to time constraints within the curriculum which advocates such methods, yet does not give enough time within the curriculum to carry out such methods. Such approaches are time consuming, as has been confirmed by some participants so although curriculum policies prescribe such approaches, time constraints delimits these approaches.

> **Mala:** ***The student centred teaching was a big hype when OBE started and one of the challenges I had then, was how do you say it is student centred and leave it to the child to figure something in maths. I cannot do that. We were so used to***

following an algorithm in maths and algebra and then just coming up to an answer. My main method remains question and answer. Not all sections lend itself to everyday problems. As much as I try, it is difficult to bring in everyday problems into the curriculum. As for students, because of their different home contexts and their social backgrounds, it is not a universal thing like going for a holiday for e.g. and flying and this is what it costs for one person and two people. The African students are shy to bring something from their culture into the class, but I think that they think it is a backward way of thinking because they do not share it very easily. Also bringing cultural items in the class is not practical and the task is time consuming. As much as C2005 and CAPS claim that we must produce critical thinkers, we are not, because I do not know how many of us have been trained in developing children's critical thinking skills. I know I have not. I do it to the best of my ability. But have I been trained? I can truly say no.

Mala is vocal about her frustration in using student centred approaches in her classroom. Like Sagie, she stresses that she does not have the time to do so. This teacher is prepared to admit that she does not have the skills to use student centred approaches to create critical thinkers in the classroom. Her statement that student centred teaching was a big hype when OBE was first introduced, lends itself to the assumption that students using the student centred methods could learn mathematics better. However, there is also an implication that the teacher can just change from teacher- centred teaching to student-centred teaching. Mala does clarify that this is not so. She says that even workshops have not assisted her to employ student-centred approaches, which has been reciprocated by other participants as well. Yet, they have to employ such approaches. Mala's admitting that she does not have the ability to use these approaches, but nevertheless being able to describe some of the student-centred approaches, such as the use of everyday knowledge and problem solving methods, shows that she is aware of these approaches but has not been adequately trained to use them. Charles admits to not using some of these approaches in the classroom and prefers using traditional approaches. So, although curriculum policies prescribe such methods curriculum planners have not considered the dilemmas of implementation. Mala states her discontent in leaving students to arrive at an answer and resorts to traditional approaches of teaching. There are challenges in using every day, the cultural approaches to teach mathematics, as have been described by Mala. The curriculum expects the use of cultural approaches to teach mathematics, based on an assumption that the use of cultural differences will bridge the gap of student diversity, but is

not feasible according to Mala. Furthermore, there is an implication that using such approaches ignores the cultural beliefs of the teachers themselves as Mala assumes that African students believe that their cultural items are a backward way of thinking. According to Mala, this approach actually accentuated differences instead of using cultural diversities to reach all students. It can also be that perhaps the teacher is not prepared enough to use such methods in her classroom, revealing that she is not an expert in mathematics pedagogical knowledge and therefore finds using the student centred methods cumbersome and time-consuming.

> **Patricia:** ***The students do not show interest, like if I try to motivate them for e.g. in a section on congruence which needs practical work where they need a pair of scissors for cutting, I will not do it in my class because of discipline problems. If it is a new section, well basically, I have to discuss all the rules and I do examples with them. Thereafter, I give students applications. Most of the sections are dealt with in this way, which is teacher centred. We are not given enough time to do student centred activities.***

In Patricia's case, she implies that the use of student-centred approaches causes discipline problems and all the students in the classroom do not have the resources to carry out such approaches. Not only is the lack of resources a problem but Patricia also alludes to the use of the scissors as a weapon. This implies that the classroom is a dangerous space thereby affecting the teaching of mathematics. She also expresses that she is not given enough time to do student centred activities. It could be that the real issue is that she is not prepared enough to carry out such activities. Her sentiments are echoed by Khan, who works in a context similar to Patricia's in that they have students mostly from poor socio-economic backgrounds. Patricia infers that she is unable to cope with using such approaches. She resorts to teacher-centred approaches because of challenges such as poor student discipline, lack of resources and time constraints. Even if she wants to employ such methods, like Khan, the many challenges she encounters does not allow her to do so. It also indicates that Patricia, like Khan, does not have the skills to carry out student-centred activities and they are having issues with coping with diversity and large class sizes. It would seem that they are finding challenges with student-centred activities in the curriculum because they do not have the necessary pedagogical knowledge to carry out such activities. Challenges in implementation in different contexts may not have been envisaged by curriculum planners. Furthermore, the ability of teachers to carry out student-

centred activities has not been questioned by the department. Using a uniform policy to meet the needs of teachers and students in different contexts does not seem to be feasible, as is articulated by the participants, when discussing their challenges in implementing policy directives in the contexts they work in. These participants, therefore, resort to teaching the way they were taught, as it seems it becomes easier for them to do so. Perhaps teacher centred approaches work well in certain contexts. Yet, policy seems to villainise such approaches.

> **Charles*: The curriculum has changed but when it comes to student centred in maths, it does not work. You have to teach. It is not something that a child can discover. You have to teach the rules. It does not really apply to maths except when you doing an investigation. Although if you are doing an investigation it will be for assessment purposes. Scaffolding does not really work in mathematics. In maths the teacher will have to stand there and teach.***

Charles articulates his resistance to using student-centred approaches and acknowledges that it does not work. In acknowledging that it does not work, he goes about teaching in the way he is familiar with. Charles admits that he is a stickler for rules which implies good student discipline if they follow rules. It also implies that Charles values memorising of rules in preparation of assessments rather than for learning. This alludes to Charles preferring to be the one in control and embracing teacher centred approaches. Mathematics has been seen as a set of rules that students follow to get to a result and Charles abides by such a knowledge base in his teaching approach. Charles makes a strong statement by saying that students cannot discover answers, so teaching must occur. He, therefore, believes that he, as the teacher, is the source of knowledge which he imparts to students, implying that students are incapable of getting a result themselves. He has not discovered challenges to implementing the curriculum and shows no frustration as he continues to teach the way he was taught to. Therefore, curriculum changes and democratic interventions have had little influence on the way Charles teaches. It is clear that he is only using such assessment strategies because it is stipulated by curriculum policies for assessment purposes. He believes that constructivist, student centred methods, such as scaffolding, will not work in mathematics and only chalk and talk methods will be productive. It does show that this teacher has resisted student- centred strategies as advocated by new curriculum policies. It may also be that this teacher sees no other method to

teaching mathematics except chalk and talk so he has it already in his mind that no other methods will be beneficial to the learning of mathematics. His saying that scaffolding does not work in mathematics shows Charles' perception of pedagogical knowledge being one of learning for assessment and examinations rather than for understanding.

Discussion of the theme

The participants of the study have decided that student centred approaches are virtually impossible to implement in the classroom. Vithal and Volmink (2005) echo participants' sentiments that having to also cope with large class sizes and poor resources in public schools make these progressive methods unreachable in many South African classrooms. Furthermore, Leong & Chick (2011) point out the work of teachers having to complete the syllabus, to teach mathematical reasoning and encourage participating in discourse within policies that do not cater for such activities in the timeframes given, yet prescribe these activities, proves to be a challenge. In terms of the 'bricolage' theoretical framework used in this study one could say, first, that there is a clear conflict or incompatibility between the ideology underpinning the policy (and related curriculum) that dictates a student-centred approach to mathematics, on the one hand, and a teacher-centred approach, which is favoured by the teachers, on the other. Furthermore, there is clearly disconnect between this ideology (or democratic discourse-driven) policy and the large classes and lack of resources in the schools. Most teachers would be driven to revert to procedural methods that are dominated by teacher discourse, calculating answers and memorizing procedures (Abromovich & Connell, 2014; Drageset, 2014). In Patricia and Khan's circumstance, the contexts that they teach in have students from poor socio-economic backgrounds. Students do not have the necessary resources to employ student centred approaches. Teachers come from middle class backgrounds and they themselves may devalue other cultures in favour of their own. It should be obvious that, in terms of Bourdieu's (1984) concepts of cultural capital and habitus, there is a huge gap separating students from poor socio-economic backgrounds and teachers from middle class circumstances, which are factors that would complicate communication at the level of student-centred mathematical education. If one takes the issue further, assessing it on the basis of Dewey's (1916) idea of promoting education as the social continuity of life, by means of open discussion and dialogue, the difficulty faced by teachers in this situation becomes even clearer. How does one encourage or facilitate such discussion with students whose cultural capital and related habitus is almost completely incompatible with those of the teachers concerned? If one thinks of it along the

lines of Foucault's (1990; 1980a) 'governmentality', it seems that there is another gap here – that between a government discourse of democratic governance, and the capacity of teachers as well as students to act accordingly. It is one thing to internalise a discourse which structures ones thinking and actions in such a way that one 'governs oneself' according to the dominant discourses (in this case those of democratic or people's education), and a completely different thing to convert this into a consistent teaching approach, seamlessly connected with the discourse in question. Students do not have the necessary resources to employ student centred approaches. Teachers come from middle class backgrounds and they themselves may devalue other cultures in favour of their own. It is therefore not surprising that mathematics is used to disadvantage the lower echelons of society by promoting middle and higher class values through access in mathematics (Brantlinger, 2014; Buckley, 2010; Vithal, 2003). Yet with the past inequalities and injustices a mathematics curriculum that is called people's mathematics has been encouraged as the mathematics knowledge would be used to create critical awareness and to transform that awareness into social and political action (Vithal, 2003). Mala has pointed out that she lacks the skills to use student centred approaches. The participants have had little experience with such methods and according to Vithal and Volmink (2005), teachers did not, therefore, see this change as worthwhile transformation but rather as an intensification of work as they would have to get used to these new methods of teaching mathematics. In Charles's situation, he does not see the change as worthwhile and prefers to ignore using student centred approaches. Mala finds issues with bringing in everyday knowledge and cultural knowledge in her classroom because of diverse race, culture and socio-economic backgrounds. Students from poorer socio-economic backgrounds may have not been on a holiday to other places so they will not be able to identify with certain aspects of a mathematics problem such as going on a holiday. Hansson (2012) argues that real world experiences require a lot of reading and preparation by the teachers because of the diversity of students. Teachers may not find the context driven mathematics personally relevant and will fail to impart this form of knowledge to students (Julie, 2013) and there is not enough time to create real-world experiences for students in the classroom (Leong & Chick, 2011). Further, the diverse groups of students in diverse contexts, makes ethnomathematics a challenge as this type of mathematics includes encompassing the everyday cultural activities and values of students who may find it embarrassing to share these activities with other students (Vithal, 2003). It seems quite transparent that curriculum policy prescriptions of student centred methodologies have unintended consequences in the classroom and school context as they produce so many challenges that it makes it virtually impossible to inspire teachers to carry it out.

New curriculum policies reduced teacher agency

> **Sagie:** ***The problem with CAPS is that it has scope of work, and you have a rate at which you have to operate, and you have to do it under very tight constraints because it is prescriptive. The time does not allow teachers to be innovative. You have a rigid syllabus with very little lee-way. Actually, in the first year of matric, teachers could not do anything additional because they just managed to finish the syllabus in that last week before the kids could go off to study for the trial exam. That is what the syllabus and scope of work limits us to. But it should go beyond that.***

Sagie says he is unable to apply creative methods in teaching mathematics in ways that would enhance student comprehension, because of the curriculum prescription. Sagie is making reference to the final year of school which determines access to higher education, rankings of the school and monitoring by the department via departmental examinations and statistics. His frustration is clearly verbalised as it seems that he is unable to use his skills as a mathematics teacher with the speed and order he would like to, because of the way the curriculum is designed. It seems that in being too prescriptive the curriculum is restricting the participants and teachers like them, in meeting the diverse needs of students. It seems that the curriculum was designed to meet the needs of all schools rather than the students and therefore, in practice, the curriculum is experienced as restrictive, prescriptive and illogical to Sagie. Sagie mentions the rate that he has to keep to, in completing the curriculum. Time constraints and curriculum prescription are preventing Sagie from being creative and innovative. He implies that he is meeting the needs of the curriculum rather than that of the students. There is an implication that if Sagie has time to be creative and innovative then he will be able to meet the needs of all the students in his class. Using student centred methods is a creative and innovative way to teach mathematics in the classroom and Sagie may wish to employ such methods, however, the curriculum prescription of content knowledge contradicts the pedagogical knowledge prescribed in the curriculum as there is not enough time allowed for the teachers like Sagie, to use these methods. Sagie points out the burdens that matriculation teachers' experience. He says that they struggle to complete the syllabus which does mean that the focus is on completing the syllabus rather than catering to the needs of the students. It therefore means that curriculum policies in their prescription are not catering for all students and at the same time are denying the teachers their individuality to be sensitive to the particular needs of their students. Sagie is

aware that the policy is limiting him and knows that he needs to go beyond that, but he verbalises his frustration that he is not able to anything about it because he just does not have the time to do so. Education therefore seems to resemble a factory with teachers being the workers caught up with mass production of students' knowledge in preparation for examination, in required time limits, leaving the workers with no time for creativity and innovation and thereby removing their individual statuses.

> **Charles:** ***Our curriculum is very prescriptive. There is no way you can do your own thing. You can do only testing, exams, assignments which is controlled tests where the child can use book and investigation. That is all that is prescribed for maths. Nothing else can be done. Does not allow you to be innovative.***

Charles also suggests that he is unable to have agency in class even though he does prefer traditional approaches. He also refers us to the perception that he will be able to do his own thing if the curriculum was not so prescriptive. However, if teachers were allowed to do their own thing there would be chaos without any clear directives on what should be done especially when it comes to the ritual of preparing students for examinations. Both Sagie and Charles infer that they follow policies rigidly and keep with assessment strategies enforced by curriculum policies. Time is required for teachers to be creative and innovative even with curriculum prescription within limited time frames. The participants follow the curriculum and keep to time. This restricts their flexibility and autonomy. Curriculum prescription, according to Charles, does not allow teachers to use student centred strategies such as peer and self-assessment as well as more discovery learning techniques except for assignments using investigations. Testing and examinations are the most commonly used strategies used to ensure student achievement. Some participants indicated that their assessments mostly involved traditional methods to assess students. There is a perception that they are resistant to creativity as they resort to the old ways of teaching and assessing rather than embracing the change that student centred methods may offer. Student achievement is prescribed by policies and it seems that in ensuring student success, there is a failure by the participants in the study to teach for understanding rather than to a test. Student centredness would be innovative and creative and perhaps teachers do not want to be prescribed about the kind of creativity they should pursue. So maybe the intention of the new curriculum was to insert a creative dimension which is resisted by teachers. Creativity and innovation can be expressed within the prescribed order

and rate, but if teachers are angry about prescription, it may also close their minds to the possibility of exercising their agency and creativity.

Discussion of the theme

Sagie and Charles have indicated that they are unable to show teacher agency when implementing the new curriculum because of the degree of curriculum prescription. In finding reasons for such prescription, Beets (2012) and Mncube and Harber (2010) argue that curriculum prescription is aligned to the global concern with quality education especially in developing countries such as South Africa. So being prescriptive in curriculum policies subscribes to global demands of improving mathematics education practices, which therefore implies that teachers such as Sagie and Charles become static and boring with no agency rather than being creative and innovative. Althusser's (1971) suggestion is that everyone is subjected to a kind of ideology and the dominant ideology it seems is that of neoliberal capitalism. The state is an agent of such an ideology through the prescription in curriculum policies, coercing teachers to abide to a similar ideology. Hardt and Negri (2001) call the dominant ideology that exist today, 'Empire', which is capitalism formed through the effect of globalisation. Similarly Foucault's (1990; 1980a) 'governmentality' works here as well, as one governs by invading another's mind and once that invasion is internalised the person becomes a subject. Mathematics teachers and policy makers are under pressure to improve achievement results, particularly the matriculation results, and this puts continuous intellectual and emotional stress on the teacher who has to cater to these demands (Brodie & Pournara, 2005). It also takes away their capacity of employing skills that they have that will benefit some students in the classroom. Tulak, Bondy and Adams (2011) argue that achievement of equity in mathematics should not be used to increase the workforce and to support economic growth but rather to achieve social justice and democracy for all the people in the country. So claiming equity for all through education policies and then subscribing to global standards (Long, 2013; Weber, 2011) of economic growth creates a paradox that lays a burden on teachers. This comes from the prescription of the CAPS syllabus which would be termed by Apple (2003), a centralising policy that involves the state being prescriptive and giving little or no autonomy to the educator in implementing curriculum policies (Apple, 2003). Teachers are seen by the state as vehicles for improving student performance. So participants are subject to curriculum prescription with the assumption that this will deliver increasing achievement in some students.

New curricula exposed teachers' content knowledge gaps

It is noted that participants show frustration with different aspects of the new curriculum policies when they were introduced. Some of the reasons for their challenges will be discussed in this theme.

> **Sagie:** ***Teachers who are teaching Grades 10, 11 and 12 are still finding difficulty to figure out the depth to which they have to do every section. Why, in the old days, we did it intensively but these days they say do not go too far in depth or you will not finish all the sections. Yet, we are afraid that if we do not do the intensity, then out children will not be prepared for the high level questions.***

Sagie and the other participants are unsure about the depth they need to cover in each section. Sagie's comments were reiterated by the other participants. Their uncertainty with the depth that they need to cover with the sections, they suggest, produces more work for them. Sagie fears that if he does not cover enough of the section then the students will be disadvantaged in the examinations. Learning is therefore sacrificed for coverage. This means that Sagie and the other participants have to work harder and find the time to cover these sections, in order to cover the assumed depth in these sections. Their uncertainty actually leads to more work and perhaps more stress. It seems that even with curriculum prescription there is still not enough specificity to the depth teachers must go to complete sections. Thus, they will not be able to complete the syllabus if they do each section in depth. It seems that examinations are the priority, as implied by Sagie, with his talking about high level questions that students have to answer. Sagie and the other mathematics teachers, therefore, cover depth, by using their own time, such as their weekends and after school hours, to complete the syllabus. Some participants confessed using their own time to cover the syllabus. There have been drastic measures taken by the government to increase mathematics results which are assumed to increase access to students in tertiary education. However, the measures taken to increase results in mathematics are putting added work pressures on the teachers.

> **Mala*****: As for textbooks, many of them were flawed, and, maybe its old school but I preferred the time when the department just recommended textbooks. For C2005 and CAPs, there were several mistakes in the textbooks, too many choices of textbooks and also they were flawed. The maths in it was flawed; there were mistakes in the textbooks.***

Mala articulates her uncertainty with choosing the right textbook to teach mathematics in her classroom. It may also indicate the limited understanding of department officials, who make decisions about recommended textbooks, regarding mathematics content knowledge, as they are unable to recommend a suitable textbook. Although Mala has been given autonomy in choosing textbooks it seems the challenge is in finding the right textbook that covers the curriculum adequately. In her quest for finding a valid textbook she has found flaws in the textbooks. Even with being given autonomy in the selection of textbooks, it is obvious that such teachers need to be guided in choosing the correct textbook. With CAPS being so prescriptive in other areas, in removing the autonomy from teachers to have their own agency, it therefore becomes a puzzle as to why textbooks related to carrying out the curriculum prescription have not been recommended by the state. It is also apparent that teachers need to settle for a textbook as indicated by Mala, when she says that there are too many choices of textbooks which refer to having to make a choice. Mala has indicated that she has still not found a textbook that addresses all the curriculum policy needs, and that indicates that she feels she is not doing justice in following the curriculum and implementing the curriculum adequately. So even if teachers want to follow policy dictates adequately their challenges and confusion in selecting textbooks hinder them from doing so. Furthermore, with Mala having found numerous errors with the textbooks it shows that the range of textbooks reaching schools has not been suitably checked for errors by the department before being given for use by teachers. If such poor quality of textbooks are provided as the choices given to teachers for use it makes it difficult for teachers to be inspired by departmental officials. So, while the department prescribes narrowly the pace, content and topics of the curriculum it does not appear the same level of detailed attention to what goes into textbooks, if Mala is correct about errors found in the textbooks.

> **Mala:** ***These changes in curriculum required greater hours of preparation, work and reading. For e.g. the financial maths that started in 1994, we were never exposed to that maths before. I mean we did know the formula to find interest and so on but we were never exposed to that kind of workshop and what comes to mind is a workshop we had when it was first introduced. It was the only workshop that we had for this section. The person who conducted the workshop, his son was doing actuarial science and he took examples from there and he went through it with us. I left that workshop thoroughly confused. I came back and told my HOD***

that I do not think I can teach matriculation the following year. It was so difficult for me to understand so how will the students understand.

VDM, shown below, represents the shift from C2005 TO CAPS thereby indicating the changes in content knowledge experienced by Mala. She has represented her visual drawing as a mind map.

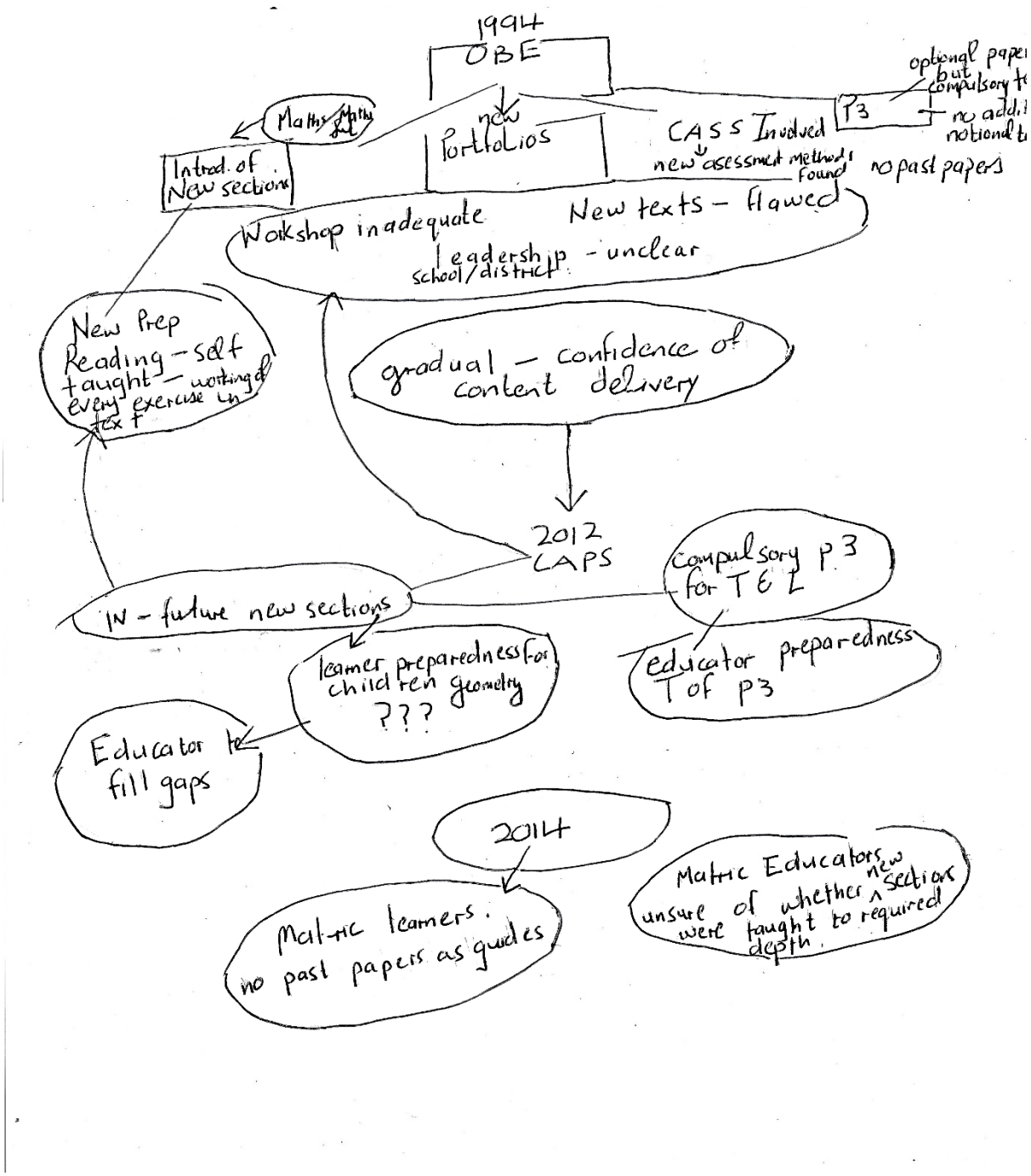


Figure 5 – Visual Drawing Mala (VDM)

The statement Mala makes explains the VDM which Mala presented during the interview where she described her challenges with curriculum change. Mala implies that she did not sit back and pretend that there was no change. She worked and prepared towards implementing new curriculum policies. However, the effort and work she put into making the change was not conducive to helping her make the change. Instead, workshops that were supposed to guide her, left her more frustrated. Other participants also expressed their displeasure with the quality of the workshops offered as well as not having continuous guidance with using new curriculum policies. Clearly, not enough time and effort was taken by the state to cascade new curriculum policies to the teachers. Even the facilitators, as is articulated by Mala, had little guidance to workshop teachers. Mala's comment describes how the facilitator used examples from his son's studies which left her more confused than ever. This shows that deep, specialised knowledge is needed by the teachers to teach a content area such as financial mathematics. Mala seemed to be hooked on the actuarial science discipline and could not see the content knowledge relevant for financial mathematics. It would also point out that perhaps Mala has only enough content knowledge at the school level and from teacher training. Furthermore, there is an implication that the curriculum is not seen as a living, dynamic document. She therefore verbalised her fear of teaching the subject to students, to her HOD. She states, evidently, that if she could not understand the section then the students will not understand the content. In so admitting, she recognises her inadequacies in facilitating new sections introduced in new curriculum policies. This means that sections that were introduced had not been done before, as this teacher, with many years of experience, declares that this is the first time she has encountered such a section. According to Mala, the department has not made sure that teachers get the required theoretical knowledge that is needed for such a section. Having a one day workshop not only confused Mala, it made her terrified to teach the section. Theoretical or content knowledge is important for Mala and the other participants in this study, to have, or they will not be able to fulfil the curriculum policy requirements of policy implementation. In introducing new content area in the curriculum, these teachers should have been adequately trained to deliver such content if curriculum policies are to succeed in achieving what it has set out to achieve, which seems to be to ensure student achievement.

Discussion of the theme

This theme showed that teachers experienced different challenges with the shift from C2005 to CAPS which has exposed and created content gaps. Mala expresses uncertainty, firstly, with

finding the right textbook to use. Having an abundance of choice and yet not being able to find one adequate enough to use is a source of frustration to this teacher. Reddy (2006) acknowledges that teachers who are now battling with having theoretical knowledge to teach mathematics are now faced with new curricula and unfamiliar teaching materials (Reddy, 2006), such as textbooks that Mala is not familiar with. Mala appears to take on the stance of Lèvi Strauss's (1963) *bricoleur* as she works with a new curriculum and tries to work with the administration, work on the content gaps, address her approach in teaching the subject as well as work with the policies and the textbooks. She tries to form cohesiveness in working with the different aspects of work stipulated by the new curriculum. Mala seems to understand the effect of the policy change on the curriculum and the implication it has for her teaching and as she makes those links there is Gadamer's (1975, p. 305), a *"fusion of horizons"*. However, when the curriculum changes again, there is a break in that fusion. Mala therefore, shows frustration at having to start her labour as a *bricoleur* all over again. Furthermore, Mala struggles with sections such as Financial Maths and lack of confidence is shown by her telling her HOD that she won't be able to teach the matriculation students. This confirms Brodie's (2010) point that teachers' confidence to carry out curriculum change is affected by their knowledge of content area. Teachers are required in the new curriculum to find out how students think and to find their misconceptions and errors (Brodie, 2010) but they will not be able to do so if they are lacking in content knowledge. Mala was dissatisfied with the quality of the workshop she received. Ball and Cohen's (1996) argument can be used in the South African situation as they declare that often professional development sessions are not substantive and intellectually stimulating to teachers. Additionally, workshops are not offered continuously as indicated by Mala. Reddy (2006) did find that professional development courses offered in South Africa were not on-going and Reddy (2006) suggested that for professional development to be effective it should take place over a long period of time. Sagie and the other participants were unsure about the depth they had to go to, to complete the required sections. Teachers used three curriculum documents, the C2005 and RNCS documents together with textbooks, to understand what and how to teach in the classroom (Reddy, 2006). However, the challenge comes with textbooks going into different depths and curriculum policies not specifying the depth of sections; hence their uncertainty.

Teaching approaches of the new curriculum were more demanding

Participants indicated that they have to teach all students in the same way without recognising diversity and individual needs of students.

> **Khan:** ***I have 40 to 45 students in a class. That is quite a number to teach and to control, especially, when you want to implement a new curriculum that asks for individual attention. That becomes a problem in the limited time that we have, per period that we can give to the students. Hence, you have to teach generally to cover the high fliers, average students as well as students who take time to come to grips.***
>
> **Sagie:** ***These major changes are putting extra burdens on teachers of grades 10, 11 and 12. This is not particular to one school. In every school you will hear maths teachers telling you that, for them to complete the syllabus with the scope of work and the rates to which the syllabus is supposed to be completed, is virtually impossible. It is actually set for a group of high fliers. Even those high fliers, logically, when we work with those high fliers we will want to stretch them to the limit but with this work rate and stuff, does not allow me to pitch them at another level. You have to finish and move on. The way they have structured the pace-setters, the pace is set for high fliers but even with the high fliers you will not have the time to pitch them.***

VDK

The VDK, drawn by Khan, is explained in the statement above.

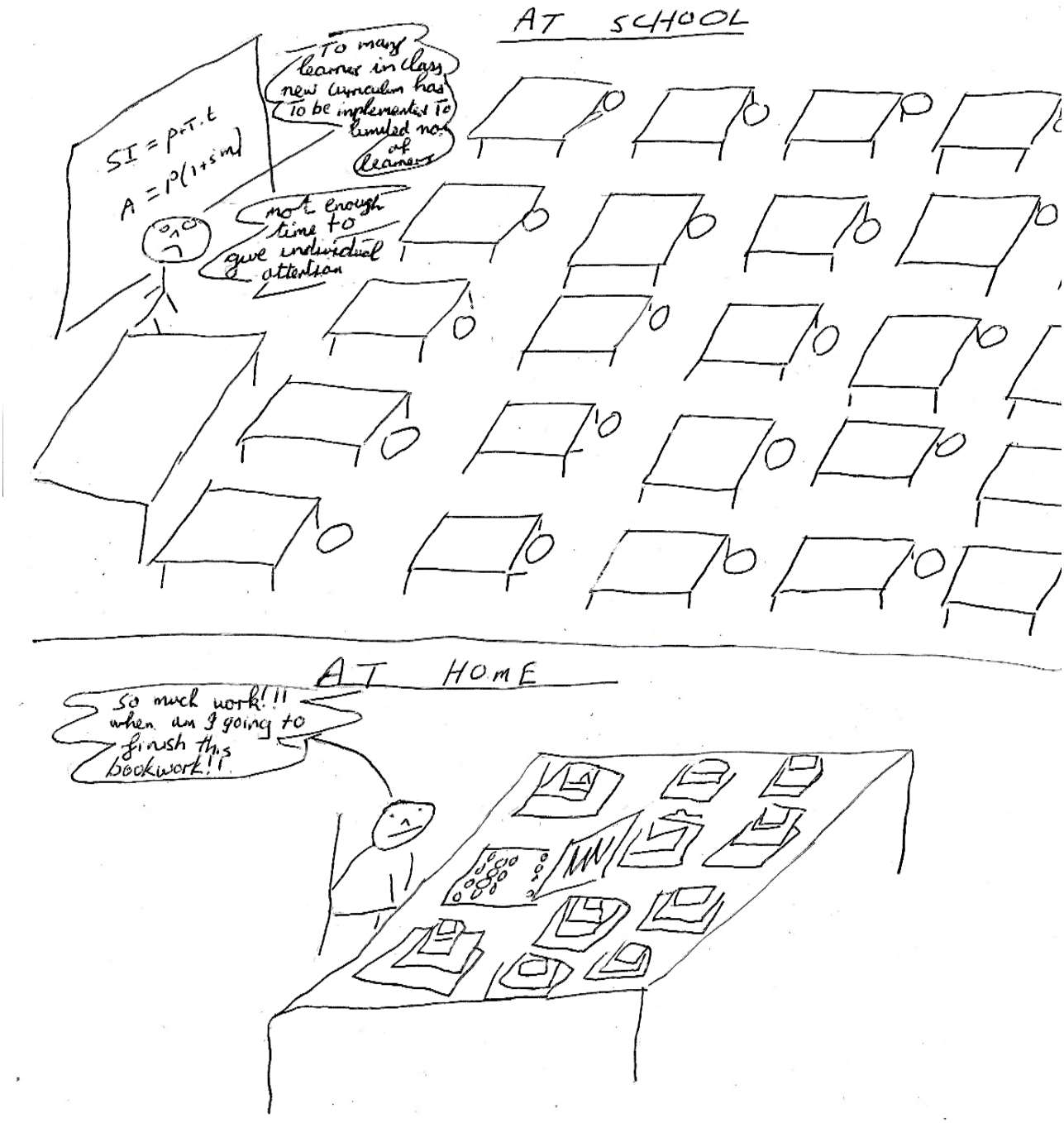


Figure 6 – Visual Drawing Khan (VDK)

Khan has a number of students in his class and both his statement above and the VDK indicate his inability to address the needs of individual students in the class. He is making some strong claims about workloads visualised in the VDK, firstly at schools, dealing with high number of students and after school with the large amount of administration tasks. It captures, rather poignantly, the pressures of size (students, assessment and preparation) on mathematics teachers. Khan has expressed that the time limits and curriculum prescription do not allow him to meet the needs of the diverse students in his classroom. The new curriculum, in advocating student centred approaches, does require attendance to the individual needs of the students. However, the contradiction is the curriculum prescription within limited time frames, which does not allow teachers, like Khan, to give an equal education to all students, as is outlined in the transformative curriculum policies. In the need for covering sections in the curriculum, weaker students are bypassed, as inferred by Khan, in favour of following the dictates of the curriculum to complete the syllabus in unrealistic time-frames. There is a suggestion that Khan is unable to cope with learning diversity and the number of students. Sagie has also expressed his frustration with not being able to reach all the students in the class. What is very discernible is that Sagie feels that the syllabus is set for the high achievers as only they will be able to cope with the time allocated to each section. It would seem that the high achievers that Sagie speaks of are those that can cope with the pace that the curriculum is set at. It does appear so as in trying to centralise curriculum policies in their prescription to meet the state's needs for student achievement, most students are being overlooked and ignored in favour of higher achievers who can cope with the curriculum requirements. The curriculum seems to favour those students that are able to cope with curriculum preparation for examination.

Participants implement new curricula with a large numbers of diverse students from different background. It would seem that, from the articulations of participants, that there are many students who are being overlooked. They claim that this is so because of the pace of the curriculum and resources demanded in implementing the new curriculum. The curriculum, therefore, caters for those students who can keep up with the pace of the curriculum and who have the necessary resources to carry out activities prescribed by the curriculum. Participants like Mala, Sagie, Khan and Patricia have communicated that the unique and new methods introduced in new curriculum policies are difficult for them to implement because of the many challenges that arise in a teacher's daily work life. It would also seem that these teachers do not have the necessary pedagogical and content knowledge to implement such methods. As can

be seen from the VDK, there is a suggestion that Khan is being overburdened with work in trying to implement new curriculum policies in school and at home. The VDK shows the heavy workloads he carries at home and at school. The possibility also arises that Khan's complaints about the work burdens are also related to his inability to cope with the large class size and the diverse range of students that he has in his classroom.

> **Patricia:** ***Students find the abstract sections very difficult, especially when dealing with algebraic expressions, such as letters and numbers. They just cannot relate to it. We have students from poor socio-economic backgrounds with language barriers as well, so it is difficult to grasp abstract concepts. I cannot manage to meet the needs of all the students in my class. I basically use chalk and talk to teach.***

Patricia communicates her distress that she is unable to meet all the needs of the students in her class. Her confessed frustration is that she is unable to teach abstract concepts to most students in her class as they are incapable of relating to it. She brings in the context that she teaches in, which has students from poor socio-economic backgrounds who, she says, cannot relate to mathematics as an abstract subject. Therefore, what Patricia alludes to is that she concentrates on the context knowledge, which interferes with the content knowledge and her pedagogical knowledge, as she uses chalk and talk because she is unable to teach the abstract knowledge to the diverse students in her classroom; hence, the rituals of teaching is being displaced by the problems she is experiencing in the classroom. What becomes evident is that teachers like Patricia need time to rethink each lesson on how to teach it, which is a difficult task with the many work burdens placed on them. Furthermore, with the prescriptions that has been imposed by the CAPS policy it becomes an issue of trying to keep up, which now brings quality into question. There seems to be quantity rather than quality of understanding that occurs in the classroom. It can be gleaned from the discussion with participants, that the CAPS syllabus is designed in a micro-managed way where each lesson is managed by the curriculum policy rather than the teacher, thereby, preventing students understanding as not enough time is given to ensure student understanding. Curriculum policies seem not to recognise different contexts that these teachers teach in and the challenges they have while implementing new curricula.

Discussion of the theme

Some participants expressed their frustration at not meeting the needs of all the students in their classroom. It would seem that new curriculum policies limit the time the participants have to ensure they meet the diverse needs of the students in the classroom. The participants have indicated that they choose to teach generally to all students as they find it difficult for them to meet the needs of individual students in their classroom. Bernstein (1996) explains the recognition rules which may apply to the South African situation where students are marginalised because they are unable to recognise the necessary school discourse. This was made evident when Bernstein (1996) questioned students and found that those from the middle class could answer in the abstract and had the necessary discourse to succeed in school but those from the working class related from their personal experience and did not have the discourse to understand knowledge transferred from the teacher. This is clearly evident in the context that Patricia teaches in as most of the students come from poor socio-economic backgrounds and cannot understand abstract mathematical concepts. Here in South Africa we experience the similar heterogeneity in the classroom with regards to socio-economic status, class and race. Vithal (2003) declares that many residential areas, especially those originally Indian, have informal settlements housing predominantly African people so it is not uncommon to find students from different economic, social, political and cultural backgrounds occupying the same classroom. Sayed (1999) argues that the current education policies accentuate inequities and divisions on class lines rather than the previous divisions according to that of race. Hence, the outcome of new curriculum policies will, ostensibly, result in a gap between advantaged and disadvantaged students as it stresses that knowledge is derived from everyday situations (Department of Education, 2003). Even with the diversity of contexts and students within the educational system, there is still a culture of prescription in curriculum policies and a uniform interpretation of curriculum policy changes is still required (Vithal & Volmink, 2005). Some of the participants expressed that they were not happy that they were unable to meet the needs of all the students in their class as they were answerable if students did not achieve as was expected. What we may be seeing is the overwhelming pressure which contexts of poverty, social problems, deprivation and under-resourcing place on schooling. When social conditions are so debilitating, teachers can lose focus and drive. They become disillusioned. They can even forget to use their training to sort out that can be sorted. The context issues, therefore, interfere with their content knowledge and pedagogical knowledge. Their concentration on the context knowledge makes them find teaching the content challenging and

they find difficulties in bringing across content to students, thereby affecting the implementation of the curriculum in the classroom. Patricia has implied that she is unable to make mathematics concrete, understood and experienced. What also comes out clearly is that students at high school level are struggling with basics. It would seem that the teachers in this study are dealing with the neglect and poverty of primary school teaching.

Althusser's (1971) Ideological State Apparatus, Bourdieu's (1984; 1977) cultural capital, experience, context and Foucault's (1990; 1980a) 'governmentality' will be used to understand the complexity of meeting the individual needs of students in a diverse classroom. Ideology does not consider the individual and the psychological insights into the differences amongst students. There is a difference not only in in cultural capital but also in intelligence. It seems that it is expected that all students will pass in the same way but people are endowed with different levels of intelligence. One can also not assume the same kind of cultural capital in all students in the classroom. A classroom has diverse students yet the dominant ideology is that of wanting to increase attainment in mathematics (a high status subject) in order to meet the global standards of neoliberal capitalism. This shows ideology in the service of power. It is a discourse that ignores the individual in order to answer to the dominant ideology of neoliberal capitalism. Even the 'habitus' of each child is different. The habitus is the unconscious set of cultural insights and knowledge that a person has built up since childhood, and which is richer, or poorer, depending on whether a person grew up in culturally 'rich' surroundings (regarding art, literature, general cultural knowledge re dress, food, etc.) (Bourdieu, 1984), providing them with a rich repository of cultural capital, or whether such a cultural landscape was relatively 'barren', as with many township children. It could be the case, however, that township children's lives are rich in African cultural capital and the corresponding habitus, but then a conflict is bound to occur between their habitus and the privileged western cultural capital and corresponding habitus, that seem to be presupposed in schools as a result no doubt of a policy that is based on the expectation that our schools should produce globally 'competitive' students. The rules and regulations in curriculum policies show the use of power which invades the minds of teachers (Foucault, 1990; 1980a; 1978) to abide by curriculum policies, thereby ignoring the individual needs of students. With regards to context and experience one should recognize that contexts and experiences differ. Crowther's (1989) use of the social sublime makes those differences explicit. It shows the vast differences amongst people, teachers and

students. Hence, participants show that they are overwhelmed with working with diversity in trying to introduce a new curriculum policy.

New curriculum policies resulted in increased monitoring and accountability

Participants state that they were all submitted to monitoring in different forms and were held accountable for the results that students achieved.

> **Sagie:** ***We have clustered ourselves in the Thomeni cluster with subject advisors for that cluster. There is a moderation instrument with 7 pages, checking if you have met all the criteria. There is a whole range of criteria to be met. First it should take place in school. HODs must confirm that it took place in school. Principals must confirm it took place in school. Thereafter, it goes to the external moderation. They check if syllabus is covered and the assessments are done. There is also a moderation of your marking and the level of your questions. That is true, the teacher completes the syllabus, whichever way they finish it. That is the sad part. Some of us have big back logs. We just do things superficially to show we have completed our work.***

As is noted, from what Sagie has divulged, and to which the other participants agreed to, there is a rigorous form of monitoring, that takes place in schools. Firstly, within the school and then externally, where teachers' work is monitored and moderated by the departmental officials. Teachers are, therefore, evidently, held accountable for their work. This is definitely a huge challenge and burden on these teachers as they have to complete the syllabus in limited time frames. The limits on time have been evidenced throughout this chapter showing that participants do not have enough time to complete the syllabus. Participants have communicated the reasons for why they have to complete the syllabus which is firstly, they write common papers. Secondly, there is this validation of completion of work by surveillance mechanisms, built within the school. So, participants have been tested and evaluated by how their students perform at external levels through these common papers. The new curriculum requires surveillance, monitoring and administration work such as the constant recording of results to ensure curriculum completion. By being monitored they are held accountable and they now make sure they complete the syllabus in whatever way they can. As Sagie admits, they have to complete the syllabus superficially to show that they have completed their work. The superficial completion of the syllabus shows that teachers such as Sagie do not want to be found

to be inept. Although they complain about the workload in trying to complete the curriculum, they will do so, so others would not see them as being incompetent. They would choose to lie and show some pretence of curriculum completion to make it seem that they are coping. With curriculum policies setting unrealistic goals, the participants use various options to hide their inadequacies. Teachers are professionals and have teacher unions to represent them to give their professional opinion. However, what can be assumed through the communication with the participants is that they choose to comply with the unrealistic time frames, set by curriculum policies, to complete the syllabus. It would seem that teacher unions do take up issues of conditions of work and salaries but they do not take up curriculum issues. This also begs the question of whether the departmental officials recognise teachers' shortcomings in completing the syllabus or if they do, do they just overlook it, as they themselves realise what a mammoth task it is to complete the syllabus.

> **Khan:** ***Invariably, somehow, the teachers make sure they complete the syllabus. We write a cluster paper which means every school is going to write it. You have to make sure your work is complete even if you have been rushing the syllabus. Well basically, you have structures at different levels. You have the HODs, the DPs, the principal and there is a form that is filled out which is sent to the department to state that we have covered our work. Even with regard to assessment in CAPS, they send us a form that asks, have we completed the tasks and what percentage did students achieve.***

Khan articulates how he is held accountable. He stresses that teachers have to complete the syllabus. They are monitored not only by moderation within and outside of school but also by departmental papers to assess students' achievement. Like Sagie, Khan talks about the different levels that they are moderated and monitored. He also refers to teachers having to make sure they complete the syllabus in whatever way they can. This statement indicates that some teachers actually do complete the syllabus even in their own time, which means after school hours, during weekends and during teachers' free periods as it may be impossible to do so within the limited time frames allocated during class lessons, to complete the syllabus. None of the participants referred to any resistance to such monitoring and it seems that these teachers complete the syllabus as if they have to; although they did communicate their dissatisfaction with having to go through such surveillance. One does recognise the necessity of monitoring to check if the system is functioning through the performance of students, yet participants find such surveillance burdensome. They profess to not having any alternative but to complete the

syllabus as they are also monitored with the external papers that students write and the statistics have to be sent through to the department. From what these teachers have enunciated, they have to work very hard to make sure that their students can show some level of achievement or they would be held accountable. It would, consequently, add more pressure on the already overburdened teacher to try to improve student achievement, which is a gargantuan task, if they are unable to meet the needs of the individual student as was signposted in the previous theme.

> **Mala:** ***Then the idea of students maintaining a portfolio. I found at the beginning, that they were not mature enough to file and to put things in order but over the years, they managed to get that in order. But it is also the responsibility of the teacher. It is an added burden to make sure that these portfolios are always available because we were told initially, that they must always be available. So if somebody does come into school, they can have a look at the portfolio. They have never come but later we formed clusters and we had to take them to Pasdeo, so that was okay.***

Teachers are also held accountable for students' portfolios, as has been conveyed by Mala. The issue, Mala finds, is about maintaining the portfolios, storing and keeping them available for departmental officials to view. Mala shows the process of how a new expectation such as keeping a portfolio can be established successfully. Students have learnt to keep portfolios. According to Mala, teachers cannot show resistance by not keeping such portfolios, as they are accountable for it. Mala says that these portfolios have to be ready for department officials to view at any time they want so this adds an additional burden to the teacher, but even with this threat, department officials have not found it feasible make an appearance to view the student portfolios. Furthermore, out of fear of reprisal from the department, if portfolios are not ready, teachers are obligated to make sure these portfolios are up to date. The triangulation of checking teachers' marks against student evidence through their portfolios is also a monitoring tool to check for students' achievement. So it seems that monitoring is a form of policing that the department is using to make sure curriculum policy demands are met. In a way this kind of policing, is expected to test how the curriculum is working through student achievement, however, development of teachers in context, content and pedagogical knowledge would make the process easier. Participants would not feel like they were being policed if they knew how to carry out the curriculum, efficiently.

Patricia: ***Teachers are also monitored via IQMS. The HOD checks on your work and you can score yourself.***

Patricia suggested another tool of monitoring that was used by teachers. IQMS (Integrated Management Systems) is supposed to be a developmental tool for teachers to develop themselves. Patricia divulged that the HOD checks the scores and gives her feedback via critique of how she renders the curriculum. Patricia is supposed to develop by becoming aware of her shortcomings, strengths and so on. However, Patricia claims that IQMS is a monitoring tool rather than a developmental tool

Discussion of theme

It is, therefore, evident from the claims of the participants that the new curriculum policies have caused added monitoring and accountability burdens on the teachers. Accountability through assessment, internal and external, moderation of teachers' work and management systems such as IQMS (Integrated Quality Management Systems) are practices that make sure that there is control (Beets, 2012). Furthermore, Gür (2014) argues that because of curriculum prescription and because of bureaucratic monitoring, teachers have less control to ensure quality education as they have increased administration tasks and they face busier schedules. Participants have shown that they are forced to succumb to the monitoring tools that the department uses to assess their work. With the internal and external moderation of the work, as is explained by both Khan and Sagie, participants are held accountable for syllabus completion as well as student achievement. Hence, the participants are subjected to rules and regulations via monitoring to ensure that they abide by departmental stipulations inherent in curriculum policies. 'Governmentality' is defined by Dean (2010) as a governing of collectively held views through many discourses that guide individuals to act according to societal norms. So participants follow curriculum prescriptions and they do so because there is control through stringent surveillance. They are therefore guided to follow what the state requires of them. 'Governmentality' through the discourse within curriculum policies and strict monitoring is used to control the participants through knowledge, by shaping the thinking and actions of individuals (Kelly, 2010; Collier, 2009). Sagie and Khan have stressed that they have to complete the syllabus in whatever way they can, which implies that they want to confirm that they are adhering to state dictates.

New curriculum policies do not cater for students with different abilities in the same classroom

Participants have indicated that they are burdened with diverse students in their classroom and subjected to prescriptive curricula, within limited time frames, as has been discussed in the previous themes. In this theme participants express their dedication in trying to assist students by putting them in classes with other students of similar cognitive abilities, which actually goes against the social justice aspect of an egalitarian, anti-apartheid education for all students. This is so because an egalitarian education is where all students are treated equally and taught in the same way, within the same classroom and not separated because of their intellectual ability.

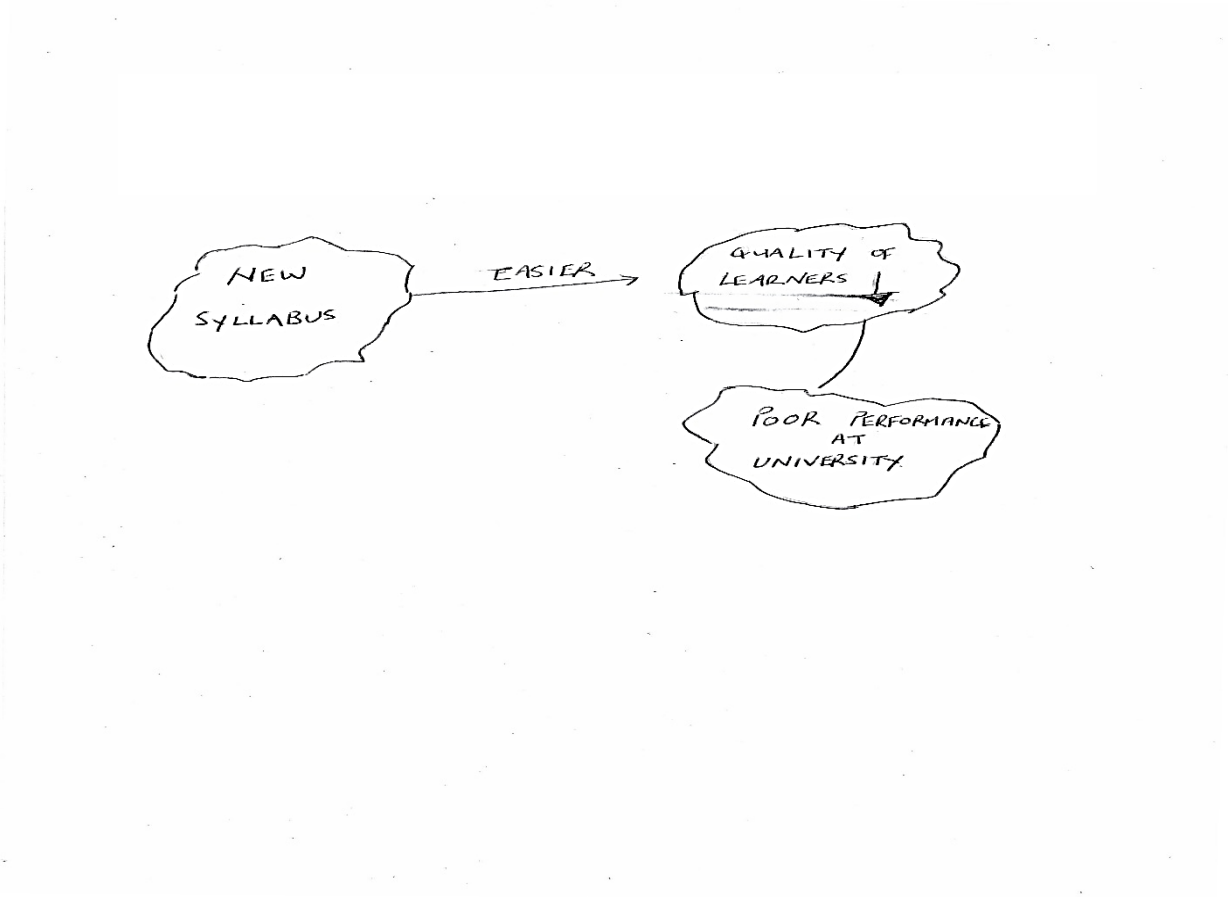


Figure 7 – Visual Drawing Charles (VDC)

Charles: ***With the new syllabus, my personal opinion is that, the maths has now become easier. There are more children getting A's that should not be getting those symbols. At the same time, the failure rates have increased because there is***

just one type of maths and it's called the core maths now. Previously, there was maths higher grade and maths standard grade. That separated the students so the best students in the higher grade got A's and they did extremely well at the university. You look at the more successful ones; they have done well at school, well at university. But now an A in maths is not a guarantee a child will obtain a top pass at university. I have seen that a number of them have failed yet had an A in maths.

Charles expresses concern with what he thinks the new curriculum has done to students. The VDC and his explanation of the drawing indicate that Charles is not impressed with the standards of the new curriculum. He strongly believes that students should be placed in homogenous ability level classes so that the higher achievers can be better prepared to perform better in mathematics at university. Charles' concern is that new curriculum policies are not preparing students adequately for university and he therefore, envisages putting students of the same intellectual ability in the same class. Charles' habitus is inferred here. He believes in student achievement for success at school and university level. He seems to work towards preparing students for examinations so that they get good results. Charles therefore is finding a solution to ensure student achievement by placing homogenous students in the same class. He believes that doing well in mathematics will allow the student to succeed, yet they are not doing so at university level. Charles blames the curriculum for the poor achievement at university level. There could also be some inadequacy in the teacher. In his endeavour to ensure student achievement he follows mathematical rules which he has previously stated. So, he works towards coverage of content rather than that of student understanding. He uses his past experiences to teach in a traditional way and resists using student centred approaches. He therefore shows a lack of pedagogical knowledge which is needed to ensure student understanding. Charles, therefore, implies that the curriculum policies do not meet the needs of students as it is too watered down to prepare them for university level. The notion that the curriculum is watered down is in contradiction to what Sagie said when he explained that the new curriculum policies are meant only for the high achievers as they are the only ones that can cope with the policy time-frames. However, Sagie also said that, even for the higher achievers, it was difficult to extend or enrich them further because of the limited time. Here are now two different points of views from the participants. Sagie, who complains about not meeting the diverse needs of all students in his classroom and Charles who is complaining that the syllabus is not enriched enough to prepare students for university.

Sagie: ***To a certain extent the syllabus is watered down. We have to change some of our strategies. What we have been doing is doing it, all inclusive. We have to do specific learning like you know what we have to put all the high fliers and teach them in one class. This is what we have to do. Otherwise we hold everybody up. Then the others who want to do maths and to stay there then you have to teach at their level to ensure that they at least pass. With the matriculation exams they can at least get their 30, 40, and 50%. You are teaching for them to get at least 60%. A distinction is out of the question. Therefore as mathematics is important to many careers we do not want students to drop mathematics and to retain, right through to matric.***

Sagie's discourse is around marks, percentages and distinctions. Sagie, like Charles, is placing emphasis on student achievement rather than about learning and the grasping of concepts. It seems, from the limited information available from the data, that Sagie's habitus includes the valuing of achievement above that of understanding. Like Charles, Sagie also believes that the syllabus is not of good quality. He also agrees to separating students according to their abilities. In Sagie's case, with a more diverse group of students, teaching the curriculum in a general way, he feels, is not benefitting students. Like Charles, he believes, that by putting a homogenous group of students in one class, teachers will be able to teach a similar ability group. Sagie is finding solutions to the challenge in making teacher's work easier. He is trying to make mathematics accessible by focussing on differentiating the abilities of students. Their suggestions entail using different content for different ability groups. This requires the separation of students according to their ability levels.

Discussion of the theme

With regards to the quality of the new curriculum policy, it has been noted by the participants that new curriculum policies are not preparing students for university education. Charles in his VDC demonstrated that students that had distinctions were unable to cope at university level. It was found that the mathematics score profile of students graduating from school show achievement that is not good enough to pursue careers in the science and engineering fields (Pitoniak & Yeld, 2013; Reddy, van der Berg, Janse van Rensburg & Taylor, 2012; Reddy, 2006). Even the National Senior Certificate, the final assessment in South African schools, that is the school exiting examination, conforms to acceptable standards and masks the educational

challenge of high levels of failure (Pitoniak & Yeld, 2013). Charles and Sagie value student achievement and have found that at matriculation level their students do achieve well. Individuals such as these two participants have their own habitus which is gained from their past experiences which in turn shapes their future experiences (Bourdieu, 1984) and that is to value student achievement above that of understanding. While discussing the habitus of Charles and Sagie I acknowledge an inference on the basis of limited information by making an informed judgement with statements they make about achievement. Boaler (2008) asserts that although an equitable access to quality education in mathematics is prioritised in new education policies, mathematics scores are ranked higher than meaningful learning in mathematics. However, those same students do not show the same achievement level at university. Mathematics teachers like Sagie and Charles, as well as policy makers are under pressure to improve achievement results, particularly the matriculation results, and this puts continuous intellectual and emotional stress on the teacher who has to cater to these demands (Brodie & Pournara, 2005). Charles seems to take on the stance of an engineer, using Derrida's (1978) explanation of an engineer as he believes mathematics should be taught and achieved in a certain way. There is a sort of precision in which he views the way students should be taught. He seems to get frustrated when he is unable to function as an engineer due to all the fragmentation and revision of policy. He wants to be a mathematics teacher in the sense of an engineer so the erosion of time with the curricular changes causes this frustration. Both Charles and Sagie, by suggesting differentiating students according to ability groups as a solution, are finding ways to improve results in mathematics achievement and thereby finding ways to continue teaching as in the precision of an engineer, in the case of Charles, and to be able to cope with diversity, in the case of Sagie.

New curriculum policies produces stress and negativity

With constant curriculum changes, teachers are burdened with work, having large class sizes, inadequate resources and other challenges that they face each day. They are therefore, subjected to stress and show negativity to teaching.

> **Patricia:** ***I find it difficult to cope because it is too stressful. My health has deteriorated because of that. Well I definitely like teaching that is why I chose it. But right now I do not. The teaching part of it is good but the kind of students we have, their attitudes, discipline, problems, I cannot cope with it. It's becoming too much.***

Patricia has repeatedly communicated the discipline problems she encounters when teaching mathematics. The stress that Patricia speaks about is the nature of the students that is the reason for her stress. Added with the stress of the new curriculum it intensifies the discipline issues. There is also the stereotype of mathematics being a difficult subject which Patricia has communicated. Patricia did say that she chose teaching because she loved it. However, what is evident is that her love for teaching has become disillusionment. She implies that student apathy and discipline problems make it difficult for her to teach. What is also evident is that Patricia is having issues with pedagogical knowledge and even content knowledge which make it difficult for her to teach the new curriculum. These issues definitely add to the stress. So much so, that she has indicated, it has inflicted health problems on her. Patricia has been teaching for a number of years and it would appear that age could also be an issue. Her age, student discipline, limited pedagogical knowledge to deal with students in the context that she teaches in, as well as having to introduce and work with a new curriculum, may have caused the health issues that she complains about.

> **Mala:** ***Firstly, when I look at myself before getting into this profession, I honestly thought it was something you would establish yourself and you would have to do the same thing for ever. But with all the curriculum changes, it is definitely not that. This makes me stressed. In fact, when you talk about diversity of students, I think now we have a diversity of teachers in a staffroom too. And with regard to curriculum change, I think the people who are doing it are not considering that. It is rather frustrating as you get older and you think you settled in your job and here comes something new. For many educators I know, each time I go to a workshop, especially the older ones, because they are almost into semi-retirement and for them to go and learn all these new things again. Many of them will tell you that if they had a choice, they will not be in this profession.***

To Mala and the teachers she speaks of it seems that change is stressful. Their disillusionment seems to increase over time. It would appear that these teachers with many years of experience and who have establishes a pattern or tradition of doing things, are more resistant to change. These changes seem to be making them feel like they do not know what they are doing. Mala thought that the teaching profession would assist her in establishing herself and she is actually determining that she and the other teachers she has spoken to, have not adapted to the change of the new curriculum. What is implied here is that Mala shows disillusionment with introducing a new curriculum, as she, and teachers like her, show resistance to learning

something new. Her source of frustration is not knowing and having to learn something new, just before retirement. This resistance to change could be due to having many years of experience teaching in the traditional way and there now arouse a difficulty to cope with change. However, it could also be that the constant curriculum changes that they have been exposed to have left them more disorientated and unsure of what to do in the classroom. This would of course lead to stress and many older, experienced teachers, according to Mala, who have suddenly been subjected to the constant curriculum changes, are now overburdened with work with prescriptive curricula that are still not specific enough to guide them to implement such changes. Additionally, teachers such as Mala, have been exposed to many years of being taught and using teacher centred approaches. To now give the students that authority to guide their own learning, could be taking her out of her comfort zone. Therefore, stress and negativity is attributed to implementing a new curriculum because of resisting this change. Instead of enjoying the profession and their career choice, they are now opting to get out of the profession.

One of the expectations in the norms and standards is for teachers to be life- long students. This particular teacher (Mala) expresses the idea that there is nothing more to learn. Teachers therefore, become frustrated. This leads to stress.

> **Mala:** ***The other stress is the student apathy. They have already resigned themselves to the notion that this is a difficult subject. Their attitude towards homework, basic homework and classwork, you are lucky, if it is done by the end of the day. It is gone home and come back the next day, untouched. Then the formula for maths, we all know that it is such an abstract subject but no matter how we try to open up to it in class, the students still have a phobia for it. Then you get basic tools like a calculator, a child will not have in grade 10, 11 and 12 and we are expected to carry them through that period. For me that is stressful as basic instruments, like a pencil, a child will not have. I am thinking that construction will be a nightmare to teach them without maths set.***

As Mala has specified, apathy and insufficient resources are a cause of stress for her. She has experienced stress from the lack of sufficient resources needed to implement the new curriculum. Added to that is student apathy, so this teacher is finding it difficult to introduce new content area to students. Her stress could also have arisen because she is ill-prepared to teach a new curriculum and blames student apathy and limited resources. She stresses that teaching certain aspects like constructions where students have to construct shapes, are a

nightmare to her because of the lack of resources and students' attitude to mathematics. Students' negativity to mathematics is a cause of stress and negativity to this participant and she is supported in her opinion by the other participants. The participants have to teach sections that are prescribed in the new curriculum, such as that on constructions, to students that do not have the necessary resources to carry out such approaches. Context seems to play a role in the cause of stress when implementing a new curriculum, as in a context where there are many disadvantaged students there may be an issue with resources. Students who do not have access to such resources can demonstrate negativity to mathematics, which will adds to the stress of the teacher to carry out her lessons based in the new curriculum as her work burdens are now increased in order to implement the curriculum.

Discussion of the theme

The nature of students Patricia has in her class has caused her to experience stress that is increased by the burden of a new curriculum. Mala's stress is due to her unwillingness to change to accommodate a new curriculum. Patricia's health issues and Mala's resistance to change seem to be related to their age. The concept of experience is relevant to understand the stress that these participants' experience. Teachers' experience (Gadamer, 1975; Dewey, 1938) of the policy change has an impact on their lives at a sensory level and an emotional level because they get frustrated and anxious for various reasons such as the discipline challenges experienced by both Mala and Patricia, not having enough resources, time and so on. They also experience stress at an intellectual level as they try to configure their attempts to convey mathematics to students in terms of new policy changes. There is more frustration when there is another policy change and the participants have to reconfigure this all over again. The new curriculum is regarded as the source of stress by the participants yet other issues such as limited content, content and pedagogical knowledge as well as resisting change could be the source of stress. Sowder (2007) asserts that having to cope with change imposes emotional burdens on the teacher. This anxiety leads to negativity towards mathematics and the teaching of mathematics and these feelings are reciprocated to students who may get feelings of helplessness and dislike towards the subject matter (Ma, 1999). The resultant effect is that students who do not have a positive attitude towards mathematics will not be able to achieve in mathematics (Maree, Fletcher & Erasmus, 2013). This is what Mala has communicated regarding the apathy that students have although it may have been as a result of her negativity and their not having the necessary resources to carry out the new curriculum. Mala, and

teachers like her, show resistant to change and this could also be because she has not been adequately prepared to implement a new curriculum. Louw *et al.,* (2011) posit that in developing countries such as South Africa transformations aimed to rectify the injustices of the past, if not enough preparations are made to adjust to the changes, it leads to difficulty for teachers to cope. Teachers then become disillusioned with educational practices and if they continue to stay in their profession they experience burnouts (Louw *et al.,* 2011). Therefore, the stress and apathy to mathematics experienced by these participants indicate that the introductory pressures of each new curriculum, teachers being ill-prepared to implement such a curriculum, resistance to change as well as contextual issues have led to such burdens.

New curriculum policies intensifies language barriers

> **Patricia:** ***Language is a problem. I think, most of them are unable to interpret the questions, so I have to explain to them. When I explain they do understand but when I give it to them in a test or exam, they do not know what to do.***

The context that Patricia teaches in has the majority of students being English second language students from poor socio-economic backgrounds. These students find language to be a barrier in learning mathematics, as many of them do not speak English at home. Each time there is a curriculum change with new sections being introduced, language barriers are intensified. Patricia has to implement a curriculum, which keeps changing, to English second language students. With each curriculum addition there will be a burden on Patricia as well as on the other participants, who have indicated that they have to now work harder to make the content understandable to all students. Even with Patricia explaining to the students she still experiences challenges as students cannot comprehend questions in the tests and exams. This will therefore impact on achievement levels for which Patricia is accountable. Language barriers are a huge challenge.

> **Khan:** ***Basically the problem lies in literacy and numeracy. We are a high school that caters for students from grade 8 to 12. I have students in grade 10 who cannot spell words like house, home, are, correctly. This impact on the understanding of maths problems.***

> **Mala:** ***But with problem solving they find it difficult to interpret the problem but if I just gave them an equation and say solve for x, they would be able to. If I presented that in a problem form, where they had to work out what that equation***

is before solving, they cannot work out the equation. So it is the translation from English to maths that they find difficult.

Khan and Mala have brought up another facet of language difficulties in mathematics during the semi-structured individual interviews, that of employing language in problem solving in mathematics. The curriculum had to change to the state ideology which is democracy. Thus a focus on problem solving to create critical thinkers has become an important part of an egalitarian education in mathematics. The language of instruction used by participants in the schools that they are teaching in, is English, and with second language English students, problem solving in the English language becomes a problem. There is also a suggestion that the participants are unable to speak in the language that the students are proficient in. Therefore, there exists a challenge in making students proficient critical thinkers because of language barriers. With the new curricula gearing up towards the orientation of critical thinking, language would be a barrier to learning. Proficiency in the language of instruction will therefore add work burdens to the participants as they have to implement problem solving as is required by the new curriculum. As has been noted from the conversations with the participants, problem solving has always been there, however, the burden is evident because of the diversity of students in the classroom which was not as evident before democracy. Therefore, language becomes a barrier to learning rather than problem solving being the issue with the participants.

Discussion of theme

Mala, Sagie, Charles and Patricia allude to language barriers creating more work burdens for them when implementing a new curriculum. South African teachers face the challenge of teaching students from multilingual backgrounds in a language that they may acquire only when they start their formal education (Visser, Juan & Feza, 2015). Reddy (2006) found that one of the reasons for underachievement in mathematics in the TIMSS examinations was that of poor ability in the English language by second language students. Howie (2003) also revealed that students perform better if the language of instruction is the same as their home language. Patricia experiences language barriers in the context she teaches in, which has increased her work burdens. One such work burden, is having to deal with teaching English as the language of instruction in the educational setting, using the mathematics content with mathematics having its own unique language (Brodie, 2010; Essien, 2010). The student centred, critical-thinking and problem solving approach is propagated by the new curriculum

policies (Department of Education, 1997; Department of Education, 1995). This approach is indeed difficult to implement if language is a problem as Khan and Mala have indicated. Moreover, teachers have the added task of making mathematics accessible to students by incorporating their everyday language, where students express what they know in their own language and then incorporate this knowledge in English and then interact with the language in the textbooks. Halai (2004) recognizes that this is not a straightforward matter. The state uses English as the language of instruction to institute its goals of achievement in mathematics. The state subscribes to global initiatives and they set the rules of following this path through the curriculum where mathematics is a high status subject and will increase economic growth for the country (Mhlolo, 2011; Apple, 1992). Althusser's (1971) state ideology and Bourdieu's cultural capital is relevant for this theme (Bourdieu 1984; Bourdieu 1977). The state's agenda seems to be about improving mathematics education so that South Africa can compete in the global market. With English being the recognised language accepted in most countries throughout the world, it would stand to reason that the state would use this language to extend their ideology of achievement in mathematics. However, mathematical understanding in a language understood by most students is difficult to achieve, as has been indicated by the participants because of difficulties in the language of instruction. This adds to the burdens of the mathematics teacher to make mathematics understandable in the chosen language of instruction. Bourdieu (1977) argues that cultural competence or knowledge is produced and given a price. In a school setting this proves to be a worthwhile argument as the required status can be given preference in a school setting. As English is the globally accepted language and since discourse in the accepted language will promote their power in relationships, it will give preference to those that have a proficiency in the accepted language. Those students who have a deficiency in the accepted language will be considered as lacking in the required cultural capital.

Seeking professional assistance from other sources

As has been discussed, participants found workshops, textbooks and curriculum documents insufficient to assist them in implementing new curricula. These teachers in this study have sought assistance from other sources to help them implement new sections in the curriculum. This theme acknowledges that if teachers do seek assistance they may be able to get it.

> **Sagie:** ***Almost every year we have a workshop here and we manage to get Mr Matthew Moodley (pseudonym), who is a chief education specialist for maths and***

he comes and tells us what level you should go, and how far you should go. We invite teachers form Thomeni (pseudonym), Pasdeo (pseudonym) and Voslo (pseudonym). For the last three years, we have been having these workshops. We use our funding money to fund that workshop. We have found ways to help ourselves. Because of these new introductions we said we will carry on to consolidate. We sit as a team and we work out the depth to which we should be going because we are still finding our way in all grades in terms of how far should we go and what we should include and what we should leave out.

All participants echo Sagie's verbalisation that they seek assistance from Matthew Moodley. They have used the expert advice of Matthew Moodley to assist them in working on the content knowledge that is prescribed in the new curriculum. They value his expert advice and, according to the participants, this person is readily available to assist teachers. Their journey with curriculum transformation has been eased by an expert who they say assists them on his own free will. These teachers have not waited patiently for assistance but went out and sought help. The participants have asked for help three years in a row. They have used their own funds to be developed and to keep in touch with the curriculum. These mathematics' teachers, pay their own way, not because they have to but because they choose to do so. However, what is apparent is that they do not seem to seek advice or guidance on what and how to teach. Instead they seems to be concerned with pace and coverage of content as Sagie states that he was concerned with the depth that he has to teach in completing the syllabus. It does appear that these teachers are not seeking advice about understanding and interpreting the curriculum. It implies that it is about them just doing enough and being at the same rate as is decided by a departmental official. Although Matthew Moodley is assisting them as they have asked for his assistance, he is still a departmental official. It would therefore, suggest that if teachers do ask for assistance, it might be available. It seems to be on a continuous basis which is of benefit as curriculum transformation and implementation can only succeed with on-going professional development which these teachers have organised themselves. The other aspect that Sagie alludes to, is the cluster formation that these teachers have organised for themselves that allows them on-going consolidation as well as an avenue to voice their challenges and fears. It seems that they require such assistance on a yearly basis, perhaps just to voice their concerns and to find solutions which may assist them with the new challenges they find each year.

Mala: ***Outside school our only means is when we meet at workshops. Other than that; nothing else. Well now, we have a very good working system where the deputy***

chief director, Mr. Moodley, liaises with us via email and that is how I managed to get quite a bit of help. He has conducted several of our workshops but on our request. If one person instigates and says what we need, then we leave it in the hands of the HOD. He makes the arrangements. Other schools are also invited to the workshop. We all have the same issues as we all want to know about the new stuff and focus on that. Many of the problems relate to the documentation not being clear about the content, the depth of the maths sections and what to expect because we have no past year exam papers. Although Mr. Moodley is employed by the department he delivers workshops at our behest. What the department needs to realise is that they need more personnel of his calibre in administration.

Mala also benefits from the expert advice of Matthew Moodley and this individual has taken time out to assist teachers even via email. This type of communication seems to make it easier for teachers to address some of the challenges. It can also be assumed that all the mathematics teachers in neighbouring schools are experiencing the same issues as has been implied by Mala; hence, the invitation to the workshop by Matthew Moodley to address these issues. Mala also points out that teachers have issues and at least some of them can be addressed. These teachers have formed a network of their own doing that aid them. Mala indicates the importance of the department having more personnel, such as Matthew Moodley in their employ. However, some participants agree that they seek assistance more for new content areas and student achievement rather than making mathematics meaningful to the diverse students they have in the classroom. From Mala's statement above there is a reference to there being deficiencies in the curriculum with regards to depth. The cultural capital of the participants is also evident as they seem to value achievement rather than understanding of the mathematics curriculum. Their focus seems to be to get assistance in the content areas so as to achieve better student results. It may have something to do with their status as mathematics teachers and recognition by the state if their students perform well in examinations. However, there seems to a lack of pedagogical knowledge that is required to implement a new curriculum to diverse students in the classroom.

Charles: ***We haven't had a subject advisor for quite a few years. But even when we did have one, he was useless. He, in my opinion, knows no maths. We basically implemented the curriculum on our own but luckily in the Pasdeo, Thomeni and Voslo areas we are all contemporaries. So we network with each other. We lean on each other. That's how we managed to go through the system.***

The subject advisor that Charles speaks is of not much assistance to him and to others. From the data it is apparent that whether there is or there is not a subject advisor, Charles found that it made no difference. He states that even when there was a subject advisor, the advisor was unable to provide the relevant support. This has led to a situation in which teachers have had to create their own support through networking. In this instance, it seems that in the absence of official support from the Department of Education, the teachers exercise their agency to manage the implementation of the mathematics curriculum. Charles has made associations with other teachers within and around the area that he teaches in, which has been a source of support to him. It seems that the Department of Education has a limited source of worthy education specialists who can help these teachers make the transition from one curriculum policy to another.

Discussion of the theme

Participants have shown that they are able to use their agency to get assistance in implementing the new content areas in the new curriculum. Participants agree that they do need professional development on an on-going basis as they have asked for the services of Matthew Moodley for three years. Reddy (2006) suggests that for professional development to be effective it should take place over a long period of time. Sagie has shown innovation by setting up workshops of small groups of mathematics teachers to assist them in implementing new curricula. It was an initiative that demonstrates that he did not just sit back and accept the cascade model of dissemination as the only means of professional development. The use of the concept of social influence is relevant here as these participants have found social networks (Dewey, 1980; 1938) to assist them in making sense of new curriculum policies. The concept of context also applies as participants that work in similar contexts can work together. South Africa was subjected to the cascade method but teacher clusters are smaller and its interventions are closer to the teachers and the classrooms (Jita & Mokhele, 2014). Mala states that mathematics teachers from neighbouring schools are invited to the workshops given by Matthew Moodley. It would seem that these teachers share similar challenges. Teachers form clusters that are closer to the context that they work in and with teachers that generally have the same issues (Sowder, 2007).

It does appear that these teachers have found an avenue to assist them with the challenge of new content areas. Professional communities, in the sense introduced by Wenger (1998), are

similar to teacher clusters. Their advantage is that they provide an on-going venue for teacher learning and the teachers in these clusters or communities share a purpose of achieving goals, sharing responsibility for decision making and co-ordinating their efforts to ensure student learning (Sowder, 2007). It was found that when teachers became part of the cluster community they were able to shed their anxieties about their teaching and content knowledge thereby giving them a sense of empowerment and confidence in their abilities in mathematics by addressing their specific needs and concerns (Sowder, 2007). In any cluster, however, there has to be access to an expert who can help the teachers with the issues they are experiencing (Sriraman & Tőrner, 2014). Fortunately for these participants they have found an expert in the guise of Matthew Moodley. That may be the difficult part if subject advisors or any other expert in the mathematics field are not readily available to cluster teams. Charles did declare that the subject advisor allocated to his area was unable to assist them because of his deficiency in content knowledge. While it has been recognized that in South Africa the Department of Education has not provided adequate support for teachers at the local and district levels (Lekgoathi, 2010), these participants have shown that they are able to use their own agency to get the required assistance. They have even chosen to pay to get such assistance.

Discussion

The shift from one curriculum to another in the post-apartheid era created numerous challenges for participants. Participants have been quite articulate in voicing the challenges that they have had. The first curriculum, being C2005, was introduced to address the inequalities prevalent in South Africa's apartheid education. OBE introduced student centred methodologies, in the hope of bridging the various diversities in the multicultural society, prevalent in South Africa. It was a good notion to create a democratic society, providing equal education for all. However, such a change in curriculum from the previous traditional type of education to the new type of education caused teachers to tread an untouched territory and therefore created an abyss of unfamiliar knowledge. This abyss created an abundance of work for teachers to interpret and implement this new policy into their classroom while being already faced with diverse challenges such as large classroom sizes, multicultural and multilingual students and their own fears of the unknown.

OBE had many challenges. The previously disadvantaged needed a great infusion of resources in order to improve the poor state of education during the reign of the apartheid government (Jansen, 1999). Furthermore, for OBE in C2005 to achieve maximum success it needed a greater infusion of finance, especially in disadvantaged schools, to make it work (Jansen, 2002; Jansen, 2001). Pedagogic practices were required to be changed from those of an authoritarian teacher-centred education system to those of a student-centred education system. Education policies had to reflect these changes via the curriculum. The top-down teaching approach that was prescribed in the apartheid system had to change to equip students with autonomy in their learning. The change in pedagogic practice is linked to political, social and economic development in order to give students access in society (Jansen, 1999). The student-centred education system would benefit students by creating critical thinkers and skilled students which would gain them access in society and to the global market.

The newly appointed government, the ANC, was responsible for the policy making process. Jansen (2001, 2002) argues that policies were symbols of politics by delving into case studies where politicians and public lend credence to the policies rather than the implementation. In order for South Africa to compete globally, the policy making body had to show their democratic allegiances that their policies were equal to the best in the world (Jansen, 2001). The policies were about purging the apartheid curriculum (Harley & Wedekind, 2004; Jansen, 2002; Jansen, 2001) and as Jansen (2002; 2001) points out, had little to do with actual practice in the classroom. The policy making body approached the changes in an undemocratic manner where a top-down approach to the planning and design of policies was used and the various provincial education departments were subsequently expected to see to the implementation of the policies (De Clercq, 1997; Jansen, 2002; Jansen; 2001).

What is important to note is that teachers were not consulted on the curriculum choice yet participated in the refinement of C2005 and the making of learning programmes (Cross, Mungadi & Rouhani, 2002; Jansen; 2001). Had teachers been consulted about the choice of curriculum, then it stands to reason that they would have advised on contextual factors that were pertinent to their schools and may have had bearing on the ultimate choice of curriculum. The complex language that South Africa brought in to be used with OBE was confusing to teachers (Chisholm, 2003; Harley & Wedekind, 2004; Jansen, 1999) and created administration

burdens. The cascade model was used to disseminate the education policies for implementation to the teachers. Pithouse (2001) argues that these workshops were poorly planned and facilitated over short periods of time. This top-down approach of dissemination not only undermined the role of teachers but caused confusion as to what was expected to be implemented in such a curriculum (Jansen, 1999).

As Jansen (1998) argues, an endeavour such as OBE required a great deal of planning and training to be adequately implemented. However, this was not so. OBE was to be implemented in a short space of time (Jansen, 1998), yet a complete overhaul of education processes was needed. This was not at all feasible. Many black teachers were excited about the prospects of the implementation of a new, non-racist curriculum (Harley & Wedekind, 2004). This meant securing an opportunity of redressing the past inequalities (Jansen, 1998).

With the many problems of the C2005 curriculum such as the lack of emphasis on content issues, new policies were introduced such as RNCS, NCS and now CAPS. As participants have stressed, with each curriculum change there has been work burdens and as Mala enunciated, by the time one gets used to one policy then there is a curriculum change which brings about more work burdens. Now CAPS has gone to the opposite dimension of C2005 incorporating OBE. It has become more centralised and prescriptive, urging teachers to comply with policy demands through monitoring and accountability which has been communicated by participants. Participants have found value in student centred approaches where they can meet the needs of diverse students in their classroom but CAPS now restricts them from using such methods because of limited time frames and prescription. Teachers have divulged their concerns about not meeting the needs of all the students in their classrooms and being forced to complete the CAPS syllabus in the required time. Participants have complained about not getting the time to be innovative and creative in the classroom and being forced to use traditional teaching methods because of the limited time frames they have. By being prescriptive policies are thought to improve the performance of students in mathematics but in so doing contradicts the critical outcomes that are present in all the transformative education policies. Apple (2003) related the contradiction to decentralising and centralising policy descriptors. Decentralising principles give greater autonomy to the educator and are based on the principles of democracy while centralising policies involve the state in being prescriptive and giving little or no

autonomy to the educator in implementing curriculum policies. Centralising policy documents, Beets (2012) and Mncube and Harber (2010) argue is because of the global concern with quality education especially in developing countries such as South Africa. By centralising policies the state has a greater control in attaining global standards for the country. The centralising principle now comes into effect where educators are forced to become robotic as they just deliver lessons that are based with specificity in the curriculum policies because of state control through curriculum policies. This argument has weight as the many accountability issues that teachers are subjected to allow them little or no autonomy.

The various contradictions within policies have been raised because of the experiences of participants who have been faced with implementing the curriculum policy changes. Findings have shown the constant curriculum changes have been a source of work and burden to teachers. They have had to deal with the changes with little help and assistance except in the form of an expert which they have found themselves and the network they have formed. The many challenges such as language barriers, work burdens, confusion that has arisen, student diversities, curriculum prescription demands as well as monitoring and accountability to ensure student achievement have all forced participants to resort to traditional methods of teaching, teaching generally to all students and thereby ignoring individual needs of students. New curriculum policy influences have shaped these teachers' work which is in contradiction to the expected outcomes of policy initiatives. However, the many challenges teachers face each day in the context that they teach in which curriculum policies ignore as they uses a 'one size fits all' perspective, has enforced the way they implement curriculum reforms.

Conclusion

The analysis done in this chapter revealed the following: There are increased administration demands on teachers, new curriculum polices have not changed the teaching approaches of the participants in this study, new curriculum policies reduced teacher agency, teacher content knowledge gaps were exposed with the new curriculum policies, teaching approaches introduced by the new curriculum policies were more demanding, the new curricular have increased monitoring and accountability, the new curriculum policies do not cater for different student ability groups, new curriculum have produced stress and negativity, language barriers are intensified and finally, participants are forced to seek professional assistance from other

sources. Certainly, the new curriculum has not benefitted teachers and implementation has become more complicated. In the next chapter I will be analysing the multiple perspective experience of the participants.

Chapter Six

Data Analysis Part 2: Mathematics teachers' contradictions, inconsistencies, differences and ambiguities in implementing new curriculum policies

Introduction

The analysis in this chapter re-examines data from the previous chapter by bringing into focus the contradictions, inconsistencies, differences of opinion and ambiguities that arise. The analysis will follow under the relevant themes and data attached to the theme. Thereafter, the conclusion will follow.

Discussion

Themes showing differences amongst participants

Profession and change

> **Mala*: Firstly, when I look at myself before getting into this profession, I honestly thought it was something you would establish yourself and you would have to do the same thing for ever. Many of them will tell you that if they had a choice, they will not be in this profession.***
>
> **Sagie*: You see from where I come from, my background, made me want the change to occur. The curriculum had to change to meet the times.***

The point that Mala is making is that people get into the teaching profession because they think it is one where no changes takes place. So as a student in school, Mala knew how schools operated, knew the curriculum and the content areas and what it was. So in becoming a teacher, she went back into a familiar system and organisation which suggests why she feels this way. For Mala, the idea is that it is uninterrupted, that it is a smooth transition as a student at school to becoming a teacher. For a student, twelve years that they have spent in school seems like a long time, so it almost seems like that is how it is going to be while teaching. She feels, in her opinion that is why people choose to become a teacher. Sagie is speaking historically. He might be alluding to apartheid and where he went to school. The way he saw it, he knew that things were not the way he liked it to be therefore he may have chosen teaching because he wanted

change to occur. According to him, the curriculum has to change to meet the changes in time so he implies that education has to meet particular conditions at particular times. Mala seems to speak from a personal, comfort-zone attitude but Sagie is talking historically. For Mala, the work is more intense for her as she has to learn a new curriculum and adjust to it. She feels safe in her comfort zone so wanting to change becomes harder. So her burden of being a mathematics teacher is increased. As for Sagie, he embraces change and he sees that as part of his work

From what Mala and Sagie have indicated, it can be assumed that their past experiences have shaped the way they react to new curriculum policies. Experiences shape the way we think and do. It echoes the argument of Bullock and Russell (2010) that teaching and learning have been embedded in teachers from a young age because they have spent many hours in schools and they may be resistant to change because of such experiences. The circular structure of experience is relevant here (Gadamer, 1975). Mala has been exposed to a past experience of school that she is comfortable with, so she does not see the need for change. Sagie has shown that his past experiences in his school context were not a positive one and he therefore sees a need for change. How each of the participants experience change shows how they have integrated their past experiences with the new experiences. Dede (2013) agrees that the decisions that teachers make in the way they implement curriculum policies are shaped by their prior experiences. Amin (2012) found that the way teachers were taught at school caused them to either resist or change their approach. Therefore, one's earlier approach shapes the way a teacher teaches (Amin, 2012). One gets a deeper understanding of what shapes the way a teacher teaches in Samuel's (2008) force-field model which explain that a teacher's identity emerges from their biography: who they are, where they went to school and where they trained to become a teacher. Therefore, what Mala and Sagie have learnt from their biographies and their schooling context reflects in their work contexts. Mala shows resistance to policy changes because of her past experiences while Sagie embraces such changes because of what he has to endure in his past. The resistance to change that Mala experiences make her career more burdensome as she has to work with overcoming her resistance and with implementing new curriculum policies.

Coping with curriculum implementation

> **Charles***: But things have changed now with the new curriculum. It is harder but I am not having such a big problem because children in my school are fantastic. They are goal orientated and motivated to study.*
>
> **Khan***: This is from my personal experience. I have 40 to 45 students in a class. That is quite a number to teach and to control especially when you want to implement a new curriculum that asks for individual attention. That becomes a problem in the limited time that we have per period that we can give to the students. Hence you have to teach generally to cover the high fliers, average students as well as students who take time to come to grips.*

There is a difference of opinion about the change in the new curriculum. Charles communicates that he is not having a problem because it seems that his school is attracting the kind of students who do not burden teachers with discipline problems and so on. Charles mentions that he has fewer students in his class and his students come from mostly middle class backgrounds so that could be a reason for his not having a problem. Khan on the other hand has larger classes so is unable to give individual attention as Charles may be able to. He also seems to have very weak and very bright students in the same classroom and he finds the new curriculum makes it harder to cope with the diverse abilities. Here one can see the contrast from one context to another. Therefore, their differences can be related to their contexts. Charles is in a school that attracts middle class students with fewer socio-economic problems and maybe fewer family problems. Charles also has smaller classes, so the only difficulty he has to deal with is the curriculum. In Khan's previous experience the schools he was in and taught at previously were organised for a particular race and students came from similar backgrounds and it therefore was easier to predict what kinds of students you have and what kind of learning they required by understanding their backgrounds. Now not only does Khan have to contend with the new curriculum, he also has to contend with students that he does not know as they come from varied backgrounds, perhaps from broken homes and from all classes and cultures. The number of students in Khan's classroom has also increased tremendously. So grappling with the students and the curriculum makes it more difficult for him to cope. So we can see, that for a mathematics teacher, who has to only deal with the curriculum, it might be easier as the work might not be as great. But, if you have to deal with the curriculum and a change of students, then the work burdens are amplified.

It becomes clear that that the contexts that Khan and Charles work at, influences their work in implementing a new curriculum. Context refers to the *"environmental influence on person and process"* (Poulou, 2014, p. 987). So a particular environment that places a group of people together with a particular set of rules and regulations can vary substantially from environment to environment. The influence of the context that both Charles and Khan work in has a visible effect on their work in implementing a new curriculum. Both experience curriculum change on their work quite differently because of the types of students that they have in their classroom.

Influence of past experience in content knowledge

> **Khan*: The other problem with the new curriculum is the introduction of sections which are not easy such as financial maths because they have timelines and so forth to deal with. This section does not only present a problem to students but to teachers as well. Experience did help me with teaching this section though because I link that section to compound increase and decrease because of mu pre-knowledge of the section. However, more is added on than in NATED 550. Older teachers are quite comfortable with that section.***
>
> **Mala*: These changes in curriculum required greater hours of preparation, work and reading. For example, the financial maths that started in 1994, we were never exposed to that maths before. I mean we did know the formula to find interest and so on but we were never exposed to that kind of knowledge.***
>
> **Patricia*: Data handling was new and I had to learn from scratch. Calculus came in as well. I did study calculus at college. Financial maths was new to ne and so were transformations. All these sections were new and I had to go to workshops to get help. In college we were trained for NATED 550.***

Khan's statement above implies that he relies on his past experiences and he sees that as an asset to help survive with the new curriculum. He represents the teacher who has content knowledge which was not in the old curriculum but he always knew that he could apply and use that knowledge. For him, transitioning into the new curriculum is much easier. When it comes to Mala and Patricia, because they did not have this content knowledge, they are finding it more burdensome. It would seem that the curriculum has been changed to make it richer and to make it more relevant. Here we have teachers who are actually confessing to not having the knowledge or they may have done it so long ago that they have forgotten about it. It means that

they have to attend more workshops and deepen their knowledge. Hence, when teachers have to learn new content knowledge or a new pedagogy then it means that they require much more information by reading, attending more workshops and they have to deal with their insecurities of not being able to teach adequately. Therefore, as implied, participants' work burdens increase if they lack the content knowledge that they are required to teach in the new curriculum.

The differences of opinions regarding content knowledge as shown by the participants, influences how they teach the content knowledge in their classrooms. Obviously, if they lack the required content knowledge, implementation of new content areas in the new curriculum will put burdens on their work. Brodie (2010) emphasises that teachers' confidence to carry out curriculum change is affected by their knowledge of content area. Brodie (2010) emphasises further that in the new curriculum teachers are required to find out how students think and to find their misconceptions and errors, however they will not be able to do so if they are lacking in content knowledge. Therefore, Patricia and Mala will have more work burdens when coping with new content areas if there is also a lack of pedagogical knowledge relevant in correcting misconceptions and errors in students' answers, whereas Khan seems to adjust his past knowledge of content to the new content areas which may ease his burdens in that aspect. Dewey's (1980; 1938) use of experience as a pragmatist, shows that one cannot say something is true unless it has been put into action. From Khan's experience one can understand that by using content areas from his past experiences, in other words, by putting those experiences into action he is able to integrate his past knowledge with the new knowledge. Gadamer's (1975) use of experience as a cumulative one shows how Khan manages to gain from his past experiences using such a content area to facilitate a new content area. There seems to a *"fusion of horizons"* as he comes to terms with the relevant content knowledge inherent in the new curriculum policy (Gadamer, 1975, p. 305).

Behaviourist approach versus student centred approach

> **Sagie*: Because maths is a developmental subject and you constantly building on old knowledge. You know the scaffolding effect. You actually remind them of things that they already know and that is your foundation and you building on that.***

Charles: ***Scaffolding does not really work in mathematics. In maths the teacher will have to stand there and teach.***

Charles***: But things have changed now with the new curriculum. It is harder but I am not having such a big problem because children in my school are fantastic. They are goal orientated and motivated to study.***

There is a difference of opinion about an approach to teaching. Sagie's understanding is that it is developmental and that you are building on old knowledge and you have to constantly start with the old and build on the new before you go forward, while Charles is adamant that he has to teach the students from scratch. A contradiction also arises from what Charles has said previously, when he said his students are great and are motivated to learn, yet he implies that he has to teach them everything from scratch. They may be able to deduce mathematical concepts themselves if they are motivated to do so. Charles is therefore implying that students do not need support in mathematics. The conjecture is that because of the school that he is in and the kinds of students that they draw, he believes that they do not need scaffolding. Perhaps Sagie and the other participants, who teach poorer students, may need to use scaffolding. Both these participants do not seem to be speaking about the Vygotskian understanding of scaffolding where students are built up to higher order thinking in the zone of proximal development. Sagie says he is building on the knowledge of the students, which he uses as a foundation for his teaching whereas, Charles, possibly, feels that you really do not need to ask them what they know. You have to teach them from scratch everything that they must know. It seems that for Sagie the teaching may lead to better outcomes because he connects it to the students, who they are and their lives. Charles states that he enjoys teaching the students that he has, maybe because the students are probably getting additional help elsewhere.

With Charles' and Sagie's varied opinion on scaffolding, what is implied is that Sagie tries to use constructivism, a student centred activity to develop students, while Charles sees no value in that. He seems to see limited value in student centred activities and believes that students need to be taught everything in mathematics. The student-centred, critical-thinking and problem solving approach which is propagated by the new curriculum policies (Department of Education, 1997; Department of Education, 1995) has its roots in Freirian (1971) philosophy. Freire (1971) rejected the behaviourist form of learning that the traditional mathematics curriculum was composed of where the teacher gave out knowledge. Charles, in believing that

teaching is about dishing out to knowledge goes against Freire's (1971) opinion on how knowledge should be presented to students. Sagie prefers to use some student-centred approaches during implementation of a new curriculum.

The *bricoleur* and the engineer are demonstrated adequately in Sagie and Charles. For Sagie, the *bricoleur*, he seems to facilitate the use of the new curriculum policies and he works to adapt new approaches to new approaches. He builds and works on old knowledge to form cohesiveness. However, Charles seems to view that mathematics should be taught in a certain way and therefore takes on a standpoint of an engineer. He believes that there should a certain way in which mathematics should be taught and no other method should intrude on that. Foucault's (1990; 1980a) 'governmentality' is also evident here as Charles communicates resistance to the use of student centred methods that are incorporated in new curriculum policies. One could also infer that the type of students that Charles teaches have the required cultural capital that is needed for them to succeed in mathematics as he says they are goal-orientated and motivated to study. It seems that the students share similar cultural capital to that of their teacher (Charles) and that is assumed to be the aim of schools, no doubt because of a policy that is based on the expectation that our schools should produce globally 'competitive' students. However, the paradox arises as the student centred approach that is also prescribed in policies is not adhered to.

Teacher centred and student centred assessments

> **Charles***: I cannot see why a child should build a bridge or even a cube and show me and get marks for it. It doesn't show me any mathematical knowledge at all.*
>
> **Sagie***: We vary the assessments. We do peer and self-assessment from time to time just for basic understanding. It is done basically for them to understand their own problems. It is student centred and it is a good idea as students start to mature that much more and they start to develop self-confidence because they have always been assessed by someone else so now they know what it means to be assessed and to assess someone else.*

Charles seems to think that student centred approaches in assessment, waste time. He feels that such activities do not show any mathematical knowledge at all. Perhaps, Charles lacks

pedagogical knowledge on some types of assessments to use. Sagie finds that all the different kinds of assessment enrich the curriculum and gives students confidence and they know what it means to be assessed and to assess someone else. Charles alludes to wanting to do everything while Sagie sees the benefits of getting students involved. One can see from Sagie's perspective that the work can be shared with students rather than being a burden to the teacher.

The participants have a difference in opinion of how assessments should be done. Charles feels that assessments must be student centred whereas Sagie incorporates many student centred activities, thereby sharing the burdens of assessment with students. Student assessment has also changed tremendously; pre-1994 student assessment consisted of tests in mathematics and now, to foster democracy, assessment is based on student-centred activities that include group assessment, formative assessment such as peer- and self -assessment, projects, investigations and assignments as well as tests and exams (Department of Education, 2011). However, Fleisch and Schöer (2014) argue that instructional policies on assessment seem to be vague and allow for multiple interpretations rather than being clear and detailed, specifying how assessment should be carried out. Therefore, pointing out that pedagogical knowledge on how to carry out student centred assessments are not clear enough for teachers like Charles to use effectively in their classrooms. Charles therefore finds that such assessment activities are not beneficial to students. Even though Charles uses student centred approaches in assessment he finds that it is a waste of time whereas Sagie finds that it develops students' understanding.

The concepts of experience, cultural capital and context are relevant to this theme. Both Sagie and Charles negotiate their past experiences in different ways. Sagie sees the benefit of student centred approaches because he may not have enjoyed being taught in a teacher centred way and sees the benefits that student centred methods may have for his students. However, Charles seems to have benefitted from the teacher centred assessments he was given when he was in school and which he used when he started teaching. So he sees no need to change those past experiences. It may also be due to their habitus that has been suggested by the comments made by these participants. Sagie may want to see to the needs of individual students in the classroom being advanced by using student centred methods. There is a deduction from the limited information available that Charles seems to have a habitus that works towards promoting achievement in mathematics and finds that teacher centred methods assists him to achieve this

goal. Context is also relevant here. Charles seems to teach in a context with students that have the relevant cultural capital that is accepted in schools so he is able to use teacher centred assessment to that advantage. However, Sagie, as he has communicated previously, has diverse students in his classroom with differences in cultural capital. The use of student centred methods may benefit these students.

Administration workload offset by technology

> **Khan***: With regards to administration, it means keeping up to date with your books, your marking of books, test records and now with continuous assessment. We have to make sure assessments are completed by students and entered. A lot of time is taken to do all of this even, more so, when compared to the days before the implementation of the new curriculum. I do most of my administration work at home.*
>
> **Sagie***: As a teacher, we have more to do, as compared to the earlier days. It was the syllabus and the curriculum which was much higher powered. NATED 550 was at its peak, in terms of its difficulty and complexity. This was pre 1994. But as technology came in, our workload seemed to have decreased drastically. Previously, you will find us typing on those stencils and running them out. Now it's cut and paste on the computer. You can get a worksheet in five minutes. Those days you had to work overnight to make sure everything was ready. Now, within an hour, you can do an entire days' preparation.*

This theme shows the difference of opinion about dealing with administration burdens. Participants such as Khan, Patricia, Mala and Charles complained about the amounts of administration work they have to cope with. Their administration work with each curriculum change required added preparation, administration work on various assessments which increased their marking as well as making of worksheets. Administration work was a ritual that did take place before the introduction of new curriculum policies, since 1994. However, participants have enunciated that each policy change has increased the range of content areas which has increased their preparation and with new content areas there had to be relearning of these areas, to prepare participants to implement them in the classroom. They have also stressed that there are more assessments than previously and because there are a greater number of students in their class than before, their marking has increased. The participants, therefore, have

to do a lot of work at home which Khan has expressed above. Yet, Sagie has shown that even though the workloads of administration burdens have increased with the new curricula, he is managing to cope better than he did before. He has the advantage of being computer literate which has eased his administration burden. Sagie articulates how easy it is to do preparation, create and creates assessments and worksheets through use of technology. He finds that it takes up very little time to complete these tasks. Although Sagie does not mention marking, it would seem that Sagie finds marking a ritual of teaching and finds little to complain about it. Consequently, the work of the participants in administration could be greatly reduced if they employed technological aids. Although the other participants have not mentioned the use of technology, Khan shows evidence of its use as in his VDK there was a drawing of a laptop at his home. This may imply that Khan prefers to use technology at home but not for administration work as he has not mentioned the use of technology.

While it has been agreed by participants that there is an increase in administration work when implementing a new curriculum, it has also been found that if agency is used as Sagie has done with the use of technology, such burdens could be drastically reduced. Clarke, Clarke & Sullivan (2012) found that technology can be of benefit for the reduction of teacher's administration work, allowing them to extend beyond the written curriculum to web sources and other educational technologies. Bragg (2014) claims that, although the benefits of technology for assisting teachings cannot be denied, access, time and skills are needed to use technology. Perhaps the reason for Khan having a laptop but not accessing the use of it could be attributed to his limitations in skills and time to use such devices. Therefore, while Sagie enjoys the assistance of technological aids to assist him in easing his work burdens, Khan has not found agency to do so which now increases his work encumbrances.

Varied opinions on work burdens inherent in new curriculum policies

> **Sagie***: When a new curriculum is introduced, I would go through the entire syllabus and then see what I can do. Most of it was not new to me. Maths does not change really. It is just bringing in new sections and taking out some.*
>
> **Mala***: The student centred teaching was a big hype when OBE started and one of the challenges I had then was how do you say it is student centred and leave it to the child to figure something in maths. I cannot do that. We were so used to*

following an algorithm in maths and algebra and then just coming up to an answer. And here now we were told that even if the child can do it intuitively and know the final answer or show it by diagrams, some problem solving diagram, you will allocate full marks. Now I found that a challenge because for years of my schooling and when I first started teaching as well, we knew that that is the only way that maths could be taught or learnt.

Mala*: I was never resistant to change. I embraced the change.*

There is a difference of opinion on what is entailed in new curriculum policies. Sagie sees the curriculum as not being so new. It is dynamic in that some sections are taken out but they come back. For him, he knew most of it and when it had gone out, he somehow had not lost touch with it. Mala seems to have an understanding that mathematics can only be taught in one way. She suggests that if there is a mathematics problem, the student has to identify how to work it out then work out the rule, then apply the rule to many examples. Student centredness, therefore, for her, is just a big hype. She does not see it as essential to get to grips with mathematics with its principles. So, she says she is unable to do that. The contradiction is that she says she embraces change but here she is saying she is unable to incorporate student centred approaches into her teaching. For Mala, it seems that getting to the answer is more important than the process. Hence, the product/outcome appears to be most important.

Sagie seems to have come to grips with the new curriculum as he may have adapted some of the old content knowledge to the new content knowledge. Furthermore, he seems to embrace the change so finds the curriculum dynamic, whereas Mala complains about the changes as she has not changed many of her old practices of implementation. Each person, teacher, actor or agent works within social relations in a field having their own attitudes and beliefs (Bourdieu, 1977). Each of the participants has their own beliefs on curriculum change which manifests in how they implement the new curriculum. Bourdieu (1977, p. 214) calls these internal attitudes and beliefs that an individual has, the habitus, and it is defined as *"a system of lasting and transportable dispositions which, integrating past experiences, functions at every moment as a matrix of perceptions, appreciations and actions and makes possible the achievement of infinitely diversified tasks"*. An individual has their own habitus which is gained from their past experiences which in turn shapes their future experiences. Mala and Sagie's past experiences shape the way they are. For Mala, she has adopted her habitus from her past

experiences and is loath to change it, although she does contradict herself in perhaps wanting to be politically correct by saying she embraces change. Sagie on the other hand has embraced the change and find the curriculum to be dynamic. It seems that his habitus allows him to adapt to the change and to be able to accommodate future curriculum changes. He does not therefore, complain about such work in implementing curriculum change while, Mala finds it difficult to cope with the change so she finds her work more difficult.

Themes denoting inconsistencies found in a participant

Established in profession and embracing change

> **Mala:** ***Firstly, when I look at myself before getting into this profession, I honestly thought it was something you would establish yourself and you would have to do the same thing for ever. But with all the curriculum changes it is definitely not that. It is rather frustrating as you get older and you think you settled in your job and here comes something new.***
>
> ***Mala: I was never resistant to change. I embraced the change.***

Mala shows inconsistency when speaking about change. Mala is entrenching the point made previously about the reason people get into this profession. She now also talks about frustration and getting older. So in a sense she is also going through time and over time changes have to take place. Ironically, she says she was never resistant to change and she embraced the change. However, she never expected change that is so frequent. Perhaps it is harder for her to actually change. It suggests that she was trying to be politically correct in saying that she was never resistant to change. The fact seems to be that Mala likes things not to change, and in order to project herself as not opposing change, she has to take that into account, which makes her work more difficult.

Even though Mala struggles to make the change, she does so because she wants to show conformity. She does not want to be seen as different from the others. In so doing she conforms to shows symptoms of conforming to Foucault's (1980a) 'governmentality'. So, although she shows resistance to change by complaining about it, she still says she embraces change as she wants to follow societal norms and does not want to be seen as different from other teachers who adapt to curriculum change. Gregoire (2003) believes that teachers' subject knowledge

beliefs and the way they implement such subjects may limit them from adopting new practices that clash with their beliefs. So, in Mala's case, she struggles to make the changes because she may believe that mathematics should be taught in a certain way and with curriculum change introducing student centred methods, these clash with her beliefs. Mala's assertion of wanting to embrace change may mean that she hopes to integrate the new knowledge with her previous knowledge. Gregoire (2003) challenges such an approach, as he believes that such integration will prevent a proper conceptual understanding of the new knowledge; the previous knowledge will bias the understanding and will fail to lead to true change in attitudes and beliefs. Guskey (2002) found that change can only occur if teachers find that a new instructional approach actually works. He established from his study that teachers believe that such an approach actually works only if students' results improve (Guskey, 2002). Participants have indicated that they have had little training in the new curricula and may have not experienced that they work in their classes, so will resort to practices that they have found, do work for them but maybe are not reflected in the outcomes which are students' results. Guskey (2002) points out that educating oneself to be adept in something new requires time and effort which participants do not seem to have. Therefore, change for Mala may only occur if she has enough time and effort to make the change. This will exacerbate her work demands in making the change to a new curriculum. With her resistance to change, the resultant biases that she has will not result in a true conceptual understanding and will impair the implementation of a new curriculum.

Association of geometry with critical thinking and work burdens

> **Sagie*: Geometry was removed and the reason they brought geometry back is this whole question of critical thinking. When you do geometry automatically you are becoming a critical thinker and universities complain how this can be left out of the school syllabus when engineers and those that can think at another level have to be produced.***
>
> **Sagie*: We questioned why geometry was removed but I must be honest as teachers we were happy that it was removed because it made our job easier.***

Sagie shows inconsistency when talking about geometry as a content area. On the one hand, Sagie connects geometry to critical thinking and sees the value of it. Yet, he is happy that it was removed as it made his job easier. He sees curriculum as either easing the burden of a teacher or increasing it. If you take out some sections of the mathematics curriculum, that

appears difficult to teach, even if it is important, it makes Sagie's work easier. Because it was brought back, it does make it more difficult for him to implement geometry in his classroom.

Although Sagie sees the value in reintroducing geometry into the curriculum, he actually welcomed the removal of geometry from the curriculum as it made his work easier. Leong and Chick (2011) determined that teachers are also faced with other challenges such as time; context (Brodie, 2010) and resources (Reddy, 2006; Vithal & Volmink, 2005). These challenges impact on teachers' work and policy implementation. Such challenges that Sagie faces in his classroom make teaching a content area such as geometry, which is thought of as an abstract subject, difficult to teach. Moreover, Slonimsky and Brodie (2006) posit that curriculum innovations require teachers to co-ordinate contextual and knowledge structures which takes a long time to develop (Slonimsky & Brodie, 2006). Therefore Sagie, finds teaching geometry difficult as he has to overcome other challenges that he finds in his classroom to bring about conceptual understanding in geometry. The concepts of context, ideology, experience and cultural capital is pertinent to understand why Sagie welcomed the removal of geometry from the syllabus, yet he sees the benefits that geometry has for students. It has to do with meeting the needs of the diverse students within the context that he teaches in. It seems that ideology does not consider the individual, their differences in cultural capital as well as differences in their intelligence. Sagie finds trying to meet the needs of all the students an overwhelming task. To teach geometry to these diverse students is almost impossible as the teacher has to integrate the experiences of these students with the present task of teaching an abstract content area such as geometry.

Context and implementation

> **Patricia***: Well I am very patient with students because I know they cannot afford the ruler, calculator, we have a problem with that as well so we allow them to borrow. And language is a problem. I think most of them are unable to interpret the questions so I have to explain to them.*
>
> **Patricia***: It is very difficult for us. Many students don't complete their homework. As a result our syllabus is not completed timeously. So we have to have afternoon classes for matriculants. Because students come from poorer backgrounds we have to prepare more worksheets to meet their needs.*

Patricia shows inconsistency as if you look at the dimensions, she has patience when students do not have something and cannot speak the language. However, she has great difficulty when homework is not complete and she is unable to complete the syllabus. So she has to do extra teaching. She seems to be frustrated by the extra work such as drawing up more worksheets and trying to complete the syllabus. Then again, she says the extra work is because of the students being poor rather than with preparation for the mathematics curriculum.

With Patricia, there is a clear indication that she is frustrated with the work demands of trying to implement a new curriculum in the context she teaches in. Although she says she is patient, the work demands are burdensome to her. Context, therefore, causes more work demands on a teacher who is trying to implement a new curriculum. There are wide -ranging demands on resources, as students come from different social backgrounds, have different achievement level and even the level of pastoral care varies from school to school (Klusmann et al., 2008). Patricia struggles with the work demands and her own beliefs. While she may be patient with the students, the challenges of the context that she works in, causes frustration. Teachers are now faced with such dilemmas and that causes difficulties as they have to, as Psycharis (2015) discusses, negotiate their external and internal (own beliefs and attitudes) when dealing with contextual factors. There seems to be a clash between the cultural capital of the teacher and the students. The teacher, in trying to ensure achievement by turning out more worksheets and having afternoon classes, struggles with what she believes is lack of mathematical knowledge in her students due to poverty. It could be the case, however that township children's lives are rich in African cultural capital and the corresponding habitus, but then a conflict is bound to occur between their habitus and the privileged western cultural capital and corresponding habitus of school knowledge.

Theme showing ambiguity

Working with children and curriculum changes

> **Charles*****: When I started I enjoyed teaching. But things have changed now with the new curriculum. It is harder but I'm not having such a big problem because children in my school are fantastic.***

Charles*: The curriculum has changed but when it comes to student centred in maths, it does not work. You have to teach. It is not something that a child can discover. You have to teach the rules.*

Charles shows ambiguity. Charles is clear that he enjoyed teaching when he started. With the changes, he finds it more difficult, but, he seems not to be having problems. However, what is not clear is whether he is experiencing the same level of enjoyment or whether enjoyment has been replaced by just accepting what he believes is change. The ambiguities also lie in that previously, he enjoyed teaching, but now he enjoys working with children. So there is an ambiguity about teaching and working with the children. Charles has also indicated that he prefers using the chalk and talk method to teach, using mathematical rules, which he says works best in mathematics. It would seem that his implementation methods have not changed, therefore, he finds the same level of enjoyment in working with the children. However, he finds the curriculum harder, which may have not been so before, hence he sees the change in the curriculum leading to imposition on him rather than with him working with the children. If Charles is not clear with what gives him enjoyment, whether it is the pedagogy or the students, then it will impact on how he understands his work and how he sees the burdens of work.

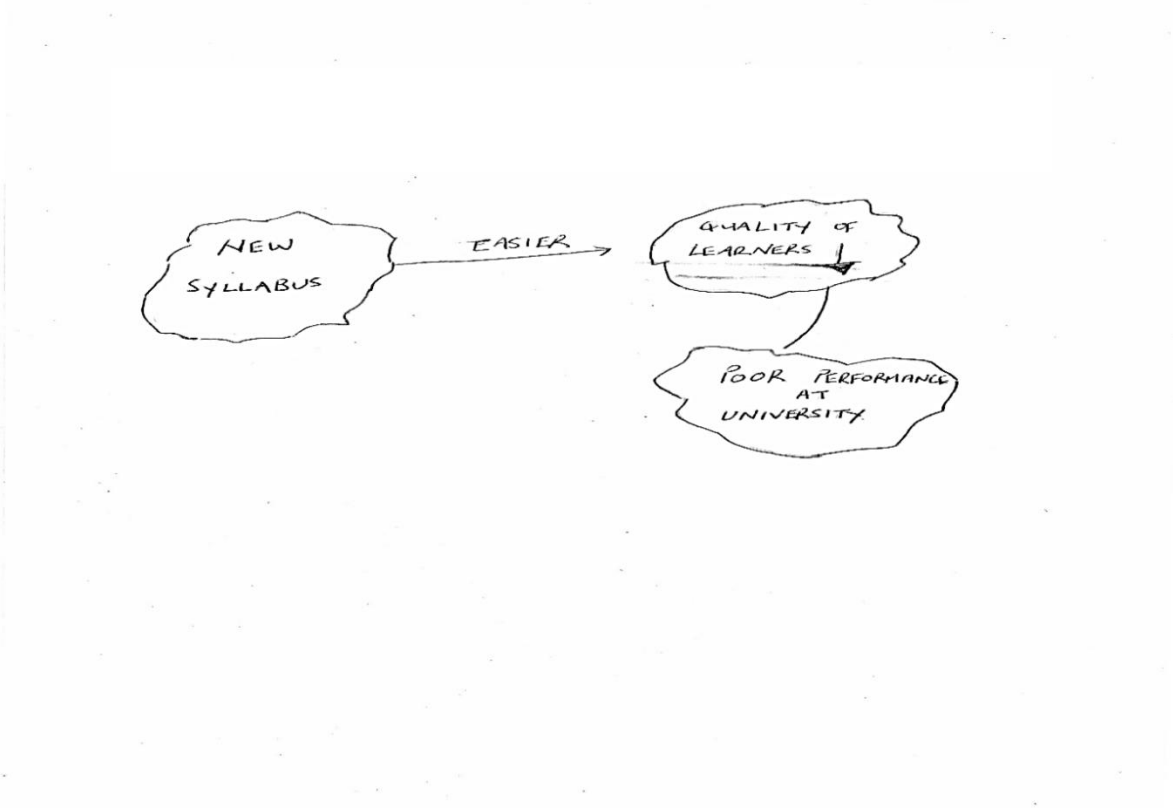
It is evident that Charles has not made the change to the pedagogical knowledge used in the new curriculum. He seems to be still teaching the way he was taught and the way he taught before 1994. Hence, he sees little change with working with the students and may just find that curriculum changes are harder. Perhaps he refers to the pace and content. Abramovich and Connell (2014) argue that teachers like Charles teach mathematics in the ways they were taught it and this means resorting to traditional mathematics procedures such as memorization and finding one right answer (Abramovich & Connell, 2014). Leong and Chick (2011) point out how the work of teachers is impacted by their having to complete the syllabus, to teach mathematical reasoning and encourage participation in discourse, within limited timeframes and policies that do not cater for such activities in the timeframes given, yet prescribe these activities. Therefore, teachers like Charles continue to use procedural methods that are dominated by teacher discourse, calculating answers and memorizing procedures (Abramovich & Connell, 2014; Drageset, 2014).

The influence of Charles' past experiences and his cultural capital induces him to view the way mathematics should be taught. He believes in exactitude in teaching mathematics, like an engineer, and since he was taught in that way he continues to teach in that way. Charles, therefore, finds no need to change the way he has taught before so he finds the same level of enjoyment with working with students as he has done before.

Themes of contradiction

Matriculation distinction, tertiary failure

> **Charles:** ***With the new syllabus, my personal opinion is that the maths has now become easier. There are more children getting A's that should not be getting those symbols.***



Charles VDC and his statement above suggest that there is a contradiction that arises from new curriculum policies. Charles claims that the CAPS syllabus is not of good quality. Some participants have stressed that there are too many content areas and the curriculum is fast paced. Charles has found that the curriculum has not sufficiently enriched students to get distinctions

and to cope at university. His visual drawing shows that the new syllabus is easier which he assumes produces weaker quality of students who are not able to cope at tertiary level. While, it has been mentioned several times by participants that the pace set for the new curriculum allows only higher achievers to cope, these higher achievers are unable to perform as well at tertiary level as those in the past. It seems that although the curriculum is fast paced, there is a neglect of challenging dimensions to the mathematics curriculum which may enable students to cope at university level. It also appears that the curriculum is exam driven in order to show good achievement by students. Yet quality is neglected, as the same students, according to Charles, are unable to cope in their chosen fields at university level. Therefore, the pace at which the curriculum functions and the large number of content areas seem to add work burdens to the participants rather than develop students adequately.

From the remarks of Charles, there appears to a contradiction between the achievement of students at university level and at matriculation level. Charles suggests that the syllabus is watered down thereby allowing students to perform well at matriculation level yet those same students fail at university. There is a suggestion made by Charles that the Department of Education in South Africa wishes to demonstrate that new curriculum policies are working, if students perform well at school. Pitoniak and Yeld (2013) argue that the National Senior Certificate, the big test in South Africa, that is the school exiting examination, seems to conform to acceptable standards and thus masks the educational challenge of high levels of failure. Furthermore, mathematics can be seen in terms of its market value so those students who achieve will have access to better careers. Perhaps, the Department of Education, in their endeavour to give more students access, have neglected quality. Chakaia, Andguladze, Janelidze and Pruidze (2014) as well as Williams (2012) stress that those that acquire mathematical knowledge will contribute to the higher echelons of society. Thus, an increased number of students performing well at mathematics may contribute to the economic success of the country. Yet, student achievement seems to be related to quantity rather than quality in new curriculum policies as the pace and content denies quality. Therefore, the contradiction arises that students that perform well at school level are unable to show such achievement at university level.

Curriculum prescription and textbook choice

> **Mala*: As for textbooks, many of them were flawed and maybe it is old school but I preferred the time when the department just recommended textbooks. For C2005 and CAPs there were several mistakes in the textbooks, too many choices of textbooks and also they were flawed. The maths in it was flawed; there were mistakes in the textbooks.***
>
> **Charles:** ***Our curriculum is very prescriptive.***

Mala and Charles suggest a contradiction between curriculum prescription and textbook choice. Charles simple statement above denotes his anxiety with the new curriculum. He, like the rest of the participants, finds the new curriculum very prescriptive, demanding that they keep to tight schedules to complete on time so as to prepare students for common papers. It would appear that with the curriculum being as stringent as it is, the participants have had to work closely with the curriculum in order to complete it. There seems to be no agency allowed to the mathematics teachers on content, time and assessments. Participants have to follow through closely to make sure they complete they curriculum. Nevertheless, the contradiction arises on the freedom of choice of textbooks given. Mala has pointed out that she and teachers like her are given a choice in the choosing of a suitable textbook to use in the classroom. With so much prescription in the new curriculum policy it seems foolhardy that the opposite rule should apply to textbooks. Mala states that she has not as yet found a textbook that covers all the content areas sufficiently. Hence, it appears that more work is allocated to the teacher to find a suitable textbook. It also implies that if a teacher, like Mala, is unable to find all the content areas in one textbook then she has to use several textbooks. If the school cannot afford to buy several textbooks for the students, then Mala will have to make worksheets to cover depth in sections that are lacking in the chosen textbook; hence, additional work burdens ensues.

The adherence of participants to the prescription of the new curriculum policies is in accordance with the state's dominant ideology of increasing student achievement. The state subscribes to global initiatives and they set the rules of following this path through the curriculum where mathematics is a high status subject and will increase the economic standing of the country (Mhlolo, 2011; Apple, 1992). The state's agenda seems to be about improving mathematics education so that South Africa can compete in the global market. Mathematics is

seen as a subject that will bring economic success to the country (Mhlolo, 2011), though, policy makers equate volume and completing the syllabus as an indicator of meeting the standards. However, the same rules do not apply to prescribing a textbook, as is indicated by Mala. It would appear that the state's dedication to improve student achievement using curriculum policies does not extend to textbooks.

Exam driven and learning for understanding

> **Charles***: Nothing else can be done. Does not allow you to be innovative. Even if you find time, maths is a subject that does not entail itself to the kinds of assessment that they are prescribing, I cannot see why a child should build a bridge or even a cube and show me and get marks for it. It does not show me any mathematical knowledge at all. Investigation is where they go through stages in a process and then discover something at the end.*
>
> **Charles***: Our system is exam orientated, unfortunately.*
>
> **Patricia***: Well basically I have to discuss all the rules and I do examples with them. Thereafter I give students applications. Most of the sections are dealt with in this way which is teacher centred. We are not given enough time to do student centred activities. We have to prepare students for exams.*

Patricia and Charles demonstrate a contradiction of their practices of teaching for examinations rather than for understanding. Charles' communication suggests that he lacks the ability to apply mathematical principles. He doesn't seem to realise that building a bridge or even a cube is related to mathematics and it requires some understanding of mathematics to be able to do those constructions. He sees that as unnecessary. He seems to be caught up in the chalk, talk and write method. He feels that the pen and paper activities are useful and not constructions. Yet, you can see the contradiction as he says that our system is exam orientated. The system is evaluated by exam but it is not exam driven throughout if you consider some of the activities such as student centred activities. Patricia, like Charles, feels the same as she finds it easier to teach rules and so on. Yet from literature we understand that students need understanding, more than rules. They need to understand first before they get the rules. Charles and Patricia are caught up in thinking of teaching as work and perhaps that is why they cannot see the importance of this discipline for the future of the students. When there is focus on the labour, then one misses out on the principles of mathematics. The deeper functions and the

epistemological foundations of mathematics are not understood by the teachers, a lack shown up in their classroom practice. For Patricia, it seems that she teaches a rule, students apply it and that is how they will pass the examinations and the same with Charles. They teach for examinations rather than for understanding.

Patricia and Charles base their teaching on the traditional approach of teaching which orientates them to teaching for an examination rather than for understanding. Teachers still hold on to the platonistic view of teaching mathematics (Webb & Webb, 2004). Furthermore, teachers such as Charles do not find any value in student centred methods and may only do so because the curriculum prescribes it. It would perhaps reflect on the cultural capital of these teachers because of what they value. Teachers have their own cultural capital which is developed primarily through the family (Zembylas, 2007) and is given statuses according to what the dominant social class values (Giroux, 1983). With the prescription of the curriculum and with participants professing to being held accountable for the results of students, the emphasis falls on the importance of examinations rather than student understanding. So Charles and Patricia will work hard using their old, traditional methods to prepare students for the immediate examination rather than an understanding of mathematical concepts that can be used in the students' foreseeable futures, in tertiary education and in their everyday lives.

Conclusion

There are differences of opinion amongst teachers and the differences relate to where they teach, who they teach, the experience that they have and the pedagogy. This then intensifies their work and makes it more difficult. This data analysis chapter serves to highlight the contradictions, differences, inconsistencies and ambiguities present in their work and the contexts within which they teach. It allows a glimpse into the work of teachers. While participants have communicated their work issues with implementing a new curriculum, many contradictions arise, which will assist in understanding why they experience such work burdens. The next chapter will conclude the thesis by highlighting the new knowledge prevalent in this thesis.

Chapter Seven

Findings: Contradiction and opportunities

Chapter orientation

Chapters Five analysed how new curriculum policies influenced mathematics teachers' work and why it did so in the way it did. Chapter Six re-examined data from Chapter Five to find the contradictions, differences, inconsistencies and ambiguities. This chapter concludes this thesis by discussing the main finding of the thesis using the heading: **Policy contradictions of equity and opportunity for all**. The conclusion of this thesis will discuss the implications for this study; delimitations of this study and the concluding remarks.

Policy contradictions of equity and opportunity for all

Policy changes had been initiated by the post-apartheid, ANC government's need for redress of past inequalities in favour of equity and an opportunity for all race groups to have an equal education. The student-centred, critical-thinking and problem solving approach which is propagated by the new curriculum policies (Department of Education, 1997; Department of Education, 1995) has its roots in the Freirian (1971) philosophy. Freire (1971) rejected the behaviourist form of learning that the traditional mathematics curriculum was composed of where the teacher dished out knowledge. Instead the critical pedagogy proposed by Freire (1971) was designed to encourage critical thinking and democratic values. Teachers are motivated to create a critical pedagogy in their classrooms so students can understand the forces that shape their lives and make decisions using a critical outlook (Freire, 1971).

Policies have been geared towards the change, however findings have shown that participants were not adequately prepared for the change. Workshops were neither adequate nor continuous to ensure such change in the implementation. Participants have indicated that they had to work long hours on their own to prepare them for the changes. Even with the long hours that they worked they encountered content gaps and had to seek avenues to find help for themselves which they did through collaboration with each other and with an expert who assisted them without any benefits to himself in terms of salary and scheduled work hours. Furthermore,

participants have been faced with numerous challenges such as large classrooms, diverse students (race, cultures, language and abilities). Apple (1992) did warn that an overemphasis on an egalitarian education system will lead to a crisis in the economy and culture. This means that equal distribution of resources to schools will lead to public schools having little resources and an unmanageable multicultural class size. This is what has been experienced by participants. Even so, participants did indicate that they welcomed the change and foresaw avenues of growth that will benefit their students. However, as soon as participants became used to one curriculum then new policies were introduced such as RNCS, NCS and now the latest CAPS. With each change there have been numerous content changes, with the introduction of many sections that participants were not familiar with. This meant more work for them to prepare to implement each policy change. Although the principles of OBE remained the same, such as equity and equal opportunity for all, the policies have changed to the extent that teachers are required to follow policy guidelines strictly in limited time frames. The centralisation of education policies shows more control by the government (Apple, 2003).

One can now see the contradiction. Participants suggest they are not allowed to show agency in their classrooms. They do not have the time to employ student-centred approaches and use methods that will be of benefit to students. They are required to complete the syllabus in required timeframes which are not enough. Darling-Hammond and McLaughlin (1995) assert that the narrow timeframes and accountability issues in curriculum policies obstruct teachers from reflecting on the needs of individual students which also leads, according to Ball (2008), to an increase in administration duties. With teachers being held accountable for student achievement, teachers feel increasingly disempowered and professionally disregarded. Participants have repeatedly articulated their frustration at not being able to meet the needs of all students. It would seem from the suggestions of the participants that the new curriculum policies have increased their work burdens, have caused them to feel de-professionalised and have taken away their agency. Biesta and Tedder (2006, p. 11) define teacher agency as the ability to *"critically shape their responses to problematic situations"*. In the study, Sagie was able to use his agency in combining different instructional strategies to teacher-centred methods and student-centred methods to solve some of the problems he experiences while implementing the new curriculum. However, this has not been the case for the other participants. Mala, Khan and Patricia, especially, have experienced other challenges and have articulated that they found it hard to use their agency when implementing the new curriculum,

so they have to teach generally to all students which means that they are not able to take care of the individual needs of the students in their classroom. So while teacher agency is important for teachers to use to solve problems and make plans to assist all students, there are other issues that need to be considered such as the context as well as teachers' own knowledge to be able to use their agency adequately. Priestley, Edwards, Miller and Priestley (2012) argue that the extent to which a teacher can use their agency varies in different contexts that they teach in as well as in their own beliefs and values. Patricia and Khan have experienced many challenges with large class sizes, diverse student abilities, language barriers as well as teaching students from poorer socio-economic backgrounds. These challenges have made it difficult for them to use their agency to meet the needs of each student because of the numerous work burdens that ensues. All participants also complained about the tight schedule they have to keep to in completing the syllabus. Mala and Charles showed difficulty in trying to change their beliefs and attitudes in the way they felt mathematics should be taught and these beliefs may have also resulted in their not using the student centred methods that are advocated in literature (Bansilal, 2011; Vithal & Volmink, 2005) to develop deep conceptual understanding of mathematics concepts.

Depending on the context they come from, Sagie and Charles have signposted that the new curriculum policy benefits the students of higher abilities as only these students can cope with the completion of the syllabus in such tight timeframes. Although participants have verbalised the benefits of student-centred approaches they are not able to use these approaches in the classroom because of the timeframes. They then resort to behaviourist, traditional teaching methods to teach mathematics so they can teach generally to complete the syllabus without meeting the different needs of students in their classrooms. Charles, a participant from a more affluent context, indicated that the curriculum is not benefitting even students with higher abilities in mathematics as it is not enriching them adequately to meet the demands of university education.

There is an implication that the new curriculum policy is causing teachers to become robotic and to deliver lessons to get maximum output. It is implied by participants that quantity of content rather than the quality of implementation has been the underlying aim of the system. The factory scenario is relevant here as participants have to work to complete the syllabus in

unrealistic time-frames with no time for creativity and innovation to make lessons interesting and to gear lessons to meet individual needs of students. From the communication of participants, the new curriculum policy seems to contradict the democratic principle of equity and giving equal opportunities for all as is seems to be further separating students, making it easier for students from average and higher socio-economic backgrounds to succeed while leaving students from poorer socio-economic backgrounds, to fend for themselves. This is a paradox as it contradicts the equity principle of post-apartheid curriculum policies.

Participants implied that they are exam-driven and so is their teaching which suggests that there is an attempt to ensure achievement through student outcomes. Participants communicated that they were very concerned about being found to be deficient with preparing their students for the examinations. The challenges that they brought up had a bearing on such a suggestion. All participants articulated their apprehension with the depth of knowledge needed for them to be able to teach this content. Their apprehension was due to them stressing about not being able to prepare students adequately for the examination. Mala was also worried about not being able to choose the right textbook. She found that textbooks were flawed and there was no one right textbook. Again, her concern implies that she had found content gaps within the textbooks and will therefore not be able to prepare students adequately for the examinations.

All participants have worked hard implementing the curriculum, using even their spare time to prepare students for examination. They have shown that they have limited time to complete the syllabus during school hours so they have to work after school hours and during weekends to make sure they cover the syllabus adequately in order to prepare students for the coming examinations. The data collection took place in 2014, the first year in which students wrote matriculation using the new CAPS syllabus. Teachers showed distress over this during the interviews and the focus group discussion as they were not sure what the examinations would be like and what depth would be included in the content. Their apprehension indicates that they are exam driven which is also due to the increased monitoring and accountability issues they face.

Teachers have indicated that there are many monitoring tools that have been used to make them accountable for student achievement. It would seem that the constant change in curriculum policies and the accountability burdens that they say are placed on them to show increase in student performance, indicate that department curriculum planners hope to increase achievement of students in South Africa. Nevertheless, it was found that the mathematics score profile of students graduating from school show achievement that is not good enough to pursue careers in the science and engineering fields (Pitoniak & Yeld, 2013; Reddy, van der Berg, Janse van Rensburg & Taylor, 2012; Reddy, 2006). Even the National Senior Certificate, the big test in South Africa, that is the school exiting examination, masks the educational challenge of high levels of failure (Pitoniak & Yeld, 2013), hence, the constant curriculum revision to improve student achievement in mathematics. So the policy itself has influenced these teachers to be exam driven and to revert to practices that they used previously. Participants have discussed the monitoring tools used to check their work within schools as well as at department level. They have the internal and external moderation of their work and student assessments, and departmentally set examinations to check the results of the achievement of students. Participants did admit that they tried to complete the syllabus, even superficially, to show that they are keeping pace with the curriculum. Mala has also indicated that students' work was monitored and they have to keep student portfolios with a record of students' work that they have to produce when required. This has produced more work burdens for them as they have to maintain these student portfolios and have to work hard to complete the syllabus because they are held accountable for the achievement of students. The centralisation of education policies is making teachers exam driven but it is also their own cultural capital that has made them the way they are. There seems to be effort from the Department of Education in South Africa to ensure achievement through prescription in curriculum policies. Participants experience this as they strive to work towards preparing students in such a way, using traditional methods of teaching, contradicting policy ideals of using student centred methods to ensure that diverse students are given equal learning opportunities. However, it was found that in their striving to complete the content prescribed in the policy, participants have indicated that they neglect the use of student centred methods which can lead to conceptual understanding and the growth in abilities of all students. Instead, they have shown that their work burdens consist of covering content, keeping pace and preparing students for examination when using the new curricula. Student centred methods are only used when required through prescribed assessment which Charles found was not conducive to mathematical knowledge.

The participants' context knowledge, content knowledge as well as pedagogical knowledge was called into question as with each curriculum change they found changes that they could not cope with and had to work hard to try to cope. However, Mala did stress that when she started to cope, then there was another change and the burdens reoccurred. It was also found that when participants struggled to cope they resorted to teach as they had learnt in schools. Again the equity ideals seem to be neglected as participants have indicated that they now use rote learning and mathematical rules which they found was the only way to cope with completing the syllabus and preparing students for examinations. However, many students, according to the participants, have been disadvantaged in this way. Khan and Patricia found challenges teaching large classes with mostly second language students who come from poorer socio-economic background. Students were blamed for their apathy towards mathematics and participants found that student results were poor because of the contexts that they have come from. In trying to cope with content and pace with which new curriculum policies burden the participants, they did express concern that in their classrooms they could not meet the individual needs of students.

Participants labelled student apathy as one of their challenges. They felt that results were not good because students do not want to achieve. Patricia indicated that students at her school have poor discipline therefore they did not do well in the examinations. She understands that if students are well disciplined then they will do well in mathematics so she is propagating the dominant view that achievement, especially in mathematics, is important. Charles also conversed about how disciplined and motivated his students were. So he is also conditioned into believing that if students achieve then he has accomplished something. It has to do with their status as mathematics teachers. Bourdieu (1973) argues that education converts social hierarchies to academic hierarchies which perpetuate the social norm of achievement linked to better careers.

Charles and Sagie discussed grouping students according to their abilities. Although this goes against the policy directives of equity, it seems that participants are finding ways to show student achievement thereby proving that they are exam driven. They want to group students, not only to make their work easier but because if similar ability students work together, they will be able to ensure student achievement. Participants felt that if they have a class with

students of similar abilities they could work at their pace to complete the syllabus and in a class with students of higher ability they would ensure students will achieve adequately at university with their chosen mathematics fields. They are finding solutions to meet the needs of all students in their classroom which does show teacher agency, however, this does not meet the equity ideals of giving all students an equal education.

Participants have all indicated that they implement the policies as required by the Department of Education, as they are held accountable to do so. Even with the many work burdens, contextual challenges and power issues as well as overcoming their own resistance to change, participants seek to do their best to follow curriculum dictates. In so doing participants show that they abide by changes which increases their work burdens with each curriculum change; their complying in what they assume is required of them suggests that a vast majority of students are ignored if they cannot keep up with the pace and content of each curriculum change. The following concepts in the conceptual framework are used to discuss how policy dictates have caused participants to contradict the democracy and equity foretold in curriculum change since 1994.

State ideology – All participants have followed state policies rigorously which therefore denotes the control of the state through their dominant ideology. Participants have indicated that the way the curriculum policies are formulated leaves little room for changes. In this way teachers are obliged to follow curriculum policies as they have little choice. Furthermore, teachers are held accountable for students' performance and have to show evidence of their work and the students' performance in school and to departmental officials out of schools. This accountability serves to ensure that they follow curriculum policies. Althusser (1971) argues that a state apparatus influences the way teachers work, as it is a force that is subtle and accepted as everyday practice. With the curriculum policy being the state apparatus, the teachers accept that they have to implement the curriculum policy in the way that it was meant to be implemented with the rules, regulations and requirements, such as being accountable for students' performance, ensure that curriculum policies are implemented in such a way. Even if a teacher wishes to shows resistance to implementing the curriculum policies as is required by the state, these rules and regulations prevent them from showing such resistance.

Influence of social networks – Participants have described the formal networks within and out of school, that seek to guarantee that they implement curriculum policies as is required of

them. The contexts that they teach in are hierarchical in structure and teachers have to follow protocol by following the top-down nature that is prevalent in all the contexts that participants teach at. New curriculum policies are disseminated in this way and teachers implement policies as, they assume, the state requires them to teach. If the network assumes a hierarchical structure, which seems to be prevalent in most schools, then the way policies are implemented will be according to demands made by the School Management Team (SMT). Sagie, one of the participants, did question this and although he says they have a democratic channel of communication within school, teachers still have to follow protocol and meet standards set by the SMT. However, what was positive from the knowledge gained by participants, is that informal networks within and out of school who share burdens help these participants to relieve their stress. Dewey (1916, p. 2) stated *that "education is the means of the social continuity of life"*, a quotation that is quite applicable as participants have indicated that they act through these social networks to help them implement new curriculum policies. These social networks, formed through collegial relations amongst colleagues, are used to assist teachers to understand the policy requirements and to find out more about content in the new curriculum policies rather than to find alternative ways to reach and teach all students. Participant agency has been used here as these participants have sought help to manage content knowledge. However, it was found that they did not seek assistance in gaining the pedagogical knowledge to use student centred methods and to manage large classrooms of diverse students.

Experience – Although participants did find that their past experiences were familiar, these experiences were used to actually assist them to manage new content knowledge in new curriculum policies. The circular structure of experience as proposed by Gadamer (1975) shows how participants' past experiences integrate with their present experiences to determine how they implemented new curriculum policies. Charles found that having had a wealth of experiences, first of all as a student and then a teacher, had helped him to work around using new teaching methods so if he could not cope he had something to fall back on. Khan also found that his past experiences gave him the ability to adapt and change. So instead of making teachers resistant to the new changes, past experiences has helped them to work with new curriculum policies. Therefore, Dewey's (1916) principle of continuity fits aptly as participants' past experiences have helped to shape their future experiences. So much so that if they were taught to obey and follow instructions, they are using the same learning experiences of obedience to follow new curriculum policies. However, participants have indicated that they revert to using mathematical rules and regulation in the platonistic fashion that they were taught

in, to cope with content changes rather than employ the student centred methods asked for in the new curriculum as it makes it easier for them to cope with the prescription of the new curriculum. Mala and Sagie showed how their backgrounds shaped the way they implemented the new curriculum with Sagie seeking to change what did not work, while Mala was comfortable with the way she was taught and saw no reason for the change. Their different experiences have affected the way they have implemented the new curriculums.

'Governmentality' – Policies are handed down to teachers with instructions for use of the policy, in a top-down manner. This hierarchical type of dissemination of the policy informs the way policies are implemented in the classroom. Foucault's (1990; 1980a) notion of 'governmentality' is evident here as there is a control of the participants who are bound by rules and regulations set up to implement the policy adequately. Participants have indicated how policies are issued and implemented in ways that demonstrate power as there is dominance of hierarchical structures which ensures control and obedience to policy instructions. These teachers take this top-down approach as the norm and follow the regulations without resistance. Sagie found challenges which he has complained about but when nothing was done about it he continued teaching as was required by the curriculum policies.

Cultural capital – Participants replicate Bourdieu's (1971) notion of cultural capital as they show signs of subscribing to dominant values of society. As mathematics is regarded as a high status subject, participants, being mathematics teachers, echo the value of mathematics in preparing students for their places in society. They have communicated that the present curriculum policy actually seeks to separate high fliers from the weaker students and serves to further disadvantage weaker students, yet participants continue to do their best to follow policy dictates to groom certain students to achieve success.

Context – All participants described their contexts which were found to be different from each other yet they have to implement the same curriculum policies in their different schools. With each curriculum change participants have faced challenges and increased work pressures. However, even with the numerous challenges, teachers have indicated that they work hard to implement the new curriculum policy in their individual contexts as they presume it should be implemented. It seems that the more challenging the context is, the harder the participants have worked to make sure curriculum demands are met.

What is becoming increasingly clear from the findings is that there is very little communication between curriculum planners and the teachers who implement the new curriculum policies. The challenges that participants have revealed when implementing new curriculum policies seem to have been not heard by the curriculum initiators, reviewers and planners. Although policy developers undoubtedly have intentions of improving education in South Africa through using constructive ways to bring about meeting the diverse needs of students in the classroom, participants have shown that they themselves lack the knowledge to do so. Participants have felt that their complaints are not heard. Darling-Hammond and McLaughlin (1995) suggest that teachers should have opportunities to participate in seminars and focus groups which will allow for debates and the possibility of being heard and heeded. Another suggestion given was that curriculum developers should allow time for teachers to work and learn with others and in this way they can learn new skills and unlearn previous beliefs and practices (Darling-Hammond & McLaughlin, 1995). Participants have also confessed to needing help with theoretical knowledge; their challenges imply that they have a lack of knowledge when dealing with diverse students in their classrooms as well as being unable to cope with the contextual issues that add to their burdens of implementing a new curriculum. They have indicated that they need proper training and on-going professional development. Participants, especially Sagie, complained about not having teachers' agency needed to make lessons conceptually stimulating for students. They felt bound to the curriculum, which implies a sense of being de-professionalised; Priestley, Biesta and Robinson (2012) report how agency is removed due to the prescriptive curriculum and unfair systems of testing and inspection. There were also complaints from participants that the curriculum does not give them agency to develop students adequately in one content area before going on to the next. Despite this sense they have of their lack of agency, it is nonetheless obvious from the findings that while content, pace and assessments have been prescribed by the new curriculum, teachers have in fact been given agency to employ their own instructional strategies. It seems this way as participants chose to use agency in teaching in a way that they were comfortable with. Most chose teacher-centred methods. It would therefore appear to be that if they were better trained in using student centred methods and were given adequate time to do so they may have chosen to do so.

While changes in curriculum policies were inevitable in the transition from the apartheid era to the democratic education systems, there have been frequent changes which have been burdensome to the participants. Mala expresses it quite adequately when she said that as she

becomes familiar with the curriculum then it is changes and she has to start all over again. The many challenges teachers face with curriculum prescription, time-frames, content challenges as well as context burdens have overburdened the participants with work. These dilemmas and with the main quandary of not meeting the needs of all the students in their classroom and trying to do so, have made it difficult for participants. Curriculum planners and teacher implementers of the curriculum have to share their burdens which might then result in change in student achievement and policy outcomes.

Implications of this study

The rationale for this study was to understand and critically analyse the influences of curriculum policies on teachers' work because it was not clear how the advent of curriculum policies influences the work teachers actually do in the classroom. What has been derived from this research is that teachers have been over-burdened with implementing new curriculum changes in their classrooms. Although they have protested about some of the repercussions new curriculum policies have had for themselves and their students, they continue to work hard to implement these policies. This study will assist in making evident the challenges that these teachers face every day in the institutions that they work in. Curriculum planners and policy makers can make use of the data in this study to note the fears and challenges that teachers on the ground are faced with and perhaps create interventions that will benefit these teachers and education on the whole. Although this study has been conducted in South Africa using South African curriculum policies, this research is applicable to many third world countries that have faced colonialism and now face the challenge of giving an equitable education to all. Even though two decades have already passed since democracy has reached South African shores, there are many issues still prevalent, in giving students an equitable education. The challenge still remains that teachers who have to implement new curriculum policies that are supposed to be giving this equitable education, are not being heard or, if they are, their concerns are not being heeded.

I sincerely hope that this research will assist in getting worthwhile intervention programmes going which will assist teachers to meet the challenges of new education policies. Teachers need assistance and with the wealth of experience that the participants in this study have exhibited, good teachers such as these that we have here will be lost to finding other worthwhile

opportunities that will meet their needs. More and prolonged training sessions are needed for the teachers to meet the challenges of new content areas and methods incumbent on them in new curriculum policies. Professional development workshops and on-going studies will not only allay the fears of teachers having to implement new curriculum policies but will give them skills and abilities to increase the value of educational initiatives.

Though this study has centred on teachers' work in implementing new curriculum policies, it points to the challenges in providing an equitable education for students. There is still a long way to go in South Africa, before we can provide an equitable education for all. Perhaps this research can be one of the means to reach such a goal. What must also be noted that the curriculum is dynamic and should be always shifting and changing to increase its worth. Therefore, what is needed are interventions that give teachers the ability to meet the challenges of an ever-changing curriculum. Even giving teachers the opportunity and the ability to research and find ways to improve the implementation of policies in the classroom will improve education. Education is for the people and therefore democracy in education, whereby teachers are made to feel that they have a say in policies, will not only improve educational initiatives but will improve benefits for the diverse student population that we have in South Africa.

Delimitations of the study

The first limitation of this study is that this study has a small number of participants and therefore there can be no generalisation to the greater population. However, this is a qualitative study so quality rather than quantity is the priority of the study. Furthermore, the geographical location of the study limits the study as participants were located in a small area in South Africa rather than from different parts of the country. Choosing participants from a small geographical location was done because of easy accessibility to participants for research purposes.

The problem of withdrawal of participants did occur. I had initially chosen six participants but one of the participants had withdrawn from the study so the sample was give. However, having five was fine as I had started with more participants than was required. The focus group had therefore five participants which worked well as the number was small and everyone had an

equal chance to be heard and the group was big enough to raise any challenges and contradictions that may have risen.

Another limitation was getting the participants together for the focus-group interview. It took me a few weeks to arrange as I had to find an adequate time and venue to accommodate participants. Mathematics teachers were very busy and trying to get them together was a mammoth task. However, this was achieved and the focus group interview was conducted successfully and produced the data used in this study.

One of the limitations of the study was that of getting an appropriate venue to conduct the individual semi-structured interviews. The participants, as mentioned in the previous paragraph, were always busy so I could not conduct interviews in the weekend. Interviews had to be conducted in the contexts that teachers worked in, at appropriate times, convenient to the participant. However, venues were a problem as schools are places of learning and there were only a few quiet areas we could use. There were constant disturbances which resulted in the interviews taking longer to complete.

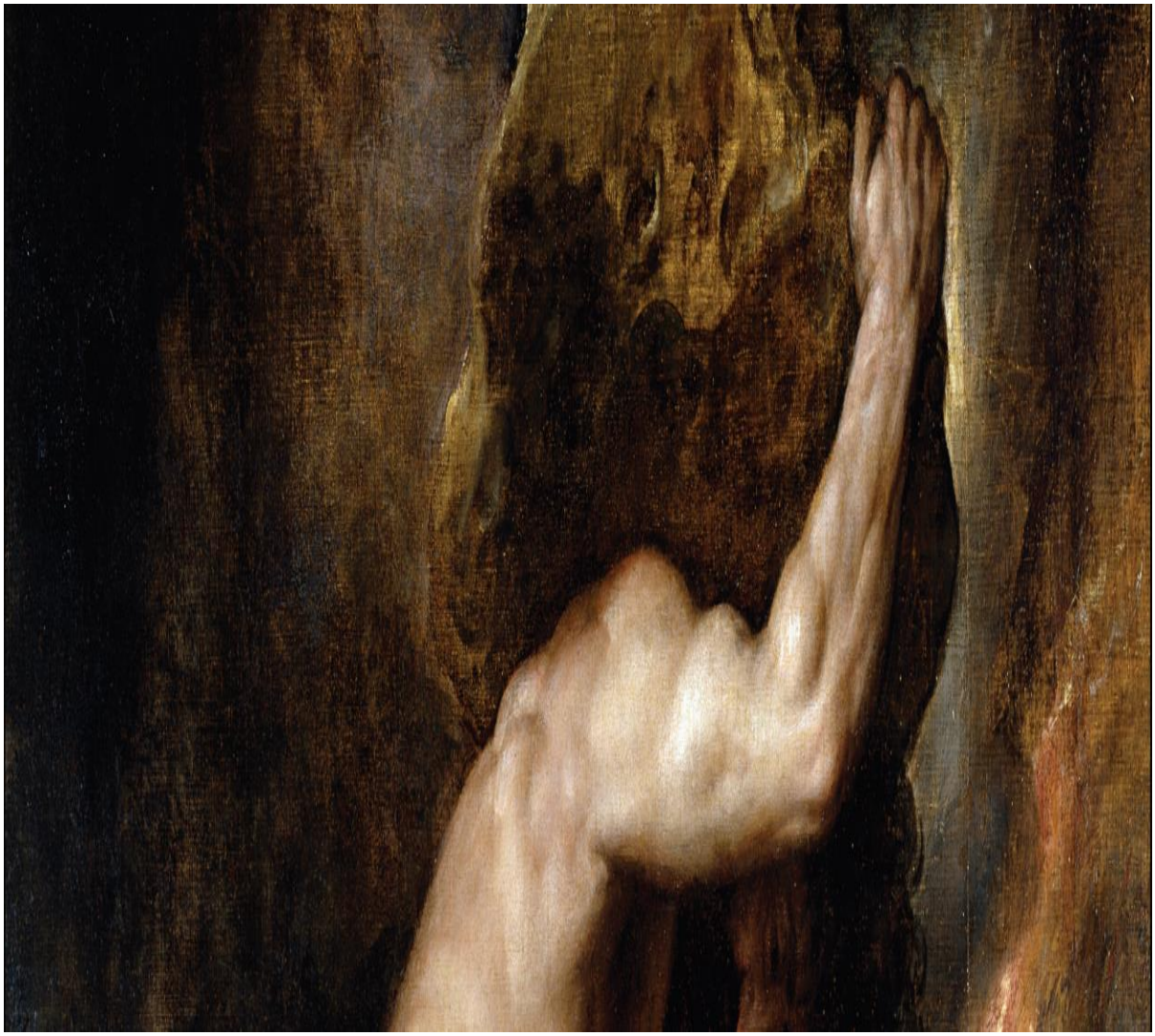
The intrusive impact of audio-taping can inhibit the relaxed collection of data (Kleiber, 2004) so the voice recorder was put in an area that is not easily noticeable to participants. There was also the use of a video camera for the focus group interview so I would be able to identify participants effectively and would also allow me to have a conversation with the participants without having to take notes. This did prove a bit uncomfortable for participants who were reluctant to speak at first, although I did ask permission to use the device. The video camera was therefore placed at a convenient place that was not readily noticeable by the participants and the conversation resumed.

Ethically, power issues between participant and researcher can arise (Kleiber, 2004) and this can be avoided by making participants as comfortable as possible in a neutral location that is beneficial to all. I also informed participants that I was a primary school teacher and this made the interview run smoothly as they did not see me as being superior to them.

The final limitation was a methodological one. With the limited data available it was difficult to make conclusive judgements on the habituses of participants. However, using the information provided I was able to make reasonably informed judgements on their habituses.

Conclusion

Teacher's work is indeed challenging and there an excessive work burden incumbent on teachers when new curriculum policies are introduced. With each policy change, new challenges and additional work burdens confront the already over-worked teacher. Sisyphus in Greek mythology continues carrying the burden of the boulder on his back which rolls down again and he has to pick it up and carry it up the hill again (Schrijver & Herman, 2005). So as the teacher carries the heavy burden of the new policy to the top of the hill and finally feels that she/he has accomplished something, then a new policy is introduced and the teacher has to start all over again. There are not only the work burdens that the teacher has to work through when implementing new curriculum policies but there are many other challenges that teachers face every day in the contexts that they work in. These teachers continue to persevere and work hard to cater to curriculum demands even though they may not be meeting the needs of all the students in the classroom and their own needs as well. In conclusion of this thesis, what must be noted is that there are many challenges ahead for teachers and the paradoxical nature of policies demands and democratic governance needs to be seriously looked at in order to ease the burden of teachers' work, Perhaps it will be apt to end this thesis with the image of the burden of the boulder on Sisyphus's back to show how this burden will continue for an eternity if something is not done about easing the burden.



Titian (Tiziano Vecellio) (c. 1487/90–1576) *Sisyphus* (1548–1549) (detail) Oil on canvas (237 cm x 216 cm) Copyright Museo Nacional del Prado, Madrid, Spain. http://www.museodelprado.es/en/

Figure 8 – Painting of Sisyphus

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Appendix 1 Permission to conduct research

Enquiries: Nomangisi Ngubane Tel: 033 392 1004 Ref.:2/4/8/262

Ms S Meeran

Seatides
TONGAAT
4399

Dear Ms Meeran

PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **"THE INFLUENCE OF NEW CURRICULUM POLICIES ON MATHEMATICS TEACHERS' WORK",** in the KwaZulu-Natal Department of Education Institutions has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning the research and interviews.
2. The researcher must ensure that Educator and learning programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Students, Educators, Schools and Institutions are not identifiable in any way from the results of the research.
5. A copy of this letter is submitted to District Managers, Principals and Heads of Institutions where the intended research and interviews are to be conducted.
6. The period of investigation is limited to the period from 01 September 2014 to 31 November 2015
7. Your research and interviews will be limited to the schools you have proposed and approved by the Head of Department. Please note that Principals, Educators, Departmental Officials and Students are under no obligation to participate or assist you in your investigation.
8. Should you wish to extend the period of your survey at the school(s), please contact Miss Connie Kehologile at the contact numbers below.
9. Upon completion of the research, a brief summary of the findings, recommendations or a full report / dissertation / thesis must be submitted to the research office of the Department. Please address it to The Office of the HOD, Private Bag X9137, Pietermaritzburg, 3200.
10. Please note that your research and interviews will be limited to schools and institutions in KwaZulu- Natal Department of Education (Pinetown District).

Head of Department: Education

Date: 15 September 2014

KWAZULU-NATAL DEPARTMENT OF EDUCATION

POSTAL: Private Bag X 9137, Pietermaritzburg, 3200, KwaZulu-Natal, Republic of South Africa

PHYSICAL: 247 Burger Street, Anton Lembede House, Pietermaritzburg, 3201. Tel. 033 392 1004

EMAIL ADDRESS: kehologile.connie@kzndoe.gov.za / Nomangisi.Ngubane@kzndoe.gov.za

CALL CENTRE: 0860 596 363; Fax: 033 392 1203 WEBSITE: WWW.kzneducation.gov.za

Appendix 2 Ethical clearance

30 October 2014

Ms Safura Meeran 204400667
School of Education
Edgewood Campus

Dear Ms Meeran

Protocol reference number: HSS/1431/014D
Project title: The influence of new curriculum policies on Mathematics teachers' work

Full Approval – Expedited Application

In response to your application received 21 October 2014, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted **FULL APPROVAL.**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

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

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

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

Yours faithfully

.....

Dr Shenuka Singh (Chair)
Humanities & Social Sciences Research Ethics Committee

/pm

Cc Supervisor: Dr Nyna Amin
Cc Academic Leader Research: Professor P Morojele
Cc School Administrator: Mr Thoba Mthembu

Appendix 3 Gatekeeper permission

The Principal

_____

_____

_____

_____

Dear Sir/Madam,

I am a doctoral candidate, under the supervision of Dr Nyna Amin, in the School of Education at University of KwaZulu-Natal. As part of the doctoral programme, I am undertaking a study entitled, "The influence of new curriculum policies on mathematics teachers' work". The participants for this study will be Grades 10-12 mathematics teachers with 20 or more years of experience. I am seeking your permission to conduct the study with one teacher from your school.

This study will examine how each curriculum change since 1994 has influenced the work that mathematics teachers do, knowing that with each curriculum change there is change in content, assessment, period allocation and so on, resulting in a change in work, roles and functions. This study will contribute to our understanding of how curriculum policy impacts on mathematics teachers' work.

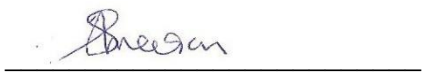
I will conduct three interviews and a focus group discussion with the participant. The duration of each of these interviews will be approximately 45 minutes. All data collection will be done outside of school hours, during weekends and holidays and it will therefore not interfere with the normal running of the school. The interviews will be audio-taped and the focus group discussion will be video-taped with the permission of participants.

Every effort will be made to ensure that no one will be able to identify participants and the school that they teach in. The study deals with the participants' work and will not bring the school's name into disrepute. No information regarding individuals connected to the school or other issues regarding your school will be sought. To protect the participant's identity I will ask them to provide a different name during the interview. The school will also be given a pseudonym. The teacher will be free to withdraw from the research at any stage without negative or undesirable consequences. All information is only intended for research purposes. All data recordings and transcripts will be stored in a locked cabinet in my supervisor's office for five years and it will then be incinerated.

For further clarification about the study, I can be contacted on 0845878648 and by email at safurameeran@telkomsa.net. The supervisor for the study, Dr Nyna Amin, can be contacted on 031-2607255 and by email at amin@ukzn.ac.za. For issues of ethics, Ms Phume Ximba

can be contacted on ximba@ukzn.ac.za and by telephone on 031-2603587.

Yours faithfully,



Safura Meeran

INFORMED CONSENT FORM

Declaration

I, _____ (full name of Principal),

hereby confirm that I understand the contents of this document and the nature of this research project and I consent/do not consent to the mathematics teacher at my school, being part of the study.

_____ _____

SIGNATURE OF PRINCIPAL DATE

School Stamp

Appendix 2 Participant Information Sheet

Appendix 4 Participant Information Sheet

Dear Participant

My name is Safura Meeran. I invite you to take part in a research study, "The influence of new curriculum policies on Mathematics teachers' work", as part of a doctoral study at the University of KwaZulu-Natal. You have been chosen to be part of the research as you meet the following criteria: you teach mathematics in grades 10 to 12, have been teaching for 20 or more years and have been trained in teaching mathematics. I would like to find out how curriculum policy change intensifies mathematics teachers' work. I would also like to find out why this is so. This is an important study as it will contribute to understanding of the relationship between curriculum policy and work intensification.

As a participant you will be required to:

- Do a visual drawing
- Answer questions in an informal interview done in three sections of about 40 minutes each
- Discuss mathematics teachers' work in a focus group interview

With your permission, these interviews will be audio-taped

As a participant

- Your involvement in the study is voluntary; there is no payment for participation
- You are assured that all interviews will take place at a time and place convenient to you
- Your confidentiality will be maintained (all participants will use pseudonyms)
- You will not be exposed to any risk and you may choose not to answer questions should you wish to do so
- You may withdraw at any time during the research process
- You will have access to your data with the rights to review, retract, revise, your opinions
- You will have an opportunity to verify transcript /s of the one-on-one interview in order to confirm if your opinions have been captured accurately
- You will receive a copy of all research reports and publications should you wish to

Permission to conduct this research study has been obtained from University of KwaZulu-Natal. Should you have any questions about your participation and your rights in the study you may contact Ms Phume Ximba of UKZN Humanities and Social Sciences Research Ethics Committee at ximbap@ukzn.ac.za or call her at 27 31 2603587. I can be contacted at safurameeran@telkomsa.net, cell no: 0845878648 for further queries. The supervisor of the study, Dr Nyna Amin can be contacted at 031 2625225 or at amin@ukzn.ac.za

Thank you for your co-operation

_____

Ms. S. Meeran

Informed Consent

Declaration

I, _____ (full names of participant), hereby confirm that I have read the information sheet and understand my participation in the study.

I understand that my real name will not be used in all write-ups of this study and that the information that I will provide will be used for this research project and other appropriate research presentations. I am also aware that,

- Participation is voluntary
- the interviews will be audio-taped
- I am not forced to answer any questions that make me uncomfortable and
- I am free to withdraw from the project at any point
- There is no payment for participation

I hereby give consent to participate in this research project.

Name: _____

_____ _____

SIGNATURE OF PARTICIPANT DATE

Appendix 5 Visual drawings

Many curriculum policies have been implemented since 1994. We have spoken about the changes and discussed the changes in a group. Now I would like you to represent visually, using drawings, images or graphics to show how the changes in curriculum policies have influenced your work.

Appendix 6 Semi-Structured Interview

This interview schedule will incorporate three sections

Section One: Focus on the visual representation

Introductions

Warming up questions

- When did you begin your teaching career?
- How long have you been at this school?
- How long have you been teaching mathematics?
- Which grades do you teach?
- What are your feelings about teaching as a career?
- Explain your visual representation
- Why have you chosen to represent it in this way?
- What does your drawing represent?
- Probes: curriculum; teachers' work, curriculum change; teaching, learning

Section Two: Focus on teachers' work

- Describe your work on a typical school day. Probes: teaching roles, administrative roles, managing and leading roles, other roles?
- What work takes up most of your time? Why?
- How much time (in approximate percentages) do you spend on planning for lessons?
  Administration
  Teaching?
  Non-teaching tasks?
- What else is your time spent on with regards to schoolwork?
- Can you share some examples of the work that you do.
- What are your views on teachers and the involvement in non-teaching tasks, during school hours? Probes: Who should be doing these tasks? Why?
- What is your opinion about the 7 roles prescribed in the Norms and Standards documents? How do these roles translate into work?
- Describe the work you do as a learning mediator with sensitivity to the needs of students. (Probes diversity and attainment in Mathematics)
- What work is do you do as a leader and an administrator?
- Describe ways you develop yourself professionally (probes opportunities for professional development and forms of professional development (workshops,

studying, seminars etc.). what forms of work is connected to professional development?

- What types of assessment is required from you and what types of assessment work do you engage in? (probes the different types of assessment and which types of assessment work is mostly used by the educator with reasons for choices, how remedial and enrichment is done)
- Describe how feedback is given to students?
- Describe your work with regard to designing and interpreting learning programmes at your school.
- How has the changes in curriculum affected the work you do?
- How have you been able to adjust to the changes in the work you do as a result of changes to the curriculum?
- Describe some changes that have occurred in the Mathematics curriculum and what are the implications for the work you do.

Section 3: Focus on why changes in curriculum policies influence Mathematics teachers' work in the way it does

- **Context**
  - Describe the context that you work in?
  - How has it influenced your work as curriculum policy implementer in the classroom?

- **Social Influence and experience**
  - Describe professional work relationships within your school
  - How have the types of professional work relationships influenced the way you interpret curriculum policies?
  - Describe the assistance you from professional networks in terms of the work you have to do
  - How have the years of teaching experience impacted on the way you work with new curriculum policies? Why?

- **Power**
  - Describe the hierarchical structures within your school?
  - How do the hierarchies work?
  - How do you know about the ways in which you work change?
  - Who checks on the work changes?

- **State ideology**
  - Can you explain how your work as a mathematics teacher has shifted over time – from OBE to RNCS to CAPS?

- In your opinion, have these shifts been similar for teachers in other disciplines?

- **Cultural Capital**
  - What has made it easy for you to deal with changes in the work you do?
  - What has made it difficult for you to deal with changes in the work you do?
  - Have the changes in the ways you work been beneficial? To whom?
  - Has the changes in the work you do improved mathematics results?

Appendix 7 Interview schedule: Focus group

The interview will focus on the following:

- Mathematics curriculum change
- Changes in the way mathematics teachers work
- Issues of power, curriculum and work
- What makes mathematics teaching work a joy?
- What makes mathematics teaching work a challenge?
- What work needs to be done, cannot be done, is done by mathematics teachers?