



**UNIVERSITY OF  
KWAZULU-NATAL**  

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**INYUVESI  
YAKWAZULU-NATALI**

**Teachers' reflections on the teaching of Mathematics in Grade 4 in Nongoma Circuit  
Management Centre**

**By**

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**This dissertation is submitted in partial fulfilment of the requirement for the Master of  
Education Degree in the Discipline of Curriculum Studies**

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**Date submitted: 12 December 2018**

## Declaration

I, Bonginkosi Lincoln Zulu declares that the dissertation entitled “**Exploring Teachers’ Reflections on the Teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre**” contains my own work. All sources used or quoted have been dully referenced accordingly. This research has not been previously accepted and is not being currently considered for any other degree at any other university.

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Dr. Cedric Bheki Mpungose

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## **Dedication**

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## Abstract

This dissertation presents an action research study of four teachers who reflected on their teaching of the Mathematics curriculum (CAPS) in KwaZulu-Natal primary schools. The study employ a critical paradigm. The study intended to explore teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre. Hence, the study used reflective activity, one-on-one semi structured interview and observation with an aim of generating data. The groups were sampled (using purposive and convenient sampling) with the intention of including teachers with whom I could work with without any difficulty. Action research was instituted with an aim of scrutinizing challenges Mathematics teachers faced when teaching Mathematics CAPS in KwaZulu-Natal. The curricular spider-web was utilised as a conceptual framework for data analysis.

The findings of the study revealed that teachers' reflections were influenced by factors such as rationale, goals, content, accessibility, teachers' activities, teachers' roles, resources, time, location and assessment. The rationale for teaching (personal, societal and professional) were found to be most influential in teachers' reflection. In the case whereby teachers were guided by personal rationale for teaching Mathematics, they demonstrated a conceptual understanding of what they were teaching. On the other hand, where teachers were influenced by societal rationale for teaching, they did not make decisions that contribution to successful teaching of Mathematics teaching. Teachers who were influenced by professional rationale believed that their qualifications assisted them to teach Mathematics effectively.

This study recommended that teachers must be directed by rationale in their teaching in order to affect the teaching and learning of Mathematics in Grade 4. Moreover, the study recommends that there is a need for on-going capacity building for Mathematics teachers by the Department of Education, so that they keep well-informed with new and pioneering methods for teaching Mathematics in Grade 4.

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## **Chapter One**

### **The synopsis, context and objectives**

#### **1.1 Introduction**

In the Republic of South Africa, there have been many changes in the reforms of the curriculum of public schools, especially after 1994 (Khoza, 2015). These changes emanate from unjust of the past due to apartheid principle (Bantwini, 2010). According to Lepik (2015) the term curriculum is broadly defined as the entirety of learner experience that occur during the educational process. In terms of this, curriculum refers specifically to a planned sequence of instruction. In other words, it is a repetition of activities of what needs to be taught in the classroom? The Minister of Basic Education, Angie Motshekga introduced the Curriculum Assessment Policy Statements (CAPS) as a new intended curriculum in the Republic of South Africa after the National Curriculum Statement (NCS). Carl (2014) asserts that for curriculum disparity of curriculum changes at different levels (Macro and Micro) for Mathematics implementation in Grade 4, hence this study explore teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre and to check which reflections teachers are using and why they reflect in a particular way.

#### **1.2 Title**

Exploring Teachers' Reflections on the Teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre.

#### **1.3 Focus and purpose of the study**

The purpose of this study is to explore teachers' reflection on teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre.

#### **1.4 Location of the study**

The study was conducted in four primary schools in Nongoma Circuit Management Centre for teachers teaching Mathematics in Grade 4 in the Zululand District, KwaZulu-Natal. The Nongoma Circuit Management Centre has 121 primary schools, so I have selected four primary schools, because they are poor in socio-economic status, specifically quintile 1 schools, and they were easily accessible to me. The schools are struggling to gain good marks in Mathematics. They are more relevant in this study since they receive learners from Grade 3 who studied Mathematics using their home language (IsiZulu) into Grade 4 to study Mathematics using their first additional language (English). The schools were referred to as A, B, C, and D as their pseudonym.

#### **1.5 Rationale of the study**

The study explored teachers' reflections on the teaching of Grade 4 in Nongoma Circuit Management Centre where learners learn Mathematics using first additional language (English). The reason I chose this study is that I was concerned teacher from one of the schools in Nongoma Circuit Management Centre. From my teaching experience, I have observed that some of the teachers are struggled in the first three months of the year (January, February and March) to make learners understand Grade 4 Mathematics content. After having an informal conversation with colleagues teaching Mathematics Grade 4 they outlined that most of the learners do not understand some of the terminologies used in English, since they were learning in mother tongue which is isiZulu in Grade 3. School Heads of Departments (HODs) responsible of managing Curriculum Assessment Policy Statement (CAPS) also voiced out that Mathematics CAPS content is prescriptive (performance-based curriculum). These reasons made learners perform badly in the first quarter of the year in Mathematics. Instead of teaching Mathematics content, teachers taught language. The language transition had a high impact on the cause of poor results of the school in Mathematics at the end of the year, particularly in Grade 4 Mathematics. Further to this, I also observed that there was little emphasis on how teachers can be part of developing curriculum and were able to voice their concern. I also observed that at Nongoma Circuit where I am teaching, little emphasis had been done in the aligning of teachers' reflections with the changes emanating from curriculum change (NCS-CAPS). As a principal for several years, I noticed that most of the teachers did not have relevant qualifications to teach Mathematics and this hindrance what they must do to assist learners to

master the subject content on Mathematics. From my experience as a teacher, it was evident that teachers teaching Mathematics in Grade 4 receive learners from grade 3 who studied Mathematics using the home language (IsiZulu) into Grade 4 to study Mathematics using the second language (English). This then becomes the barrier to teachers in the teaching of Mathematics in Grade 4 progressively. It is concerning that efforts have been made for the reform of curriculum (NCS to CAPS), but I feel that little has been done to teachers with how they can master the teaching of Mathematics in Grade 4. As a result, I was then motivated to pursue the study so that teachers can reflect in order to improve their Grade 4 teaching practices.

According to Kant (2006) reflection is about associating and to hold together given presentations either with other presentations or one's cognitive power, in reference to a concept that this [activity] makes possible. Teachers must be able to think systematically about their practice and learn from experience. They must be able to critically examine their practices, seek the advice of others, and draw on educational research to deepen their knowledge, sharpen their judgement, and adapt their teaching to new findings and ideas (Kant, 2006). The National Commission on Teaching and America's future (2016) concurs by stating that reflection and engaging in empirical research is the only way in which teachers can improve their practice. According to Mpungose (2016) on teachers' reflections of the teaching of Grade 12 Physical Science CAPS in rural Ceza circuit, teachers decided to continue with the way they had been working throughout their years of teaching without reflecting on their practices. Reflection is viewed as a process or activity that is central to developing practices (Dewey, 2013). Teachers should engage with the three stipulated levels of reflections, namely: self-reflection, written reflection and verbal reflection (Pedro, 2005). According to Dewey (2013), self-reflection is the personal active thinking about one's own thoughts, and feelings and it emerges out of habitual actions from the family interaction. Verbal reflection it is about teachers thinking of their actions based on what others are saying (social world). Written reflection is about written documents (such as policy, articles, and journals). The literature suggests that journal writing helps to bridge the gap between knowledge and action (Larrivee, 2010). According to Lepik (2015) the term curriculum is broadly defined as the totality of student experience that occur in the educational process. This definition refers specifically to a planned sequence of instruction. Reys, Reys, Lapan, Holliday, and Wasman (2003) further referred to curriculum as a set of learning goals, which are articulated across grades, outline the intended curriculum



content, and process goals at particular points in time throughout the school programme. Curriculum has three levels namely planned, assessed and achieved curriculum. These studies (verbal, written and personal reflections) outlined those teachers teaching Mathematics in grade four mostly do not reflect in all levels of reflection. This study might help Grade 4 teachers to reflect on their actions in order to be empowered to improve the teaching of Mathematics in Grade 4.

The finding of this study might benefit Principals, Departmental Heads, Teachers and particularly learner who suffer a lot in the beginning of a phase is (Grade 4 from Grade 3). Teachers might have an opportunity to reflect on their practices as the agent of change in the classroom. The findings of this study might assist Policy developers and curriculum planner to implement changes in the teaching of Mathematics in Grade 4.

## **1.6 Literature Review**

A study conducted by Majoni (2017) scrutinised issues that brought heaviness to curriculum and assessment in the course of curriculum change which included subject overload in school, change of concepts in curriculum such as learning outcomes and aims of a subject, changes in assessment, and teaching resources like the availability of trained or qualified educators. The study by Majoni (2017) further stated that the critical determination of effective teachings knowledge of the subject matter, as do the motivation to teach and the reason why teachers were teaching. In conclusion, the above study states that for quality delivery of subject matter, all rest upon individual teacher. This asserted that the seven roles of the teacher are outlined in Darling-Hammond and McLaughlin (1995). Just to name one: a teacher is the designer and interpreter of a learning programme. This also suggested that, an individual teacher needs to reflect on the practices done in the class to deliver quality teaching in the teaching of Mathematics. The above study displayed curriculum elements that would assist teachers to reflect on their teaching. Moreover, Voogt, Tilya, and van den Akker (2009) explained elements of curriculum in a question form in a more meaningful and understandable way. These questions were as follows: Why are they teaching? (Rationale); Towards which goal are they teaching? (Aims and objectives); What are they teaching? (Content), how are they teaching? (Learning attitudes); How is the teacher facilitating their teaching? (Teacher role); With what

are they teaching? (Material and resources); With whom are they teaching? (Grouping); Where are they teaching? (Location); When are they teaching? (Time) and lastly, How are they assessing teaching? (Assessment). A study by Khoza (2015) on teachers' reflection on their practices of curriculum and assessment policy statement stated that for the curriculum to be evaluated, curriculum elements become the cornerstone and recommended basis for evaluation, it is then important to look back on what they have done. This suggests that it is important for teachers to reflect on their practices based on curriculum components so that they will improve teaching.

### **1.7 Research Questions**

- a) What are the teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre?
- b) Why do teachers reflect in the particular way when teaching Mathematics in Grade 4 in Nongoma Circuit Management Centre?

### **1.8 Research objectives**

- a) To explore teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre.
- b) To understand the reasons why teachers' reflections are in the particular way when teaching Mathematics in Nongoma Circuit Management Centre.

## **1.9 Research Design and Methodology**

### **1.9.1 Research Paradigm**

This study was structured by a critical paradigm. Paradigm is defined by Lincoln, Lynham, and Guba (2011) as the simple belief system of world view that guides the investigation. The study further asserts that for a researcher the best way to understand what is going on is to become immersed and move to the culture of organisation being studied and experience what it is like to be part of it, rather than looking at one portion of reality that cannot be split or unitised (Guba

& Lincoln, 1994). This suggested that for better understanding of any practice, it is important to be physically involved. I would be physically involved in supporting participants in the teaching of Mathematics in Grade 4. Brooke (2013, p. 15) defined paradigm “as the way of looking at the world, different assumptions about what the world is like and how we can understand or know about it”. This study adopts critical paradigm since it endeavours to change teachers’ reflection practices on the teaching of Grade 4 Mathematics in Nongoma Circuit Management Centre by capacitating them with best reflective practices in their teaching (Izuma & Murayama, 2013). It is assumed that in the critical paradigm the character of actuality (ontology) is subjective and built on the basis of issues of power whereby the character of knowledge (epistemology) is constructed by involving participants reflectively in order to bring justice and transformation (Creswell, 2012). This drives me to choose this paradigm in order to understand teachers’ reflections on the teaching of Mathematics in Grade 4. Mpungose (2016) concurred that the research finding from critical paradigm are subjective and are not replicable. This suggests that finding were based on ideas, which are verbal rather than statistical. Mpungose (2016) further, asserts that the findings of this study exposed social injustice via transformation of the participants’ context in their teaching of the curriculum. I made a point that the outputs of this study constitute findings and recommendations which will serve as a reference to other teachers on how to reflect on the teaching of Mathematics in Grade 4. I then chosen to use critical paradigm as the most relevant paradigm for this study due to character of knowledge that is embodied by social, political, cultural and economic values of the society.

### **1.9.2 Research approach / style**

Mouton, Hawkins, McPherson, and Copley (1996), defined research approach as an attempt to gain an in-depth understanding by asking questions that not only give information to the researcher, but also stimulate the participants to reflect on why they reflect in a particular way. This suggest that teachers may benefit in this study since information required may assist them to correct, reflect on their practices on the teaching of Mathematics. This study adopts qualitative research approach. Qualitative research is also defined as that research which uses less structured data, which emphasises the central place of subjectivity in the research process and which studies “a small number of naturally occurring cases in detail” using verbal rather than statistical (Brooke, 2013, p. 12). The methodology approach is befitting for this study since the purpose is to explore teachers’ reflections on the teaching of Mathematics in Grade

4. It may assist teachers for knowledge growth in their practices. Creswell (2012) asserted that qualitative researchers deal with socially constructed realities and qualities that are complex and indivisible into discrete variables. Moreover, Babbie (2004) outlined that the aim of qualitative research is to promote better self-understanding and to increase insight into teachers' reflective practices. Gonzalez, Brown, and Slate (2008) articulated the strength of qualitative research approach in that it provides in-depth intricate, and detailed understanding of meaning, actions, non-observable practices as well as observable phenomena, attitudes interaction and behaviors and these are well served by the naturalistic enquiry. The rationale of this study is to explore reflections, which are observable phenomena of the teachers teaching Mathematics in Grade 4. This approach was appropriate because I want to explore and get in depth understanding of teaching Mathematics, specifically what and how they teach Mathematics in Grade 4. Trochim (2000) outlined that qualitative researchers do not assume that there is a single unitary reality apart from our perception. This suggested that I would not rely on single reflection, but would explore and exhaust all propositions of reflection, which were verbal, written, and personal, to arrive at the concrete conclusion using action research style.

#### **Research style: Action research**

Action research is defined by Maree and Van der Westhuizen (2007) as a type of research that encourages a collaborative or participative approach to find solutions to practical problems experienced by participants. The study uses a critical action research process in order to assist participants to learn, plan and reflect on their practices in order to improve them (Fernandez-Flores & Saeb-Lima, 2016). I continuously assist teachers to assess and evaluate the effectiveness of an intervention, so that practices prevail reflections. Matsunaga et al. (1996) further asserted that action research is defined as inquiry or research in the context of focused efforts to improve the quality of an organisation and its performance. This definition resonates from Elliot (1991) who asserted that action research is the study of a social situation with a view to improve the quality of action within it. This study employs action research qualitative approach. This was because it was driven by its main purpose which was to produce rich description of teachers' improvement of their practices of teaching through their reflections (Lisle, 2010). Moreover, Matsunaga et al. (1996) further asserted that action research could provide chances for reflection, improvement, and transformation of teaching. This suggested that there were better opportunities available for teachers to correct their practices in order to improve their teaching practices in Grade 4 Mathematics. This study aimed to gain an in-depth

understanding by seeking clarity that not single out information to the researcher but also gives interpretation to the reflective practices of teachers and what informs the reflection (Mouton et al., 1996). I assisted teachers to understand what they are reflecting on by bringing theory and practice with an aim of getting practical solution. This action research approach would involve four primary school as participants to reflect on their teaching practices in the teaching of Mathematics in Grade 4 in Nongoma Circuit. Action research has limitations that raised a number of possible ethical dilemmas, such as, the bias of the researcher towards the data that is collected, contamination of the research data, and level of involvement of the researcher. I would not be bias in the research in whatsoever reason and I would not use my emotions. Another limitation of action research is that it faces challenge of earning the trust of participant. To mitigate this, relied on strategies such as spending more time on introductory sessions to gain trust from participants.

Action research is unlike any other research style; it is unique since “it is done by researchers on their own practice” (Christiansen, Bertram, & Land, 2010, p. 45). Creswell (2014) outlined that action research in education assumes that teachers know best what is happening during the teaching and learning process. Hence, in this study, I take teachers as the best people to participate in order embrace the action research’ principle of participation, reflection, empowerment and emancipation. Hakim (2000) asserts that this process (action research) is not suitable in education because it may take place even without following a scientific research process and be influenced by opinions rather than facts, nonetheless this study combined action research with a critical paradigm to overcome the above mentioned weakness. Berg and Lune (2004) outlined three levels of action research: technical collaborative approach (researcher comes up with a research problem which is presented to participants), practical collaborative approach (both the researcher and participants come up with a research problem) and emancipatory collaborative approach (both researcher and participants come up with a problem from a political point of view).

Christiansen et al. (2010) named approaches as collaboration and action of all participants that involve four stages: strategic planning (first stage), implementing the plan (second stage), observing of the plan (third stage), and lastly reflecting on the plan (forth stage). In the first stage, which is planning, I will articulate questions based on the given reflective activity on the teaching of Mathematics to spot problems with aim of developing an intervention strategy. If I

am done with those questions, we will proceed to the implementation stage. For the third stage, I will observe teachers in their teaching practice. Lastly, I will share results with teachers, to allow them to see what the outcomes of the intervention are. Moreover, these stages do not involve learners. For teachers as participants, they would be assisted in order to see what they are practicing is right or wrong.

### **1.9.3 Sampling**

Sampling is described by Christiansen et al. (2010) as selection process of a particular group of people, location, actions and activities for the study. Kutlubaev and Hackett (2014) further asserted that sampling refers to the process used to select a portion of the population for study. This suggests that sampling is relevant to this study because, to gain accurate information, I need to sample and interact with teachers from other school and ask them to engage on this study. Perry and Thomson (2015) explained methods of sampling which are: simple random sampling; systematic sampling; stratified sampling and cluster sampling. The strength of sampling is that it is sampling-quick and cheap, but does not result in representation sample this will employ purposive sampling (Perry & Thomson, 2015). This study adopted convenience and purposive sampling. Purposive sampling described the process of choosing a particular group of people to be utilised as sample (Christiansen et al., 2010). I decided to select four teachers within my proximity in Nongoma Circuit Management Centre; teachers I knew and could get along with them easily, since we are teach same content in the same area. The criteria used for their selection was based on experienced teachers. An experienced teacher is one who has five years and above teaching Mathematics in Grade 4. Secondly, I chose qualified teachers only; those who have learned methods of teaching Mathematics. I used four educators as participants, (PA, PB, PC and PD). Teachers' knowledge of Curriculum Assessment Policy Statements (CAPS) was vital in this study. This would avoid limitation where if I sample any one will not yield desired outcome. Duggleby et al. (2016) asserted that convenient sampling refers to particular group that is easily contacted by the researcher. This suggests that I chose a group of teachers that were easily accessible to me, whom I could contact or meet regularly without any obstacles.

## **1.10 Data generation method**

Three data generation methods were used: firstly, educators' reflections through open-ended questionnaire; secondly, one-on-one semi structured interviews, and thirdly, unstructured observations.

### **1.10.1 Reflective activity (open-ended questionnaire)**

Reflective activity is described by Cohen, Manion, and Morrison (2011) as a transcribed activity that asks teachers to complete a short series of questions about the issues studied. In this study, teachers reflected using a series of open-ended questions I designed as an activity to reveal their perceptions about the Mathematics curriculum in Grade 4 implementation. For completion of the questionnaire, a reasonable time of two weeks was granted to all participants. As, some participants may be reluctant to divulge written information honestly, I prepared one-on-one semi structured interviews for further clarity.

### **1.10.2 One-on-one Semi structured interview**

Semi-structured interviews are defined as the in-depth, loosely structured form of interview which is characterised by a relatively informal style and a thematic topic centred, biological, or narrative approach (Krish, 2008). Using this method (one-on-one semi structured interview), allowed me to acquire specific information comparing it with open-ended questionnaire. This would allowed me to also gain authenticity of this study and, to achieve desirable outcome (Khoza, 2015). The study further outlined that audiotaping verified that triangulation, transferability, conformability and curricular concepts are supported, which could ensure that findings are reliable and proven. This suggested that verbal reflection is dominant in semi-structured interview. For completion of interviews where issues are clarified then, observation is engaged.

### **1.10.3 Unstructured observation**

Observation is described as the systemic process of recording the behavioural patterns of participants, objects and occurrences without necessarily questioning or communicating with the participants (Chaboyer, Johnson, Hardy, Gehrke, & Panuwatwanich, 2010). Charteris and Smardon (2015) further outlined that, investigation observation offers an investigator the opportunity to gather live data in situation from naturally occurring social situations rather than, for example reported data. Its advantage is that it lead the researcher to attain information about

the educational environment, including the different learning styles, resources used and the interaction that outplayed amongst the learners and between the teacher and learners (Phan & Locke, 2015). This suggest that better opportunities would avail, so as to see which reflection teachers were using in their class, when teaching Mathematics in Grade 4.

### **1.11 Data Analysis**

Qualitative data analysis is defined by Seuring and Gold (2012) as creating sense of data in terms of the participants' definition of the situations by noting patterns, themes, categories and regularities. In data analysis "a researcher has an ethical duty to ensure that the results of the research are reported fairly, credibly, and accurately, without misrepresentation, unfair selectivity" (Khan et al., 2012, p. 279). Thus, attempts were made to report logically, fairly and be consistently. Leech and Onwuegbuzie (2009) asserted that there is no one 'right' way (to analyse) data. This suggests that I would be able to analyse all information or data received from participants, without separating or choosing certain data. I would employ guided analysis which involves deductive and inductive reasoning process. Creswell (2014) asserted that guided analysis refers to predetermined categories of the theory of curriculum, which is the theory of coding data, Therefore, the analytical process was engaged by constructing questions to facilitate analysis of what was studied which was exploring teachers' reflection in the teaching of Mathematics in Grade 4.

### **1.12 Ethical issues**

Loutzenhiser (2016) defines ethics as an activity which critically examines morals, questioning its rules and seeking orientations, which are well thought out and correct. The study further assert that ethics uses rigorous analysis to reveal the flaws of logic and contradiction of the reasoning and seeks to go beyond them. "Ethics dealt with what we should or should not do, but it does so by applying reasoning, for or against in order to decide on the conduct to be taken when faced with a moral problem" (Loutzenhiser, 2016, p. 2). I will make an effort of following all ethical practices in order to conduct this study. Orb, Eisenhauer, and Wynaden (2001) asserted that the limitation of ethics is the concept of relationship and power between the researcher and the participants. The study further asserted that the desire to participate in a research study depends upon a participant's willingness to share his or her experience. I would request permission from the Department of Education at Nongoma Circuit Management Centre to conduct this study thereby adhering with a code of professional ethics. I have adhere to ethical principles listed below.



### **1.13 Trustworthiness**

Trustworthiness is defined by Morrow (2005) as the way a researcher is able to convince the reader that the findings of this study are accurate and are of high quality. The study further outlined that credibility, transferability, dependability and conformability should be considered in qualitative research study. I will then pay more attention to the above-mentioned dimensions; credibility, transferability, dependability, and conformability.

For a research to be trustworthy, Cope (2014), defined credibility as the findings reflecting the ‘reality’ and lived experiences of the participants. Mustafa (2011) further asserted that credibility is concerned with whether the research understanding what it intends to test. Credibility would be achieved through the relationship already built between me a researcher and teachers as participants. This relationship ensure the environment is at ease during interviews whereby trustworthiness in questions shall prevail. Credibility is threatened by errors in which research subjects respond with what they think is the preferred social response, which is data (Golafshani, 2003). I have used prolonged engagement in detecting response set where informants consistently agree with questions.

Confirmability is concerned with whether the findings reflect the experiences and ideas of the participants (Pool & Reitsma, 2013). I have made an attempt to ensure that participants’ responses address what is being researched. Anney (2014) noted that transferability is more about the responsibility of the person wanting to transfer findings to another situation or population than that of the researcher of the original study. I have made an attempt that accurate findings and recommendations on the teaching of Mathematics are well kept, and can be applied at the later stage by other teachers. Anney (2014) proposed that dependability criterion relates to the consistency of findings. Dependability will be enhanced by returning raw data and interpretations back to the participants for accuracy verification and for the crystallisation of captured data. In addition, interviews would be audio-recorded through audio recorder to enhance accuracy and authenticity of the findings and that bias was eliminated during transcription. Triangulation would be used to make sure that verification is enhanced.

### **1.14 Anticipated Problems / Limitations**

I acknowledged my positioning as a principal that I had pre-determined knowledge or answers against certain interviews conducted with teachers teaching Mathematics in Grade 4 and it likely to be bias somehow. I made an effort to maintain professionalism by not divulging

information I had. Moreover, I maintained my emotions; avoided expressing my ideas or views about the study I conducted. I guarded against untrue responses from participants of any attempt to try to please the researcher. As I was involved in qualitative research, I was aware that results of the study are subjective, personal, and contextual which means that they cannot be generalised. Participants provided their own ideas without my interference.

## Chapter Two

### Review of Literature

#### 2.1 Introduction

It is of paramount importance for this chapter (literature review) to begin by clarifying its purpose. Literature review is defined as the study of collected works of different research studies (Rowe, 2014). This chapter intends to define the research phenomenon, which is teachers' reflection and its layers or levels (verbal, written, and personal) from different literature. For teaching to take place, there must be teachers who are the deliverers of the curriculum to the learners (Powell & Kalina, 2009); (Khoza, 2017a). It is evident that curriculum cannot be disseminated without teachers, so they are the corner stone and source of information that learners turn to. Although teachers have difficulties in teaching Mathematics, it is crucial for teachers to have professional training in teaching Mathematics so that knowledge will be easily transferred to learners (Newton, Darling-Hammond, Haertel, & Thomas, 2010). Thus, this chapter provides further explanation on the levels of curriculum.

The primary reason for this study is to explore teachers' reflections on the teaching of Mathematics in Grade 4 in the Nongoma Circuit Management Centre. Curriculum issues are discussed with its layers, which are: intended, implemented, and attained; curriculum design approach and history of Mathematics curriculum in South African context; as well as concepts of curriculum. These curriculum issues are integrated in the study by Khoza (2015) explained on teachers' reflection on twenty two postgraduate university students who specialised in curriculum studies as curriculum as teaching signals. These signals will clarify what is expected of the teachers in the classroom. This chapter will also try to ask the following questions: a) What are the teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre; b) Why do teachers reflect in the particular way when teaching Mathematics in Grade 4 in Nongoma Circuit Management Centre? The questions above will be linked with objectives of the study, which are: a) To explore teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre; b) To understand the reasons why teachers' reflections are in the particular way when teaching Mathematics in Nongoma Circuit Management Centre.

## **2.2 Phenomenon (Teachers' Reflections)**

Studies by Liston and Zeichner (2013); Ghaye (2010); Brantlinger (2007) as well as Osterman and Kottkamp (2004) assert that reflective practices empower teachers to become successful decision makers who take responsibility for their action. The continuous practice of teachers' self-reflection helped them to construct professional knowledge. Clarà (2015), on looking for clarity in ambiguity, asserts that reflection is a form of mental processing that we use to fill a purpose of justifying practises or to achieve some anticipated outcome. The study furthermore outlines that reflection is applied to gain a better understanding of relatively complicated or unstructured practices and is largely based on the reprocessing of knowledge, understanding and, possibly, emotions that we already possess. "Reflective practice in teacher education is one reform effort that has taken hold in the education community" (Pedro, 2005, pp. 49-66). The reflective practice phenomenon in teacher education is one effort that has taken hold in the education community (Hatton & Smith, 1995; Kristensen, Borritz, Villadsen, & Christensen, 2005). This suggests that teachers may reflect to do justice in their teaching practices. Reflection helps teachers to understand and have control over the content and processes of their own work (Sutherland, Howard, & Markauskaite, 2010), and it develops the teacher as a decision maker, who can help to define the direction of schooling (Sutherland et al., 2010). A great deal of research has been dedicated to the conceptual analysis in teacher education. Liston and Zeichner (2013) are acknowledged as key originators in the 20<sup>th</sup> and 21<sup>st</sup> Century of the concept of reflections. Kelly (2016) defined reflection as any thinking process that transforms an unclear situation into a clear one. Dewey (1933) reasoned that reflection precedes intelligent action and is the act of active persistent in the light of grounds that support it, and the consequence to which it leads. Moreover, Schon (1983) reasoned that reflection talks to the teacher, suggesting new ways to give coherence to the unclear situation. Further to this, Schön (1987) proposed that reflection is seen as a conversation with the situation. The study further asserts that the conversation with the situation takes place in a cognitive world, which constitutes a mental context within which the situation behaves as it would in the real world. This suggests that the situation the teachers find themselves in for the teaching of Mathematics in Grade 4 allows them to reflect in their practices. Further to this Mezirow (1990) as well as Redmond (2017) asserts that reflections enables teachers to correctly twisted knowledge in their beliefs and errors in problem solving.

Furthermore, studies by Schon (1983) introduced the element of the timeframes in which reflection takes place and linked reflection to action. It is outlined that reflection is purposeful, systematic inquiry into practice, and emphasised that professionals should learn to frame and reframe problems they face, test out various interpretations, and modify their results (Hatton & Smith, 1995). A study by Moon (2013) affirmed that other models of reflection have also considered varying time frames in which reflection takes place in order to make changes to behaviour (Boud, Keogh, & Walker, 2013). Schon (1983), further clarifies the idea of reflective practices e.g. reflective-in-action; reflective-on-action. Teachers reflect over their practices to reshape their teaching actions and to search out feasible solutions to teachers problems (Wildemeersch, 2014). Schön (2017) further explained that Reflective-in-action is a conscious attempt to make teachers action more reasoned and purposeful. Richards and Rodgers (2014), highlight that teachers who are involved in reflections, put serious efforts into investigating the effectiveness of their teaching and to better meeting the learning needs of their students. This suggests that teachers may not ignore reflections, especially in Mathematics, if their consciousness is to produce better learners. Moreover, if teachers make reflection their habit, it will help in construction of professional knowledge (Greenwood, 1998; Iqbal & Jumani, 2015). This enables teachers to also imagine what they are doing and how it might be made better (Alsulami & Taylor, 2012). (Iqbal and Jumani (2015)) assert that if teachers reflect on their teaching it will lead to better management of their teaching practices.

An interpretive case study by Khoza (2015) with an aim of understanding student educators' reflections on their practices of Curriculum and Assessment Policy Statements (CAPS), findings suggests that when people are given an opportunity to reflect, it encourages ongoing self-reflection, verbal reflection, and written reflection. Schon (1983) concurs with Pedro (2005) that teachers should engage with the three levels of reflection, namely: verbal reflection, written reflection, and self-reflection.

### **2.2.1 Self-reflection**

According to Ellis, Carette, Anseel, and Lievens (2014), self-reflection is personal active thinking about one's own thoughts, and feelings. The study further asserts that reflection emerges out of habitual actions from the family through daily interaction and what an

individual is used to. Ellis et al. (2014) further stated that it is active thinking about one's thought and feelings and emerges out of social interaction. This assertion exemplifies Dewey (1933) notion of active deliberation of their actions and the consequences of those actions. Dewey (2013) concurs with Zeichner and Keneth (1987) that the attitude of the individual brought to bear on the act of reflection could either pave the way for learning or block it. This suggests that self-reflection is the individual's own thought of action in his or her teaching practice. In other words, self-reflection is self-introspection of an individual, for instance teachers teaching Mathematics in Grade 4 may also be driven by self-reflection in their teaching in order to do justice in their practices to the improve subject. Thus, without a positive mind-set there will be no progress in the dissemination of the content and self-reflection is particularly valuable for teachers to defuse disruptive situations (Skovholt & Trotter-Mathison, 2014). Further to this, Kazempour and Amirshokoohi (2014) outlined that reflection is not a linear process starting with a process at one point and ending with the other, but it is a cyclical process which includes in action (in the midst of practice), on action (Task takes place after action), and for action (desired outcome of both previous types of reflections). This suggest that there is no one type of reflection, teachers should engaged also in written reflections.

### **2.2.2 Written reflection**

The literature outlines that journal writing helps to bridge the gap between knowledge and action (Pedro, 2005), and that reflective studies help to prepare teachers to gain the knowledge of doing and analysing what they do during the teaching process (Khoza, 2018). The study conducted by Pedro (2005) affirmed that written reflection seeks teachers to engage in a number of written documents that guide their teaching practice for the improvement of curriculum delivery. In support of this Mpungose (2016) concurs with (Khoza, 2016) that the practices of teachers driven by written reflection are always professional because they are guided by what is stated from reading and completed journals and other written policy documents. This suggests that in maintaining professional teaching practice, Grade 4 Mathematics teachers should be driven by written reflection so that their practices may be guided by CAPS documents, departmental circulars, and all other documents in teaching. N. J. Newton and Anderson (2017), in line with Borich (2016), comment by saying that knowledge for some professions may be found in case books, handbooks of practice, precedent of law, and

others. Further to this, it is important for teachers to write and sharpen their skill in development of their carrier by also drawing from verbal reflection.

### **2.2.3 Verbal reflection**

Furthermore, Pedro (2005, p. 61) states that, “verbal reflection requires teachers to share ideas about their teaching practice, and this can be achieved in various ways, such when teachers attend workshops, cluster meetings, staff developmental meetings”. Further to this, Cooney (2002) as well Fraser (2014) asserts that time needs to be claimed for meetings where reflective practice is allowed to take place. These studies further clarify that verbal reflection is paramount to teachers regarding school matters. As this study is based on teachers’ reflections on the teaching of Mathematics in Grade 4, verbal reflection is paramount. In other words, verbal reflection creates a social space where issues of subjects can be discussed in addressing the needs of the society (all stakeholders in teaching) (Khoza, 2016). This suggests that teachers may talk to each other about what they are doing in class, their challenges, and ways to improve their practices and how to support and comfort each other. This can often have observed when teachers’ practices are driven by what is verbally shared with their mentors (subject advisors), circuit managers, and principal in the form of instruction (Pedro, 2005). In other words, this will enable teachers to gain insight from well-experienced individuals, in the social and professional side of teaching Mathematics in Grade 4. For teachers to take a decision to reflect, they need reflective action which will lead to better curriculum delivery.

### **2.3 Curriculum presentation (Intended curriculum, implemented curriculum, and attained curriculum)**

According to van den Akker (2013) curriculum is defined, ‘as a plan for learning’ which reflects on a combination of the intended/planned and attained curriculum. The study by van den Akker (2013) further states that curriculum is divided into International (Supra), national (Macro), school (Meso), classroom/teacher (Micro), and learner curriculum (Nano). Majoni (2017) and Zipin (2013) argue that curriculum should be understood as a complicated conversation among teachers and students through text and the concept they communicate in specific places at particular historical moments. Further to this, Pinar (2012) Introduced the notion ‘currere’, shifting the focus from curriculum as noun to curriculum as verb. The study

by Pinar further stated that curriculum is not a thing but something that we do. Thus, Pinar refers to curriculum as running the course of teaching and learning in line with this. Bobbitt (2013) describes curriculum as a series of process that children and youth must do, and experience by way of developing abilities to do the events that make up the affairs of adult life. Moreover, Ebert, Ebert, and Bentley (2013) Refer to curriculum as a means and materials with which learners will interact for achieving identified educational outcomes. This then suggests that curriculum is an action-based activity which teacher must acquire so they will be able to reflect (personal, verbal, and written) in order to teach correctly. Metzler, McKenzie, van der Mars, Barrett-Williams, and Ellis (2013) Noted that there is no substitute for the intelligent participation of the teacher in curriculum improvement. Thus, studies further state that, curriculum can be understood as a process of selecting courses of study or content (Beauchamp, 1977; Thomas, 2015). Similarly, “curriculum is also defined as the document, plan or blueprint for instructional guide, which is used for teaching and learning to bring about positive and desirable learner behaviour change” (Offorma, p.87, 2014). In other words, these curriculum definitions seek educators to be driven by all levels of reflection, so that they cater for the needs of the profession, society, and themselves as person. Additionally, van den Akker (2004) as well as Hoadley (2015) clarified three forms or levels of curriculum namely; intended, implemented, and attained curriculum.

### **2.3.1 Intended curriculum**

Roberts (2016) concurs with Madden and Wiebe (2013) that intended curriculum refers to a set of objectives set at the beginning of any curricular plan. Intended, planned, or prescribe curriculum is formal in nature and is found in written documents. For example CAPS (Curriculum Assessment Policy Statements) is a formal and legal document to be used by teachers (Bergqvist & Bergqvist, 2017) (Mligo, 2016). As an official document, CAPS explains all required work or activities to be practiced by teachers in the classroom (Cobbinah & Bayaga, 2017). This suggest that teachers teaching Mathematics in Grade 4 may reflect on different sources of textbooks and not rely only on CAPS documents. Further to this, teachers should familiarise themselves with all curriculum documents such as pacesetters or Annual Teaching Plans (ATP), lesson plans, and curriculum coverage tools, in order to reflect on shortfalls that might take place (Benedict, Thomas, Kimerling, & Leko, 2013). In a case study conducted by Johansson (2016) takes textbooks as the potentially implemented curriculum, that textbooks



are a most important features of teaching Mathematics in the classroom, in Sweden as well in many other countries. A study by Fomunyam (p. 127, 2014) outlined that, “intended or planned curriculum relates to the political dimension of schooling”. Further to this, the study by Mpungose (2016) on the teachers’ reflections of the teaching of Grade 12 Physical Science CAPS in rural Ceza circuit asserts that the intended curriculum’s aims and objectives are designed to meet the vision of a ruling political party, including all the prescripts. This suggests that teachers teaching Mathematics in Grade 4 should be driven by written reflection in order to be in line with political aspirations of the ruling party in a country.

Furthermore, in the South African context, multiple curriculum developments have emerged since the dawn of the new era (1994) after the Christian National Education (CNE) which was drilling and limited high-order thinking (Khoza, 2015), formed Outcome-based Education (OBE), Revised National Curriculum Statements (RNCS), National Curriculum Statements (NCS) up to date CAPS. Before 1994, curriculum was largely based on the core beliefs of the CNE manifested by authoritarian teaching and rote learning (Machin, 2016). Mudaly and Ismail (2016) concur with Hoadley (2017) by eluding that in their brief summary of Apartheid curriculum, the curriculum was developed by so called experts and imposed on educators and learners. They continue stating that content was often abstract and theoretical, which suggests that learners were unable to contextualise their learning with real-life situation. Both Anney (2014) and (McKimm & Jones, 2018) outline that intended curriculum is official and is based on stipulated national and international standards. In other words, intended curriculum relates well with written reflection where everything must be written and prescribed in black and white. This suggests that teachers seek to be driven by written reflection in order to understand what is prescribed to them by following international trends. In other words, there must be no deviation since all prescribed documents are in place and what is taught emanates from written documents. For example, the themes of the space and shapes section in the CAPS documents require teachers to cover all shapes (geometric) like square, circle, octagon, Hexagon, 3D shapes, etc. so that learners will be able to know all questions that might be asked. Moreover, Khoza (2014b) in an interpretive qualitative case study of six university lectures from a university in South Africa, reflects on lectures’ views on their experiences in teaching post-graduate modules as part of the Honours curriculum, outlined that intended curriculum consists of ideal (vision/rationale) and formal/written (intentions as specified in documents) components. Niebling (2012) as well as Ekeoba (2014) agreed that the intended curriculum is

reflected in curriculum policy documents, grade plans, and even on the overview of the policy documents (CAPS). Hoadley (2012) as cited by Fomunyam (2014), asserts that it raised eyebrows why teachers in certain schools seems to teach different curriculum in different ways to others despite having the same intended curriculum. This suggest that, it is imperative that teachers teach what is prescribed by the intended curriculum, through understanding implemented curriculum.

### **2.3.2 Implemented curriculum**

Another level of curriculum is implemented, enacted, or practiced curriculum, which interprets the intended curriculum in practice (van den Akker, 2013) and (Boesen et al., 2014). The study conducted by Galane (2016) on subject advisors' reflections of the supervision of Grade 3 Mathematics CAPS implementation in the Mpumalanga Province asserts that implemented curriculum focuses on the classroom level whereby the teacher puts the intended curriculum in practice. The study further outlines that it is of outmost importance to understand curriculum, because it provides a knowledge and view of teaching and learning. Further to this, Hoadley (2012) outlines that the implemented curriculum also emphasises the educators' role as interpreters of curriculum. Thus, Hall and Hewings (2013) outlined that implemented curriculum refers to the actual use of a syllabus or what it consists of in practice. Moreover, Maile (2013) concur with Khoza (2014b) by saying that implemented curriculum includes how teachers and learners practice implemented curriculum. This suggests that implemented curriculum is when the actual process of teaching and learning takes place and both teachers and are engaged, so without it no teaching and learning can take place. In other words, teachers may reflect on what are they teaching to learners using verbal reflection. As a result, Schmidt and Datnow (2005) further outline that implemented curriculum's intentions and objectives at the level of the teacher and classroom activity are considered as the implemented curriculum. Moreover, teachers are interpreting Mathematics content and made it available to the learners they teach. The study by Khoza (2015) on students teachers' reflection on their practices of CAPS indicates that in the practiced curriculum, teachers set the pace on how teaching will be practiced, which means that learners have little control over what will be delivered to them. This also suggests that learners become the recipients of the implemented curriculum through verbal reflection. Moreover, teachers must be able to reflect to improve their practice since learners are on the receiving side of the curriculum (Mpungose, 2016). As implemented

curriculum is practiced in a structured pattern, it manifests necessary social needs of the school (Scholl, 2012). Thus, a study by Anthony, Lesh, and Baek (2014) states that implemented curriculum is the area of study that is actually implemented by the school's teacher and presented to the learners. As a result, teachers' beliefs, what they think and what they do in their classroom, shape the kind of learning their learners received (Galane, 2016). This suggests that implemented curriculum is where relevant skills for teaching of Mathematics are tested so that the teacher can apply levels of reflection for improvement, which will assist learners in the attained curriculum.

### **2.3.3 Attained curriculum**

The third level of curriculum is the attained curriculum, achieved or assessed, which is the learning experience as perceived by learners measured through their learning output (Khoza, 2014b) and (Mpungose, 2016). A study by Cuban (1992) on how teachers taught: consistency and change in American classroom defined attained curriculum as what students reciprocate in the implemented curriculum by remembering what is asked. As a result, Fomunyan (2014) and Cuban (1992) defined achieved curriculum as to what learners practically learn in classroom and what they understood in the implemented curriculum. Thus, Johansson (2016) alludes that attained curriculum is at the student level. The study further outlined that the results of what takes place in the classroom at the level of students' outcomes is therefore, considered as the attained curriculum. This suggests that teachers should reflect on what learners achieved to be able to know where the improvements should be. Moreover, a study by Mpungose (2016) asserts that teachers should be aware of the assessed curriculum which includes different types of assessment. This suggests that for teachers to assess learners, they should reflect and understand all assessment techniques that will make the intended more purposeful. Further to this, justice should be done by teachers for reflecting on intended and implemented curriculum before administering attained curriculum. Moreover, Voogt and Roblin (2012) as well as Mereku and Mereku (2015) state that attained curriculum is curriculum which indicates the knowledge, understanding, skills, and attitudes that learners actually acquire as a result of teaching and learning, assessed through different means in practice. This suggests that if all forms of assessment used in Grade 4 Mathematics (Socratic, narrative and other methods) have been applied correctly, written reflection will be determined by learner performance whether intended and implemented was initiated correctly. All levels of curriculum are important, but

attained curriculum is what teachers understand, because if intended did not achieve its meaning and implemented curriculum was not practiced correctly, personal reflection will prevail in attained curriculum which seek teacher to have an understanding of some curriculum design approaches.

## **2.4 Curriculum design approach**

Thijs and van den Akker (2009), assert that curriculum development includes innovations and improvement strategies involved in the development of education. Eisner (2000) further outlined how curriculum design also includes strategies that are employed to determine in which manner basic knowledge is transmitted from one person to another. Literature from Hoadley (2012), Khoza (2015), and Firth (2012) asserts that in education, various approaches are used. As a result, van den Akker, Branch, Gustafson, Nieveen, and Plomp (2012) identified four types of curriculum developments: instrumental approach; communicative approach; artistic approach; and pragmatic approach.

### **2.4.1 Instrumental Approach**

According to Thijs and van den Akker (2009), as well as Malcolm (2014), the instrumental approach has a framework that comprises four components. First is, what are the objectives that the education should aim for? Secondly, what are the learning experiences that will be suitable in obtaining these objectives? Thirdly, how can these educational experiences be effectively arranged? Lastly, how can we determine whether these purposes are being attained? These studies affirm that, if the four above curriculum development questions are answered appropriately it will yield to good curriculum, hence “objectives, learning experiences, organised the learning experiences and embankment on evaluation is taken into account” (Offorma, p.87, 2014). Further to this, questions are specific and help the curriculum developers to be on track, always focusing on the objectives. In a curriculum that is influenced by instrumental approach, the objectives, curriculum content, and methods to be used are clearly outlined in a sequential manner (Thijs & van den Akker, 2009). The instrumental approach emphasises the importance of a systematic design process (Tyler, 2012). In other words, instrumental approach is linear, its steps progress from one point to another. This suggests instrumental approach draws more from Tyler’s approach which may assist teachers

to use written reflection on their practices in order to follow step-by-step, not in jumping to other steps while first step is incomplete, checking where they have left and which path they can move to. For instance, teachers may trace their reflective practice in teaching Mathematics in Grade 4, through learner performance. Thus, Galane (2016) outlines that shortcomings of this approach is based more on the written documents which address the subject content and leave out societal needs. In other words, communicative approach is vital in bringing social elements during teaching and learning.

#### **2.4.2 Communicative Approach**

Tyler (2010) as well as Yu, Mei, and Qian (2014) outlined that communicative approach emphasises the importance of relationship strategies. In this approach (communicative), all stakeholders take part in the development stage (Bogie, 2016). This suggest that it is imperative that teachers use verbal reflection so that they can come up with different teaching strategies as they take part in curriculum implementation. Studies by different researchers who focus on curriculum planning, development, implementation and enactment like, Pissourios (2013); Chantal and Gabriele (1997); Khoza (2015); Berkvens, Vandermeulen, Vercauteren, Peremans, and Weyn (2014); Bantwini (2010); Zeichner and Keneth (1987) just to mention a few stressed the importance of relational strategies in curriculum development. The above studies further assert that all stakeholders' relationships are eminent, hence teachers' reflection are of paramount importance. Communicative approach starts with the more subjective perceptions and views of the designers, the target group, and other stakeholders (Hanks, 2018). Designers are perceived as the societal process in which the interested parties involved reach consensus. Hence, deliberation and negotiation are the core of the design process through the process of verbal reflection.

Moreover, Pansiri (2008), who explored challenges between policy and practice in Botswana, affirms that communicative approach is of use in bringing ideas of stakeholders involvement in curriculum implementation. The research question of the Pansiri's study focused on the level of commitment of schools to universal basic education, school-community partnership in school governance, and parental involvement in school curriculum implementation processes. The study outlined that curriculum developers at the national Department of Education should

consider how feasible the policies are at the school and classroom level. For the developers to understand the feasibility factor, it is imperative to engage teachers in the process of reflection (Hoadley, 2012). This suggests that communicative approach has its foundation of involvement of all stakeholders for consensus to be agreed on.

In addition to the above, Richards and Rodgers (2014) came out with the deliberative model, which is naturalistic, and reflects on the actual practice of communicative curriculum development. This model comprises of the following: The platform of ideas: This is the first phase of curriculum development where designers and other parties engage together and discuss their views and opinions about the problem, while striving for consensus. In the first phase, Walker (1971) concur with Wellington (2015) that the results of the deliberations phase is transformed into a draft of the final product. This suggest that if teachers reflect on Mathematics there must be an end result in mind of what are they reflecting on, since it is clear that social factors are greatly considered in communicative curriculum development, although Voogt, Tilya, and van den Akker (2009 ), reasoned that this model is time consuming. For South African curriculum, CAPS is performance-based as its more understanding of levels from development to the implementation phase (Taole, 2013) (Hoadley, 2015). There is no evidence on the input of society in the development of CAPS. CAPS is prescriptive in nature and no input done or changed no matter how challenges teachers may find themselves in (Khoza, 2015). Further to the above statement, teachers are able to reflect on their practices of teaching Mathematics in the institution they work in or in the implemented curriculum.

Thus, the second phase is Deliberation: Here, the designers and other parties involved, generate possible solutions for the problem identified and discuss/debate the most desirable and suitable solutions. This suggests that robust debate and engagement are placed into practice. Further to this, problems are identified, and teachers' reflections in the engagement developed (Zipin, 2013). In addition to this, Taole (2013) outlines that the intended curriculum requires (CAPS) a high level of understanding from development to the implementation phase. Lastly is Design. During this phase, the most desirable solutions are transformed into a draft of the final product, which is the policy document. This draft is presented for amendments by all stake holders involved to accommodate all diverse concern that might arise. Although van den Akker (2013) outlines that communicative approach is time consuming, its nature shows competence

curriculum model which was identified by (Bernstein, Swenson, & Tsichritzis, 1975) as well as (Khoza, 2017a) to engage peoples' ideas. It is then, imperative that teachers engage on the pragmatic approach in order to embrace practical consequences.

### **2.4.3 Pragmatic approach**

Czujko (2013), defined pragmatic approach as the doctrine that clinches practical significances as the criteria of knowledge, meaning, and value. This definition resonate from Tyler (1959), where pragmatic approach is illustrated as an attribute of accepting realities of life and favouring practicality and literal truth. In other words, Pragmatic approach to curriculum is moulded personal reflection since it seeks individual practical experiences and observation rather than theory. This suggests that teachers teaching Mathematics must be driven by reflections in order to connect between theory taught and experiences in education (Khoza, 2015). Further to this, pragmatic approach stresses the importance of developing personal and critical consciousness about cultural, societal, racial, and ethnic diversity in the teaching-learning environment (Khoza, 2015).

Moreover, both Khoza (2015), and Barber and Cucalon (2017) alluded that pragmatic approach emphasises the practical usability of product of the curriculum, and the development of the curriculum that takes place in close relations with local practice and users. Dewey (1933) concurs with van den Akker by stating that curriculum should be regarded as a developmental continuum of learning, as it derived from *currere*, and also should be the series of individual experiences which teachers must have by the way of acquiring objectives. Bakshi, Kett, and Oliver (2013) explained that, the main objectives of pragmatic approach should be the habits, attitudes, appreciations, and forms of knowledge that learners need in order to be competitive in their daily lives. This suggests that for teacher to undergo pragmatic approach, learner-centred approach must be applied whereby teachers must be driven by personal reflections in order for learners to gain experiences on their own, so that they will have long lasting memories. The intended curriculum (CAPS) does not accommodate pragmatic approach (Long & Lampen, 2014), since pacesetters used by teachers indicate the use of resources without specifying the actual resources to be used. Studies by Bantwini (2010), Fomunyam (2014), and Taole (2013) have proven that teachers, as the implementers of curriculum, have no influence

during the curriculum development stage. The above aspects of design approaches are summarised in the table below, adopted from (Van den Akker, 2010).

**Table 2.1: Comparison of aspect of curriculum design approaches**

	Instrumental approach	Communicative approach	Pragmatic approach
Sequence of activities	Logical sequence	No strict sequence	Cyclical
Characterisation of activities	Rational process	Intensive deliberation during part of the process	Frequent evaluation with users
A good curriculum	Meeting predetermined requirements	Meeting requirements about which a broad consensus exists	Meeting the user's requirements

## **2.5 Competence/Horizontal curriculum versus vertical/performance**

Due to the background of the Apartheid curriculum and the changes, that emerged and that were done by the post-apartheid, curriculum was completely transformed (Bantwini, 2010; Muller, 2012). As of now, two curriculum models i.e. Curriculum 2005 and Curriculum Assessment Policy Statement emerged, and it may be debated that there is a clear distinction between the two, because they both draw from Bernstein's approaches to curriculum, which are competence and performance curricular (Bernstein & Solomon, 1999).

### **2.5.1 Horizontal curriculum**

Hoadley (2012) outlines that the designers of horizontal curriculum are interested in encouraging the learners' natural competencies. Further to this, it resembles what learners



acquired through learning, not what they want is imposed from outside. An essay by Bernstein (2006) on vertical and horizontal discourse asserts that horizontal curriculum entails a set of strategies which are local, segmentally organised, context specified, and dependent for maximising encounters with persons and habitats. The study further asserts that this curriculum is acquired every day through common sense knowledge or everyday knowledge, and also asserts that in this curriculum there are distributive rules regulating the circulation of knowledge, behaviour, and expectations according to status/position. Bernstein (2006) assert that the teaching or learning environment is called competence or integrated or horizontal curriculum. The study further outlined that in horizontal discourse, knowledge acquisition is competent-based, rather than graded performance.

In a study by Khoza (2016) on, whether teaching without understanding curriculum vision and goals a high risk? Reasoned that in competence curriculum, subject were combined to form a learning area. The study further outlined that in South Africa, in particular from 1997-2012 (Curriculum 2005-C2005, Revised National Curriculum Statement-RNCS, National Curriculum Statement-NCS), subjects like Mathematics, Physical Science, and Technology, were combined into a single learning area. Further to this, the study specified that in a horizontal curriculum, outcomes were divided into seven critical outcomes, and five developmental and learning outcomes; levels of outcomes (low, middle, and high order) were not taken into consideration. These levels of outcomes resonate from Blooms Taxonomy. This suggests that horizontal curriculum made teachers struggle in reflecting since it is a combination of different subject, achievements of outcomes were a core irrespective of which levels learner achieved. This led teachers to deal with quantity instead of quality in disseminating content to learners.

Bernstein and Solomon (1999) described knowledge in competence curriculum, as horizontally generated from simple sources. This suggests that what learner learned manifest teachers to reflect personally in order for learners to grasp the content. The formation of questions in the assessment did not demand learners go beyond what they have learnt or apply their knowledge. Moreover, Zipin (2013) and Khoza (2015) outlined that horizontal discourses encourage the knowledge that comes from learners' points of view. This suggests that learners gain a moral boost and seen as more superior than others. This suggests that, those learners who received

more outcomes than others are seen as more competent than others and valued more highly by the society they reside in. In horizontal curriculum, learner-centred approach is adopted and it builds confidence in learners on how they learn (Khoza, 2015). This suggests that teachers may be driven by verbal reflection on how learners learn Mathematics if they drive their learning, since the teacher serves as a facilitator. In other words, teachers may discover what steps learners used, for example in the long division. Hence, this suggests that in a competence curriculum, fast learners are revealed by their submission while doing tasks assigned to them. This may help educators when reflecting to consider diversity on their practices when teaching Mathematics curriculum in order to understand those learners with learning barriers.

In addition to the above, Horizontal curriculum (Curriculum 2005), represents an example of a bureaucratic-driven process of curriculum (Cross, Mungadi, & Rouhani, 2002). Organisational approach, according to Carl and Habib (2005), places particular importance on certification (close attention is given to regulation and administrative question; official documents serve as guidelines for formulation). Moreover, Du Toit (2011 p.48) further explains, “This approach (bureaucracy) can block creative curriculum and promote centralised, rather than decentralised decision making”. For this curriculum, (curriculum 2005), it was not what was estimated for. It failed due to an overload of vocabularies, which teachers found difficult to explain to learners since they also failed to understand and lacked content specification (Galane, 2016). Further to this, Ingram (2014) concurs with Hoadley (2012) in that there was no clear guidance for teachers as to what learning outcomes were to be achieved in each grade and there was no measure of or standard of progression. Despite the introduction of National Curriculum Statements (NCS), continuous challenges on how teachers were supposed to teach persisted, which yielded the introduction of Curriculum Assessment Policy Statement (CAPS). Thus, horizontal curriculum cannot be isolated in discussion, since there is also vertical curriculum.

### **2.5.2 Vertical curriculum**

Performance curriculum emphasises professionalism and is run hierarchically (Khoza, 2015). Similarly, vertical curriculum takes the form of coherent, explicit, and systematically principled structure, hierarchically organised as in sciences, or it takes the form of a series of specialised languages with specialised modes of interrogation, and specialised criteria for the

production and circulation of text, as in the social sciences and humanities (Hoadley, 2013). Further to this, in South Africa in particular, Curriculum Assessment Policy Statement – CAPS is performance curriculum because it is more specific and indicates what content need to be disseminated to learners, and how, when, which is typical to (Tyler, 1959) approach to curriculum. (Galane, 2016). Thus, the Minister of Basic Education in the Republic of South Africa suggested that this curriculum is built on the previous curriculum, however CAPS is a combination of RNCS and NCS with an aim of clearer specification of what is to be disseminated on daily basis (DBE, 2011). In line with this, Khoza (2016) further asserts that each subject was given its own intentionally identified content. In the vertical curriculum, recorded facts, school knowledge, and international standards are used in making decisions. As a result, this curriculum puts content and at the centre of teaching and learning to ensure that all basic knowledge is imparted (Park, Chen, & Wood, 2012). For teachers to be able to reflect and understand performance curriculum, they should take into consideration knowledge, assessment, time, space, learner, and approach, as the key factors (Zipin, 2013). Both Khoza (2015) and Gleeson, O’Flaherty, Galvin, and Hennessy (2015) further outline that teachers are the drivers of curriculum. This suggests that teachers must administer their role of imparting and delivering knowledge to the learners. The knowledge should be recorded since there must be authenticity of whether it has been passed to learners (Bernstein et al., 1975). Moreover, the knowledge that is chronologically and systematically imparted to learners specifies periods (pacesetter or Annual Teaching Plan) is evident in Curriculum Assessment Policy Statement (CAPS) documents. This suggests that they must be driven by written reflections on how and when they must finish the content prescribed to them, for an example, when they are supposed to write assessment task and which task they are going to administer, and what marks are allocated to it.

Furthermore, below is a table which clarifies competence or horizontal, and performance or vertical curricula, which is based on, but not limited to, some of the common identifying curriculum concepts that need to be dealt with in implanting the curriculum which (Voogt et al., 2009) announced as curriculum concepts.

**Table 2.2: Comparisons of the competence approach and the performance approach to curriculum**

	<b>Competence /horizontal curriculum</b>	<b>Performance /vertical curriculum</b>
<b>Process</b>	❖ Enacted	❖ Implemented
<b>Learners</b>	<ul style="list-style-type: none"> <li>❖ Controls what, how and when and which content is to be taught</li> <li>❖ Learners learn in a different way</li> </ul>	<ul style="list-style-type: none"> <li>❖ Has limited control on what, how when and which content is to be taught</li> <li>❖ Assumes that not all learners can learn at all levels and excludes some learners</li> </ul>
<b>Teacher (role)</b>	<ul style="list-style-type: none"> <li>❖ Facilitate learning</li> <li>❖ Control is personally negotiated</li> </ul>	<ul style="list-style-type: none"> <li>❖ Directly teachers the learner's role and the sole source of knowledge</li> <li>❖ Control is hierarchical, the educator decides</li> </ul>
<b>Pedagogy</b>	<ul style="list-style-type: none"> <li>❖ Focus on learning</li> <li>❖ A move towards a common pedagogy and a common practice of teaching</li> </ul>	<ul style="list-style-type: none"> <li>❖ Focus on subject to be taught</li> <li>❖ Reveals differences rather than commonalities</li> </ul>
<b>Knowledge</b>	<ul style="list-style-type: none"> <li>❖ Subjects are integrated</li> <li>❖ Various content becomes part of greater whole and each content is made explicit</li> <li>❖ Syllabus of a given content is subordinate to a general idea</li> <li>❖ Strong links to learner experience and everyday knowledge</li> </ul>	<ul style="list-style-type: none"> <li>❖ Subject are clearly demarcated from each other</li> <li>❖ The fundamental concept does not reduce the overall independence of the separate content</li> <li>❖ Syllabus is controlled by the educator and those who evaluate it</li> </ul>

	<ul style="list-style-type: none"> <li>❖ Emphasises ways of knowing rather than states of knowledge</li> <li>❖ Shared cooperative educational talks</li> <li>❖ Weaken hierarchy, teachers may enter a social relationship with each other</li> </ul>	<ul style="list-style-type: none"> <li>❖ No link between school knowledge and everyday knowledge</li> <li>❖ Knowledge is scarce</li> <li>❖ Hierarchy is evident in staff like with learners</li> </ul>
<b>Assessment</b>	<ul style="list-style-type: none"> <li>❖ General competent area</li> <li>❖ Common examining style</li> <li>❖ Focuses on what the learner know and can do</li> <li>❖ Teachers shares the task of evaluation with the learner</li> </ul>	<ul style="list-style-type: none"> <li>❖ Specific performance criteria</li> <li>❖ Permits differences in form of examining</li> <li>❖ Focuses on what the learner has left out</li> <li>❖ Teachers performs the task of assessment</li> </ul>
<b>Learning sites</b>	<ul style="list-style-type: none"> <li>❖ Anywhere</li> <li>❖ No fixed periods</li> </ul>	<ul style="list-style-type: none"> <li>❖ Clearly marked learning sites</li> <li>❖ All time periods firmly fixed</li> </ul>

## 2.6 Conceptual framework: Curriculum spider-web

Studies conducted on South African curriculum reform by Majoni (2017) scrutinises issues that bring pressure to curriculum and assessment in the course of curriculum change which include subject overload in school, change of concepts in curriculum such as learning outcomes and aims of a subject, changes in assessment, and teaching resources like the availability of trained or qualified educators. Moreover, this study by Majoni (2017) further states that the critical determination of effective teachings are: knowledge of the subject matter, motivation to teach, and the reason why teachers were teaching. In addition to the above, studies affirmed that quality delivery of subject matter all rest upon the individual teachers' understanding of curriculum concept. This suggests that the teacher should adhere to seven roles of the teacher that are outlined in Darling-Hammond and McLaughlin (1995). For example, a teacher is the designer and interpreter of a learning programme. In other words, an individual teacher needs

to reflect on the practices done in the class to deliver quality teaching in the teaching and learning of Mathematics. Moreover, above studies display curriculum elements that will assist teachers to reflect on their teaching. Moreover, Thijs and van den Akker (2009), clarify elements of curriculum that need to be understood by teachers in question form, in a more meaningful and understandable way. These questions are organised in a table format below:

**Table 2.3: The table is presented in terms of concepts, propositions, and core questions**

<b>Concept</b>	<b>Proposition</b>	<b>Core question</b>
<b>Rationale</b>	Personal rationale; Content rationale; Societal rationale	Why are they teaching?
<b>Accessibility</b>	Physical; Financial; Cultural	Whom are they teaching?
<b>Goals</b>	Aims; Objectives; Learning outcomes	Towards which goals are they teaching?
<b>Content</b>	Content Knowledge	What content are they teaching?
<b>Teacher Role</b>	Facilitator; Instructor; Assessor	What activities are they teaching?
<b>Activities</b>	Teacher-centred activities; Content-centred activities; Learner-centred activities	How are they teaching?

<b>Resources</b>	Hard-ware; Soft-ware; Ideological-ware	With what are they teaching?
<b>Location and Time</b>	Weekly; Days; Hours	Where and when are they teaching?
<b>Assessment</b>	Formative assessment; Summative assessment; Continuous assessment	How are they assessing?

A study by Khoza (2015) on teachers' reflection on their practices of curriculum and assessment policy statement stated that for the curriculum to be evaluated, curriculum concepts become the cornerstone and recommended basis for evaluation. It is then important to look back on what they have done. As a result, this study is guided by the above-mentioned curriculum concept, which play an important role in the teaching and learning of Mathematics in the Intermediate Phase. This suggests that it is important for teachers to reflect on their practices based on curriculum components so that they will improve teaching, particularly the element of goals.

### **2.6.1 Why are they teaching? (Rationale)**

Tyler (1948) as well as Loughran (2013) reasoned that personal pedagogy refers to the importance of learning and development from the personal point of view. This suggests that the teacher has an obligation to prioritise teaching being driven by personal reflection in order for it to take place. Likewise, van den Akker (2013) defined rationale as the elementary reason to accomplish a duty. Moreover, Voogt et al. (2009) outlined that "the rationale serves as a central link, connecting all other curriculum concepts". Alluding to this assertion, a study by Oakes, Lipton, Anderson, and Stillman (2015) revealed that teachers teach to change the world. This suggests that verbal reflection drives teachers to teach Mathematics in order for learners to acquire skills. Furthermore, rationale has three propositions, which are, personal rationale, content rationale, and societal rationale (Davison, Basu, Goldstein, & Chawla, 2014; Voogt et

al., 2009). This suggests that, rationale revolves around other curriculum concepts in the spider-web, which drives the teacher to teach a particular subject. Hence, for teachers to understand rationale (why are they teaching Mathematics?), they must dwell on these three above-mentioned propositions.

In addition to the above, Martins and Santos (2012) conducted the study to explore why teachers must become the agent of change. The study randomly sampled 220 students-teachers as participants. The study reveals that the majority of participants' rationale of teaching was to make significant changes in the lives of learners and to bring awareness for other teachers to the value of education. This suggests that teachers, as they are driven by personal reflection, can make lives for themselves in teaching Mathematics easy. Further to this, if teachers have passion for what they are teaching, automatically they may inspire learners, because of what they portray to them. In line with this statement, Mpungose (2016) further reasoned that personal rationale has a remarkable duty in attaining curriculum goals. This suggests that without teachers' enthusiasm and commitment learners can attain no curriculum goals, which is the core duty of teaching and learning.

Expanding on the above, a case study conducted by Foster, Anthony, Clements, Sarama, and Williams (2016) on school managers' reflections on their experiences of managing CAPS in the city of Bloemfontein outlined that the personal rationale for a teacher to teach places the individual teacher at the centre of teaching and learning. Reflective activity, semi-structured interviewed, and focus group were used to generate data; the findings of the study revealed that school managers are committed and dedicated to their job however, the school managers were lacking knowledge and understanding of what is required from them in managing CAPS. This suggests that teacher's lack knowledge and understanding of what they do in the classroom; and make it difficult for reflection to take place; there will be no reason for them to teach. In a case study conducted by Khoza (2015) on students educators' reflections on their practices of Curriculum and Assessment Policy Statement (CAPS), outline that educators do not have what it take (rationale) to implement the curriculum, as a results they work like technicians. Galane (2016) and Khoza (2015) reasoned that technicians are given manuals to follow when they fix something without applying their experiences; hence, educators are given curriculum policy to



follow without changing anything. The study further outlines that teachers teach Mathematics content because it is compulsory.

Moreover, Berkvens, Vandermeulen, et al. (2014) outline that focuses on why teachers are teaching and what outputs they are aiming to achieve when teaching the content is vital. Thus, the content reason is defined as rationale that upholds a profession as the cornerstone for managing teaching and learning (Bernstein & Solomon, 1999; Shengli, Jianxia, & Jie, 2008). De Grez, Valcke, and Roozen (2009) as well as Richards and Schmidt (2013) add that teachers teach, or practice implemented curriculum on how they identify themselves, which is described as teachers' identities, and teachers teach what they teach through their profession. This suggests that professionalism plays an important role, because the knowledge teachers possess measures the content level the teacher has. In other words, qualifications that the teacher possesses relates to the knowledge of a subject in the profession for teaching (Allan & Love, 2010; Galane, 2016). The professional teacher should therefore be qualified and continue to improve themselves with regard to teaching and learning (Msibi & Mchunu, 2013). This suggests that a teachers' knowledge of content through qualification is vital for the teachers to be able to reflect on the subject (Mathematics). Msibi and Mchunu (2013), indicate that teachers who are not qualified to teach Mathematics should not be allowed to teach Mathematics as they both lack subject content and knowledge and the pedagogical content knowledge. Moreover, Zuma (2015) reasoned that forcing teachers to teach Mathematics without relevant knowledge would be detrimental to learners, as they can lack Mathematical knowledge and skills needed to solve problems in their real lives. Thus, teachers who are not properly qualified to teach Mathematics may find it difficult to apply the above-mentioned critical elements of teaching as well as reflecting on Mathematics (Zuma, 2015); (Mji & Makgato, 2006). Moreover, Jansen (2004) outlines that teachers teach for personal rationale, which occurs when teachers understand the society they work in which is influenced by societal rationale.

In line to the above, Fiedler (2008) as well as Banks (2015) reasoned that, societal rationale focusses on teachers' value of education in respect to world and societal views. Further to this, Schiro, Pang, and Shanbhag (2013), maintain that societal reason value society in teaching and learning process. This suggests that teachers teach Mathematics are driven by verbal reflection

and expectations of the community. In line with this, Napitupulu, Suryadi, and Kusumah (2016) assert that, Mathematics is an intellectual achievement of great sophistication and beauty that epitomise the power of reasoning. Moreover, they reasoned that for people to participate fully in society, they must know the whole realm of human endeavour. This brings desire for teacher to teach Mathematics particularly because learners must have an opportunity to face real life situation. Further to this, Mathematics, teachers must be driven by verbal reflection in order to for learners to be competent beings in society without being deprived of opportunities. Thus, Adler, Ball, Krainer, Lin, and Novotna (2005, p. 360) further outline that, “Mathematics is taught because is viewed internationally as a necessary for critical citizenship.” Clements and Sarama (2014) reasoned that Mathematics should be taught in early grades for learners to gain foundation and enable them to meet abstract concepts in their higher grades. This suggests that teachers must use societal rationale and be able to teach in a manner that reflects easily on their practices, because they understand what they are taught. Moreover, teachers are getting paid for what they do in the classroom and this might be the other reason why are they teaching (Okamoto & Miura, 2013). Nachlieli, Herbst, and González (2009) argued that teachers teach because of two obligations: personal and societal. However, the reason for teaching of Mathematics in Grade 4 can be influences by goals.

### **2.6.2 Towards which goals are they teaching? (Aims, Objectives, and Outcomes)**

Goals are defined as purposes that a teacher may adapt in guiding teaching and learning (Chan, 2004). A study conducted by Khoza (2016) with the purpose to check whether teaching without understanding curriculum vision and goal is a high risk outlines that if teachers can understand teaching vision, they can identify relevant curriculum goals. The study continuously declare that goals are divided into aims, objectives, and learning outcomes. Further to the above, Kennedy, Hyland, and Ryan (2006), and Wilson, Sztajn, Edgington, and Confrey (2014) differentiated between aims, objectives, and learning outcomes.

Moreover, Harlen (2018) in line with Wilson et al. (2014) illustrate that aims are broad general statements of teaching intentions of what the teacher deliberately want to cover during teaching and learning process. The above studies further clarify that aims are usually written from the teachers’ point of view to indicate the general content and direction of the topic that is to be

taught in the classroom situation. For example, in Grade 4 Mathematics, a teacher's aim can be to introduce basic Mathematical counting skills. Moreover, Aron (2017) assert that aims have no formula for developing them. This is further clarified by the study conducted by Schoenfeld (2013) whereby it was articulated that teachers are not clear about what aims are. This suggests that teachers teaching Mathematics in Grade 4 must be driven by aims for them to reflect, meaning that they must ask themselves clear intention of reflection in order to unlock misinterpretations between aims and objectives. In other words, teachers seek to be driven by self-reflection during the teaching and learning process in order to meet objectives.

On other hand Wilson et al. (2014) as well as Kennedy et al. (2006, p. 5) further defines objectives as "specific statement of teaching intention". For instance, for Grade 4 Mathematics objective can be that learners must know how to add numbers above hundred thousand. Moreover, Berkvens, Van den Akker, and Brugman (2014) reasoned that objectives drive teachers to decide what is more important and what is to be taught or covered (content) in the class. Especially in Mathematics, there should be clear objectives. It is not a mere presentation of the subject to learners, but objectives must be structured for making learners understand well. This suggests that for the teacher to create conducive teaching and learning situations, they must be driven by written reflection on objectives which will bring consciousness in designing lesson plans. Further to this, at no point can a teacher teach learners without preparation, because it is where objectives are articulated, which can drive the lesson (Naseri Karimvand, Hessamy, & Hemmati, 2014). Moreover, objectives give clarity and growth on what is to be achieved at the end of the lesson. In extension to the above, Voogt et al. (2009) reasoned that teachers need to follow clearly defined objectives for betterment of learning outcomes.

In addition, Kennedy et al. (2006) and as well as Haugaard (2015), further clarify learning outcomes as statements of what it is expected learners achieve at the end of a lesson and it is constructed on the side of a learner. Moreover, Munisi (2017) further clarifies that learning outcomes are more concerned with what learners achieve at the end rather than the teachers intentions. An example of outcome might be after the lesson has taken place (Mooney, Langrall, & Hertel, 2014). This suggests that teachers must be driven by verbal reflection in order to meet the needs of a learner. A further case study conducted by Boud (2013) as well as

Haugaard (2015) outlined that learning outcomes are achieved by means of learner-centred approach. In addition, a study by Nkopodi and Mosimege (2009) as well as Zuma (2015) reveal that teachers should plan learning outcomes that can engage learners to apply Mathematical terminologies; identify properties of a square and rectangle; and describe the process of construction of chess board. Moreover, learning outcomes describes actions that are demonstrable and assessable (Redmond, 2007). Being clear about which outcomes are relevant, teachers should consult the CAPS documents.

In the Mathematics CAPS document, there are aims, objectives, learning outcomes, but aims are referred to as general aims, objectives are referred to as specific aims, and learning outcomes are referred to as specific skills (DBE, 2011). In addition, curriculum aims are appropriate to help teachers in describing goals which learners should achieve. Also, the context of Grade 4 Mathematics assists teachers to be able to teach learners to count without relying on devices in counting like calculators. DBE (2011) outlines that general aims have been articulated for the entire subject, resuming from grade foundation phase (Grade R) up to last phase, Further Education and Training (Grade 12). Thus, DBE (2011, p. 4) outlines that aims are designed in order “to ensure that children acquire and apply knowledge and skills in ways that are meaningful to their own lives. In this regard, the curriculum knowledge is in local context, while being sensible to global realities”.

### **2.6.3 What content are they teaching? (Content)**

Magnusson, Krajcik, and Borko (1999), share the same sentiment with Howell and Heap (2013) in defining content as a form of information and knowledge that the educator imparts and that learners should be learning in a particular learning area. In addition to the above definition, Ball, Thames, and Phelps (2008) as well as Fernandez-Flores and Saeb-Lima (2016) further defined content as a wide range of aspects of subject matter knowledge and teaching of subjects matter. Moreover, Zipin (2013) reasoned that content is described as an approach which fosters knowledge and the performance curriculum and builds a school’s knowledge capacity. This suggests that knowledge of what is to be taught in Mathematics is derived from content presented to the teacher. Studies conducted by Kelly (2009); Carl (2012); Hoadley (2015) and Berkvens, Van den Akker, et al. (2014) outline that curriculum implementation should begin

with what knowledge needs to be well versed by learners (subject knowledge) and what subject matter needs to be disseminated as per intended curriculum.

Furthermore, these studies Berkvens, Van den Akker, et al. (2014) argued that the formulation of subject content is dependent on the subject topic that is taught from practical, experimental, and subject knowledge. The empirical study by Venkat (2013) asserts that primary school Mathematics teachers should, at the most basic level, have mastery of the content knowledge that they are required to teach. This suggests that teachers must reflect on their practices as they are driven by personal reflection in classrooms for better curriculum and content dissemination. The study further asserts that a range of smaller scale studies have analysed data-based teaching and make inferences about the nature of primary teachers' disciplinary knowledge of Mathematics and their subject knowledge for teaching. Further to the above-mentioned study, curriculum implementation should start with what knowledge needs to be understood by learners and what subject matter teachers need to deliver. This suggests that teachers must be able to acclimatise themselves with the content knowledge to be able to face any challenging questions from learners. Further to this, a teacher should be able to reflect on expected questions that learners might ask during teaching and learning, and secondly be able to cater for diversity in the class. As it was alluded to above, in Mathematics, "there are five content areas which are number operations and relationship; patterns; function and algebra; space and shapes; measurement; and data handling" (DBE, 2011, p. 4).

Furthermore, the above-mentioned areas are what teachers should focus on when teaching Mathematics in Grade 4. Firstly, Numbers, Operations and Relationships, focuses on the range of numbers developed by the end of the phase extended to nine digits whole numbers; decimal fractions to at least 2 decimal places, common fraction and fractions written in percentage form (DBE, 2011). Secondly the document also outline Patterns, Functions, and Algebra which involves numeric and geometric patterns with a special focus on the relationship between terms in sequence. In addition, learners should be taught numeric and geometric patterns that develop the concepts of variables, relationships, and functions. Thirdly, Space and Shapes (Geometry) focuses on two-dimensional shapes and make models of three-dimensional objects, describe location, transformations, and symmetry. Another content area is measurement whereby learners should be exposed to a variety of measurement activities, for example angles, area,

perimeter, and capacity or volume. Lastly is Data Handling: teachers must expose learners to a variety of context for collecting and interpreting data and a range of questions in interpreting the data (DBE, 2011).

In addition, a study conducted by Mpungose (2016), on teachers' reflections of the teaching of Grade 12 Physical Science CAPS in the rural Ceza Circuit, argued that decisions on content and subject are determined by subject topics to be covered, practical work/experience, and content-related knowledge. The study further outline that knowledge of the teacher is of vital importance for content delivery. Further studies by Loucks-Horsley (1995) and Dhaliwal (2015) outlined that a teacher is a lifelong learner in that the teacher must know changing subject matter. This suggests that teachers must be able to reflect and check what is required of them in order for learners to master the content of Mathematics in Grade 4; what relevant for the topics needed to be tackled, and how to approach them. Moreover, a qualitative case study conducted by Shulman (1987) further concurred with Loucks-Horsley (1995) and Sleeter (2014) by stating that a teacher is a scholar who must know all aspects of the subject. Interviews and documents analysis was used to generate data, which revealed that teaching begins with the teachers' understanding of what is to be learnt and how it is to be taught, and teaching ends with new understandings by both the teacher and learners. This implies that teachers should be driven by written reflection when they teach in order for them to cascade information to learners in their best possible way. Poor or no qualification in teaching Mathematics in Grade 4 might result in poor content delivery. This also suggests that a teacher is the fountain of information. If the teacher fails to deliver the correct content to learners due to a lack of reflection, the learners might not be able to master the content.

In addition to the above, Loucks-Horsley (1995) as well as Voogt, Fisser, Pareja Roblin, Tondeur, and van Braak (2013) asserts that content knowledge involves knowledge of the subject and its structures or parts whereas curricular knowledge is characterised by certain programmes for the teaching subject. This suggests that every teacher teaching Mathematics in Grade 4 must have relevant content and curriculum knowledge which will help in order to check whether justice has been done to learners. This also implies that, without reflecting on the content and curriculum there will be no relevant and accurate information required by learners. Moreover, Hoadley (2012) asserts that the intended Curriculum (CAPS) is found in

different sources or documents and applies to different levels of curriculum. In addition to the above, the Mathematics syllabus, pacesetters (Annual Teaching Plans), lesson plans and the textbooks are all curriculum documents at different levels of the curriculum. This suggests that teachers should be driven by written reflection on different documents in order to deliver the best possible content. Additionally, Zuma (2015) illustrates that curriculum content should be systematic, logical, and mechanical and this will help educators know what to teach as prescribed.

In highlight of Zuma (2015) on exploring of teaching strategies for Grade 5 Mathematics CAPS in three primary schools at KwaNdengezi Circuit in Pinetown District outline that curriculum content should be systematic, logical, and mechanical and this will help teachers to know what to teach. This suggests that teachers' reflections should be based on the content they deliver to learners. Reasonably, in Grade 4 Mathematics, teachers should teach topics step-by-step for learners to grasp. For example, in a number of operations, learners must be able to know units, tens, hundreds and thousands, to be able to count accurately. In addition, Radford (2008) outlines that teachers should use a metallic teaching strategy that involves written questionnaires, intervention, interviews, and drawing exercises to gain an indication of what is going on in the mind of learners. This suggests that teachers must give learners activities like snake and ladder in Mathematics content with an aim of developing counting (forward and backward), problem-solving, and vocabulary skills.

According to CAPS documents, Grade 4 Mathematics has five content areas which are weighted as follows: Numbers; Operations and Relationships 50%; Patterns, Functions and Algebra 10%; Space and Shapes 15%; Measurement 15%; and Data Handling 10% (DBE, 2011). Moreover, DBE (2011) articulates that Mathematics shows consistency because it has vision, overarching goals, and objectives, and its meaning, skills, and knowledge are integrated. It further states that each content area contributes to the acquisition of specific skills, the general focus of the content area, as well the specific focus of the content area. In addition, school-based research conducted by Long and Dunne (2014) on curriculum coverage and cognitive depth in a primary school in the Gauteng province, revealed that a topic approach underlines the design of the order and progression of the topics are carefully planned, so that the conceptually preceding are presumably taught before to the more concrete topics. This suggests

that teachers should be driven by written reflection in order to deliver the best content to learners. Thus, content is better understood if materials and resources are in place.

#### **2.6.4 With what are they teaching? (Materials and Resources)**

In an interpretive study conducted by Khoza (2013) with university lectures who use the online environment in teaching, learning resources are defined as any person or thing that communicates learning, or anything which helps learning to happen. In addition, Khoza (2013) argued that there are three types of resources in teaching. These resources are software resources (any material that display or carry information or data), ideological-ware (things that are not tangible like methods, policies, theories etc.), and lastly hardware (any machine, object, or tool used in education). The study further asserts that the word 'ware', represents 'awareness' in using these teaching and learning resources. This suggests that teachers cannot merely rely and reflect on single a resource available, but that they must be aware that there are other resources available. Moreover, teachers teaching Mathematics in Grade 4 should be driven by both personal and written reflection in order to understand which resources are applicable in their practices.

Moreover, Khoza (2013) defines hardware resources as any machine, object, or tool used in education. In addition to the above, Krishna, Pulcini, Moore, Teo, and Staines (2014) outlines that teachers believe successful teaching and learning depends on the teaching and learning resources. This suggests that teachers understand the value of hardware resource in order to facilitate teaching. In addition to the above, rural schools mostly depend on hardware resources like textbooks (Zuma, 2015). Moreover, Reid (1995) states that several resources used by teachers and learners are teaching aids. Hence, in Grade 4 there are workbooks (hardware resource) which support teachers in their teaching and learning. The major problem identified in Mathematics workbooks are printing errors and an absence of teachers' guides (Zuma, 2015). This suggests that teachers need to be driven by written reflection on these workbooks as another resource, but be so cautious about misprint on them. However, resources are a plus in teaching and learning, so it is important for teachers to take care of them. In addition to the above discussion, in Mathematics there are accurate measurements that needs to be done. This implies that hardware resources like Mathematical instruments, abacus, rulers, and protractor



serves as pre-requisites for teachers to teach learners using them especially in Grade 4. This suggests that teachers should be driven by both personal and written reflection so that they will be of great assistance to learners by not theorising when they teach, but learners be able to see and touch resources in order to understand and be able to relate with what is learned. Harley and Wedekind (2004) as cited in Thuzini (2011) argued that the limitation of smooth learning and teaching in Mathematics is lack of resource. This suggests that if teachers fail to reflect on the correct resources, they might find it difficult to deliver quality learning. In addition, a study conducted by (Long & Dunne, 2014) indicate that teachers need to be encouraged to improvise resources that they consider useful and that will be within the context of the learner in the interest of professional development. The study further outlines that in the case of textbooks and other resources, publishers should be able to bring a bank of project ideas that are appropriate in the context of Mathematics education. This suggests that crafters of resources need to network within their sphere to develop relevant and appetising resources. Mpungose (2016) further articulates that hardware resources play some role in the teaching process, but also ideological-ware should be considered.

Ideological-ware are the policies, theories, and teaching and learning methods used by teachers to teach (Khoza, 2012a). Moreover, a case study conducted by Shezi (2013) on Grade 4 learners' experiences of learning Mathematics using English as a second language argued that learning in Mathematics needs discussion (ideological ware) so that learners can construct meaningful knowledge from the resources they use and be able to solve problems. This suggests that teachers should reflect on the opportunities that may arise and for the learners if they expose them to resources. Further to this, a literature review by Sosibo (2016) discovered that group work with the necessary materials could be useful in the teaching and learning of Mathematics. In addition to this, a mixed method study conducted by Minot (2008) reveal that grouping of students according to the availability of resources assist them. Moreover, Voogt et al. (2009) argued that teachers become team players, activities are unified, and they are used in engaging into awkward scenarios, so they can use resources when working with groups of learners. This suggests that teachers should be driven by verbal reflection on ideological-ware in order to improve learning. Moreover Berkvens, Van den Akker, et al. (2014), as well as Zuma (2015) outlined that curriculum resources that are issued in schools are relevant to the type of teaching, which is intended, and are consistent. Additionally, a study by Mupa (2015)

argues that resources are essential for implementation of teaching and learning, but ideological-ware is not sufficient alone, there is also a need for soft-ware resources.

Moreover, software resources are defined as “any teaching/learning resources that display.” In addition to that, Kumashiro (2015) asserts that resources are what teachers use when teaching. This suggest that any material used by the teachers and learners in the classroom environment is a learning aid. Without teaching resources, effective teaching cannot take place. Moreover, resources assist teachers to reflect on and check whether they are, helpful to learners or not. This can give teachers an opportunity to change if they are not useful enough, as Khoza (2015) outlines, teachers are one of the most important resources during curriculum implementation in the sphere of curriculum change. Personal reflection can then drive teachers to identify the correct aid in teaching and learning. One might argue that a subject teacher as a line manager in the subject, must be clear enough, and do a thorough networking in order to assist institutional heads in procuring the right resource, meaning they must not rely on what is on their disposal, but rather improvise. Moreover, Leendertz (2013) outlines that teachers should be conversant about computer skills for improved teaching and learning of Mathematics. Further to this, not all resources (software) for Mathematics are relevant in every class, but they are according to the level capacity of the grade. This suggests that teachers must be driven by personal reflection in order to assist learners in enabling them to gain Mathematical skills through information technology. In clarifying the above, teachers must bring pedagogical knowledge, for an example, calculators are different, so teachers must guide learners in using relevant calculators. In support of the above, availability of quality, resources and facilities have a great influence on curriculum implementation.

In the context of South Africa, DBE (2011) specifies the resources that must be used in class. In addition to the above, DBE (2011) issued workbooks, which are CAPS aligned as a resource that both teachers and learners can use to obtain activities. In addition to the above, the KwaZulu-Natal Department of Education (2013) specifies that resources are essential in facilitating teaching and are a pre-requisite in teachers’ support. The above statement resonates from the Department of Basic Education Curriculum Action 2014, which acknowledges that South African schools do not have resources, but they are committed to delivering adequate resources to schools. Moreover, DBE (2011, pp. 124-126) further illustrates that learners

should “count using apparatus like counters, number grid, number names and words”. Hence, Berkvens, Van den Akker, et al. (2014) reasoned that it depends on how teachers utilise resources during teaching and learning in order to make assessment meaningful to learners.

### **2.6.5 How do teachers assess? (Assessment)**

A study by Arend and Bromiley (2009) outlines that assessment refers to the full range of information gathered and synthesised by teachers about their students and their classroom. Further to the above definition, Magare, Kitching, and Roos (2010) reasoned that assessment is the strategy that is used to ascertain the level of skill, values, and knowledge that the learner has attained. Moreover, Kennedy et al. (2006) reasoned that assessment is illustrated in terms of formative assessment, summative assessment, and continuous assessment. Earl and Katz (2006) concurs with Jones and Sallis (2013) by stating that assessment is not a singular phenomenon. In addition, Simms and George (2014) assert that assessment is key in assuring quality education. This suggests that teachers must reflect on different forms of assessment when teaching Mathematics and they cannot rely on single assessment in the teaching and learning activity, but rather broaden their minds with an aim of assisting learners. In other words, teachers cannot be pleased to be giant in teaching and loading all information to learners while learners themselves are dwarf in knowing their achievements in Mathematics.

Moreover, Panadero and Jonsson (2013) reasoned that formative assessment is concerned with the creation of, and capitalisation upon, ‘moments of contingency’ in instruction for the purpose of the regulation of learning. In addition to the above assertion, Hair, Black, Babin, Anderson, and Tatham (2009), outline that formative assessment is known as assessment for learning, which takes place during the instructional process. Furthermore, the study by Olusola and Luneta (2015) further clarifies that formative assessment is assessment for learning because it includes all activities done by both educators and learners during the teaching and learning process. Additionally, Moyosore (2015) defined formative assessment as a process of providing feedback to learners with an aim of improving learner attainment. The study further outlines that formative assessment provides teachers with a gist of what learners understood during teaching and learning. This suggests that teachers must be driven by personal reflection in order to improve teaching and learning practice. In a clear sense, formative assessments, are

developmental, whereby a teacher can assess learners anytime (Khoza, 2015). This can include informal evaluation of a teacher to learners, in the form of class activity, a verbal question and answer method to check whether intended curriculum is being understood by learners or not. In addition to this, in the interpretive study by Moyosore (2015) on the interaction effect of formative assessment/testing and attitudinal types as they affect student's achievement in Mathematics, sampling was done from 120 students through purposefully sampled, using quasi-experimental design. The findings revealed that all in the experimental groups exposed to formative testing perform relatively better than those in non-formative testing group. The study concluded that formative testing is an important evaluation technique that adds quality to the national education if it meets its requirement of being functional, usable, and effective. This suggests that if teachers follow all principles of assessment in their teaching, the intended curriculum can be attained accordingly.

In another interpretive case study by Cornelius (2013), on exploration of formative assessment as implemented in primary classroom in Cyprus, data was generated through semi-structured interview, classroom observation, and document analysis. Four educators with varying teaching experiences were sampled. The findings indicated that educators were positive about their utilisation of formative assessment. However, they were unable to divulge what they do in classrooms as a means of summative and formative assessment. They did however agree that it is an important tool that can be used to promote teaching and learning. The study recommend that teachers should be trained on how to use formative assessment. This clearly suggests that teachers must administer formative assessment and be able to clarify between formative and summative assessment.

Moreover, Long and Dunne (2014) described summative assessment as containing judgements which, for immediate future, form the basis of one more decision which stems from that judgement. However, Garrison and Ehringhaus (2007) as well as Cornelius (2013), outlined that summative assessment (assessment of learning) is assessment that is given periodically, which means is formal in nature. Additionally, Kennedy et al. (2006, p. 9) asserts that summative assessment “tries to summarise the learning at some point in time and it has been described as end-of-course assessment”. This suggests that teachers should be driven by personal reflection to ensure that summative assessment take place timeously. Additionally,

the survey study conducted by Koronovsky and Naimark (2013) exposes that the main purpose of assessment is to clarify what the learners know, what they can do, and to give feedback to learners on their weaknesses and strength. In line with the above, Berkvens, Van den Akker, et al. (2014), outlines that assessment of learning is required in measuring the effectiveness of the implemented curriculum. This suggests that summative assessment assists both teachers and learners to identify gaps on how their teaching and learning unfolds. In addition to the studies, Earl and Katz (2006), as well as Galane (2016) assert that summative assessment includes high stake tests, standard state exams, district or interim tests, and final exams. These studies also outline that summative assessment can also be used to check teachers' mastery of subjects every few weeks or months. Moreover, Harlen (2005) concurs with Cornelius (2013) that summative assessment is used to conclusively track teachers and learners performance. Hence, teachers need to be driven by verbal reflection on the interaction between themselves and learners with an aim to measure their practice, by checking the attainment of learners' marks as early as possible. Further to this, as teachers administer summative assessment, they can come up with an intervention to assist poor performing learners in Mathematics. As it is clear that formative and continuous assessment must be administered, continuous-assessment should be catered for as well.

Moreover, Amedeker (2014) defines continuous assessment as a form of educational examination that evaluates a learner's progress through a prescribe course of study. In addition, a study by Kennedy et al. (2006) revealed that summative and formative are combined in continuous assessment. The study further reveals that continuous assessment often amounts to repeat summative assessment with marks being obtained, but little feedback is being given to learners. Furthermore, the purpose of continuous assessment is to improve teachers' learning as well as learners' learning (Walsh & Sattes, 2016). Moreover, as teachers involve learner in continuous assessment, learners' skills of facing summative assessment are sharpened (Zuma, 2015). The study further outlines that this type of assessment is done through the lesson to influence the learning process. This suggests that teacher can be driven by written reflection in order to administer continuous assessment. It can be argued that if teachers have no teaching skills, the purpose of this assessment cannot materialise. In addition to this, when time on task also is not observed there might be problems in teachers side whereby learners might struggle in other assessment, since this one should be done over and over again through different methods.

Moreover, Olusola and Luneta (2015) resonate with Meyer (1992) definition by stating that authentic assessment should be used as well as part of learning support using multiple ways to ensure that all skills are assessed in an equitable manner. Ramsden (2003), asserts that assessment takes place at the end of the teaching and learning process for facilitators, while it takes place at the beginning of lesson for learners. This suggests that teachers need to teach before they conduct assessment to learners which will serve as a true reflection on what has been taught, while learners are assessed on everything they learn, which has no limit. For Mathematics, learners must have an opportunity to be given steps to lead to the answer. Boureau, Le Roux, Bach, Ponce, and LeCun (2011), further asserts that teachers should be aware of each element of their teaching so that their actions do not affect learner' performance. This suggests that if the teacher does not teach all aspects required for Mathematics, learners will struggle to gain answers. This suggests that verbal reflection can drive teachers to instruct learners to reciprocate what they learned in the classroom.

Moreover, DBE (2011), alludes that assessment is a continuous planned procedure for identifying, gathering, and interpreting information regarding the performance of learners, using several forms of assessment. Consequently, DBE (2011) is very vocal about assessment in all curriculum documents. However, DBE (2011) outlines that all assessment in Grade 4 is internal, and they are categorised into two; informal or daily assessment and formal assessment. For Mathematics, informal activities involve classwork, homework, informal tests, and mental activities. In addition to the above, DBE (2011) on the strategy to teaching across the curriculum, highlights that teachers should teach learners assessments that they must understand. Particularly in Mathematics, terms like solve, underline, calculate, identify, draw should be known by learners. Moreover, DBE (2011) on National Protocol for Assessment indicates that all teachers are expected to keep a file as evidence of assessment done by learners, including annual teaching plans, assessment plans, formal assessment tasks, and memoranda, and any resource used. In addition to that, prescripts like mark sheets, intervention plans are within teacher's jurisdiction to keep above-mentioned documents. This suggests that teachers should be driven by written reflection on their files to make sure that nothing is missing in case of the verification of marks, moderation, and accountability purposes by the departmental head, principal, subject advisor, or departmental official. Earl and Katz (2006) further outlines that

assessment is necessary in the teaching and learning process. This suggest that for teachers teaching Mathematics, they must put ignorance aside to improve learner performance.

Further to the above, in Grade 4, CAPS (2011) outlines that Mathematics has nine formal assessment task per year, and these tasks are tests, examination, assignment, investigation, and project which forms 75% of school-based assessment and 25% comes from final examination. Additionally, CAPS (2011) further outlines that assessment in Mathematics should cater to a range of cognitive levels and abilities of learners, where knowledge should be 25%, routine procedure 45%, complex procedure 20%, and problem-solving 10%. Another issue is moderation, whereby intensity should be brought to cater for quality assessment in order to meet achievable maintained standards (DBE, 2011). This suggests that teachers should be driven by written reflection in order to administer assessment accordingly. Thus, assessment should be administered in a manner that no learner can be denied access.

#### **2.6.6 With whom are they teaching? (Accessibility)**

Phillipson and Rojas (2014) outline that access means the assurance that learners gain education without any discrimination. Berkvens, Van den Akker, et al. (2014), reasoned that everyone has a fundamental human right in the whole world which is education, and no child can be deprive education regardless of race, gender, sex or socio-economic background. In line with the above statement, Khoza and Mpungose (2018) outlined that accessibility of learners to attain education depends on different aspects like, physical accessibility (is it possible to reach the school), financial accessibility (are the school fees affordable), and cultural accessibility (is the school programme socially acceptable). This suggests that, for better curriculum delivery, teachers must reflect on physical, cultural, and financial accessibility in order to understand whom they are teaching. Then, physical accessibility paves the way for other accessibility.

Moreover, Anthony et al. (2014) as well as Shaikh and Hatcher (2004) define physical accessibility as to whether there is availability of transport, physical distance of the school, and time taken to reach the school. However, the performance approach to curriculum encourages

demarcated physical access such as classrooms (Bernstein et al., 1975). This suggests that teaching of Mathematics should take place in a conducive environment. Moreover, many schools, especially in rural areas, lack basic needs like ablution facilities, water, electricity, and road access, which cripples the performance of learners (Ramnarain, 2014). This suggests that teachers need to reflect on the environment where learners are coming from, and ask themselves: How prevalent is the poverty of the community they teach?; Is the school accessible; What is the Post-Provisional Norm (PPN) of the school? Hence, this puts pressure on some of the teachers to go to struggling schools and teach, because some teacher prefer well build schools with all facilities, good roads and easily reachable (Anthony et al., 2014). Moreover, a case study conducted by Mutesi (2016) on the experiences of five Grade 9 Mathematics learners at a secondary school in Umzimkhulu, data was generated through semi-structured observation, focused group discussion, and one-to-one semi-structured interview. The study recommends that content-centred teaching approach underpins performance curriculum. The study outlines that having enough teachers is a prerequisite for achieving attained curriculum and having professional teachers to teach Mathematics. This suggests that teachers should be driven by written reflection on the post provision norm that is allocated to them, despite of the situation they face with, they must put the interest of learners first. Moreover, physical accessibility is not adequate alone, but cultural accessibility is important as well.

Moreover, Greco (2016) defines cultural accessibility as an instrument to access human rights. In a mixed-method study conducted by Kloppers and Grosser (2014), in order for teachers to teach learners the value and meaning of critical thinking and they must model teaching strategies with an aim of instilling critical thinking skill when teaching Mathematics, hence critical thinking motivates teachers to use learner-centred approach. The above study suggests that including learners' background and cultural makeup, who are learners and no consideration of who are teachers (Zuma, 2015). The study further outlines that teachers should consider that they are the implementers of curriculum. Moreover, Zuma (2015) further reasoned that there is a need to conduct a case study using reflective and focus group discussion for teachers to reflect on their teaching and learning when developing teaching in Mathematics and to consider financial access as well.



Furthermore, Leone, Cetorelli, Neal, and Matthews (2016) define financial accessibility as the ability to obtain financial service. Moreover, Johansson (2003) as well as Ngcobo and Tikly (2010) outline that rural schools lack funds, and they are poorly resourced. This is concurred by Ertmer (1999) as well as Tyler, Boyd, Coetzee, and Winkler (2014) who state that financial barriers block progress for schools to access quality education. In poor rural areas, the Department of Education introduced No-Fee Schools in order for learners to access education (Nkosi, 2014). Due to a lack of funds, schools find it difficult to access specialist whenever they are in a dire need. This suggests that department officials or specialists are not easily accessible due to a shortage of staff. In line with the above, Mestry and Ndhlovu (2014), argued that in terms of Section 34 of the SASSA, the state is mandated to fund schools on revenues equitable to schools in order to exercise the rights of the learners to education and redress past inequalities. Additionally, a study by Nxumalo (2009) on the funding to the No-Fee School outlines that as the Department allocates funds to school, the major problem is that Section 21 funds are deposited to school accounts later than they are expected. This results in the constraints in teachers' progress; additionally teachers find it difficult to gain what they need to use. This suggests that teachers should be driven by personal reflection on the poverty environment their school is in, in order for them to understand what they are faced with in teaching and learning.

Hence, in light of South African Schools, Act 84 of 1996, parents are required to ensure that their children attend school by the age of 7 until the last day of the year in which they turn 15, or the end of Grade 9, whichever comes first. This suggests that teachers should be driven by verbal reflection with an aim of consulting learners with the importance of attending school daily. Moreover, the political landscape of the community plays a major role in teaching and learning (Anthony, 2016). This further suggests that teachers must be driven by personal reflection on how to conduct themselves in the community they teach.

Moreover, DBE (2014), through the Stats SA General Households Survey (GHS) of 2012 findings, show that 98.8% of 7 to 15-year-old children were attending an educational institution. The survey showed that approximately 548 776 children were not attending school. This suggests that some children are still deprived of access to education. The White Paper on Education Training (1995) also articulates the fundamental principles for transformation,

namely open access to quality education and redress of educational inequalities. DBE (2014, p. 89) outlines that, “Schools in South Africa are categorised through poverty index.” Furthermore, schools are categorised from quintile 1 to quintile 5 (Council, 1996). Those schools that range from quintile 1-3 are regarded as previously disadvantaged, while quintile 4-5 were regarded as advantaged schools and were known as Model C schools. This suggests that teachers should reflect on the poverty indicator of their school and assist learners by improvising where there is a need so that learners gain the best education possible. As much as access is the key factor, location and time, should be taken into consideration.

### **2.6.7 Where and when are they teaching? (Location and time)**

Fraser (2012) defines location as the social, psychological, and pedagogical context in which learning, and teaching takes place. In other words, location is about where teachers are teaching (Killen, 2007) (Khoza, 2013). Moreover, Killen (2007) goes further to outline that location is more than a classroom, it involves the library, school grounds, even the school surroundings. Further to this, a study conducted by Visser, Juan, and Feza (2015), asserts that location is extremely important in the academic achievement of teachers to generate an environment that is favourable to learning. Moreover, Meier and O’Toole Jr (2005) declares that teaching and learning is the essential activity of schools and universities, at times that teaching or learning do take place in classroom (formal location), in other times it occurs at unexpected place (informal location), and it also occurs in both places (blend location). Berkvens, Van den Akker, et al. (2014) indicates that teaching takes place anywhere, in or outside, the school building. This suggests that Mathematics teaching can take place in the classroom or outside the classroom, hence teachers must be driven by personal reflection on where they are going to teach, taking into consideration the environment they teach.

Moreover, O’Toole Jr (2005) outlines that formal location is where teaching and learning take place, which is the classroom. In addition to this, Fraser (2012) defines the classroom environment in terms of shared perception of the teachers and learners and has the double advantage of characterising the setting through the eyes of a participant. Further to this, Emmorey (1995), further illustrates that location can have an influence on teaching or learning and it can encourage group work amongst learners. In the classroom situation, teachers should

make it conducive to teaching and learning. In other words, teaching needs face-to-face interaction where learners are assisted by teachers to create a space where written documents are unpacked. Especially in Mathematics; learners must be assisted since it is more challenging. This suggests that written reflection enhances teachers to prefer the use of formal location for contact with learners to know where they lack, because this will assist the teacher to reflect on their strength. Hence, the formal location cannot claim to be absolute in teaching and learning but informal location is in the midst.

Moreover, informal location is defined as learning through every day embodied practices; horizontal and in a non-educational settings (Colley, Hodkinson, & Malcom, 2003). In other words, an informal location is when learning is taking place everywhere and all time meaning, hence learning is not valued and non-sequential (Melber & Cox-Petersen, 2005). Moreover, informal location can be a school grounds, places within our day-to-day routine. This suggests that teachers should be driven by verbal reflection in informal location for betterment of teaching and learning. Hence, informal location and formal location can be mixed to constitute blended location for teaching and learning to take place. Moreover, blended location refers can mean almost any combination of technologies, pedagogies and even job task (Bryan & Volchenkova, 2016). In line with the above Procter (2003) defines blended location as the effectiveness combination of different modes of delivery, models of teaching and styles of learning in a certain environment. In other words, blended location is when formal and informal location are mixed together to deliver teaching and learning. This suggests that teachers must be driven by written and verbal reflection in order to understand all types of location. In this location, (blended) teachers and learners' involvement is enhanced, at the same time flexibility is prominent.

Moreover, Khoza (2013) refers to word 'time' as to when and how long should teachers teach learners. In addition to the above, Vowinckel, Westerhof, Bohlmeijer, and Webster (2017), further defined time as to measure or record the part at which something happens, the length of period it takes for something to happen, or the rate at which certain action take place. In addition to the above definition, Girelli, Liberati, and Sindoni (2011) as well as Allman, Teki, Griffiths, and Meck (2014), reasoned that time is that which a clock measures. Additionally, contact time is when teachers are in contact with learners in the class situation.

Moreover, contact time must be used effectively for teaching and learning. This illustrates that teachers cannot justify that everything has been correctly done if time is not used effectively in the classroom. Hence, timetable is necessary tool to guide teachers on when to teach, what to teach and how long it will be. Furthermore, Zuma (2015) asserts that if contact time is not utilised accordingly, learners can lack subject knowledge. This suggests that if teachers fail to honour timetable, which drives them to class, they can consider written reflection in order for to administer entire educational programmes of the school. In addition to the above, Mshololo (2014) on how school manager managing time asserts that Department of Basic Education needs to provide teachers with time management training to ensure that they direct and organise their tasks in a manner that they take into account the importance of time prioritisation in activities to be performed. However, contact time alone cannot justify that it is suitable for teaching, but extra time also is needed as well.

Moreover, extra time is time whereby teachers do their work out of contact time (Khoza, 2016). Additionally, Berkvens, Van den Akker, et al. (2014) reasoned that teachers need time to understand how to use the materials and preparations to ensure that during teaching and learning there are no disturbances whatsoever. Moreover, Zuma (2015) reasoned that teachers need more time to do preparation in order to understand what they are going to teach in the class. This suggests that teachers must be driven by verbal reflections in order for them to do justice in teaching and learning because they should organise extra classes so that they drill learners. If In addition to the above, for teachers to improve more understanding in learners, they need extra classes' time. This time can be after hours' time, morning classes, and weekend classes. Hence, this time assist teachers to complete syllabus in time and able teachers to do remedial work (Berkvens, Van den Akker, et al., 2014). Moreover, Fook (2002), further asserted that time needs to be set aside for reflective practice to occur. This suggests that teachers must be given an opportunity to have verbal reflection whereby they can discuss their challenges and have an opportunity to gain views from other teachers. Moreover, this can be done through capacity building meetings, phase or departmental or subject meetings and even when teachers plan collectively. After teachers have taught learners, they need holiday time.

Hence, holiday is the time whereby teachers need to relax and refresh themselves. Moreover, a study by conducted by Azongo, Awine, Wak, Binka, and Rexford Oduro (2012) outlines that

time is something that we need in order to do our work, accomplish our goals, spend with our loved ones, and enjoy everything that life has to offer. The study further outlines that teachers utilise holiday time, they have to sharpened their skills in teaching during this period. In addition to the above, Another study by Lentsch, Withrow, Ackermann, and Bumpous (2003), as well as Carter (2017) concurs that time is a component of the entire system of human acquaintance, entire manner of manifestation, and it is linked to the mind function, it is an essential piece of the cosmos. As there are holidays, these give teachers an opportunity to reflect back on the past term on what went wrong, which enable them to improve quality teaching of Mathematics. This suggests that teachers can be driven by personal reflection on how they can start the new term. In addition to this, teachers can be driven by written reflections on how they can shape their resolutions for the term ahead in making sure that teaching time is utilised accordingly (Alexova, 2015).

According to the CAPS documents, little has been written about where Mathematics teaching has to be taught, but Mathematics is taught at schools. This suggests that there is a dire need for research whereby clarity should be made available on where conducive teaching and learning of Mathematics should take place. Moreover, the Employment of Educators Act of 1998, is vocal about teaching time where it states that teachers should have 7 hours contact time with learners (DBE, 2011). In Mathematics, according to the CAPS documents, there are six periods per week, which is regarded as contact time. Moreover, DBE (2011), asserts that allocation of time has been allocated for 10 weeks in a term, with 6 hours for Mathematics per week. Further to the above, between 3 and 6 hours have been allocated for revision per term. In addition, 6 hours have been allocated for summative assessment, therefore, 210 notional hours have been distributed across the content areas. This suggests that teachers must be driven by written reflection by checking on time table in order to be aware of time at their disposal.

#### **2.6.8 How are they teaching? (Teacher's role)**

The study conducted by Khoza (2015) on student teachers' reflection on their practices of CAPS emphasise the issue of teachers role. Furthermore, Crasborn, Hennissen, Brouwer, Korthagen, and Bergen (2011), defined the three roles of a teachers for better curriculum dissemination: instructor (teacher-centred), facilitator (learner-centred), and assessor (content-

centred). In line of the above Mpungose (2016) outlines that teachers should be aware of all the roles in order to identify teachers' role. This suggests that teacher should reflect on the afore-mentioned approaches with an aim of acquiring their role during the teaching and learning of Mathematics.

Moreover, an instructor is one who instruct on how to accomplish a task (Betihavas, Bridgman, Kornhaber, & Cross, 2016). Hence, the teacher is an instructor in the teaching and learning when they are exercising control over learners. In addition to the above, Khoza (2015) articulates that the teachers role is distinguished by the role a teacher adopts in teaching and learning. Hence, Panadero and Jonsson (2013) further outline that teachers are supposed to take account of their role. Furthermore, the teacher is responsible for designing and implementing an effective learning environment, and the learner is responsible for learning. In this role, Roberts (2016) reasoned that teachers expect learners to arrive at an outcome without checking how or when the learner is going to achieve learning outcomes. This suggests that teaching is done in order for learners learn and to finish the content prescribed. Moreover, Khoza (2015) concurs with Johansson (2016) by stating that participants pursue the teacher-centred role in order to finish their syllabus from the CAPS documents. This suggests that for teachers to complete syllabus, they see themselves as the solo deliverers of curriculum, whereas they are not because there are other stakeholders involved. Khoza (2015) further believes that when teachers are in a position of an instruction, school knowledge is stimulated. This suggests that Mathematics teaching can be influenced by a specific setting, a classroom, and this seeks teachers' personal reflection to prevail (Stronge, 2018). Additionally, teachers should also engage on another role that enable them to be a facilitator.

Hence, Kudryashova, Gorbatova, Rybushkina, and Ivanova (2016) asserts that the teacher is a facilitator when they are assisting learners to evaluate their own progress, present judgements against some set of criteria, and providing justified explanations to phenomenon. This suggests that the facilitator guides and gives leadership without taking any rule. This role adopts a learner-centred approach in teaching whereby learners find information for themselves. The teacher is not the source of information, but guides learners to arrive at the desired learning outcome in the teaching of Mathematics. In addition to the above, Liang and Zhou (2009) outline that facilitation is not about transmitting knowledge but learners are encouraged to

explore new information. The teacher assists where the need arises. This suggests that learners develop a burning desire to learn without being passive participants. In other words, those learners stimulate a love of Mathematics and are able to stretch their capacity to think in order to arrive at the desired learning outcome of the intended curriculum. Furthermore, this can develop learners' talent and promote communication skills amongst learner. In addition to this, teachers must be driven by verbal reflection in order to give learners an opportunity to own their learning, which will make teaching and learning more exciting. As teachers' role are not limited to the above roles (facilitator and instructor), it is imperative to go as far as being researchers.

However, another teachers' role is that of an assessor. Therefore, Sherin (2014) defines an assessor as one who creates theory and can inform and generate sound curricular practice. Moreover, a researcher is a lifelong learner, which implies that teachers must be more knowledgeable about teaching and learning in Mathematics (Khoza, 2015). In line of the above, Borko, Koellner, and Jacobs (2014) assert that a teacher's professional development is essential to efforts to improve our schools. Moreover, a paper written by Goodwin et al. (2014) on focusing on teacher as researcher outlines that teachers must move towards aligning their practice and scholarly research that leads to transforming curriculum and pedagogy. Additionally, Goodwin et al. (2014) argues that teachers must engage in research with three goals in mind: to transform the self, to transform the curriculum, and lastly to transform teaching. This suggests that the teacher must be a scholar because new information is needed timeously to face challenging question that might come from learners and able to acquire new knowledge and skills of imparting information to learners. In other words, teachers must be driven by written reflection in order to shape and be capacitated by new knowledge to fulfil their roles in teaching and learning of Mathematics.

Despite, teachers having roles stipulated above, Sindhu (2012) further articulates that a teacher has to perform other professional duties, which are a superintendent, a supervisor, a planner, and a controller. Hence, these duties encourage a teacher to be more responsible, since they are entrusted with responsibilities and managerial duties. In other words, when teachers act as an assessor, they are making sure that learners are doing what they supposed to do in the manner they are supposed to do them, in this case learning, writing classwork, homework, and

assignments are being mastered. Moreover, when a teacher acts as an assessor, is when they are making sure that everything is in order, exercise books are marked, what is written is in accordance with what is expected to be answered. The teacher is able to access all textbooks used by learners, to check whether they are numbered correctly and assess how many are damaged and need to be replaced. Additionally, in terms of planning, teacher have to plan for a lesson, homework, and tests. In light of the above, Williams (2016) argues that Mathematics teaching needs a dedicated and committed teacher. Byo (1999) concurs with Lamont and Molnár (2002) that Mathematics teachers require additional skills whereby they become specialists and generalist. This suggests that teachers should be driven by both personal and written reflection when they teach in order to be competent enough to teach Mathematics.

However, DBE (2011) does not mention anything about the role of a teacher as a facilitator. Moreover, DBE (2011) asserts that moderation should be carried out internally at school and/or externally at district, provincial, and national level. DBE (2011) further articulates that tasks must be moderated by the Head of Department or specialist senior teacher at a school level, before any administration of the assessment task. This suggests that CAPS regards teachers as assessors since they require learners work before, during, and after assessment. However, the DBE (2011) Mathematics document does not specifically indicate any role of a teacher but there are developmental programmes that are in place to equip teachers with knowledge and skills to teach learners. However, the absence of the role of a teacher in the CAPS document cannot hinder teachers' activities in teaching and learning.

### **2.6.9 What are they teaching? (Teacher's activities)**

Morgan (2010) defines activity as that which teachers design in order to bring the condition of teaching that is conducive to the classroom. In addition to the above definition, Hwang, Wu, and Ke (2011) further define learning activities as the experience that learners need in order to acquire learning competencies. Moreover, Li (2016) articulates the three levels of learning activities as teacher-centred, content-centred, and learner-centred. This suggests that teachers must be driven by personal reflection on how they are teaching learners in order to master different kinds of activities.



Moreover, Chisholm (2000) as well as O'Neill and McMahon (2005) define learning activity as the activities designed for teaching and learning in class where learners become more active than teachers. In line with the above definition, Eisner (1987) outlines that learner activities represent what could be called 'partnership models'. In other words, teaching activities should ensure the following is taken into consideration; to understand the main purpose for each activity; learners are capacitated in order to be responsible for their learning; activities bring knowledge and skills that are beyond the classroom situation (Khan, 2015). However, Ilyas, Qazi, and Rawat (2014) on mixed-method study of 14 males and 16 females' teachers aimed at the translation of the concept of fractions using learner-centred activities, data was generated through pre-test, post-test, and semi-structured interviews. The findings expose that the teaching of fractions via a learner-centred activity produced good results. This suggest that teachers can use learner-centred activities, since they generate learner confidence. In addition to the above, Whatmore (2002) outlines that if learners are motivated in learner-centred activities are more likely to actively participate. This suggests that teachers must be driven by verbal reflection in order to assist learners to actively engage in their activities. However, if leaners have developed a desire for learning, the teacher must be able to administer teacher-centred activity.

Teacher-centred activities are defined by Chalmers and Gardiner (2015), as well as Cho and Rathbun (2013), as instructions that teachers utilise to direct how, what, and when learners learn. This suggests that teachers are driven by personal reflections in order to teach learners. Moreover, teacher-centred activities means that the teacher controls what is taught and under what conditions (Hall, 2017). The study further outlines that teachers-centred activities seek teachers to have activities in mind when they enter the classroom. In other words, teacher-centred activities can be identified by the following elements: the teacher's verbal communication exceeds the leaner's verbal communication during instruction; instruction is mostly with the entire class; and the teacher determines each episode within the lesson (Hall, 2017). This suggests that teachers can be driven by personal reflection in order to select any activities that are suitable to them in order to address their needs during the teaching and learning process in Mathematics. Hence, teachers should also engage on content-centred activities.

Furthermore, Moya (2014) as well as Cenoz (2017) define content-centred activities as activities that are content-based in learning and teaching. Firstly, in content-centred activities, the teaching focusses more on facts and details, which are pointed out by a curriculum policy document (Postareff, Lindblom-Ylänne, & Nevgi, 2007). In a mixed-method study conducted by Ross and Onwuegbuzie (2012), it is outlined that most activities given to learners are drawn by textbooks in order to instil Mathematical knowledge to learners. However, Bennie and Newstead (1999) reasoned that Mathematics content-based activities require more problem-solving activities, which challenge the ability of learners to understand Mathematics content. Moreover, Coetzee (2009) states that teaching methods must involve content-based activities. Further to this, Chamane (2016) indicates that learning activities are important in the content-centred activities because they give learners more knowledge. This suggests that teachers can be driven by written reflection in order to follow what is prescribed in CAPS.

In the context of DBE (2011), the policy document acknowledges that in early grades, learners must be exposed to Mathematical skills, whereby they have to do, talk, and record. In addition, DBE (2011) provides teaching activities that are to be taught under the concepts and, skills, for example learners should solve numbers, write number sentences to describe problems. This suggests that teachers can be driven more by verbal reflection in order to engage activities outlined by CAPS documents. Moreover, DBE (2011) outlines learning activity, which include mental Mathematics, consolidation of concepts, whole numbers (addition and subtraction), and classroom management whereby teachers use their time to allocate independent activities to learners. In addition, the DBE (2011) document specifies teaching guidelines with suggested activities.

## **2.7 Conclusion**

The literature has explored levels of reflection as the phenomenon of this study. Moreover, the literature used in this study is from other countries as well as within or country (The Republic of South Africa), which focuses on Mathematics teaching and learning. The issues of curriculum, such as horizontal versus vertical, have been discussed. The literature further explored ten curriculum concepts, which are: rationale; aims; objectives and learning outcome; resources; content; role; assessment; accessibility; location and time; and activities. The next chapter will then explore how research questions will be answered through the research methodology.

## Chapter Three

### Research design and methodology

#### 3.1 Introduction

The literature review, in the previous chapter, presented literature from studies on educators' reflections as the phenomenon on the teaching of Mathematics in Grade 4 curriculum based on local (South Africa) and worldwide literature. The literature displayed the teachers' reflections (phenomenon) and its relevant propositions in the teaching and learning of Mathematics. The issues in the literature review further involved curriculum enactment, implementation and curriculum design approaches that are instrumental, communicative and pragmatic approach. Chapter Two also displayed ten concepts of curricular spider-web with its propositions as principles of a conceptual framework guiding the study.

Thus, the study aims to explore educators' reflection on the teaching of Mathematics in Grade 4 through the following questions.

- What are the teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre?
- Why do teachers reflect in the particular way when teaching Mathematics in Grade 4 in Nongoma Circuit Management Centre?

The study intends to achieve the following objectives.

- To explore teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre.
- To understand the reasons why teachers' reflections are in the particular way when teaching Mathematics in Nongoma Circuit Management Centre.

This chapter portrays and analyses the procedures in designing the study and the methodology. Hence, the main purpose of this study is to explore teachers' reflections on the teaching of

Mathematics in Grade 4 in Nongoma Circuit. The procedures mentioned above are critical paradigm; research approach; purposive and convenient sampling; data generation methods which encompasses reflective activities, semi-structured interview and observation; trustworthiness that encompasses credibility, dependability, transferability, and conformability; data analysis; ethical issues; and study limitations as well. However, Hakim (2000) defines research design as the systematic chronological pattern in which a particular research is intended to be determined. This definition is also in line with Christiansen et al. (2010) that research design is a logical sequence that relates empirical data to a study's initial research objectives and conclusion. Therefore, this chapter aims to give more sequence and logical details to address research questions and objectives.

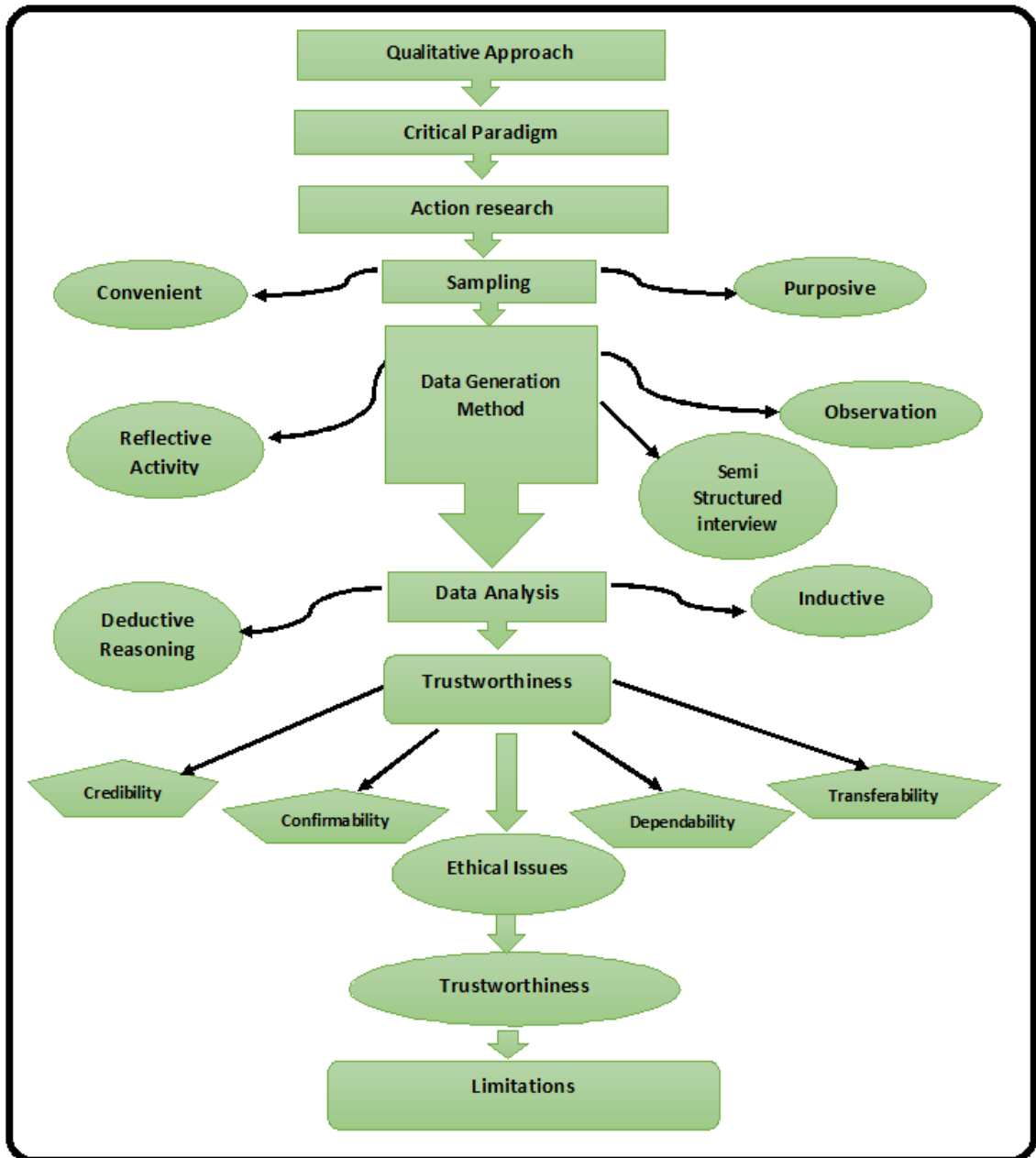


Figure 3.1: Chapter 3 Flow model

### 3.2 Research Paradigm: Critical

Brooke (2013) defines a paradigm as a way of looking at the world, different expectations about what the world is like, and how we can comprehend or know about it. In addition to this definition, paradigm is also regarded as an “accepted model or pattern” of doing research (Arndt, 1985, p. 23). Moreover, paradigm is further defined by Lincoln et al. (2011) as the “basic belief system of world view that guides the investigation”. The study further asserts that

for a researcher to understand what is going on, they must become immersed and move to the culture of organisation being studied and experience what is like to be part of it, rather than looking at one portion of reality that cannot be split or unitised (Guba & Lincoln, 1994). This suggests that for better reflection of any practice, it is important for a researcher to be physically involved in the teaching and learning, to gain first-hand information. Thus, I was physically involved in the conduction of this study in order to unpack participants' reflections in the teaching and learning of Mathematics in Grade 4.

Furthermore, this study adopted critical paradigm since it endeavours to change teachers' reflection on their practices in the teaching of Grade 4 Mathematics in Nongoma Circuit Management Centre by capacitating them with best reflective practices in their teaching (Izuma & Murayama, 2013). Moreover, Creswell (2012) concurred with Christiansen et al. (2010) that critical paradigm focuses on bringing social change that will help those groups of people who have little power, and few opportunities or choices because of their sex, race, and class. I was able to use critical paradigm in order to bring change to teachers who teaches Mathematics, particularly from disadvantaged schools like those in the context of this study, since the Department of Education imposes all policies to be implemented by teachers without consulting them. Therefore, the study aims at gaining meaning from how teachers make sense of truth and inner understanding and reflections from their teaching of Grade 4 Mathematics with an aim of transforming and improving their practices.

Moreover, it is assumed that in critical paradigm the character of reality (ontology) is subjective and built on the basis of issues of power whereby the character of knowledge (epistemology) is constructed by involving participants reflectively in order to bring justice and transformation (Creswell, 2012). This drove me to choose this paradigm in order to understand teachers' reflections on the teaching of Mathematics in Grade 4. Mpungose (2016) concurred with Mokoena (2013) that the research findings from critical paradigm are subjective and are not replicable. This suggests that finding are based on ideas, which are verbal rather than statistical. This also suggests that teachers should be driven by verbal reflection in order to find what is really happening in the teaching of Mathematics in Grade 4.

Furthermore, Madden, Wong, Vera Cruz, Olle, and Barnett (2017) asserts that the findings of this study exposed social injustice via transformation of the participants' context in their teaching of the curriculum. I made a point that the outputs of this study constitute findings and recommendations which served as a reference to other teachers on how to reflect on the teaching of Mathematics in Grade 4. I then chose to use the critical paradigm as the most relevant paradigm for this study due to the character of knowledge, which is embodied by social, political, cultural and economic values of the society. This suggests that teachers' inability to have a say or view in the intended curriculum were assisted by gaining their views heard and how they feel about their teaching in Grade 4. In other words, this study gave teachers a platform to reflect verbally on their practices, which is teaching and learning. In addition to this, Mpungose (2016) reasoned that in some instances, teachers may know that they are oppressed, but feel incapable of taking actions. Hence, the critical paradigm was chosen to change teachers' perceptions and the practices they are engaged in. However, Christiansen et al. (2010) cautioned about the issue of power between researcher and the participants, which might cripple the critical paradigm. Therefore, I avoided inherent power conflicts with participants since I am a senior to them. This was done in order to prevent influencing them with my ideas or influence participants to move my own direction; as a result, we shared the same social position just to make the participants feel at ease.

Furthermore, McGregor and Murnane (2010) concurred with Mpungose (2016) that this study is qualitative in nature; therefore, its foundation is on power dynamics and social practices. In other words, qualitative research is primarily sensible on perceptions, meanings, reflections and feelings. This suggests that this study has an intelligence in a manner that data received is realistic. Therefore, teachers got an opportunity to weigh, explored, and transform their practices on the teaching and learning of Mathematics in Grade 4 through reflection. Additionally, Christiansen et al. (2010) concurred with Cohen et al. (2011) that qualitative research forges ahead to find how people perceive their lives and how other people perceive truth in different ways. Thus, this constitutes qualitative research approach to be subjective in nature. Moreover, Christiansen et al. (2010) agrees with the above assertion, that qualitative approach gives a researcher an understanding on how different people make subjective sense of their lives. Thus, this enabled made to me understand why teachers teach Mathematics. However, I assisted teachers to revive their attitude in a positive manner by encouraging them to change and transform their practices. In addition to the above, teachers were able to know



and understand why they are teaching Mathematics, and then socially constructed realities were dealt with.

Furthermore, McGregor and Murnane (2010) outline that bias and manipulation serves as shortcoming of the critical paradigm. However, for me to overcome this limitation, I ensured that all teachers receive the same questions during the interview. This was done in a manner that was friendly so that teachers gave their best when answering questions. However, Christiansen et al. (2010) viewed asymmetrical power relationship in the critical paradigm as a shortcoming. Thus, I managed this shortcoming by ensuring that teachers as participants must search for information by means of being scholars themselves in teaching Mathematics with an aim of finding challenges wherever possible.

### **3.3 Research Approach: Methodology approach**

Mouton et al. (1996) as well as Yilmaz (2013) defines the research approach as an attempt to gain an in-depth understanding by asking questions that not only give information to the researcher, but also stimulate the participants to reflect on why they reflect in a particular way. This suggests that teachers may benefit in this study because information required to them may assist them to reflect correctly on their practices on the teaching of Mathematics in Grade 4. However, this study adopts a qualitative research approach. Hence, qualitative research is defined as that research which uses less structured data, which emphasizes the central place of subjectivity in the research process and which studies “a small number of naturally occurring cases in detail” using the verbal rather than statistical (Brooke, 2013, p. 12). Moreover, Mcmillan and Schumacher (2010, p. 428), define qualitative research as a collaborating face-to-face research, which requires relatively extensive time to systematically observe, interview, and record processes as they occur naturally. Moreover, Bazeley (2004) as quoted in Cannella and Lincoln (2007), defined qualitative study as an autopsy process of understanding social or human problems, based on building a complex, holistic picture, formed with words, reporting detailed views of the informants, and conducted in a natural setting. Additionally, the researcher in qualitative research forge to obtain systematic and holistic integration overview of the context under this study (Mokoena, 2013).

Moreover, the methodology approach is befitting for this study since the purpose is to explore teachers' reflections on the teaching of Mathematics in Grade 4. It may assist teachers for knowledge growth in their practices. Moreover, Creswell (2012) asserts that qualitative researchers deal with socially constructed realities and qualities that are complex and indivisible into discrete variables. However, Babbie (2004) outlined that the aim of qualitative research is to promote better self-understanding and to increase insight into teachers' reflective practices. Gonzalez et al. (2008) articulates the strength of the qualitative research approach in that it provides in depth, intricate, and detailed understanding of meaning, actions, non-observable practices, as well as observable phenomena, attitudes, interactions, and behaviours and these will be served by the naturalistic enquiry. As a result, I used qualitative approach to socially construct all teachers' practices when teaching Mathematics, through studying their different levels of reflection, which are personal, verbal and written reflection. This led me to gain an in-depth of understanding of how teachers teach Mathematics in Grade 4. Thus, through this study, teachers were able to reflect for empowerment of their practices.

However, the rationale of this study is to explore reflections, which are observable phenomena of the teachers teaching Mathematics in Grade 4. However, Trochim (2000) concurred with Denzin (2017) by outlining that qualitative researchers do not assume that there is a single unitary reality apart from our perception. This suggests that I did not rely on single reflection, but I explored and exhausted all propositions of reflection, which are verbal, written, and personal, to arrive at the concrete conclusion using action research style.

### **3.4 Research style: Action research**

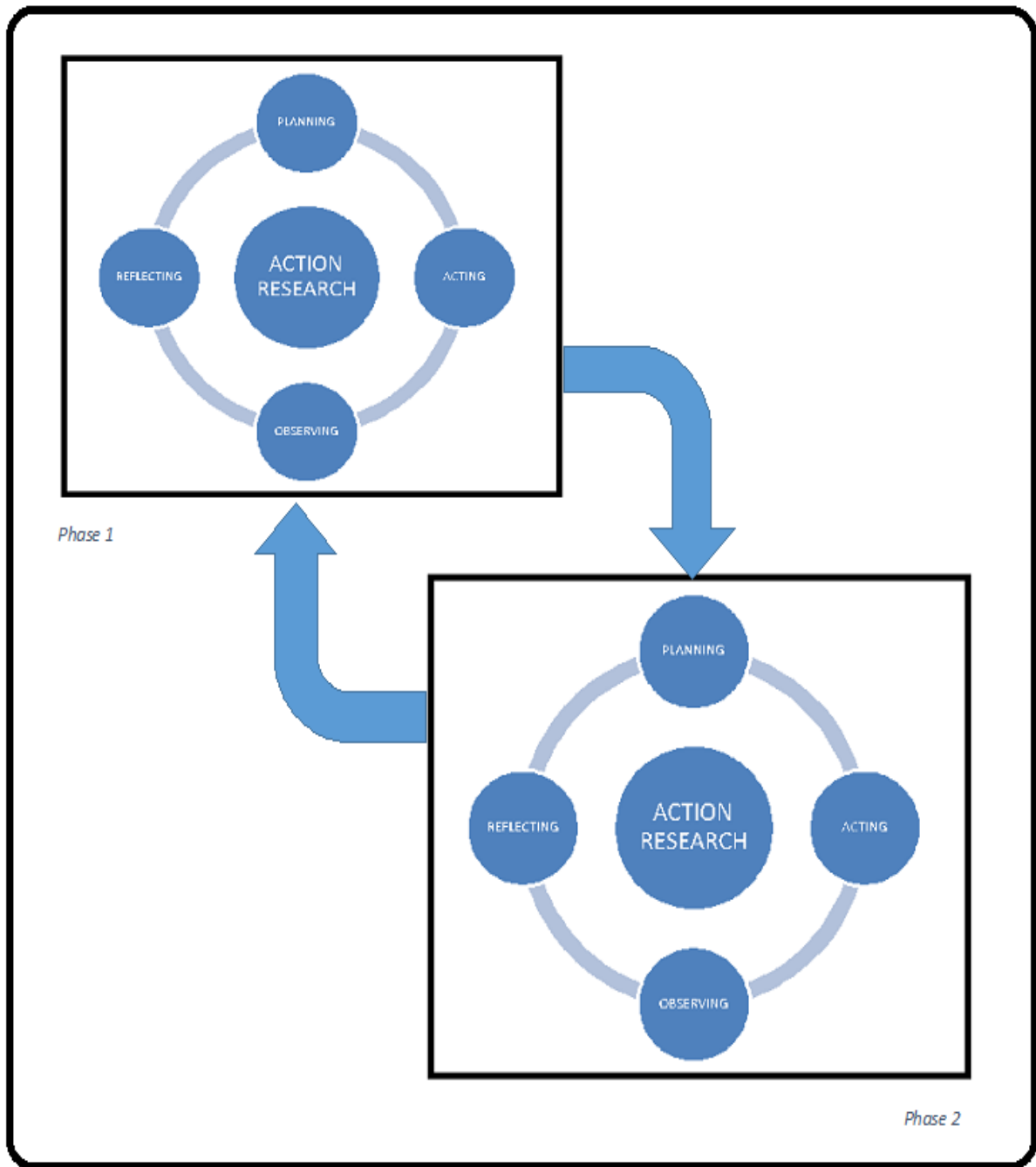
Eksvärd and Rydberg (2010) define action research as an orientation to knowledge creation that arises in a context of practice and requires researcher to work with participants. Moreover, Reason and Bradbury (2001) define action research as a participatory, democratic process concerned with developing practical knowing in the pursuit of a worthwhile human process, grounded in a participatory world view which we believe is emerging at this historical moment. This suggests that action research represents formative orientation to knowledge creation in that the action researcher seek to take knowledge production beyond the gate keeping of professional knowledge maker (Eksvärd & Rydberg, 2010). Moreover, Essa (2011) outlines

that action research is a type of research that encourages a collaborative or participative approach to find solutions to practical problems experienced by participants. Additionally, the study uses a critical action research process in order to assist participants to learn, plan, and reflect on their practices to improve their practices (Fernandez-Flores & Saeb-Lima, 2016). I chose action research with an intention to explore teachers' reflection in the teaching of Mathematics in Grade 4 by means of gaining in-depth knowledge in a real-life situation. However, I continuously assisted teachers to assess and evaluate the effectiveness of an intervention, so that practices prevail reflections. Matsunaga et al. (1996) as well as Smith and Smith (2015) further assert that action research is defined as inquiry or research in the context of focused efforts to improve the quality of an organisation and its performance. Moreover, the above definition resonates from Elliot (1991) who asserts that action research is the study of a social situation with a view to improve the quality of action within it. Therefore, this study employs action research qualitative approach. This is because it is driven by its main purpose which is to produce rich description of teachers' improvement of their practices of teaching through their reflections (Lisle, 2010). In addition to the above, Lewin (1947) asserts that in education, this approach is one method which teachers use to improve their practices, and also learners' learning outcomes as well. Also, Matsunaga et al. (1996) further asserts that action research can provide opportunities for reflection, improvement, and transformation of teaching. This suggests that better opportunities were available for teachers to correct their practices in order to improve their teaching practices in Grade 4 Mathematics.

Furthermore, this study aimed to gain an in-depth understanding by seeking clarity that not single out information to the researcher but also gave interpretation to the reflective practices of teachers and what informed their reflection (Mouton et al., 1996). Therefore, I assisted teachers to understand what they are reflecting on by bringing theory and practice with an aim of gaining practical solution through construction of minds, since certainty could not be mathematically measured. Moreover, this action research approach involved four primary school teachers as participants to reflect on their teaching practices in the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre. However, action research has limitations whereby it raises a number of possible ethical dilemmas, such as the biasness of the researcher towards the data being collected, contamination of the research data, and level of involvement of the researcher. Therefore, I avoided these by not being bias in the research in whatsoever reason and I avoided using my emotions. Moreover, another limitation of action

research is that it faces challenge of earning the trust of participant. Therefore, I relied on strategies such as spending more time on introductory session to gain trust from participants.

Furthermore, action research is unlike any other research style; it is unique since “it is done by researchers on their own practice” (Christiansen et al., 2010, p. 45). Creswell (2014) outlines that action research in education assumes that teachers know best what is happening during the teaching and learning process. Hence, in this study, I took teachers as the best people to participate in order to embrace the action research principles of participation, reflection, empowerment, and emancipation. Ritchie (2003) asserts that this process (action research) is not suitable in education because it may take place even without following a scientific research process and be influenced by opinions rather than facts. Nonetheless this study combined action research with a critical paradigm to overcome the above mentioned weakness. Berg and Lune (2004) outlines three levels of action research: technical collaborative approach (researcher comes up with a research problem and presents it to participants), practical collaborative approach (both the researcher and participants come up with a research problem), and emancipatory collaborative approach (both researcher and participants come up with a problem from a political point of view).



**Figure 3.2: Action Research stages**

Furthermore, Christiansen et al. (2010) named approaches as collaboration and action of all participants that involve four stages which are: strategic planning (first stage), implementing the plan (second stage), observing of the plan (third stage) and lastly reflecting on the plan (fourth stage). However, the above Figure 3.2 illustrates cyclical stages of action research, which

brought social change or transformation to teachers teaching practices. The cycles indicates procedures of action research, starting with identification of a plan based on the challenges of teachers, which they faced on their day-to-day practices.

According to Hagger and Luszczynska (2014), planning is seen as a means to obtain a broader, more complex set of behavioural responses. Furthermore, Gray (2013) suggests that planning must be flexible to allow adaptation for unforeseen effects. Additionally planning starts usually with a general idea. For one reason or another it seems desirable to reach a certain objective (McNiff, 2013). In the planning stage, I met with participants in a formal meeting where we sat together to identify challenges that teachers are faced with in the teaching and learning of Mathematics and we came out with the best possible solutions. As a result, teachers in the planning stage engaged with a reflective activity, which led them to identify the problem in order to raise the possible solutions. On the second stage (acting), after selecting the most challenging theme in Mathematics (teach number, operations and relations), we then designed a lesson plan with the same details to be taught in class.

Kemmis, McTaggart, and Nixon (2013) reasoned that participants act to implement the plan and use the action as a platform for the further development of the further action. With this in mind, teachers had to teach numbers, operations and relations. Furthermore, on the third stage, I then had to go and observe their teaching and learning process, using the observation schedule to see what was planned, and had been really implemented accordingly. In the observation, Stringer (2013) concurred with Coghlan and Brannick (2014), by outlining that it is where evidence is collected which allows thorough evaluation. The study further outline that observation is necessary because the action will be constrained by realities. After all observation and implementation had been done in Stage 4 we sat and reflected whether the possible solution was successful or not. As it was identified, not all the participants were successful in implementation due to the misunderstanding of curriculum concepts (rationale, goals, content, accessibility, time, teachers' activity, materials, location, teachers' role and assessment). Thus, I then had to give them readings to read during intervention so that they would master issues of curriculum during teaching and learning of Mathematics. We also checked CAPS documents so as to reflect on other prescripts on how the content should be approached. This process instituted us to go to

a second phase, following the same cycle of action research (planning, acting, observation and reflection).

Furthermore, in the second phase of action research, the planning stage was for improving teachers' practices when they teach. However, content implementation was previously identified during the first phase of the action research, which was numbers, operations and relations. I then led teachers in designing one lesson plan in order for teachers to use it, expanding so that positive outcomes could be realised. I therefore alerted teachers to focus more on their reflection in the second phase, on top of the implementing side. During this phase (second) teachers had to focus on personal reflections. This suggests that teachers had to reflect on their practices, which would transform them. This constituted me to conduct an interview (one-on-one) with an aim of bringing awareness to gain core understanding of a content. As teachers realised they had overlooked their practice in the teaching of Mathematics content (numbers, operations, and relations), they then transformed their practices socially by realising that they did not use all steps in operational signs for learners to acquaint more knowledge. This was evident during the one-on-one interview that they understood concepts underpinning their practices in Mathematics CAPS. Teachers then personally reflect in all curricular concepts. Hence, they were able to understand that for them to reflect accordingly, propositions should be taken into consideration. During the observation stage, it was evident that teachers understood issues of curriculum, for instance lesson duration was met and activities were given to learners. Moreover, this encouraged me, because learners were scoring higher marks than in the first cycle. Hence, action research was realised which led teachers to transform appropriately.

### **3.5 Sampling**

Sampling is described by Christiansen et al. (2010), and Etikan, Musa, and Alkassim (2016), as a selection process of a particular group of people, location, actions, and activities for study. Moreover, Kutlubaev and Hackett (2014) further assert that sampling refers to the process used to select a portion of the population for study. This suggests that sampling was relevant to this study because in order to gain the information I needed and interact with teachers from other school and asked them to engage on this study. Then I visited teachers who were going to be involved in the study in their school to discuss matters relating to it, so that they could

have clear idea of what was to going to take place. Moreover, Perry and Thomson (2015) outline that there are methods of sampling in educational research such as probability and non-probability sampling. Hence, Probability sampling involves simple random sampling, multi-phase sampling, cluster sampling and stage sampling while non-probability sampling involves quota sampling, purposive sampling and convenience sampling. Therefore, this study used purposive sampling and convenience sampling because they belong to probability sampling.

### 3.5.1 Purposive sampling

Purposive sampling describes the process of choosing a particular group of people to be included as sample (Christiansen et al., 2010). I decided to select four teachers within my proximity in Nongoma Circuit Management Centre and teachers whom I know and can get along with them easily, since we are teaching the same content in the same area. Teachers' knowledge of Curriculum Assessment Policy Statements (CAPS) was a pre-requisite and vital for this study. Moreover, Etikan et al. (2016), outlined that the other criteria used for their selection was based on resources, time available and study's objectives, as well as the closeness of schools. However, the selected teachers' reflections do not represent the wider population Mathematics teachers in general; therefore, results cannot be generalised beyond the group sampled. Thus, the variation of teachers' qualification and experience paved the way for different reflection to take place. I only chose qualified teachers who have learned methods of teaching Mathematics. Therefore, Table 3.1 below displays selected teachers who were purposefully sampled for the study.

**Table 3.1 Teachers' profiles**

<b>Teacher / Participant</b>	<b>School</b>	<b>Teaching subject(s)</b>	<b>Grade</b>	<b>Qualification</b>	<b>Gender</b>	<b>Race</b>
TA	SA	Mathematics and English	4-6	M+4	Male	African
TB	SB	Mathematics and Life Skills	4 & 5	M+4	Female	African



TC	SC	Mathematics and Social Sciences	4	M+4	Female	African
TD	SD	Mathematics	4	M+5	female	African

Therefore, Cho and Rathbun (2013) outlines that the researchers cannot select any participants who do not possess necessary knowledge. Hence, I chose teachers with relevant knowledge of Mathematics in Grade 4 and who are implementing CAPS. These teachers were able to reflect on their teaching of Mathematics CAPS. However, selected teachers do not represent the whole population of Nongoma Circuit Management Centre.

### 3.5.2 Convenience sampling

Duggleby et al. (2016) assert that convenient sampling refers to a particular group that is easily contacted by the researcher. Therefore, sampling was convenient because I chose a group of teachers that are easily accessible to me, whom I can contact or meet regularly without any difficulty. Etikan et al. (2016) outline the rationale for convenience sampling that it would be superlative to use the whole population, but in most cases, it is not possible to include every subject because the population is almost limited. Moreover, I selected qualified teachers who are in post level one and who have depth experience in Mathematics. Additionally, I opted for teachers who are dedicated in teaching Mathematics, who would need to gain more knowledge by being part of this study. I also assumed that these teachers were matured enough; therefore, I was optimistic that they could be part of this journey. However, the selected schools for this study are conveniently located near to me. This enabled me to avoid financial constraints. This means that these schools reduced travelling expenses on my side, since and they were less than seven kilometres from each other.

Moreover, Cohen et al. (2011) reasoned that convenience sampling is far less difficult to set up and it is less expensive. However, the drawback of convenience sampling, is that it is less representative of an identified population (Mcmillan & Schumacher, 2010). As a result, the

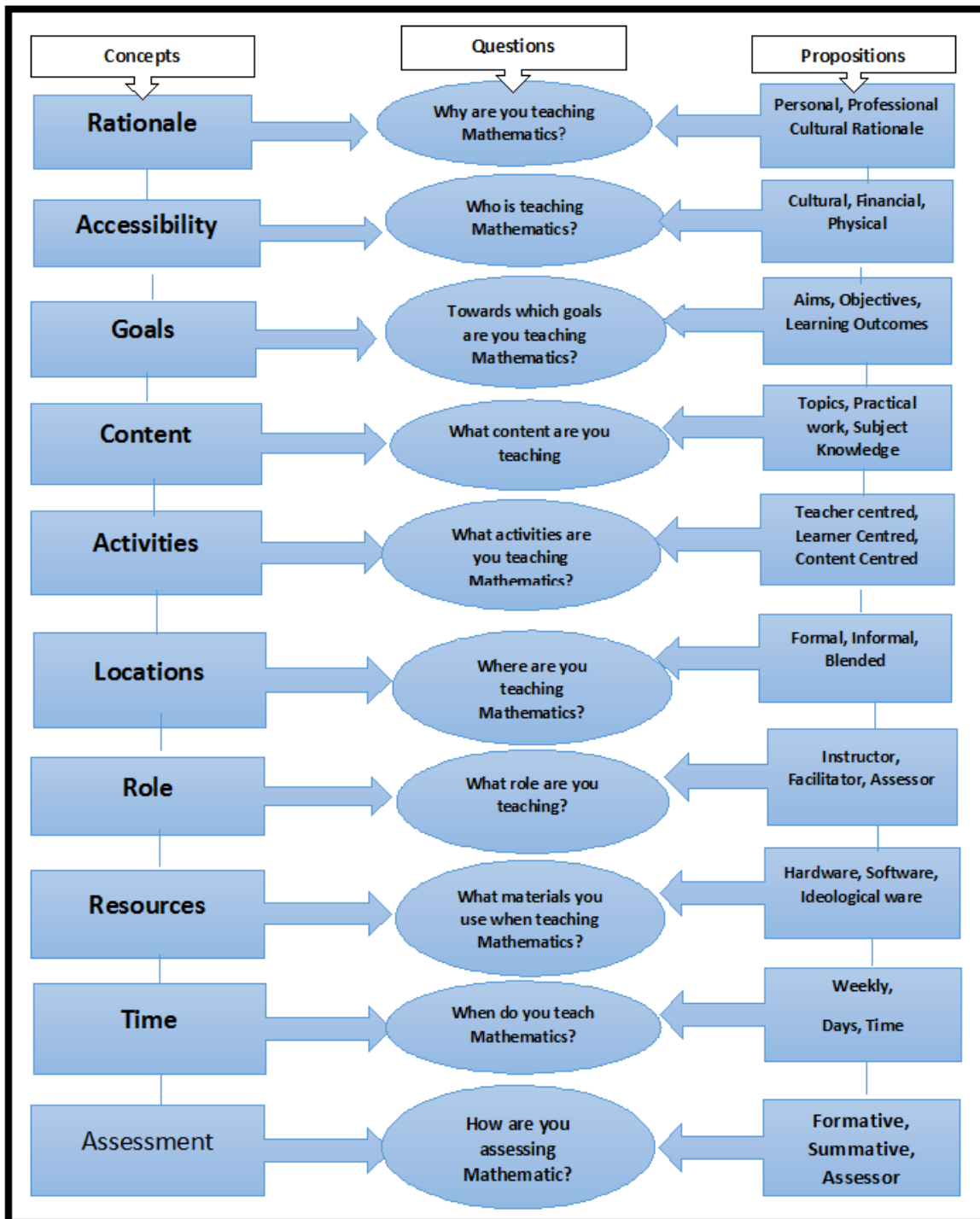
purpose of the study was that it is not focused on an identified population, but rather it intends to obtain a better understanding of any similarities and differences that may take place between teachers teaching Mathematics in Grade 4 in Nongoma Circuit Management Centre,

### **3.6 Data Generation Methods**

Wahyuni (2012) outlines that data generation is in the form of primary data. Therefore, this study used primary data to explore teachers' reflection on the teaching of Mathematics in Grade 4. The study adopts the following three techniques in data generation: reflective activity (open-ended question), one-on-one semi-structured interviews and observation.

#### **3.6.1 Reflective Activity (Open-ended questionnaire)**

Reflective activity is defined as the process of learning through and from experience towards gaining new insight of self and or practice (Cohen et al., 2011). Moreover, Cohen et al. (2011) as well as Marcos, Miguel, and Tillema (2009) continuously described reflective activity as a written activity that requires a participant to answer a series of questions about the phenomenon in research. Therefore, this study took reflective activity as the first method, with an aim that participants could bring their experiences, to lay foundation in their future actions and behaviour. This suggests that teachers were afforded an opportunity to reflect back on their teaching experiences in the teaching of Mathematics in Grade 4. The reflective activity was developed from the curricular spider-web as a conceptual framework of the study. Therefore, teachers were given a short series of questions, which teachers reflect on as they are presented below in Figure 3.3.



**Figure 3.3: Concepts, questions and propositions**

Questions are used as a tool for teachers to gain class control and to enhance student motivation, as well as to increase participation of reluctant students. Then, I designed questions that appear above, which served as yardstick for all teachers (participants) to reflect on. These questions

were based on curriculum concepts. Therefore, questioning is of great importance for teaching, because its primary purpose is to promote learning in the broad sense of the word (Zhang, 2013). Likewise, Malhotra, Kim, and Patil (2006) asserts that questions are operative means of understanding the conduct, approaches, preferences, views and intents of people. In this study reflective activity were used to explore teachers' reflections on the teaching of Mathematics in Grade 4.

The first question teachers were asked to reflect on was why they were teaching Mathematics' CAPS. The question was based on three propositions (personal, cultural, and professional). Therefore, teachers were expected to voice their enthusiasm for teaching Mathematics, they were also expected to elaborate on how their relationship with the community in terms of teaching and learning and lastly their content knowledge of the subject based on their academic qualification(s).

In addition, the second question focused teachers' accessibility in the teaching of Mathematics. In this question, teachers were expected to reflect on cultural, financial, and physical accessibility. Cultural access refers to social, political and religious interferences when they teach Mathematics physical access refers to how funds are utilised to access the school; and lastly physical access refers to transportation needed to reach the school.

On the third question, teachers were expected to refer to their goals when teaching Mathematics. Teachers were expected to provide answers on aims, which are long-term goals, objectives that are the short-term goals, and learning outcome, which are proclamations that should be accomplished after teaching and learning, has taken place.

The fourth question asked teachers to articulate on the content which they taught learners in Mathematics CAPS. As a result, Mathematics illustrates that there are five content areas in Grade 4 (DBE, 2011). In this question teachers were expected to answer on subject knowledge, topics taught and practical work they engaged in when teaching and learning.

Furthermore, Question Five asked about the activities the teacher engaged learners on while teaching Mathematics in Grade 4. Teachers (participants) were expected to respond on tasks such as teacher-centred, learner-centred and content-centred. For example classwork, home works, group work, and individual work.

Moreover, in Question Six teachers were expected to respond on the availability of venues when they teach Mathematics for example inside or outside the classroom, Mathematics lab, places like playgrounds, or at home. Teachers were expected to respond based on formal, informal or blended learning.

Additionally, Question Seven asked teachers how they perceive their role as Mathematics teachers. Teachers were expected to respond on the three propositions under role, which are being instructor, facilitator and assessor. Hence, this role was meant to equip teachers with what was expected of them in and outside the classroom.

Moreover, Question Eight asked teachers to respond on the kind of materials or resources they used during the teaching and learning process. Therefore, teachers were expected to reflect on resources such as hard-ware (books, chalkboards, chalk etc.) which are any tools or machine used during teaching, soft-ware resources (electronic devices like computers, tablets, calculators etc.) which are components that display information, and lastly ideological-ware (methods or strategies used in Mathematics) meaning those element in teaching which cannot be seen or touched.

Furthermore, in Question Nine teachers were expected to reflect on how they utilise prescribed time in their teaching and learning to cover the content of Mathematics. Teachers were to respond on time at their disposal, which is framed by three propositions that are weeks, days, and hours. Moreover, they were also expected to reflect on when they are planning: how much time is needed for specific topics and when they are doing their lesson preparation.

Then last question, examined how teachers assess learning. Their replies were expected to include formative assessment (assessment for learning). In this one teachers had to reflect on group work, classwork, homework and oral assessment. In summative assessment (assessment of learning), teachers were expected to respond on examination, tests, assignments and projects. Then continuous assessment (assessment as learning) teachers had to respond on peer assessment with the aim of measuring learners' strength and weaknesses.

As the reflective activity needed time and energy for a person to respond, I enabled teachers time to answer, at least two weeks before the interview. This was in line with Cohen et al. (2011) who believed that the researcher should design and provide questions so that participants can respond. This suggests that teachers in reflective activity are weaknesses whereby participants might not reflective honestly on their questions. Therefore, I safeguarded that participants gave their best through professionalism they possess, which is in line professional code of ethics. I also allowed them to contact me whenever they need clarity on the questions. Moreover, for verification of answers, I instituted one-on-one semi-structured interview to ensure that what the teachers responded was valid, substantial and factual.

### **3.6.2 One-on-one semi-structured interview**

Cohen et al. (2011) as well as Mcmillan and Schumacher (2010) define a semi-structured interview as a conversation between a researcher and a participant in which information is stimulated about how participants make sense and meaning of their experiences in their lives. Moreover, Kallio, Pietilä, Johnson, and Kangasniemi (2016) outline that semi-structured interviews involve the use of predetermined questions where the researcher is free to seek clarification. In addition to the above, the researcher is free to vary the order and wording of the questions (Doody & Noonan, 2013), depending on the direction of the interview, and to ask additional questions.

Therefore, I used semi-structured interview with the aim of allowing teachers (four participants) to respond in details to different questions asked as indicated in the reflective activity. I started by asking teachers to tell their life story, which provided more detail on their

experiences in teaching Mathematics in Grade 4 through CAPS and led me to probe further if there was no satisfaction in their answer. This allowed teachers to reflect freely without any limitation in their answers. This was done in a relaxed manner whereby they used language of their choice (English and IsiZulu) with the aim of ensuring comfortability. This generated more data, which is reliable and honest.

However, Creswell (2012) suggests that semi-structured interviews are more favourable than structure-interviews due to sophisticated information of the qualitative phenomenon. In semi-structured interview, participants were free to interact with the researcher to gain more clarity on what should transpire in the interview, so that relevant data can be collection. Moreover, one of the drawbacks is that novice researchers are often unable to identify where to ask prompt questions or probe responses, so some relevant data may not be gathered (Doody & Noonan, 2013). Then, I ensure that there is no mixing of processes. Transcription of data was later done so as to not disturb the process of an interview. Hence, a cell phone was used to record data from teachers. Then, at a later stage, I transcribed data from the recorded source. In addition to this, during the interview. I talked less and wrote more, to avoid a mass of data loss. Moreover, interviews were done during free periods and in separated locations from the classroom environment enable them to feel free to respond and prevent teachers' from their teaching.

Moreover, Cohen et al. (2011) outlines that through the interview process there must be a mutual understanding between participant and researcher. Interviews were designed in such a way that answers that cannot lead to more clarity like yes or no are to be avoided. Additionally, Aruwa (2011) outlined that the researcher must try to speak in a tone that does not show a position of superiority to the participant. Therefore, I ensured that we engaged freely.

### **3.6.3 Observation**

Observation is the systematic process of recording the behavioural patterns of participants, objects and occurrences without necessarily questioning or communicating with them (Chaboyer et al., 2010). Moreover, "Observation offers an investigator the opportunity to gather first hand, 'live' data in situation from naturally occurring social situations rather than,

for example reported data”, (Charteris & Smardon, 2015, p. 247) and “second hand accounts” (Phan & Locke, 2015, p. 213). The advantage of observation is that it leads the researcher to attain information about the educational environment, including the different learning styles, resources, and interactions that are evident amongst the students, and between the facilitator and students. Observation was undertaken see how content was delivered to learners, with an aim of checking whether teachers change their practices in class.

Moreover, in this technique I actually saw what was happening in the teaching of Mathematics (Creswell, 2014; Scott-Phillips & Kirby, 2010). I used this opportunity to observe which reflection teachers were using for the teaching of Mathematics in Grade 4 by doing class visits to observe their teaching practice, files, and documents. Although, observation has drawbacks, whereby it can be potentially intrusive which can change the dynamics of situation. This suggests that for my presence during the observation, teachers or learners might have felt unsettled during the process, due to a stranger in their midst, but I ensured that everyone was comfortable in a sense that I provided learner token of appreciation at the end of the lesson as to gain what I was observing from them.

### **3.7 Data analysis**

Qualitative data analysis is defined by Seuring and Gold (2012) as creating a sense of data in terms of the participants’ definition of the situation, noting patterns, themes, categories and regularities. Moreover, Biggam, Hough, Kay, and Simmons (2011) outline that data analysis is about bringing together the evidence, breaking it into manageable units, fusing it, and searching for patterns while discovering what is important and what is to be learned. Therefore, this suggests checking what data says and interpreting so as to present the findings to the readers. Additionally, Kothari (2004) reasoned that data also needs to be categorised or organized into groups or classes based on common features. Therefore, based on their naturalistic framework, I extracted explanations, assertions, and understanding of teachers’ reflection on how they practiced CAPS (2011).



In this qualitative action research, data analysis was classified into deductive and inductive reasoning process. Hence, I employed guided analysis in this study with inter alia deductive and inductive reasoning. Creswell (2014) asserted that guided analysis refers to predetermined categories of the theory of curriculum, which is the theory of coding data. Moreover, Nguyen et al. (2013) outlined that guided analysis is characterised by prior judgement and through interaction with data. Therefore, I considered that the participants were clear at first of doing this project that my mission was to make sense of their action. Leech and Onwuegbuzie (2009) asserts that there is no 'right' way (to analyse) data. This is shown on my collected data using my cell phone as a recording device and other three data generation methods (reflective activity, semi-structured interview and observation) with an aim that no information is lost.

Moreover, Christiansen et al. (2010) declared that inductive reasoning includes the logic of reasoning proceeding from particular fact to a general conclusion, meaning the beginning is with the receiving of the raw data that has been generated, whereas, deductive reasoning involves inferences from general principles and related to logical deduction. I then began with detecting patterns from research methodology (reflective activity, semi-structured interview and observation) used to draw some conclusion. Therefore, themes that were related in the data were grouped together. However, Gibbs et al. (2007) asserts that qualitative guided analysis is guided and framed by the pre-existing data and concepts. Thus, themes were then adopted from concepts from the curricular spider-web, which is the conceptual framework for the study. As a result, this study had ten themes, namely; rationale, goals, accessibility, content, time, resources, role, location, activity, and assessment. Nguyen et al. (2013) declared that guided analysis is flexible in a manner that it allows researchers to adjust principles of theories to accommodate important issues that come out from the data. I therefore became flexible in this study by allowing other theories which are relevant to pop in. I continuously utilised open coding, which is well defined by Cohen et al. (2011) as a simple new label that a researcher associates to a piece of text to describe and categorise that piece of text. Therefore, I used guided analysis to code participants' responses in order to draw conclusion in this study by ensuring the in-depth information I generated.

In data analysis "a researcher has an ethical duty to ensure that the results of the research are reported fairly, credibly, and accurately, without misrepresentation, unfair selectivity" (Khan

et al., 2012, p. 279). Thus, I ensured to attempt to report logically, fair and be consistent. Moreover, I was able to analyse all data received from participants, without separating or choosing certain data. However, data analysis has huge financial implications to those who hire a scribe to transcribe and time consuming. Thus, this could lead scribes to write in their own words, which might distort the information. To overcome this challenge, I spent time transcribing to gain all relevant information from cell phone recording, using my own words. Furthermore, I employed all ethical consideration to dodge violating participants' rights in this study.

### **3.8 Ethical issues**

Loutzenhiser (2016) defines ethics as an activity which critically examines morals, questioning its rules, and seeking orientations, which are well thought out and correct. The study further asserts that ethics uses rigorous analysis to reveal the flaws of logic and contradiction of the reasoning and seeks to go beyond them. Moreover Loutzenhiser (2016, p. 2), asserts that “ethics deals with what we should or should not do, but it does so by applying reasoning, for or against in order to decide on the conduct to be taken when faced with a moral problem”. In order to meet the ethical requirements of this study, I requested permission in writing to conduct a study from Department of Basic Education through the Nongoma Circuit Management Centre. Therefore, I applied for the ethical clearance from the University of KwaZulu-Natal prior to the research. Therefore, the Circuit Manager on behalf of the Department of Basic Education, KwaZulu-Natal, granted permission to conduct a study with the four schools (Annexure B). Moreover, the schools' principals also granted me permission to conduct the research in their respective schools (Annexure A). I visited the teachers who are teaching Mathematics in Grade 4, to ask them to be part of the study (Annexure C). They in turn, signed the consent and also alluded to what transpired in the study.

Christiansen et al. (2010) concurs with Wexler (1990) that within consent forms there should be ethical norms of voluntary participation and the provision of no harm to participants. Hence, protection of human right is a mandate in education research (Shanmugam & Srinivasan, 2012). In addition to the above, Wexler (1990) asserts that it is the researchers' responsibility to be granted permission to conduct the study and inform participants about their right. I then made

teachers aware that, due to human rights, they are free to step aside whenever they feel like doing so. Conversely, I made it clear to teachers that they would not benefit financially from the study. I made an effort to follow all ethical practices while conducting this study. Orb et al. (2001) asserts that the limitation of ethics is the concept of relationship and power between the researcher and the participants. The study further assert that the desire to participate in a research study depends upon a participant's willingness to share his or her experience. Through mutual relationships I made with participants, I fitted to be in their position so that they feel free in the study.

Moreover, participants have a right to confidentiality and privacy, therefore the researcher should make it a point that participants are clear about these issues so that they would give the best of their knowledge knowing that their safety is guaranteed. I continuously assured the participants that their real name and school would remain anonymous using pseudonyms instead of their real names; they were participants PA, PB, PC, and PD. I visited them one by one. This proves that participants can never be traced, and this could yield confidence to participants. However, Cohen et al. (2011) outlined that there are drawbacks in ethics, for example the divulging of school names. I ensured that betrayal would be avoided at all cost and their information will be kept for five years in the schools safe and that the information will not be used by anyone.

### **3.9 Trustworthiness**

Trustworthiness is defined by Morrow (2005) as the way a researcher is able to convince the reader that the findings of the study are accurate and of high quality. Moreover, the study further outlined that credibility, transferability, dependability and conformability should be taken into account in qualitative research study as the four proposition. Cohen et al. (2011) outlined that trustworthiness is associated with the principle of truth, value and neutrality of the research. Guba and Lincoln (1994) further articulate that, paying more attention to these dimensions (credibility, transferability, dependability, and conformability) increase trustworthiness of the study.

Cope (2014) defined credibility as the findings reflecting the ‘reality’ and lived experiences of the participants and for a research to be trustworthy. Moreover, Mustafa (2011) asserts that credibility is concerned with whether the research understands what it intends to test. Hence, credibility was achieved through relationships already built between me, a researcher, and teachers as participants. This relationship made things easy during interviews whereby trustworthiness in questions prevailed. However, Credibility is threatened by errors in which research subjects respond with what they think is the preferred social response which is data (Golafshani, 2003). I used prolonged direct response set where informants consistently agree with questions.

Furthermore, Confirmability is concerned with whether the findings reflect the experiences and ideas of the participants (Anney, 2014). I made an attempt that participants’ responses talked to what was being researched. Furthermore, Anney (2014) noted that transferability is the responsibility of the person wanting transfer findings to another situation or population, and not the researcher of the original study. I made an attempt that accurate findings and recommendations on the teaching of Mathematics are well preserved and can be applied at a later stage by other teachers.

Dependability refers to the consistency of research findings (Cohen et al., 2011). Furthermore, Anney (2014) proposed that the dependability criterion relates to the consistency of findings. Mpungose (2016) asserts that dependability is about giving correct and direct information in the study. Therefore, dependability was enhanced by returning raw data and interpretations back to the participants for accuracy verification and for the crystallisation of captured data. In addition, interviews were audio-recorded through cell phone to enhance accuracy and authenticity of the findings and that bias was eliminated during transcription. Triangulation was used to make sure that verification is enhanced.

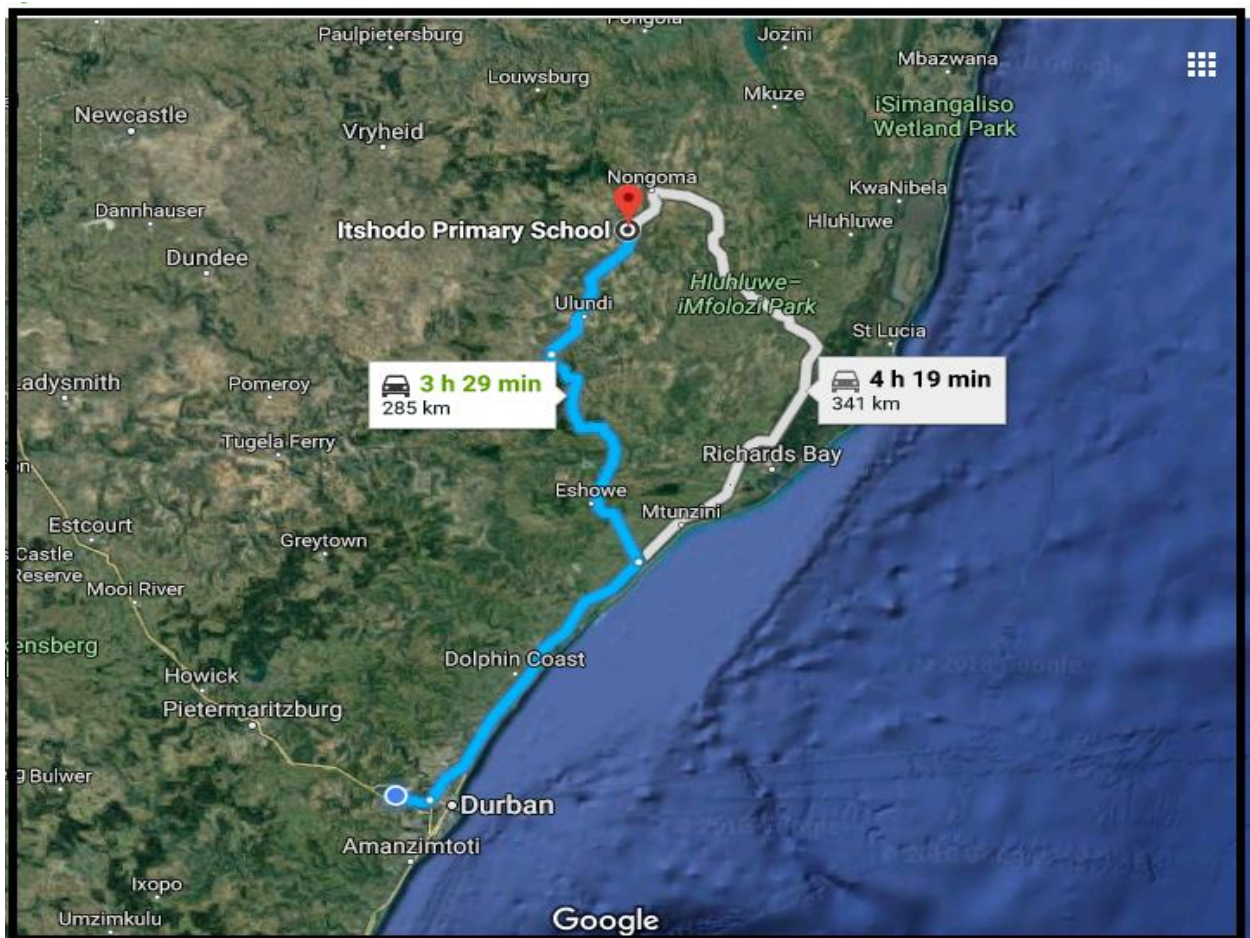
### **3.10 Limitations**

I acknowledged my situation as a principal, I have pre-determined knowledge or answers against certain interviews conducted with teachers teaching Mathematics in Grade 4 and it is

likely to be bias somehow. I attempted to maintain professionalism by not divulging information I have to teachers. Moreover, I maintained my emotions; avoided expressing my ideas or views about the study I was conducting. I guarded against untrue responses from participants, or their attempts to please the researcher. As I am involved in qualitative research, I am aware that results of the study are subjective, personal and contextual which means that they cannot be generalised. In other words, other teachers may refer to findings if it is applicable to their own context.

### **3.11 Location**

The study was conducted for teachers' reflection on teaching Mathematics in four primary schools in the Nongoma Circuit Management Centre, under the Zululand District. I had selected these four primary schools because they are in poor socio-economic status, which is quintile 1, and they were easily accessible to me. Most of the learners in these schools depend on social grants for living; others live with grandparents, while others are child-headed households. Classes for these schools cater for Grade R to Grade 7. All of the learners in these schools use mother tongue (IsiZulu as their home language). Hence, their medium of instruction from Grade R to 3 is IsiZulu, then from Grade 4 to 7 is English. This implies that in Grade 4 learners are first learning Mathematics in English. The map location where the study is located is shown below.



**Figure 3.4: Location of the study**

### **3.12 Conclusion**

Chapter Three elaborated on the research design and methodology of this study. Hence, this chapter defined research paradigm, research approach, sampling, data generation methods, data analysis, trustworthiness, ethical issues and limitations of this study. All these stated methods clearly outline the way this study was steered and how it intends to answer research questions. Furthermore, the teachers' reflection on the teaching of Mathematics in Grade 4 were explored using the above-mentioned methods. Moreover, weaknesses of the different methods used were also addressed. The focus of the following chapter (Chapter Four) is to present the research findings through discussion that follow the data analysis defined earlier in this chapter.

## **Chapter Four**

### **Research findings and discussions**

#### **4.1 Introduction**

This chapter (Chapter Four) presents the findings that emerged from the data generation process. The data was generated using the following three methods: reflective activity, one-on-one semi-structured interview and, observation, which was done in duplicate. The data was generated from four Grade 4 teachers from four different schools in the Nongoma Circuit Management Centre. This chapter is framed around using the concepts of the curricular spider-web as a conceptual framework of this study. Hence, the data that come from this study were explored using the curricular spider-web where the themes were developed.

Moreover, four participants were referred to as participants PA, PB, PC, and PD respectively as they appear in Table 3.1 in the previous chapter (Chapter Three) to accomplish the assurance of confidentiality and for encoding data. In this chapter, direct quotations generated from the participants (PA, PB, PC, and PD) will be used to produce the reality of the findings. Moreover, the literature review is used to compare and analyse the findings. Furthermore, the Grade 4 CAPS document is also used to compare whether teachers' reflections are in line with the intended curriculum. In addition, the above reflections are separated by levels, which are categorised as technical level of reflection, practical level of reflection and the critical level of reflection (personal reflection). The levels of reflection are arranged to each category.

#### **4.2 Findings and discussions**

The findings and discussions of this research are presented through the concepts of the curricular spider-web. However, themes and categories came from the data generated as aligned to the questions following the concepts of curricular spider-web through thematic analysis (inductive and deductive reasoning), as it appears in Table 4.1 below.

**Table 4.1: Themes, questions, categories, and reflection levels from the curricular spider-web.**

Themes	Questions	Categories	Reflection levels
Rationale	Why do you have an interest in the teaching of Mathematics in Grade 4?	Personal Societal Professional	Technical level Practical level Critical level
Resources	What resources do you use when teaching Mathematics?	Hard-ware Soft-ware Ideological	Technical level Practical level Critical level
Accessibility	Who are you teaching Mathematics to, in terms of financial, cultural and physical aspects?	Physical Financial Cultural	Technical level Practical level Critical level
Goals	How do you ensure justice when teaching Mathematics lessons?	Aims Objectives learning outcomes	Technical level Practical level Critical level
Content	What content are you teaching in Mathematics?	Topics Practical work Subject knowledge	Technical level Practical level Critical level
Activities	What are teaching activities do you use when teaching Mathematics lessons?	Teachers-centred Learner-centred Content-centred	Technical level Practical level Critical level
Teachers' role	How do you perceive your your character when teaching	Instructor Facilitator	Technical level Practical level



	Mathematics lessons?	Assessor	Critical level
Location	Where do you teach Mathematics lessons?	Informal location Formal location Blended location	Technical level Practical level Critical level
Time	What is the time allocation for each Mathematics concept?	Weekly Days Hours	Technical level Practical level Critical level
Assessment	How do you assess Mathematics lessons?	Formative Summative Continuous	Technical level Practical level Critical level

#### 4.2.1 Theme 1: Rationale

- Why are you teaching Mathematics in Grade 4?

##### Phase One

The following methods were conducted using the questions outlined around the curricular spider-web, namely: the reflective activity, one-on-one semi-structured interview and observation were conducted using the questions around the curricular spider-web. Rationale is the major guiding theme of all the other nine themes. Participants reflected on one or two reflective categories. None of the participants reflected on all three categories (personal, societal and professional) in the first phase. PA, PB, PC, and, PD outlined that they teach Mathematics to assist families to have better individuals who can solve problems in the community. PB said, *“I teach Mathematics to prepare learners to be scientist and Doctor in their education endeavour.”* (Societal rationale). PC further said, *“I want these learners to be better people in the community and be able to solve problems.”* Moreover, during reflective activity, four participants; (PA, PB, PC, and PD) indicated that they have a love for

Mathematics because they have qualifications in the subject. Participant PD said, *“I have ACE in Mathematics that is why I am teaching Mathematics in Grade 4.”* Moreover, participant PA goes further to say, *“I have Bachelor of Education majoring with Mathematics.”* Hence, participants were not aware about all three categories of rationale as they are illustrated above. Three participants talked about personal rationale.

## **Phase Two**

However, during the second phase of reflection, following the action research intervention, all the participants were clear about the three propositions and were able to reflect on each of them. Below are responses of their reflections.

### **Personal rationale**

PA: *“I am a teacher who has love for Mathematics and I am striving to make my learners to also love the subject.”*

PB: *“Mathematics is my life. I cannot imagine how I can live without this subject in my entire career. I love Mathematics because it is associated with intelligent learners, so I want to be always on toes since I expect any challenging question from my learners.”*

PC: *“I develop much love for all other subjects but specifically Mathematics. At my early years, I wanted to create love to my learners and I am curious about all developments and knowledge about Mathematics. This brought me passion about the subject.”*

PD: *“I like to work with numbers and be able to solve other people’s problems. I want to be a respected individual in the community by assisting people in the community.”*

Moreover, it is clear that all participants (PA, PB, PC, and PD) have understood the personal rationale as to why they teach Mathematics in Grade 4. Participant PC outlined that she is teaching Mathematics because she has passion for teaching Mathematics. This suggests that, as PC is passionate about teaching Mathematics, it can drive her to dig deeper and enable her to give learners the best education. This suggests that teachers were driven by personal reflection

in their teaching of Mathematics. Moreover, Khoza (2015) outlined that personal rationale is the most influential rationale that drives teachers to successfully teach their subject. The study by Khoza (2015) continuously stating that when teachers are guided by personal rationale, they demonstrate a conceptual understanding of their subject. This is in line with the above findings since most of the participants had a love of teaching their subject and this show that they are more influenced by the personal rationale.

## **Societal rationale**

### **Participants said:**

PA: *“I teach Mathematics in order for families to benefit by having learners in the community who will be scientist. Moreover, I want to produce learners who will be able to solve future problems in the community.”*

PB: *“I teach Mathematics to curb the notion that Mathematics is the difficult subject of them all, so that learners can become doctors and scientist in the community. Furthermore, the community I am teaching Mathematics depends on social grants, so I want learners to definitely progress to other grades to alleviate poverty in the society by progressing to the next grade.”*

PC: *“I teach learner Mathematics to assist parents to have competitive learners who can face challenges when they go to other school. Furthermore, I teach Mathematics with an intention that parents should know that Mathematics is the subject that can alleviate poverty in the society.”*

PD: *“I teach Mathematics to open doors for all learners, since most of the jobs require people who have Mathematics and learners need to get decent job and assist the government. Moreover, Mathematics pave the way in tertiary institution.”*

Apparently, all participants display their commitment to ensuring that the community they teach needs much development. This suggests that societal rationale also influences the teaching of Mathematics in helping the community. This is in line with assertions made by Freire (1985) that the location in which someone lives influences their everyday practices at

the working station. It is also evident that if teachers are driven by societal rationale they can assist society to have better people. Both participant PC and PD reflected on assisting learners to be able to be better learners when they finish school and have good jobs, so they are driven by verbal reflection in their teaching. Chevallard (2007) concurred with Vintere (2018) by asserting that society had in some way or another, recognised Mathematics as a basic, major ingredient and driving force of the economy and social development. This suggests that if teachers are driven by societal rationale the society can have competent learners who can be scientists and assist the government with skills that are lacking and in line with what 21<sup>st</sup> century demands.

### **Professional rationale**

#### **Participants said:**

*PA: “I teach Mathematics because I am qualified to do so. Mathematics is my life since I struggled in my school years, so I wanted to major with Mathematics to impart good knowledge to my learners.”*

*PB: “I teach Mathematics to develop mental process at an early stage and prepare them to senior phase. Secondly, I am a qualified Mathematics teachers holding ACE in Mathematics. This brings me confidence when cascading information to my learner.”*

*PC: “I teach Mathematics because where I am working we are not specialising, it is a must, but I have gained confidence because of workshops I have attended and our subject advisor are on hand to assist us in acquiring all necessary skills required to teach Mathematics. Furthermore, cluster have helped me to grasp relevant information about Mathematics.”*

*PD: “I teach Mathematics because I did ACE just to make sure that I am confident with what I am doing. I also wanted to gain confidence when I am in front of learners. This bring much oomph when I am in front of learner.”*

Participant PA, PB and PD share the same sentiments when stated that that they both possess Mathematics qualification. This suggests that they were driven by written reflection in the teaching of Mathematics. Therefore, Ernest (1989) outlines that knowledge of Mathematics

provides a foundation for teacher's pedagogical knowledge and skills for teaching Mathematics. Moreover, Marks (1990) as well as Loewenberg Ball, Thames, and Phelps (2008) concurred with Borum (2012) by outlining that Mathematical knowledge for teaching goes beyond that captured in measures of Mathematics courses taken or basic Mathematical skills. For example, teachers teaching Mathematics may not only need to reflect on calculating correctly but also need to know how to present concepts and procedures to learners. In other words, they need not only rely on their qualifications when teaching Mathematics, but they must go beyond, read more Mathematics books and also develop themselves by furthering their studies. On the contrary, participant PC did not have relevant qualifications in Mathematics. This is in accordance with an assertion by Shapiro (2010) that some teachers choose to care about their personal feelings while other teachers are more concerned about professional identity. This suggests that teachers should take into consideration of all other rationale in teaching.

Moreover, Van den Akker (2010) defines rationale as the elementary reason of accomplishing a duty to teach by following three levels of rationale namely; personal rationale, professional rationale and societal rationale (Voogt et al., 2009). However, both Khoza (2015) and Galane (2016) reasoned that teachers do not have what it take to implement, and curriculum, and as a result they work like technicians. In other words, technicians are given manuals to follow when they fix something, without the knowledge, skills, or freedom to change anything. This suggests that teachers' rationale in the teaching of Mathematics is driven by what is written in the CAPS policy document, and as a result, teachers' rationale is dominated by written reflection in the teaching of Mathematics in Grade 4.

Findings from Phase One of action research; revealed that teachers were aware of personal and societal rationale. For instance, teachers were driven by passion in their teaching of Mathematics and they were willing to assist learners for their future. This suggests that teachers were greatly influenced by both personal and societal rationale to teach Mathematics in their classroom. In other words, these findings indicate that teacher's practices in Mathematics are driven by both personal and verbal reflection, which seeks that they love teaching and be willing to meet the needs of the community. On the contrary, teachers were not aware of one rationale and this suggest that they were not driven by written reflection which seeks teachers

to be driven by their content and their qualification in their teaching and learning process. However, after the intervention in Phase Two of action research, all participants were all well aware of the level of rationale in their teaching. Thus, this led them to much improve in their teaching of Mathematics.

However, Khoza (2015) outlines that CAPS is associated with the performance curriculum, which focuses on the hierarchy of topics to be taught; a high level of understanding of the subject matter is the key for success in the implementation of intended curriculum. Moreover, Zipin (2013) as well as Zeichner and Keneth (1987) assert that teachers need to think critically since that is related to content knowledge. For teachers to read what CAPS requires of them can make teachers understand the professional rationale behind the teaching of Mathematics. DBE (2011, p. 4) outlines that the aim of the policy statement is to “equip learners, irrespective of their socio-economic background, race, gender, physical ability, or intellectual ability, with knowledge, skills and values necessary for self-fulfilment, and meaningful participation in society, and citizen of a free country”. The policy further states that there is facilitating of the transition of learners from education institution to the workplace. This suggests that Mathematics prepares learners for the workplace and to become competent citizens. Therefore, CAPS framed teachers to be driven by written reflection in order to teach learners Mathematics in Grade 4.

## **Theme 2: Accessibility**

- Who are you teaching Mathematics, in terms of financial, cultural and physical aspects?

### **Phase One**

In the first phase, not all participants reflected on all three categories of accessibility. They all focused on physical accessibility of the school. Participant PA said, “*Our school is next to the road and buildings are accessible. Since road is in good state I always travel with my car.*” Participant PD went further to say “*even physical challenged learners can access the school with ease*”. Participant PD said, “*Our school is next to the tar road, the school is easily*

*accessible even during rainy season.*” This reveals that while they teach in rural areas, their schools are easily accessible. However, participant PB reflected on financial accessibility by stating, *“I am teaching in a No Fee School, where parents depend on the social grant for a living.”* PA said, *“I teach learners who are from poor background.”* In other words, participant PB and PA confirm the poor background of the learners they teach. Findings revealed that participants responded less to the cultural background of learners in the community they serve.

## **Phase Two**

### **Physical accessibility**

On the second phase of action research, participants reflected on all three propositions of accessibility and said:

PA: *“Our school is easily accessible, although the road is a gravel, but that does not hinder any accessibility to reach school.”*

PB: *“The school I am teaching in is next to the road. There is no worry in when you are preparing to go to school due to problem of physical access. The issue is the lack of teachers, since learners are few which makes subject overload.”*

PC: *“Our school is well built, no challenges so far. The department of Education KwaZulu-Natal recently renovated the school. This makes the school to be more accessible.”*

PD: *“I teach in a well accessible school, whereby I don’t have to hassle when I suppose to go to school. Although our school is in rural area, there is no problem when you need to go to school. Our school has few number of learners.”*

However, all four participants reflected on physical accessibility of the school they teach. It is evident that participants understood physical accessibility. Participant PB and PD reflected that, their school has a shortage of learners, which resulted in overloading the teachers. The findings revealed that if teachers have good access to their classes they can deliver well. Therefore, Khan et al. (2012) reasoned that overcrowded classrooms affects learner

performances. This suggests that participant PB and PD does experience any problem in teaching of their learners, but the main issue is the accessibility of meeting them frequently, where learners are denied access. As a result, teachers were influenced by written reflection in teaching of Mathematics in Grade 4.

### **Financial accessibility**

In the second phase of action research, participants reflected on financial accessibility, noting that PB and PA responded on financial accessibility. However, all participants seemed to have understood all categories. For an example, PC and PD share the same sentiment that “*our principal make no attempt to assist us to attend workshops by providing us with finance.*” PC went further to say “*it hard to attend workshops that are organised after ten o’clock since I have to pay twice for transport in one day.*”

Therefore, it is evident that PC and PD have financial constraints when they have to travel to workshops, which has negative impact on learners’ performance, since workshop all difficult issues pertaining subject are unpacked. This is in line with Baker and Levin (2014) assertion that in rural school’s financial support tends to be low as compared to urban schools. Moreover, the study further asserts that rural schools are likely to struggle to provide a specialised services because of a combination of poverty and higher cost owing to small scale operations and shortages of such services will tend to make teaching Mathematics less attractive. This suggests that if teachers are not reimbursed by the school to have access to workshops, since this is where knowledge is shared amongst teachers they can lose interest in teaching. The findings suggests that financial access is a barrier in the teaching of Mathematics CAPS in rural schools that have a small number of learners. Thus, this seeks teachers to be driven by personal reflection so that they should ask for financial assistance and use their own time to do school activities related to the teaching of Mathematics.



## **Cultural accessibility**

Moreover, all participants responded on the cultural accessibility of the school. This suggests that the three categories of accessibility were unpacked. The participants said:

PA: *“The community value education highly, because they allow learners to have morning class before school commences as usual.”*

PB: *“Parents come and do volunteer work at school like sweeping classrooms after school. Apparently, most community learners worship in Nazareth Baptized church; hence I experience a challenge if I need my learners during Saturday because learners attend church services.”*

PC: *“Parents value school in such a way that during Dipping day for cattle they allow learners to use weekends only so that they are not disturbed.”*

PD: *“Most parents make an attempt to assist their children to come to school on time, as Mathematics is mostly take place in the first period, however if I to give my learners homework I find it difficult to others since parents do not understand English as the medium of instruction.”*

In line with the above, PA and PC share the same sentiments when they mentioned that parents value their learners in high regard. In addition, PA and PD mentioned that parents assist learners to come to school early so that they can be on time. This suggests that verbal reflection assists teachers to inform parents about the importance of coming to school early, since Mathematics is understood better in the morning when the mind is still fresh and there is better concentration span. Therefore, Greco (2016) defines cultural accessibility as an instrument to access human rights. A mixed method study conducted by Kloppers and Grosser (2014), indicates that teachers required to teach learners the value and meaning of critical thinking and they must to model teaching techniques with an aim of imparting critical thinking skill when teaching Mathematics, hence critical thinking motivate teachers to use learner-centred approach.

In support of the above, Berkvens, Van den Akker, et al. (2014) assert that accessibility is a fundamental right; any human being has the right to access education regardless of race, gender, sex, cultural background, or even financial background. This suggests that every learner who is doing Grade 4 is entitled to access Mathematics education. Moreover, Berkvens, Vandermeulen, et al. (2014) assert that there are three levels of accessibility in teaching: financial access, physical access and cultural accessibility. In line with the above assertion by Berkvens, Vandermeulen, et al. (2014), the Bill of Right also caters for children's right to education, where by accessibility to basic education and adult education is emphasised (Marcos et al., 2009). Therefore, it is imperative that accessibility in education provides quality education to learners (Ngubane-Mokiwa & Khoza, 2016).

Moreover, findings from Phase One of action research revealed that all participants (PA, PB, PC, and PD) reflected on physical access but two participants, PA and PB, continued by reflecting on financial accessibility when teaching Mathematics in Grade 4. They explained that they teach in a No Fee Schools, which means that the community they teach in are poor. This suggests that the majority of participants were driven by written reflection since they knew that teaching and learning should occur in a classroom. Further to this, two participants (PC and PD) were not aware about financial access which forms part of accessibility, and this means that teachers were not aware that they should use their personal reflections to use their own funds to attend workshops so that they can claim thereafter. Consequently, in Phase Two of the action research, participants were capacitated with readings and were able to reflect on both financial and cultural accessibility including physical access.

However, DBE (2011) is silent about cultural accessibility as it relates to religion. In other words, the CAPS policy document does not specify cultural accessibility of learners in the teaching of Mathematics. Consequently, with teachers there is no guideline as to how teachers can access learners during the weekends. Moreover, DBE (2011) further assert that knowledge is delivered to learners regardless of the culture and financial background and the physical ability of learners (physical access). Moreover, if teachers were unable to access learners to know the value of Mathematics, less is the meaning of critical thinking that can be enhanced to other learners (Kloppers & Grosser, 2014). Consequently, DBE (2011) outlines language of teaching and learning in Mathematics Grade 4, so teachers find it difficult to communicate with

parents as to how to assist learners. This suggests that according to DBE (2011) teachers should be driven by verbal reflection to cater for learner needs in the teaching of Mathematics in Grade 4.

#### **4.2.3 Theme 3: Resources**

- What resources do you use when teaching Mathematics?

##### **Phase One**

From the data generated during the first phase of action research, participants showed that they were unaware of all three categories of resources that should be used when teaching Mathematics. However, all participants (PA, PB, PC, and PD) share the same sentiments by stating that the resources that they use in the classroom are textbooks, chalkboards and workbooks (hard-ware resources). In addition to the above, PA clarified more by stating, *“I use scales, counters, Mathematics instruments, and metre rulers.”* Moreover, PD continuously stated that, *“I even use bottle tops, beans, rice as counters.”* It is evident that all participants were well versed with hard ware resources. All participants (PA, PB, PC, and PB) continued to explain that they use calculators as resources, but PB and PC further stated that, they do not motivate their learners to use calculators daily, so that they can develop their learners’ Mathematics counting skills. PA and PD stated that they use computers or tablets. In other words, all participants also reflected on soft-ware resources when they teach mathematics. PD said, *“I sometimes use tablets as they were donated by the department, but I do not rely on them due to lack of data bundles.”* All participants were silent on ideological-ware.

##### **Phase Two**

In the first phase of action research, it was evident that participants were well versed with both hard-ware and soft-ware resources. Therefore, in the second phase of reflective activity participants responded on the ideological-ware and said:

### **Hard-ware resources**

PA: *“I use metre rulers, textbooks, scales, and chalk.”*

PB: *“I use textbooks, chinks, and workbooks. Although I have a challenge of less workbooks in my school, but I do copies.”*

PC: *“I use objects, textbooks, rulers, instruments.”*

PD: *“I use ample of resources like different textbooks, policy document, charts, bottle tops.”*

Generally, it was evident that participants used resources that were provided to them by the Department of Education (textbooks) as their primary resource. All participants (PA, PB, PC, and PD) share the same sentiments by stating that they used textbooks. In line with the above accounts by participants, Kelly (2009) concurs with Remillard and Heck (2014) that textbooks determine the knowledge the teacher seeks to deliver to learners. Furthermore, Taylor and Medina (2013) reasoned that textbooks assist teachers to obtain daily activities. This suggests that teachers were driven by written reflection in their utilisation of textbooks as a hard-ware resource. However, PB was deprived by the shortage of workbooks for her class, which led to an absence of activities for her learners. This is in line with Prinsloo (2007) assertion that a lack of resources is one of the major obstacles to a smooth curriculum dissemination.

### **Soft-ware resources**

PA: *“I normally use data projector connected to my laptop when I teach, especially when I want my learners to see certain shapes like 3D.”*

PB: *“I use calculators although I do not encourage my learners to use it in simple calculations. I also use my smart phone to check district papers and cluster activities.”*

PC: *“I usually use iPad that are in my school.”*

PD: *“I sometimes use digital tablets or computers that were donated to our school.”*

It is evident that all participants use soft-ware resources when they teach Mathematics. Although, PD said that she sometimes use digital tablets or computers. She should regularly use soft-ware resources to meet the demands of the 21<sup>st</sup> century. In line with the above accounts by teachers, it is evident that they are familiar with soft-ware resources and they utilise them to facilitate teaching Mathematics. Moreover, Sanders (2013) believed that school principals should ensure that they buy hard-ware and soft-ware resources for their teachers in order to successfully implement the intended curriculum. This suggests that teachers must be driven by verbal reflections in order for them to acquire soft-ware resources. In other words, they are the ones to choose which resources are suitable, because they understand their learners better than anyone else does.

### **Ideological-ware resources**

PA: *“I usually use different methods when teaching Mathematics. If see that my learners are filing to do work individually, I group them.”*

PB: *“I use different approaches (teachers-centred and learners centred) to teach my learners depending on the topic I teaching.”*

PC: *“I normally use my ideas as a parent in front of them applying in [in loco parentis], whereby I always on handy to their challenges, especially to those who are slow in counting during counting work by giving them counters.”*

PD: *“I take every method from CAPS document to implement and add my own methods when teaching Mathematics. I also use cognitive levels when I assess my learners.”*

Clearly, participants now understood ideological-ware (teaching methods/theories) as a resource in the second phase of action research, since in the first phase of action research no participant responded to ideological ware resources. In the second phase participants, PA and PD reflected that they used different methods. Khoza (2014b) asserts that it is of paramount importance for teachers to utilise ideological-ware as a resource to make teaching and learning conducive. Clearly, teachers must identify ideological-ware in order to know how the intended curriculum is going to be approached. Moreover, Khoza (2015) asserts that ideological-ware is one of the resources that drives any lesson. This suggests that, it is imperative that teachers

attend to ideological-ware resources (teaching methods/theories) when they teach. In addition to the above, Hoadley (2012) asserts that teachers must be driven by personal reflection when they utilise ideological ware as a resource. This suggests that if teachers can apply the correct methods or strategies in the teaching of Mathematics, learners will have fewer challenges in their learning.

In support of the above, Khoza (2013) identifies three types of resources when teaching: hardware resources (any tool or machine used in education), software resources (materials that display data like computers), and ideological-ware resources (resources that you cannot see or touch in education such as strategies or methods). It is evident that teachers cannot teach Mathematics using any of resources in order to ensure teaching and learning. Moreover, Mpungose (2016) argues that teachers also use resources during curriculum implementation. This suggests that teachers should view themselves as role players in the teaching of Mathematics, because learners can consult them when they want information, just as they would other resources (hardware, software and ideological ware).

In the context of South Africa, DBE (2011) is vocal about the resources (hardware) that must be used in the Mathematics class. As a result, DBE (2011) specifies that Grade 4 is allocated workbooks to be used by teachers as a supporting document in the teaching of Mathematics in Grade 4 where different activities are done. Therefore, DBE (2011) drives teachers to be driven by written reflections in order to teach Mathematics in Grade 4. This suggests that teachers must apply their knowledge by reading CAPS documents whole-heartedly as to understand resources they must use when teaching Mathematics in Grade 4. Moreover, Hoadley (2012) reasoned that personal ideology and attitudes drive all other resources that are used in teaching and learning.

The finding from the first phase of action research in resources clearly stated that teachers were clear about hardware and software resources, but they lacked knowledge about ideological-ware. During the second phase they showed that they understood ideological-ware since they were given different prescripts to gain more knowledge and do introspection as to what are they doing in their teaching? Their ignorance of ideological-ware in the first phase of action

research disadvantaged learners in the better attainment of knowledge. In line with the above assertion, Khoza (2015) reasoned that teachers are at liberty to use multiple teaching strategies (ideological-ware) they know to disseminate the intended curriculum, such as questioning and demonstration. Consequently, teachers are not limited to the methods they use in the teaching of Mathematics in Grade 4. Therefore, before teachers can embark on ideological-ware they must understand ideological ware that supports their teaching.

#### **4.2.4 Theme 4: Goals**

- How do you ensure justice when teaching Mathematics lesson?

##### **Phase One**

In the first phase of action research participants were not clear that aims are not the same as objectives, since aims are short-term goals while objectives are long-term goals. Khoza (2014b) asserts that most educators did not understand how aims were different from objectives. However, Kennedy et al. (2006) asserts that if teachers confuse aims and objectives that can lead to negative effects on the attainment of learning outcome. Moreover, Carl (2012) continuously states that setting accurate goals can add to the smooth running of a programme and make effective use of obtainable time. Participants reflected on aims. PA said, *“I teach my learners to acquire Mathematical skills.”* While, participant PB said, *“I teach my learners to appreciate the beauty of mathematics.”* PC said, *“I teach Mathematics just to develop Mathematical curiosity to my learners.”* PD said, *“I don’t understand learning outcomes”*. It was evident that, participants were not aware of the three categories that underpin goals in teaching of Mathematics.

##### **Phase Two**

During the second phase of action research, all participants responded on all categories of goals, as they had been given readings and became aware of all the categories. Herewith, are their own reflections:

## **Aims**

PA: *“I teach my learners to acquire Mathematics skills.”*

PB: *“I teach Mathematics to my learners so they can be critically aware of how Mathematical relationship used in social, environmental, cultural and economic relationship.”*

PC: *“I teach Mathematics in order develop a spirit of curiosity and love for Mathematics.”*

PD: *“I teach my learners to acquire knowledge and skills necessary for further study in Mathematics.”*

These accounts suggests that teachers were clear about their aims in the second phase of action research. For instance, it became apparent that teachers were driven by personal reflection in their teaching since PC indicated that she was driven by curiosity and love in her teaching and learning process. Kennedy et al. (2006) argued that if teachers fail to understand and set proper aims in their teaching that can constitute negative results that can affect the attainment of learning outcome. This suggests that aims are influenced by personal reflections in the teaching of Mathematics. Moreover, teachers must have a clear set of aims in order to achieve the intended curriculum.

## **Objective**

PA: *“I teach my learner to develop number vocabulary, number concepts and calculation skills.”*

PB: *“I teach my learners to pose and solve Mathematics problems daily and be able to pass tests and of course examination.”*

PC: *“I ensure that my learners always develop the correct use of the Mathematics language.”*

PD: *“My objective is make my learners apply Mathematical knowledge, investigate, analyse and represent and interpret information in their daily lives.”*



In the second phase of action research under objectives participants outlined that they all employ pragmatic approach in the teaching of Mathematics in Grade 4, since their objectives of teaching mathematics are linked to day-to-day experiences. PB said “... *to pose and solve Mathematics problems daily.*” While PD said ‘...*make my learners apply Mathematical knowledge, investigate, analyse, and represent and interpret information in their daily lives*’. Thus, they were driven by objectives stipulated from the CAPS document as intended curriculum when they teach Mathematics. As a result, participants were influenced by written reflections in the teaching and learning of Mathematics.

### **Learning outcome**

PA: “*When I teach shapes I expect learners to draw different shapes learnt at the end of the lesson.*”

PB: “*I always teach my learners in a way that, at the end of the lesson they must write class activity to check whether they grasp was has been learnt.*”

PC: “*When I teach learners addition I expect that when they do sums they follow BODMAS rule.*”

PD: “*I usually give learners homework for the work done in the class so as to continue with other more work on their own to check whether they can do sums alone.*”

Moreover, participants reflected well on learning outcome in the second phase of action research. Furthermore, Kennedy et al. (2006) reasoned that learning outcomes are explained as statements that defines what the learners have to do at the end of the lesson. It is evident that all participants (PA, PB, PC, and PD) were clear about learning outcomes in the second phase of action research. Thus, participants were driven by verbal reflection in order to construct learning outcomes in the teaching of Mathematics. Furthermore, Kennedy et al. (2006) argued that it is of great importance for teachers to use Bloom’s Taxonomy for writing learning outcomes. Accounts from participants above showed that teachers employ everyday knowledge to implement the goals of teaching Mathematics curriculum based on school knowledge (Zipin, 2013). Moreover, Khoza (2013) concurred with Boud et al. (2013) that

learning outcomes need to be noticeable and determinate in order for leader teachers on their intentions.

In support of the above, Kennedy et al. (2006) argued that goals in teaching have three categories: aims, objectives and learning outcomes. The study further articulates that aims are long-term goals while objectives are immediate goals. However, Khoza (2013) concurred with Mpungose (2016) that both aims and objectives indicate the intentions of a teacher for the anticipated outcomes from learners. In addition to the above Khoza (2013) reasoned that learning outcomes are what the learner is expected to know at the end of a learning. This suggests that teachers' experience must be clear on what learners should know at the end of the lesson and be able to articulate on what was delivered to them during the teaching of Mathematics.

Moreover, findings from Phase One of action research revealed that participants were clear about aims, but PD was not clear about learning outcome. In the second phase of action research participants were well versed with all categories that underpin goals in the teaching of Mathematics. This was a result of the attainment of the CAPS documents to read with understanding and able to identify goal of teaching Mathematics, which are aims, objectives, and learning outcomes. Their lack of knowledge in reflecting in Phase One proved that the intended curriculum (CAPS) was not properly implemented to learners because participants did not know how to institute goals. Moreover, we designed one lesson plan to equip participants on who to include all goals when they teach. It was evident that participants ignored learning outcome; whereas, it serves the purpose of teaching Mathematics.

In the context of Mathematics CAPS. DBE (2011) specifies the general aims of the curriculum, which directs the knowledge, skills and values worth learning in South Africa. This suggests that mathematics teachers should specify aims, objectives, and learning outcomes in their lesson preparations. This would assist teachers to be reminded about their intentions when teaching Mathematics. Moreover, these curriculum goals indicated that CAPS equips learners with skills irrespective of race, gender, physical ability or socio-economic background necessary for self-fulfilment in society as a citizen, in other words; Grade 4 Mathematics CAPS

alludes to learning outcomes (skills) that learners should acquire after the teaching and learning process. Moreover, teachers should be given time to reflect on their teaching goals so that they are able to align their practices with the intended curriculum.

#### **4.2.5 Theme 5: Content**

- What content are you teaching in Mathematics?

##### **Phase One**

During the first phase of action research all participants share the same sentiment on the Mathematics content they teach in Grade 4 based on the five content areas namely: Number Operations and Relationship; Patterns, Functions and Algebra; Space and Shapes (Geometry); Measurement and Data Handling. This similarity is caused by the fact that DBE (2011) specifies all five content areas to be learned and taught in Grade 4. PA *“I teach mathematics based on five content areas”*. Moreover, PB said, *“I teach Mathematics content based on five content areas for grade for from CAPS document. I also teach specified topics, concepts and skills that directs me of what to be taught.”* PC stated that, *“I teach five content areas as stipulated by CAPS”*. PD went on to say, *“I teach Mathematics in Grade 4 based on the five content areas and in line with Annual Teaching Plan.”* This indicates that teachers need to be well versed with other categories of content, which are topics and subject knowledge.

##### **Phase Two**

In the second phase of action research participants elaborated more after they were capacitated. They said:

##### **Topics**

PA: *“I teach all relevant topics in Mathematics Grade 4, but before I teach I link previous topic with the new one so that learners can understand better.”*

PB: *“I teach specific topics, concepts and skills stipulated in the Annual Teaching Plan for Grade 4 Mathematics.”*

PC: *“I focus on each and every topic, but before every topic my learners do mental work.. Moreover, whenever I find it difficult in some topic I consult cluster members to assist me on how to tackle in that topic.”*

PD: *“I stick to the topics that are I am expected to teach, for instance if I deal with whole numbers I focus on counting forward and backwards.”*

Participant PA, PB, and PD share the same sentiments when they reflected on the topics they teach. For instance, PA said that he teaches all topics that he is supposed to teach. Hoadley and Jansen (2013) outline that a teacher must know all topics of the subject that they are teaching, so that they will yield good results. This suggest that PC was driven by verbal reflection when he teaches Mathematics topics in Grade 4. Therefore, topic centred approach underlies the design of CAPS (Long & Dunne, 2014). However, Jones and Sallis (2013) defined content as a wide range of aspects of subject matter, knowledge and teaching of subject matter. Additionally, Shulman (1987) as well as Schön (2017) argued that, for better implementation of Mathematics content, teachers need to be well versed with all aspects of the subject. It was evident that after Phase One of action research participants understood that, content is not often limited in single documents, but from numerous documents that outline the content for learning areas and subjects and that these documents apply different levels of curriculum as suggested by (DBE, 2011). This suggests that teachers were driven by written reflection in the teaching of Mathematics. Moreover, the pace setter (Annual Teaching Plans), textbooks as well as lesson plans are also curriculum documents. Participant PB clearly was in line with this when she said *‘.... teach specific topics, concepts and skills.’*

### **Subject Knowledge**

PA: *“I teach learners space and shapes in order to involve my learners in practical activities.”*

PB: *“For my learners to pass Mathematics I apply different approaches so that they can master the content. For instance when they do geometry I apply content knowledge I have so that they can master the subject.”*

PC: *“I teach content like shapes since they are part of their daily lives. Although there is a problem in certain words to grasp easily because they were learning Mathematics in Home Language (IsiZulu) the previous year.”*

PD: *“I teach learners geometry so that learners acquire skills.”*

It is evident that participants are clear about the subject knowledge that they teach. The above findings showed that teacher’s subject knowledge provides learners with necessary knowledge of Mathematics especially space and shapes, but the challenge is the issue of language where PC outlined that she has a problem in certain words because learners were using isiZulu as the language of teaching and learning. PA reflected that when he taught his learners, he involved them in practical activities. On the other hand, PB talked about the application of different techniques or approaches with them aim of her learner-attained content. This suggests that when learners master the subject knowledge they can apply their knowledge in their daily lives. In other words, teachers were driven by written reflection in ensuring that learners acquire subject knowledge in the teaching of Mathematics.

Moreover, DBE (2011) is vocal about which content need to be taught in Grade 4 Mathematics, which are Number, Operations and Relationship; Patterns, Functions and Algebra; Space and Shapes; Measurement and Data Handling. Moreover, teachers need to be driven by written reflection in order to meet content requirements in Mathematics. In addition, DBE (2011) outlined that Mathematics is a form of communication that makes use of signs and techniques. This suggest that teachers need to be aware of the different signs they encounter in the dissemination of Mathematics content in Grade 4.

The findings from Phase One of action research revealed that teachers focused on the five content areas of Mathematics which are: Number Operations and Relationship; Patterns, Functions and Algebra; Space and Shapes (Geometry); Measurement and Data Handling. This suggests that participants were driven by written reflection when teaching Mathematics. In the second phase of action research teachers reflected on other categories of content which are topic and subject knowledge. This was due to the capacity building we engaged in, whereby I

demonstrated to all of the four participants during observation as to how to approach content. This was evident when, teachers believed that their background, experience and subject knowledge was essential to teach Mathematics in Grade 4 before they were capacitated. Moreover, topic knowledge was overlooked in the first phase. In addition to the above, Dalgarno and Colgan (2007) asserted that self-reflection influenced how the teacher teaches the subject in future. Moreover, the issue of language causes a barrier for some learners to grasp the content easily due to code switching from IsiZulu to English.

#### **4.2.6 Theme: Activities**

- What teaching activities do you use when teaching your Mathematics lessons?

##### **Phase One**

In the first phase of action research, all participants responded on one category of activity (theme). They focused on teacher informal activity. PA said, *“I give learner ten minutes mental work daily before I teach. I further organise morning classes where I teach learners in pairs or groups.”* While on other hand PB said, *“I give learners activities that challenge them in my teaching so that they will gain more knowledge.”* While participant PC said, *“I give learners’ class works, group works, home works or assignments.”* PD share the same sentiment as PC by stated that, *“I give learners informal activities (class works or homework) to check whether I teach them was understood or not.”* Van den Akker (2010) assert that it is imperative for teachers to consider the best activities for attainment of subject aims. Thus, the participants were given a chance in the second phase of action research to reflect on the other two categories.

## **Phase Two**

On the second phase of action research participants reflected and said:

### **Teacher-centred activities**

PA: *“I give my learners class activities, home works using learner’s book from different publishers, and activities from work books prescribed by the Department of Basic Education (DBE).”*

PB added and stated: *“I normally focusing on activities from prescribed programme of assessment I received from cluster meeting. I use question and answer to introduce every activity that need to be done in the class.”*

PC: *“I do presentation of what activities should be done in the classroom.”*

PD: *“I introduce, explain and demonstrate on how new activities should be done. This is done to guide learners as to how they supposed to approach the activity.”*

From the above accounts in the second phase of action research proved that, participants were better transformed because they all reflected on teachers-centred activities. They reflected on their activities while teaching Mathematics for example all, participants share their teacher-centred activities while they are in class. They all reflected about what they normally do in their classroom as teacher-centred activities. However Georgii-Hemming and Westvall (2010) argued that learners should not be the receivers of information, but they must be engaged in creating thoughts and explore different talents. This suggests that teachers should be driven by personal reflection in ensuring that learners receive information that is due to them. In other words, teachers need to assist learners to explore their talents and stretch their minds to the horizon as much as possible.

### **Learner-centred activities**

PA: *“I give learners activity that they do themselves especially using computers where they can learn and discover problems on their own.”*

PB: *“I give my learners different shapes to tell me how many phases are there in a shape.”*

PC and PD seemed to share the same sentiments by stating that they give learners activities to write work. PC went further and stated that, *“When learners have to do division as an activity, I group the objects so that they can divide them.”*

In addition to the above reflection by participants, it was clear that they all (PA, PB PC, and PD) understood learner-centred activities. Moreover, Zain, Rasidi, and Abidin (2012) assert that in learner-centred activities, learners are seen to be more extrinsically motivated. In learner-centred activities, learners are not passive recipient of information, but are active agents engaging as they construct their own knowledge. This suggests that teachers should be driven by verbal reflection in ensuring that when they teach Mathematics, learners must be given opportunities to explore learning by themselves. Moreover, it is important that learners engage in their activities since they learn as they encounter the knowledge, i.e. they construct meaning and the system of meaning. Additionally, Krishnan (2015) asserts that when learners are formed into small groups for learning activities, it allows them to interact more actively, share ideas and show some commitment towards the team members.

In line with the above activities, Khoza (2013) asserts that lesson delivery involves teaching activities, which can assist teachers to facilitate teaching in Mathematics. Moreover, Hwang et al. (2011) defined activities as the experiences that learner need in order to have particular behavioural competencies. This suggests that activities drives learners to be capacitated in order to be responsible for what is learned in and beyond the class (Smith, 2015). In addition to the above, activities are outlined in three categories of teaching: learner-centred activities, teacher-centred activities and content-centred activities (Li, 2016).

According to DBE (2011), teaching activities are provided that need to be taught under concepts and skills. Moreover, DBE (2011) caters for teachers’ flexibility by allowing them to use different activities and further allowing learners to choose what they like. This suggests that teachers need to be flexible in aligning themselves with different activities in their teaching of Mathematics. Moreover, Zuma (2015) reasons that the CAPS document offers teaching



activities that are aligned with curriculum policies. In addition to the above the DBE (2011), outlines that if teachers reflect on activities to be done in the class it is imperative that teachers caters for learner with barriers to learning. In other words, if teachers prepare activities well all learner can be accommodated in activities done during the teaching and learning of Mathematics.

The findings from the first phase of action research revealed that teachers focused more on the teacher-centred activities, as an activity that is dominant in their teaching of Mathematics. There was no evidence that teachers used multiple activities to engage learners in their teaching of Mathematics in Grade 4. In the second phase of action research, teachers showed that they understood other activities (learner-centred and content-centred activity) when they teach Mathematics. This was characterised by the engagement I did with all the participants by capacitating them in order to reflect on types of activities that they should administer in the teaching of Mathematics. On the other hand, DBE (2011) is a performance-based activity. In other words, a teacher-centred activity is framed as an empty vessels since learners receive knowledge only, there is no opportunity for the learner to explore alone. Moreover, Bernstein and Solomon (1999) assert that the teacher-centred activity and content-centred activities should be utilised in the performance curriculum.

#### **4.2.7 Theme: Teachers' role**

- How do you perceive your character when teaching Mathematics lesson?

#### **Phase One**

During the first phase of action research Participants PA, PB, and PD share the same sentiments about the role they played in the teaching of Mathematics. They reflected on their role as an instructor. PA said, "*I always teach my learners ensuring that they listen to what I tell them.*" While PB said, "*I always give my learners instructions to do when we are learning*". On other hand PC said, "*I teach my learners. I use question and answer method to check whether they listen to me. I do this through monitoring my learners' work*". While PD said, "*I guide my learner on what is to be done in class.*" Therefore, all participants were driven by personal

reflection on their instructor role. This suggests that they are familiar with this role. Contrary to Van den Akker (2010) who asserts that when it comes to improving curriculum, the difficulty of creating a balance and maintaining consistency between all components of curriculum is a problem. Therefore, as there was no balance, participants reflected on the instructor role alone. Teachers were then capacitated and made aware of the other two roles (facilitator and accessor).

## **Phase Two**

During the second phase of action research participants reflected on teacher as a facilitator and said:

### **Facilitator**

*PA: "I group learners with an aim of those who are performing well; they can assist those who are struggling in learning."*

*PB: "I encourage learners to participate in group discussions whereby I guide them in attaining better understanding of activity done in class, allowing them to share ideas as they learn."*

*PC: "I usually give learners an opportunity do new sums on their own with an aim of checking how they arrive to an answer."*

*PD: "I give learners activities and move around the classroom to check whether I have given them are done accordingly. I also check whether the group leader is in charge of what they are doing so that when they present to the whole class, there is something done during discussion in their groups."*

It is evident that all participants (PA, PB, PC, and, PD) engage learners in the group works since they play their role as facilitators. Jacobson and Ruddy (2004) reasoned that a facilitator must show genuine interest in the learners and their learning, so that meaningful learning can take place in Mathematics. Moreover, Landsberg, Krüger, and Nel (2005) assert that a teacher is a facilitator who creates a classroom environment that is full of opportunities to make

learners knowledge, skills and values to be learnt in the intended curriculum. In other words, PA and PB reflected and were in line with the above assertion by involving learners in group works so that they can solve problems on their own. In addition to the above assertion, Kabugi (2013) argued that active and practical learning helps learners to learn by seeing and doing to solve their problems with confidence. Moreover, Suherman et al. (2011) reasoned that the teacher might use the role of being a facilitator by employing group work. This suggests that teachers are driven by verbal reflection in assisting learners to be part of teaching and learning. Therefore teachers facilitate the teaching and learning in their classrooms. Moreover, the data generated also revealed that teachers are in charge in guiding learners (Khoza, 2015b).

### **Assessor**

Participants said:

*PA: “I access my learners with an aim of checking their understanding of the concept we talked about. I use different assessment techniques, using Blooms Taxonomy so that when they are facing examination they understand all levels of questioning. Urgently I give them feedback so that they can know how they performed.”*

*PB: “I ensure that after teaching and learning has taken place I check whether learners understood what has been learnt or not.”*

*PC: “Before I teach shapes I distribute rulers to each and every learner so that when we do measurements I show them how to start counting. After demonstration, I give them an activity where they are expected to calculate length and breadth using their rulers.”*

*PD: “I teach my learners and ensure that everything I taught them is being assessed. Moreover, I ensure that when I am done with assessment I give them feedback with an aim of assisting them to know where they faulted and where they should improve.”*

It is evident that after Phase One of action research participants understood what they were supposed to reflect on as they reflected on their role as assessors. Participant PA reflected on different methods he uses when he assesses learners. This assertion is in line with Jones and Sallis (2013) that assessing is not a singular phenomenon. Therefore, teachers must take into

consideration that their role should also reach learners' skills and capabilities. This suggests that teachers should be driven by written reflection in order to play their role as an assessor. Moreover, Carl (2012) assert that a good assessor is one who is knowledgeable about the subject matter and is able to use different methods to empower those who are assessed.

In support of the above, Zipin (2013) asserts that the role of a teacher is determined by the methods the teacher adopts in the class. This suggests that teachers are the ones who must execute their intentions of playing their roles in the teaching of Mathematics. The above study continuously argued that the teacher being an instructor, facilitator and assessor determines the role of a teacher in teaching of Mathematics. Additionally, Williams (2016) assert that teachers' roles are not limited in the teaching of Mathematics. The study further claimed that teachers should reflect on their creativity when teaching Mathematics. In other words, a teacher must choose relevant roles in teaching for better implementation of the intended curriculum. This suggests that teachers should be able to utilise their authority in the classroom in order to institute their roles in the teaching of Mathematics (Khoza, 2013).

However, the findings from the first phase of action research revealed that teaching was dominated by their role as an instructor. Hence, learners were disadvantaged since they were not given opportunities to take part in their learning. They did not obtain opportunities whereby teachers played their role as facilitator and assessor. This resulted in assisting them in order to be clear about other roles they could play in the teaching of Mathematics. Therefore, we sat and discussed with all the participants and gave them prescripts in order to be capacitated. During the second phase of action research, specifically in the observation during their teaching it was clear that all participants understood their roles because they were able to utilise their roles in their teaching of Mathematics. In other words, teachers had to be influenced by verbal reflection in order to enhance smooth teaching and learning, because learners were able to engage positively in their learning and teachers were confident in delivering the curriculum.

However, DBE (2011) does not specify where teachers should base their roles (instructor, facilitator, and assessor) when teaching Mathematics in Grade 4. This suggests that teachers' roles are not clearly defined in the teaching of Mathematics. In other words, teachers have to

be driven by personal reflection in the role they should play in their teaching, which might result teacher confusion about what they should do. Moreover, Mathematics CAPS, is not consistent for better implementation by teachers (Mpungose, 2016). The study further articulates that there might be minor chances that CAPS may sustain much longer. In other words, when CAPS is not clear, teachers also might fail to play their role in their practice.

#### 4.2.8 Theme: Location and time

- Where and when are you teaching Mathematics?

#### Phase One

During the first phase of action research all participant reflected and said

PA: *“I teach Mathematics in a classroom, using six hours per week that is allocated for Mathematics lesson and ten weeks per term.”*

PB: *“I teach Mathematics in school in the classroom. I use one hour and twelve minutes per day when teaching Mathematics.”*

PC: *“I teach my Mathematics in the classroom situation where I always use sixty minutes (one hour) per day and have one hour more in a week which makes six periods.”*

PD: *“I teach in a classroom and utilise six hours that are allocated by CAPS to teach. In these six hours per week, I have double period on Monday since a week has five days. I do this in order not to confuse other teachers since our periods are sixty minute per subject.”*

All four participants (PA, PB, PC, and PD) share the same sentiments during the reflective activity and semi-structured interview that they use classrooms as the location for teaching Mathematics (formal location). This is in line with the assertion by Voogt et al. (2009) who stated that teaching might take place anywhere inside the school building. They further reflected on specific hours that they are supposed to teach, which six hours per week according to the CAPS document. They further articulated that the classroom is where actual teaching and learning is takes place. This suggests that participants are driven by written reflection in

the teaching of Mathematics in the classroom. However, participants seemed unaware of other categories of location and time. Therefore, that arose the need for capacity building which made them aware of the categories that they overlooked.

## **Phase Two**

### **Informal and blended location**

During the second phase of action research, it was evident that teachers were better transformed. This is through the accounts they made on other categories of location and time. Participants said:

PA: *“I usually take my learners outside of the classroom whereby we learn for an example if I want we do measurements. I use school fence, length and breadth of our veranda, classroom etc. I also use check other information I need from visual media as an example.”*

PB: *“I introduce what I want to teach my learners and take them out to do it practically to our sports field if I we do shapes. I also give them work to do by consulting their neighbourhood libraries.”*

PC: *“I sometimes teach my learners out of classroom, but I am discouraged by the high level of grass in the school.”*

PD: *“I teach my learners outside of classroom sometimes whereby, I give learners work to do at their home during weekends which I expect them to be assisted at home by their families and go to find more information from the library.”*

All participants reflected on the informal location but based at a school level. For instance, participants PB and PD reflected on informal location other than the school but move beyond school level and talked about home. Their account is in line with assertion made by Killen (2007) that the teaching location is much more than just the classroom in which the teacher presents a lesson; it contains school grounds, the library, and the immediate vicinity of the neighbourhood of the school. This suggests that teachers were be driven by verbal reflection in teaching Mathematic outside the classroom. Moreover, participants PA, PB, and PD reflected that they refer their learners to the public library for more information. This is in line the with

assertion made by Berkvens, Van den Akker, et al. (2014, p. 48) that “learning should take place through interesting activities out in inspiring environment that provide adequate teaching and learning materials”. This suggests that teachers should not focus or concentrate on one location when they teach but instead look around for other locations. Moreover, this suggests that teachers should be driven by personal reflection in aligning their teaching location with what is relevant in learners and also time is not sufficient at school to give learners all relevant information they need but they must be given an opportunity to learn at home during weekends.

Therefore, DBE (2011) Mathematics affirm that lack of time and location cannot bring quality education by teachers. This suggests that teachers should allocate time and broaden their minds in order to profitably utilise their time familiarized their learners. Moreover, DBE (2011) does not specify location of where teaching and learning should take place. On the contrary, CAPS specifies teaching time that should be utilised when teaching Mathematics in Grade 4, those six hours per week are allocated for teacher’s contact with learners. This suggests that when teachers teaching the concepts they will understand and unable to forgot by learners (Mpungose, 2016). Moreover, the CAPS documents provide the Annual Teaching Plan (ATP), which are also known as the pace setters, whereby themes of teaching per week and per term are articulated. Furthermore, the Employment of Educators Act (1998) clarifies that teachers should be in class teaching a minimum of seven hours per day.

The findings from the first phase of action research revealed that teachers are aware about the formal location of teaching Mathematics (time per day, and per week that they should utilise) but that they have little information about other locations that could be used to teach Mathematics. Furthermore, the lack of time in the side of teachers was a drawback since teachers were unable to utilise time on task in their practices. In the second phase of action research, it was paramount that participants were capacitated in time management by reflecting on the policy handbook for educators on how to manage time effectively. This changed their thinking as they were able to understand that a teacher’s work goes beyond the call of their duty. Their attitude change drastically and able to be workaholics I the teaching of Mathematics in Grade 4. Moreover, teachers should allocate their time even during school holidays to ensure that learners’ practice Mathematics outside of instructional time. That can assist teachers to ensure that during assessment, learners have acquired all relevant information.

#### **4.2.9 Theme: Assessment**

- How do you assess Mathematics lesson?

##### **Phase One**

During the first phase of the reflective activity, one-on-one semi-structured interview and observation of teachers' responses was generated twice to produce the rich data of information. The participants reflected and said

PA: *"I always give my learners informal assessment, when I teach my learners in Grade 4. These informal tasks are not recorded in Mathematics record sheet."*

PB: *"When I teach Mathematics, I always administer informal and formal assessment (projects and assignments)."*

PC: *"I use informal assessment and formal assessment. When I talk about informal assessment I talk about daily activities then for formal assessment I use tests"*

PD: *"I administer informal assessment in my teaching which are classwork, homework and also administer formal assessment like tests, assignments and projects"*

In addition to the above, participants reflected on informal and formal assessment. This suggests that teachers were not well versed with all other categories of assessment when they teach.

##### **Phase Two**

In the second phase of action research participants reflected on all categories of assessment in the teaching of Mathematics after they were capacitated by given prescripts to familiarise themselves. They reflected and said:

##### **Informal assessment**

PA: *"I use informal assessment like classwork, homework and practical assessment when I assess my learners in Grade 4."*



PB: *“After class activity I ensure that I give learners some sums to do as to check whether they understood. I give them as one, pairs or in groups”.*

PC: *“During my Mathematics lesson I try by all means that I use informal activities in order to check learners understanding of what we learn in”.*

PD: *“At the end of my lesson and even in the middle of my teaching practices I give learners informal work to do taken from textbooks and even Mathematics books to check their readiness for formal assessment. I also usually give them short tests just to prepare them”.*

All participants (PA, PB, PC, and PD) reflected that they administer informal assessment when they teach Mathematics in Grade 4. PA and PB accounted that their informal assessment was based on classwork. PC continuously stated that she used informal assessment to check learners understanding of the concepts they do. Moreover, PD stated that she administer informal assessment during and after the end of the lesson. This suggests that teachers were driven by personal reflection in the teaching of Mathematics, because assessment assists to check how far learners have mastered the content. In addition, Zipin (2013) argues that formative assessment develops the learning process by giving learners class works, which assists them to be in line with teaching and learning.

### **Formal Assessment and continuous assessment**

Participants reflected and said:

PA: *“I used formal assessment tasks as provided by CAPS documents in my teaching of Mathematics and I also expose my learners to continuous assessment when I teach them”.*

PB: *“According to CAPS, I administer two formal assessment task which are assignment and a test. I then record these assessment tasks for making sure that they are reserved for school based assessment”*

PC: *“I administer formal assessment when I teach Mathematics in Grade 4. I ensure that these assessments are individuals’ learners’ work. I also ensure that during formal assessment I supervise my learners.”*

PD: *“I engage my learners in the formal activities as per requirement by the DBE, but I ensure that these assessments are fair by submitting to my HOD for pre-moderation and post-moderation.”*

In line with the above accounts made by participants, it was evident that they understood formal assessment. Participant PA, PB, and PD share the same accounts by stating that they use stipulated formal assessment task as per the CAPS documents. This suggests that teachers were driven by written reflection in the administration of formal assessment task in the teaching of Mathematics in Grade 4 because it constitute promotion to the next grade. Moreover, the study conducted by Kennedy et al. (2006) outlined that continuous assessment is the occurrence of repetitive summative assessment with results being documented. However, but small or no particular feedback is given to the learners. This suggest that when teachers administer continuous assessment are driven by verbal reflection in ensuring that learners engage in assessment. Moreover, continuous assessment includes formal recorded tasks, which are combined with a final assessment mark to promote a learner to the next grade.

In line with the above, assessment is defined as the process of collection and discussing information from numerous and diverse sources in order to develop a profound understanding of what learners distinguish, comprehend and can do with their knowledge as a result of their scholastic practices (Huba & Freed, 2000). Moreover, Boud and Falchikov (2006) argued that assessment is primary used to give feedback to teachers and learners on their teaching and learning process. This suggests that it is important for teachers to utilise various teaching techniques of checking in order to monitor learners’ progress in Grade 4 Mathematic. Likewise, Kennedy et al. (2006) argues that assessment is illustrated in terms of formative assessment, summative assessment, and continuous assessment. In addition to the above assertion, after assessment teachers should reflect on learners’ feedback to know their strengths and weaknesses (Koronovsky & Naimark, 2013).

Findings from the first phase of action research revealed that teachers paid more attention to formative assessments when teaching Mathematics. This suggests that they regarded assessment as a single entity in teaching, whereas it is not. During the second phase of action

research, I made copies of the CAPS documents where we unpacked all forms of assessment to be used in class when teaching Mathematics curriculum. During the observation process, it was discovered that teachers reflected on all forms of assessment in their lesson and assessment plans. This proved that their practices changed. It is then imperative that teachers understand the importance of all forms of assessment in order to not lose focus on the intended curriculum when they teach.

DBE (2011) prescribes three types of assessment to be used when assessing, which are, informal assessment, formal assessment and continuous assessment. Moreover, DBE (2011) specifies the types of assessments tasks that should be done per term in Mathematics. Additionally, DBE (2011) outlines what to assess and period of when to assess. This suggests that teachers should be driven by written reflection in the assessment of learner. In addition the CAPS document outlines that after assessment, recording should be done so that it can provide evidence of the learner's conceptual progression with a grade and their readiness to be promoted to the next grade. DBE (2011) continuously states that records of learner performance should be used to verify the progress made by teachers and learners in the teaching and learning process. In true sense then, CAPS is a vibrant appropriate and reliable source of information when it comes to assessment.

### **4.3 Concluding statement**

In this chapter (Chapter Four) presented the reflections from four Mathematics teachers, teaching Grade 4. The findings resulted from the analysed data generated through the reflective activity, semi-structure interview and observation of four participants (teachers) teaching Grade 4 Mathematics. The findings were analysed and discussed according to the themes and categories of the curricular spider-web as the conceptual framework for this study. Hence, the following chapter (Chapter Five) will give a summary of the entire study and interpretations (major findings) of the conclusion resulting in the recommendations drawn from the findings.

## Chapter 5

### Study summary, conclusion, and recommendations

#### 5.1 Introduction

The study explore teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre. This chapter (Chapter Five) discusses the findings by comparing the literature, Mathematics CAPS document, and data generated from ten conceptual frameworks, which are regarded as themes underpinned by three categories (personal reflection, verbal reflection and written reflection). The data generation method involved the reflective activity, one-on-one semi-structured interview and observation. The study also pursued the exploration of teachers' reflection on the teaching of Mathematics in Grade 4 by responding to the following research questions, which are:

- What are the teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre?
- Why do teachers reflect in the particular way when teaching Mathematics in Grade 4 in Nongoma Circuit Management Centre?

The study further intends to respond on the following research objectives

- a) To explore teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre.
- b) To understand the reasons why teachers' reflections are in the particular way when teaching Mathematics in Nongoma Circuit Management Centre.

The study intends to summarise the previous chapters, which are Chapter One to Four. For verification of checking whether the afore-mentioned research questions were answered, the findings of the action research will then be summarised from the literature review and, data analysis, conclusion will be drawn, and recommendations will be instituted. The chapter will also reflect on the proceedings undertaken through the study. Moreover, the conclusions will

indicate whether this study is regarded as valuable or not. In addition, guidance on how the study could be progressed will also be initiated.

## **5.2 Summary of chapters**

### **5.2.1 Chapter One (The overview, context and background)**

Chapter One presented the general background of the proposed study. It first presented the title of the study, which is “Exploring teachers’ reflections on the teaching of Mathematics in grade 4 in Nongoma Circuit Management Centre.” The chapter also presented the location: four different primary schools in Nongoma Circuit Management Centre. Moreover, my personal reasons for conducting the study were attained in the rationale, even the phenomenon (teachers’ reflections) and its propositions (personal reflection, verbal reflection and written reflection) as well as study focus, which is the teaching of Mathematics in Grade 4. Objectives of the study are also clarified, which are

- a) To explore teachers’ reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre.
- b) To understand the reasons why teachers’ reflections are in the particular way when teaching Mathematics in Nongoma Circuit Management Centre.

I introduced research design and methodology by articulating the research paradigm (critical paradigm), research style (action research), sampling (convenient and purposive), research methods (reflective activity, one-on-one semi structured interview, and observation), data analysis, ethical issues and trustworthiness (credibility, transferability, conformability, and dependability) and lastly anticipated problems. Location of the study was also mentioned, four different schools in Nongoma Circuit Management Centre in Zululand District.

### **5.2.2 Chapter Two (Literature Review)**

This chapter covered the literature review centred on Mathematics teaching in Grade 4. It started with discussing the phenomenon and its propositions, curriculum presentation (intended, implemented, and attained curriculum). The curriculum design approach (instrumental, communicative and pragmatic approach) was also articulated. The proposed study also compared horizontal curriculum against vertical curriculum. Moreover, the chapter established that the curricular spider-web was made up of ten conceptual frameworks to organise the reviewed literature. The ten concepts are rationale, goals, accessibility, content, activities, resources, role, location, time, and assessment (Voogt et al., 2009).

### **5.2.3 Chapter Three (Research design and methodology)**

In the third chapter, research design and methodology are outlined in detail. The chapter also adopted qualitative research design approach which employs paradigm (critical paradigm), research style (action research), sampling, data generation method (reflective activity, one-on-one semi-structured interview, and observation), and data analysis. This chapter also adopted guided analysis, which included both inductive and deductive reasoning to analyse data. In addition to this, the aim of the study was to change teachers' practices in the teaching of Mathematics in Grade 4 for betterment of learners' performance in Mathematics learning.

### **5.2.4 Chapter Four (Research findings)**

Chapter 4 offered findings from teachers' reflections in their teaching of Mathematics in Grade 4. The data was generated through the subsequent of the ten themes of the curricular spider-web in Chapter Four of the proposed study. These ten themes developed categories that were related to teachers' reflection. As a result, the following discussion indicate which reflection Grade 4 Mathematics teachers in each theme mostly used. The chapter presented, discussed, and analysed the action research findings from four participants: PA, PB, PC, and PD. Therefore, the summary of the findings from analysed data in Chapter Four are presented in 5.3 below.

## **5.3 Summary of the major findings**

### **5.3.1 Introduction**

This section provides the summary of the findings that were generated in chapter four of the study following the ten themes of the curricular spider-web (rationale, goals, accessibility, content, activities, location, time, role, resources, and assessment) which teachers reflected on.

### **5.3.2. Rationale**

According to the study by Voogt et al. (2009) and Lesseig (2014) the rationale behind teaching any subject lies on personal rationale, societal rationale and content rationale. This suggests that when teachers know the rationale of teaching Mathematics, it can improve effective teaching and learning. Moreover, Khoza (2016) argues that in teaching and learning there can be no successful implementation of curriculum if there is no ‘why’ question. In addition, the above studies also outline that rationale behind the teaching of any subject is crucial as it is at the centre of all the curriculum concepts of teaching any subject. This suggests that rationale is the driving force of the teaching of Mathematics, because it is the foundation of all themes in the curricular spider-web. These studies, Khoza (2015) and Solomon (2011) further assert that the main driving rationale for teaching and learning of Mathematics is content as compared to others (societal and personal rationale). This, seeks teachers’ written reflection to prevail in their teaching process and seek teachers to draw much from their qualifications.

The findings from data analysis revealed that participants’ rationale behind teaching of Mathematics is based on the societal rationale. Moreover, participants’ accounts also revealed that professional rationale influenced their teaching of Mathematics in Grade 4. Hence, findings revealed that societal and professional rationale influenced teachers to teach Mathematics in Grade 4. However, some teaches without Mathematics qualification were teaching Mathematics because it was allocated to them. Moreover, the participants were not aware that they were guided by all categories of rationale in their teaching. Khoza (2013) asserts that cognisance of rationale promotes a good connection between theory and practice. In other words, personal rationale is also important in the other two rationale in teaching since it enhances passion and enthusiasm to improve the performance of Mathematics teaching

(Williams, 2016). Based on the above assertion, it suggests that teachers are more driven by written and verbal reflections than personal reflection in the teaching of Mathematics. This addresses the main first research question and its respective objective, namely: What are teachers' reflections on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre? Further, to explore teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre.

In addition to the above, DBE (2011) does not specify rationale behind the teaching of Mathematics in Grade 4. This suggests that DBE (2011) is lacking in the theme rationale because teachers are not directed as to why they teach Mathematics in Grade 4. Instead of being guided or alerted by CAPS, nothing informs teachers. Since rationale improves teaching and learning in the teaching of Mathematics, so teachers do not know how to infuse the rationale of teaching in their practices. In other words, teachers seem to not reflect on the rationale for teaching Mathematics, since CAPS does not engage teachers. Moreover, teachers need to be introspective themselves as to why they teach Mathematics. However, CAPS is driven by performance curriculum which is driven by the prescribed content, and this requires teachers to draw much from the content rationale when teaching Mathematics in order to be influenced by written reflection.

### **5.3.3 Accessibility**

The literature review according to Berkvens, Van den Akker, et al. (2014) outlined that, accessibility of teaching Mathematics in Grade 4 is based on three categories of accessibility, which include physical accessibility, cultural accessibility and financial accessibility. This suggests that when teachers can understand all access to education, there could be better opportunities for learners to acquire the best education without any discrimination whatsoever. In addition to this, Ngubane-Mokiwa and Khoza (2016) concur with Onwuagboke, Singh, and Onwuagboke (2014) who argued that accessibility in education provides quality education to learners. In other words, accessibility allows learners to be catered for in the teaching of Mathematics, despite their background. Additionally, every child who is at school deserves good education from teachers. Simultaneously, teachers also need to not be denied access to meeting learners for curriculum dissemination. Further reviewed literature, reveals that



accessibility in education (i.e. education for all), remains an important part of the post-2015 education agenda (Berkvens, Van den Akker, et al., 2014). In addition to the above, (Khoza, 2017b) revealed that accessibility is a fundamental right every child should possess. This suggests that teachers need to be driven by personal reflection in order to assist learners in accessing education when they teach. As a result, the first research question and the second research objectives are addressed (What are the teachers' reflections on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management? To understand the reason why teachers' reflection are in the particular way.)

In the context of Act (1996) constitute National Norms and Standard for School Funding which entails that schools are provided with funds to run the schools. This suggests that teachers should be driven by verbal reflection in attaining funds from their schools. In other words, teachers have to be at the mercy of their principals or senior managers at school to access funds. This crippled teachers' enthusiasm in attending Mathematics workshops. Moreover, Act (1996) states that schools are allocated funds to every school in order to cater for basic demands of running the school. Moreover, DBE (2011) is also silent about what teachers should do when they want to access learners outside of instructional time. Other teachers struggled to teach during Saturdays since most of the learners attend church services.

The findings revealed that physical accessibility dominates teachers when they are teaching Mathematics particularly in Grade 4. Teachers outlined that they teach Mathematics, primarily in the school and in the classroom. This suggests that teachers are aware of the physical accessibility when teaching Mathematics. Moreover, findings also revealed that learners whom they teach come from poor social economic backgrounds (financial accessibility), in a deep rural area. Hence, learners whom are taught by them are financial contracted as they persist on highlighting that they teach learners who come from poor background communities. This suggest that teachers understand the community they teach and that they have no stable salary. In other words, their schools are classified as quintile 1-2 according to the poverty index (DBE, 2014). In some instances teachers had to pay double amounts when they attended workshops, because their principals failed to reimburse them. The findings also revealed that there is no provision or assistance on how to cater for teachers, who travel long distances to workshops when they start at school. From Phase One and Two it was found that physical and financial

access dominate in the teaching of Mathematics. This suggests that teachers teaching Mathematics in Grade 4 are influenced by verbal reflection and written reflection in their teaching and learning process.

#### **5.3.4 Resource**

The reviewed literature outlines that a resource is any object or person that facilitates teaching and learning (Khoza, 2012). Moreover, Khoza (2015) asserts that resources have three categories, hardware resources, software resources and ideological ware resources. Moreover, Krishna et al. (2014) asserts that resources make teaching and learning successful. This suggests that if teachers can critically reflect positively on resources while they teach Mathematics, their lesson can be successful. In other words, resources serves as a backup for teachers when they teach their lessons to be successful. However, Siyepu (2013) concur with Mntunjani (2016) that most teachers when they teach Mathematics they rely on hardware resources such as textbooks and chalk. This suggests that teachers are driven by written reflections when they teach Mathematics in Grade 4. Contrary to reviewed literature by Van Hoorn, Monighan-Nourot, Scales, and Alward (2014) who assert that information technology like computers for internet play at the centre of teaching and learning. In addition to the above assertion, teachers seems to be reluctant to utilise computers for internet and applications like MS Word (software) resources at their disposal. The literature also outlined that teachers themselves are also taken as primary resources (Mpungose, 2016). This suggests that for teachers to teach they should understand that all is within themselves. Learners relied on teachers to make learning more successful. In other words, if teachers fail to be good resources to learners there are better chances that learners might find it difficult for them to understand the teacher.

In light of the above DBE (2011) mentioned that teachers use of resources in the teaching of Mathematics is based on textbooks (hardware resource). This leads teacher to utilise multiple textbooks, which are no parallel to CAPS as a performance curriculum (Khoza, 2015). This suggests that teachers are mostly driven by written reflection since they draw their teaching from textbooks as prescribed content. Moreover, the Department of Basic Education DBE (2011) also supplement resources in Mathematics by offering workbooks (hardware resources)

as part of resource that they must use in order to teach. Additionally, DBE (2011) also mentioned software resources, whereby PowerPoint slides and excel are to be managed and retrieved by teachers for usage in their teaching of Mathematics. In addition, DBE (2011) also affirm that ideological ware is also a resource in teaching and learning. For instance, teachers have to apply different methods in their teaching like telling methods, question, and answer method. This suggests that the CAPS document (intended curriculum) brings balance in the practice of resources by Grade 4 Mathematics teachers. In other words, teachers should be driven by written, verbal and personal reflection in the utilization of resources when they teach Mathematics in Grade 4.

The findings revealed that teachers use hardware resources as their main resources, followed by software resources. This suggests written reflections dominate their teaching of Mathematics followed by verbal reflections. In other words, teachers were good at using textbooks and internet resources in their teaching. The above findings concur with assertions by Remillard and Heck (2014) that the most common form of curriculum materials teacher uses are textbooks. The findings proved that ideological-ware became the last resources in their teaching. However, Khoza (2015) reasoned that ideological-ware is the one of resource that should drive the lesson. In other words, as findings revealed, teachers lack knowledge of methods that they should utilize when they teach Mathematics lessons in Grade 4. This shows that when teachers teach Mathematics they ignore methods in their teaching. Consequently, the first research question: What are the teachers' reflection on the teaching of Mathematics in grade 4 in Nongoma Circuit Management Centre? And the second research objective; To understand the reasons why teachers' reflections are in the particular way when teaching Mathematics in Nongoma Circuit Management Centre were addressed.

### **5.3.5 Goals**

DBE (2011) is vocal about aim, objectives and learning outcomes. Aims are clarified as general aims while objectives as specific aims and learning outcome as specific skills (DBE, 2011). In other words, DBE (2011) displayed that general aims of teaching dominates teaching and learning of Mathematics in Grade 4. Hence, DBE (2011) specifies general aims for all subjects. Moreover, Kennedy et al. (2006) articulate that general aim guides teachers the path of content

to be covered. This suggests that teachers should be driven by personal reflection in the integration of aims when teaching their lesson. The study conducted by Khoza (2014a) also revealed that general aims that are found in the CAPS documents tends to complicate teachers understanding, since teachers failed to differentiate between aims and objectives. This is evident in data analysis, because teachers used aims and objectives that are defined in the intended curriculum, while they do not matching Mathematics content in Grade 4 Mathematics. It is imperative that teachers understand the difference between aims and objectives because they drive the lesson and direct the teacher to desired learning outcome. Khoza (2014b) also argued that, if there are no observable outcome, there could be no successful teaching and learning of Mathematics. Hence, learning outcomes are less dominant when teachers teach Mathematics in Grade 4. In other word, verbal and written reflection dominate teachers when they teach Mathematics.

The findings from data analysis especially in Phase One, revealed that teachers were confused in understanding the difference between aims and objectives. Whereas, Carl (2012) asserts that accurate goal setting such as aims, objectives and learning outcome could add to the smooth running of teaching and learning. This suggests that if teachers reflect on aims, objective, and learning outcomes in their teaching, better attainment of results could be achieved. In other words, findings showed that aims and objectives dominated teachers in their teaching of Mathematics in Grade 4, which suggests that learning outcomes were less dominant. Thus, verbal reflection is less dominant when teachers are teaching Mathematics, whereas both written and personal seems to be the main drive when teaching Mathematics. The engagement of teachers in equipping them with more readings from the CAPS document improves their understanding of how to inculcate goals in their teaching and learning. Moreover, the findings respond to research on, why teachers reflect in a particular way when teaching Mathematics in Grade 4 and its respective research objective: to understand the reasons why teachers' reflections are in a particular way when teaching Mathematics.

The reviewed literature defined goals as that teacher may adapt in guiding teaching and learning (Cho & Rathbun, 2013). Moreover, Kennedy et al. (2006) outline that goals have three levels which are aims, objectives and learning outcomes. The reviewed literature revealed that aims and objectives dominate teachers when they are teaching Mathematics lesson in Grade 4.

This suggests that teachers should be driven by personal reflection when effect aims, objectives and learning outcomes when preparing their Mathematics lessons. Moreover, Kennedy et al. (2006) outline that aims are broad general statements whereby the teacher specifies what to cover in the process of teaching and learning of Mathematics. In other words, aims attend to the whole chapter to be taught. On other hand studies by Kennedy et al. (2006) further articulate that objective are the specific statement of teaching intentions. This suggests that objectives are specific to the Mathematics topics that they teach in Mathematics. Moreover, Mooney et al. (2014) concurred with Van Manen (2016) that teachers need to be more cautious by reflecting on learning outcome in order to improve Mathematics practices. Thus, as literature outlines that aims and objectives are dominating when teachers teach Mathematics. Therefore, teachers should be driven by personal and verbal reflections in their teaching of Mathematics.

### **5.3.6 Content**

Berkvens, Van den Akker, et al. (2014) define content as knowledge, skills, attitudes and values that culminates in learning activities that learners experience in and outside the class. The literature outlined that in order for teachers to disseminate content, they should familiarise themselves with three propositions of Mathematics content, which are topic, practical work and subject knowledge when teaching Mathematics. In addition to the above, Hoadley (2013) alluded that the prerequisite for teachers to teach Mathematics content, they must have pedagogical content knowledge on what topic require of them to be taught. This suggests that teachers need to be driven by written reflection when they teach Mathematics. In other words, before a teacher can go further to unpacking the topic; there must be a clear reflection on what is expected of them to be done so that learners can understand better. That is the reason why, Luneta (2014) argued that if most of the teachers lack basic knowledge of Mathematics in teaching Mathematics content, this result in the poor performance of learners. This suggests that personal reflection drives teachers when teaching geometry in Grade 4.

In addition to the above, findings from data analysis from Phase One indicates that when teachers teach Mathematics in Grade 4, they teach contents that is aligned with CAPS documents which are Number, Operations, and relationships; Patterns, Functions and Algebra; Space and Shapes; Measurement, and Data Handling. This suggests that teachers use content-

centred approach, which dominate their teaching of Mathematics. In other words, teachers were driven by written reflection in their teaching of Mathematics, because they adhere to what is prescribed to them. Moreover, teachers use CAPS document as their guide when they teach Mathematics. In addition to the above, Hoadley (2012) concur with the assertion made by teachers by stating that CAPS document outline the content teachers should teach. Furthermore, findings from Phase Two of action research showed that teachers were transformed better due to the accounts they made on all other categories. Moreover, studies revealed that since CAPS is performance-based, it is dominated by teacher-centred and content-centred approach. Moreover, it was highlighted above that DBE (2011) is specific on which content teachers should use when they teach Mathematics. Teachers are following the CAPS documents since CAPS is a performance-based curriculum. DBE (2011) issued pace setter or Annual Teaching Plan (ATP) with the content teachers should embark on when teaches Mathematics. This suggests that teachers should be driven by written reflection when they teach the content as the core function of teaching and learning.

### **5.3.7 Teaching activities**

The reviewed literature articulates that there are three activities during teaching and learning of mathematics that teachers should embark on (Kennedy et al., 2006). These activities are teacher-centred activity, learner-centred activity, and content-centred activity. In other words, teachers are the main source of information to the learners. In addition to this, studies such as those of Hwang et al. (2011) also outline that activities are the experiences that learners need in order to have a particular behavioural competency. This suggests that if teachers do not reflect on the best activities, learners' competency can never be achieved. In other words, Khoza (2015) clarifies that teachers should engaged learners in different activities when teaching Mathematics. For instance, teachers should be driven by written reflection when delivering content-centred activities in order to assist learners to have proficiency in the Mathematics content through the use of language of teaching and learning (English). Thus, the first research question namely: What are the teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre? Thus, the research objective, to explore teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre was addressed.

During the first phase of action research, findings revealed that teachers engage on teacher-centred activities, because they outlined that they can easily control those activities. In other words, learners were less active in the teaching, because they were regarded as passive. This suggests that teacher-centred activities dominated activities when teachers teach Mathematics. Thus, personal reflection prevailed in their teaching in order to meet their needs. Moreover, the accounts by teachers in the second phase revealed that they embark on learners-centred activities and content-centred activities, which is line with CAPS since it is a prescribed curriculum based on performance-based techniques. The analysed data from second phase of action research also revealed that teachers engage more and contributed in all the activities when they teach. Moreover, Ilyas et al. (2014) assert that learners centred activity provide good results to learners. This suggests that when teachers allow learners to lead their learning, they can value what they learn and have better understanding.

In addition to the above, DBE (2011) outlines activities a teachers should engage in when teaching Mathematics, those are teacher-centred and content-centred activities. Similarly, to the above the Department of Basic Education (DBE) also issued Mathematics workbooks whereby teachers can obtain different activities for learners. These workbooks are aligned with activities a teacher needs and that address the needs of the subject content to embark on when teaching or presenting a lesson. Hence, teachers should be driven by written and personal reflections when crafting activities that need to be done in the teaching.

### **5.3.8 Teaching role**

According to the literature reviewed, three roles are eminent when teachers teaches Mathematics in Grade 4 (Khoza, 2015). The reviewed literature outline that roles are classified in three levels in teaching and learning: which are instructor, facilitator, and assessor. The instructor and assessor role dominate the facilitator role in teaching. The teacher can be an instructor, facilitator, and assessor (Kudryashova et al., 2016). This suggests that teachers should be driven by verbal reflection when they play their role of the facilitation of the teaching of Mathematics and learners are able to grasp what they learn. Further to the above, the teacher's role is determined by the method that the teachers is engaging in with in the teaching of Mathematics. The reviewed literature also articulates that teacher's roles are not limited.

This suggests that teachers should reflect on different roles when they teach. In other words, teachers must be dynamic and change with the times. Khoza (2015) reasoned that the teacher could utilise the above-mentioned roles to complete the given tasks. This suggests that when teachers are able to apply all the roles, this could yield good results to learners. Thus, this could be achieved only when teachers reflect.

Data findings from the first phase reveal that the, instructor roles dominate the teaching of Mathematics in Grade 4. The second role a teacher uses is facilitator and the last role is that of being an assessor. Additionally, Khoza (2014b) concurs with the above teacher's accounts by asserting that a teacher is the one who should guide teaching and learning. This suggests that a teacher should understand the role they should play in teaching in order for the lesson to go in the correct path. In addition to the above, teachers used the questions and answer methods, which are associated with instructor role. This suggests that teachers were driven by personal reflection in their teaching of Mathematics. However, in the second phase of action research teachers reflected on all other categories which prevail significant improvement in the understanding of teacher roles. In terms of DBE (2011), roles are specified when teaching. These roles specify that teachers should lead, manage teaching, become administrators and involve themselves in the moderation of learning activities. In other words, teachers need to be driven by written reflection in ensuring that their roles are affected in their teaching of Mathematics. Moreover, DBE (2011) is vocal on what role the teacher should play when they are teaching Mathematics. However, less is said on details on how to practice those roles. In other words, teachers assume how they should play those roles when they teach.

### **5.3.9 Location**

Location as the social, psychological and pedagogical context in which learning and teaching takes place (Martins & Santos, 2012). In other words, location is about where teachers are teaching (Khoza, 2013; Killen, 2007). Moreover, teachers need not to be confined in a single location when they teach Mathematics, they should reflect on other location to cater for all learner needs. This suggests that personal reflection should drive teachers when they teach Mathematics, because not all learners are able to learn comfortably in the class. Berkvens, Van den Akker, et al. (2014) made an example of classroom in the South American Amazon where



teachers taught a complete series of lessons about the forest but, unfortunately learners never left classroom. In other words, teachers were theorising what was supposed to be seen, touched, and smelled.

However, findings from data analysis revealed that most of the Mathematics teachers in Grade 4 executed their duties inside the classroom (formal location) and outside the classroom. This advocates that teachers were driven by verbal reflection in their teaching by allowing learners to engage with a teacher by speaking, discussing, and raising question whenever they need to. Moreover, few teachers use blended locations. This suggests that teachers were driven by personal reflection in ensuring that learners acquire more knowledge in their teaching. Thus, the first research question, What are the teachers' reflections on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre; and the first research objective, which is, To explore teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre were both addressed.

The Employment of Educators Act (1998) outlines that teachers should teach learners in class. This suggest that when teachers teach, it should be driven by written reflection in understanding the location of their teaching of Mathematics. Further to this, DBE (2011) articulates that there should be parent's meeting, school visitation days, parent-teacher conferences (environment). This suggests that teachers should be driven by verbal reflection in locating parent's information about their practices in Mathematics. Both personal and verbal reflection dominates the location of Mathematics teaching.

### **5.3.10 Time**

The reviewed literature defined time as when and for how long a teacher should teach learners (Khoza, 2013b). Girelli et al. (2011) classify time in three propositions, which are contact time, extra time, and holiday time. Contact time and extra time dominate teaching and learning time in the teaching of Mathematics, while holiday time is not prioritised. However, Meddings and Thornbury (2017) outline that contact time is when learning and teaching is taking place. Furthermore, Berkvens, Van den Akker, et al. (2014) outline that extra time for teaching of

Mathematics is spent outside instructional hours of teaching. The literature also outline that time tables are consecutive, while other learning opportunities are ignored. This suggests that teachers could ensure that time is not merely on what is written or prescribed for them. In other words, teachers should be driven by personal reflection in ensuring that all time at their disposal should be utilised proficiently. The reviewed literature, further articulates that if time is not properly used, learners can lack subject knowledge in their learning of Mathematics (Box, Jenkins, Reinsel, & Ljung, 2015).

Findings from data analysis revealed that teachers teach for approximately six hours per week and they utilised prescribed time when they teach Mathematics lessons in Grade 4. This suggest that teachers are influenced by written reflection in their practices of Mathematics, since they refer to time-table per week. However, findings also revealed that teachers ignore holiday time in executing their duties of ensuring that they are well prepared. Moreover, data analysis also revealed that when schools are closed, they do not engage with their time to prepare lesson beforehand. Thus, the second research question, Why do teachers reflect in the particular way when teaching Mathematics in Grade 4 in Nongoma Circuit Management Centre?: and the second research objective, To understand the reasons why teachers' reflections are in the particular way when teaching Mathematics in Nongoma Circuit Management Centre were addressed.

DBE (2011) is uttered and clear about teaching hours teachers should engage in when they teach Mathematics in Grade 4. DBE (2011, p. 32) outlines that, "ten weeks per term, with 6 hours per week, between 3 and 6 hours have been allocated for revision per term. In addition 6 hours have been allocated for summative assessment for all subject in term 2 and four, therefore, 210 notional hours have been distributed across the content areas." This suggests that teachers should be driven by written reflection in the issue of time when they teach Mathematics in Grade 4, so that they utilise their given time profitably.

### **5.3.11 Assessment**

The findings from data analysis revealed that formative assessment dominated teaching in the assessment of Mathematics in Grade four. This suggests that teachers were driven by personal reflection in the assessment of learners because. Additionally, summative assessment became the second dominant when they assess learners for progression and promotion processes. Further to this, teachers' assertions concur with the CAPS document by alluding that they use formative and summative assessment when they assess learners in Grade 4. Hence, the first research question, What are the teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre?; and, the second research objective which is, To understand the reasons why teachers' reflections are in the particular way when teaching Mathematics in Nongoma Circuit Management Centre, was also addressed.

In line with the above, DBE (2011) is declaring what assessment teachers should engage in when teaching Mathematics in Grade 4, which are informal assessment, the daily monitoring of learners' progress and is known as assessment for learning. Its purpose is to collect information about learner performance that can be used to improve their learning. DBE (2011, p. 294) also mentions, that "Formal assessment comprises of School-Based Assessment (SBA) and end of the year Examination." This implies that teachers should be driven by both personal and written reflection to administer assessment in Grade 4.

Kennedy et al. (2006) assert that assessment is in three levels: formative assessment, summative assessment, and continuous assessment. This suggests that when teachers assess their learners they should reflect on all levels of assessments in order for their learners to fulfil all assessment requirements at the end of the year. In other words, if teachers ignore any of the mentioned assessments learners could be disadvantage in meeting the requirements for promotion and progression requirements purposes. In addition to the above, Bromiley and Rau (2014) defined assessment as a filled choice of information gathered and synthesised by teachers about their learners in their classroom. Literature revealed that formative assessment and summative assessment dominate teaching and learning of Mathematics in Intermediate Phase. The literature also revealed that assessment is primarily used for feedbacks to teachers and learners on how the teaching and learning unfolds (Boud & Falchikov, 2006). This suggests

that teachers are driven by written reflection in the assessment of learners, since they need to understand themselves as to how they practice Mathematics teaching in Grade 4.

#### **5.4 Suggestion for further research**

The following are the recommendations that are suggested for further research

- I suggest that there should be further research made on quintile 1-2 schools in the teaching of Mathematics in Grade 4 especially in previously disadvantaged areas. Teachers should be made aware about propositions of themes in the curricular spider-web in order to improve their practices.
- A further study needs to be conducted on the prominence of reflections when teachers are teaching Mathematics CAPS in the Intermediate Phase (grade 4-6).
- The literature review indicate that there is inadequate exploration that focus on teachers' reflection on Mathematics implementation. Hence, it may be sensible to spread this type of research to other rural Districts.

#### **5.5 Recommendations**

##### **5.5.1 Recommendation 1: Rationale**

It was prominent from the findings that most teachers teaching Grade 4 were not drawing much from the professional rationale, and this saw them not follow the policy document in their teaching. As a result, they were lacking written reflections. Thus, the study recommends that teachers should understand the professional rationale for teaching Mathematics in Grade 4 by furthering their studies. In addition to this, the Department of Basic Education needs to revisit the notion that every teacher can teach Mathematics in primary school and employ relevant teachers to teach Mathematics. The findings also revealed that some teachers are teaching Mathematics without any qualifications and this makes them miss the professional rationale of teaching, which draws much from written reflection. Consequently, this recommends that the Department of Basic Education should equip those teachers who are already in the system by offering them with Mathematic content in capacity building workshops in order to improve, especially in rural schools.

### **5.5.2 Recommendation 2: Accessibility**

It was evident that teachers were not concentrating on the cultural need of the community when they teach Mathematics, as a result cultural accessibility was overlooked. It is recommended that the Department of Education equips teachers by organising workshops whereby “the issues of human rights, inclusivity and social justice will be unpacked for an example race, religion, language, age, disability, and other factors” (DBE, 2011, p. 5). This suggests that Mathematics teachers in Grade 4 should be driven by written reflection so that teacher could promote a non-discriminatory school environment amongst the school community. It is then recommended that when teachers call learners during weekends, they should understand the norms and religious practices of the community they serve.

### **5.5.3 Recommendation 3: Resources**

When teachers were disseminating content to the learners, ideological ware seemed to be ignored. Whereas, Khoza (2015) outlined that ideological ware should drive any lesson and learning is not only about material things, but is about ideology in learning. This suggest that teachers should be driven by personal and written reflection whereby the policy document will enable teachers to know what methods encompass their teaching. It is then recommended that the school departmental heads should ensure that before a teacher delivers a lesson, methods that should be used are clearly defined in lesson preparation in order to achieve the objectives of intended curriculum. For example, a teacher should use telling methods when teaching measurements whereby the learners will be instructed to investigate the relationship between the perimeter and area of rectangles and squares (DBE, 2011). Additionally, when teachers teach number patterns, they can use discussion method whereby learners can discuss what they notice when they compare the examples.

### **5.5.4 Recommendation 4: Goals**

It was found that teachers were clear about aims, but they were not clear between objectives and learning outcomes. As a result, when teaching Mathematics, they confused objectives and learning outcomes. In addition, written and verbal reflections were lacking in their teaching. It is recommended that the Department of Education conduct workshops for teachers to clarify

between objectives and learning outcome in order for teachers to know how to identify objectives and learning outcome in the policy document when they prepare Mathematics teaching. Thus, if teachers ignore learning outcome that indicate that learning was mostly about facilitators' satisfaction not learners because aims and objectives are about facilitators' intention (O'Sullivan, Moneypenny, & McKimm, 2015).

#### **5.5.5 Recommendation 5: Content**

It was found that teachers were clear about what content they teach in Mathematics. Contrary, to that, teachers were not clear about topic knowledge in the teaching of Mathematics. As a result, teachers were lacking written reflection in their teaching. It is recommended that during the time when teachers attend workshops, topic should be unpacked of how teachers can approach them in order for teachers to gain in-depth understanding of topic knowledge in Mathematics teaching. In other words, some topics need different approaches in order for learners to understand. For instance, Mathematics content should be more relevant by assisting learners to acquire practical skills.

#### **5.5.6 Recommendation 6: Activities**

It was noticeable from the findings that most teachers were not utilising learner centred activities when they were teaching Mathematics in Grade 4. Hence, their practices lacked verbal reflection. In other words, teachers did not draw attention by utilising learners centred activity. It is then recommended that the Department of Education should organise capacity-building workshops for Mathematics teachers that will deal specifically with learner centred activities since they are essential in the teaching of learners. Jang, Reeve, and Deci (2010) concurred with the above assertion by stating that a learner-centred activity is more important because learners become responsible for their own learning by giving them the chance to explore and be engaged in their own learning process.

### **5.5.7 Recommendation 7: Teacher Role**

It was revealed that teachers did not draw their attention to the facilitator roles when they teach Mathematics in Grade 4. This suggests that they lack the utilisation of verbal reflection when they teach Mathematics in Grade 4. It is recommended that the Department of Education conducted in- service training workshops that will equip teachers with facilitation roles during the teaching and learning process. Moreover, the department should also establish in service training interventions in order to check whether teachers utilise the knowledge they gain (Jansen & van der Merwe, 2015).

### **5.5.8 Recommendation 8: Location**

The findings revealed that most of the teachers use formal location when they teach Mathematics. These revelations clarify that informal location was side-lined by most of the teachers. It is evident that personal reflection was not given much attention in their teaching. It is recommended that teachers utilize informal location when they teach Mathematics lessons, by integrating formal and informal location in order to meet requirements of the 21<sup>st</sup> century. Moreover, the departments should empower teacher with computer skills in order for them to affect blended learning when they teach Mathematics in Grade 4. Thus, Ceylan and Kesici (2017) outlined that blended learning provides more effective learning outcome gains through enriching todays developing Web Technologies with learning environments.

### **5.5.9 Recommendation 9: Time**

It was evident that when teachers were teaching Mathematics they used contact time when they teach. This suggests that extra time lacked attention and as a result, personal reflection was less prominent. This recommends that there is a need for teachers to utilise time they have in order to complete Annual Teaching Plan for Grade 4 Mathematics teaching. Findings revealed that teachers do not use holiday time. It is recommended that teachers utilise extra time for teaching Mathematics in order to cater for those learners who are struggling with Mathematics content.

#### **5.5.10 Recommendation 10: Assessment**

The findings revealed that teachers do not administer continuous assessment when they teach Mathematics in Grade 4. This suggests that they lacked written reflection when they administer assessment. It is recommended that the Department of Education conduct workshops for Mathematics teachers specifically for continuous assessment in order for teachers to do justice in marks obtained by learners. Thus, “Teachers must be able to use continuous assessment liberally and intelligently both for learning and as learning. This implies that most essential considering continuous assessment in the classroom as vital pedagogical tool i.e. one which teachers and students alike can employ to check and guide their progress continuously in a constructive way” (Muskin, 2017, p. 46).

#### **5.6 Study limitation**

Since this is a qualitative study, findings can never be generalized. However, any one can use findings in order to improve teaching of Mathematics in Grade 4.



## **5.7 Conclusion**

The purpose of this study was to explore teachers' reflections in the teaching of Mathematics in Nongoma Circuit Management Centre. The discoveries of this study revealed that if one concept from curricular spider-web is ignored, others are paralysed (Van den Akker, 2010). This was done by effecting two research questions, which are 1. What are the teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre? and 2. Why do teachers reflect in the particular way when teaching Mathematics in Grade 4 in Nongoma Circuit Management Centre? The research questions went concurrently with the research objective, which are 1. To explore teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre. 2. To understand the reasons why teachers' reflections are in the particular way when teaching Mathematics in Nongoma Circuit Management Centre.

This chapter presents a summary of outcomes from literature, data analysis and comparison with the Intermediate Phase Mathematics CAPS document specifically to Grade four. The study further bring recommendations for all concept from data analysis. Findings revealed that if teachers are transformed to reflect; the accomplishment of intended, implemented and attained curriculum could be achieved. This was evident in the second phase of action in this study. Hence, well informed and competent teachers can prevail in Nongoma Circuit Management Centre.

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## 1. Annexure A: Letter to Principal



Curriculum Studies, School of Education,  
College of Humanities,  
University of KwaZulu-Natal,  
Edgewood Campus,

Dear Principal

### **Informed Consent Letter**

My name is Bonginkosi Lincoln Zulu. I am a Masters student studying at the University of KwaZulu-Natal, Edgewood campus, South Africa. I wish to engage your teacher in my study “Exploring teachers’ reflection on the teaching of Mathematics in Nongoma Circuit, under Zululand District.” I selected your teacher due to vast experience I know and your school is within my proximity which will be convenient to me. The study will sometimes need my presence whereby, I will be observing his/ her practices in the teaching of Mathematics in Grade 4.

Please note that:

- I will guarantee confidentiality of your school name, as a result inputs will not be attributed to your teacher or your school in person, but reported only as a population member opinion.
- There will be interviews that may last for about 45 to 60 minutes, relevant documents will be analysed, and the reflective activity will be sent to you via e-mail.
- Any information given by your teacher or your school cannot be used against you, and the generated data will be used for purposes of this research only.
- There will be no limit on any benefit that you may receive as part of your participation in this research project;
- Data will be stored in secure storage and destroyed after 5 years.
- You have a choice allow your teacher to participate or stop to participating in the research. You will not be penalized for taking such an action.
- Your teacher is free to withdraw from the research at any time without any negative or undesirable consequences to himself or herself;
- Real names of the participants will not be used, but symbols such as A, B, C, D, and E will be used to represent your full name (pseudonym);
- Your teacher involvement is purely for academic purposes only, and there are no financial benefits involved. I request patriotic support only.
- If you are willing your teacher to be interviewed, please indicate (by ticking as applicable) whether or not you are willing to allow the interview to be recorded by the following equipment:

Below is the work plan for my study.

<i><b>Time Frame</b></i>	<i><b>Guidelines</b></i>
6 February to 9 April 2018	Proposal Development
10 to 30 April 2018	Proposal defence and ethical clearance application
1 May to June 2018	Literature (Chapter 2)
1 to 25 July 2018	Data Generation, research design and methodology (Chapter 3)
26 July to 18 September 2018	Data Analysis (Chapter 4) and intention of findings
1 October to 30 October 2018	Summary conclusion and recommendations (Chapter 5)
1 December 2018	Final submission

I can be contacted at:

Email: [blz@webmail.co.za](mailto:blz@webmail.co.za)

Cell: +27 83 6653458

My supervisor is Dr. CB Mpungose who is located at the University of KwaZulu-Natal School of Education and Curriculum studies

Contact details: [mpungosec@ukzn.ac.za](mailto:mpungosec@ukzn.ac.za) Phone number +2731 260 3671

Discipline Co-ordinator is Dr. Carol Bertram,  
Curriculum Studies, School of Education,  
Edgewood College, University of KwaZulu-Natal  
(Tel) (033) 260 5349, Email: [BertramC@ukzn.ac.za](mailto:BertramC@ukzn.ac.za)

You may also contact the Research Office through:

P. Mohun

HSSREC Research Office,

Tel: 031 260 4557 E-mail: [mohunp@ukzn.ac.za](mailto:mohunp@ukzn.ac.za)

**DECLARATION**

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

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

SIGNATURE OF PRINCIPAL

DATE

.....

.....

## 2. Annexure B: Letter to the Department



Curriculum Studies, School of Education,  
College of Humanities,  
University of KwaZulu-Natal,  
Edgewood Campus,

Dear Circuit Manager

### **Informed Consent Letter**

My name is Bonginkosi L. Zulu. I am a Masters student studying at the University of KwaZulu-Natal, Edgewood campus, South Africa. I am interested in exploring teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma circuit. As a teacher, I have observed that learners are struggling in grade 4 when learning Mathematics in English since they understand IsiZulu as their language.

Please note that:

- Your confidentiality is guaranteed as your inputs will not be attributed to you in person, but reported only as a population member opinion.
- The interview may last for about 45 to 60 minutes, relevant documents will be analysed, and the reflective activity will be sent to you via e-mail.
- Any information given by you cannot be used against you, and the generated data will be used for purposes of this research only.
- There will be no limit on any benefit that you may receive as part of your participation in this research project;
- Data will be stored in secure storage and destroyed after 5 years.
- You have a choice to participate, not participate or stop participating in the research. You will not be penalized for taking such an action.
- You are free to withdraw from the research at any time without any negative or undesirable consequences to yourself;
- Real names of the participants will not be used, but symbols such as A, B, C, D, and E will be used to represent your full name;
- Your involvement is purely for academic purposes only, and there are no financial benefits involved.
- If you are willing to be interviewed, please indicate (by ticking as applicable) whether or not you are willing to allow the interview to be recorded by the following equipment:

	willing	Not willing
Audio equipment		
Photographic equipment		
Video equipment		

I can be contacted at:

Email: 213527952@stu.ukzn.ac.za

Cell: +27604250382

My supervisor is Dr. C.B Mpungose who is located at the University of KwaZulu-Natal

School of Education and Curriculum studies

Contact details: [mpungosec@ukzn.ac.za](mailto:mpungosec@ukzn.ac.za) Phone number +2731 260 3671

Discipline Co-ordinator is Dr. Carol Bertram,  
Curriculum Studies, School of Education,  
Edgewood College, University of KwaZulu-Natal  
(Tel) (033) 260 5349, Email: [BertramC@ukzn.ac.za](mailto:BertramC@ukzn.ac.za)

You may also contact the Research Office through:

P. Mohun

HSSREC Research Office,

Tel: 031 260 4557 E-mail: [mohunp@ukzn.ac.za](mailto:mohunp@ukzn.ac.za)

Thank you for your contribution to this research.



DECLARATION

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

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

SIGNATURE OF PARTICIPANT

DATE

.....

.....

### 3. Annexure C: Consent letter from teachers



Curriculum Studies, School of Education,  
College of Humanities,  
University of KwaZulu-Natal,  
Edgewood Campus,

Dear Participant

#### **Informed Consent Letter**

My name is Bonginkosi L. Zulu. I am a Masters student studying at the University of KwaZulu-Natal, Edgewood campus, South Africa. I am interested in exploring teachers' reflection on the teaching of Mathematics in Grade 4 in Nongoma circuit. As a teacher, I have observed that learners are struggling in grade 4 when learning mathematics in English since they understand isiZulu as their Home Language.

Please note that:

- Your confidentiality is guaranteed as your inputs will not be attributed to you in person, but reported only as a population member opinion.
- The interview may last for about 45 to 60 minutes, relevant documents will be analysed, and the reflective activity will be sent to you via e-mail.
- Any information given by you cannot be used against you, and the generated data will be used for purposes of this research only.
- There will be no limit on any benefit that you may receive as part of your participation in this research project;
- Data will be stored in secure storage and destroyed after 5 years.
- You have a choice to participate, not participate or stop participating in the research. You will not be penalized for taking such an action.
- You are free to withdraw from the research at any time without any negative or undesirable consequences to yourself;
- Real names of the participants will not be used, but symbols such as A, B, C, D, and E will be used to represent your full name;
- Your involvement is purely for academic purposes only, and there are no financial benefits involved.
- If you are willing to be interviewed, please indicate (by ticking as applicable) whether or not you are willing to allow the interview to be recorded by the following equipment:

	willing	Not willing
Audio equipment		
Photographic equipment		
Video equipment		

I can be contacted at:

Email: 213527952@stu.ukzn.ac.za

Cell: +27604250382

My supervisor is Dr. C.B Mpungose who is located at the University of KwaZulu-Natal

School of Education and Curriculum studies

Contact details: [mpungosec@ukzn.ac.za](mailto:mpungosec@ukzn.ac.za) Phone number +2731 260 3671

Discipline Co-ordinator is Dr. Carol Bertram,  
Curriculum Studies, School of Education,  
Edgewood College, University of KwaZulu-Natal  
(Tel) (033) 260 5349, Email: [BertramC@ukzn.ac.za](mailto:BertramC@ukzn.ac.za)

You may also contact the Research Office through:

P. Mohun

HSSREC Research Office,

Tel: 031 260 4557 E-mail: [mohunp@ukzn.ac.za](mailto:mohunp@ukzn.ac.za)

Thank you for your contribution to this research.

DECLARATION

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

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

**SIGNATURE OF PARTICIPANT**

**DATE**

.....

.....

#### 4. Annexure D: Permission from the Department



education

Department:  
Education  
PROVINCE OF KWAZULU-NATAL

Enq.: CF mbatha

Tel:0358310229

Date: 24/05/2018

Mr BL Zulu  
P.O. Box 888  
NONGOMA  
3950

#### PERMISSION TO INTERVIEW LEARNERS AND EDUCATORS

The above matter refers.

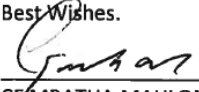
Permission is hereby granted to interview Departmental Officials, learners and educators in selected schools of the Province of KwaZulu Natal subject to the following conditions:

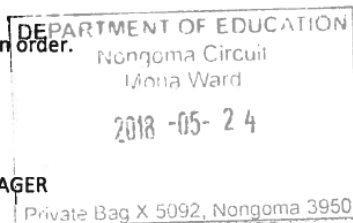
1. You make all the arrangements concerning the interviews.
2. Educators' programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Learners, educators and schools are not identifiable in any way from the results of the interviews
5. Your interviews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

The KZN Department of Education fully supports your commitment to research: **Exploring teachers' reflections on the teaching Mathematics in Grade 04 in Nongoma Circuit Management Centre.**

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

Best Wishes.

  
CF MBATHA:MAHLOMBE CIRCUIT MANAGER  
NONGOMA CMC



...Championing Quality Education - Creating and Securing a Brighter Future

KWAZULU-NATAL DEPARTMENT OF EDUCATION  
Postal Address: Private Bag X9137 • Pietermaritzburg • 3200 • Republic of South Africa  
Physical Address: 247 Burger Street • Anton Lembede Building • Pietermaritzburg • 3201  
Tel.: +27 33 392 1029 • Fax.: +27 033 392 1212 • Email: Nompumelelo.gasa@kzndoe.gov.za • Web:www.kzndoe.gov.za  
Facebook: KZNDOE...Twitter: @DBE\_KZN...Instagram: kzn\_education...Youtube:kzndoe

## 5. Annexure E: Permission from the University



07 August 2018

Mr Bonginkosi Lincoln Zulu (218086286)  
School of Education  
Edgewood Campus

Dear Mr Zulu,

Protocol reference number: HSS/0646/018M

Project Title: Exploring teachers' reflections on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre

### Approval Notification – Expedited Application

In response to your application received on 08 June 2018, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has 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

Professor Shenuka Singh (Chair)

/ms

Cc Supervisor: Dr Cedric Mpungose  
Cc Academic Leader Research: Dr SB Khosa  
Cc School Administrator: Ms Tzyer Khumalo

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

Westville Campus, Govan Mbeki Building

Postal Address: Private Bag 251001, Durban 4000

Telephone: +27 (0) 31 260 3587/3550/4857 Facsimile: +27 (0) 31 260 4608 Email: [shms@ukzn.ac.za](mailto:shms@ukzn.ac.za) / [prosecrm@ukzn.ac.za](mailto:prosecrm@ukzn.ac.za) / [robhup@ukzn.ac.za](mailto:robhup@ukzn.ac.za)

Website: [www.ukzn.ac.za](http://www.ukzn.ac.za)



100 YEARS OF ACADEMIC EXCELLENCE

Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

## 6. Annexure F: Reflective Activity

Full name: \_\_\_\_\_

School name: \_\_\_\_\_

This Reflective Activity is for reflections of your teaching of Mathematics in grade 4. You may use various sources to complete this activity. Presents your reflections by following the curricular spider web themes/questions as follows.

1.1 Why are you teaching (Rationale/vision) Mathematics in Grade 4?

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1.2 Towards which goals are you teaching (Aims/objectives/outcomes) Mathematics in Grade 4?

---

---

1.3 What content are you teaching Mathematics in Grade 4?

---

---

1.4 Which activities/tasks are you using to teach Mathematics Grade 4?

---

---

1.5 What resources are you using to teach Mathematics?

---

---

1.6 How do you facilitate learning (Teacher role) of Mathematics in Grade 4?

---

---

1.7 How do you access (accessibility) the teaching of Mathematics in Grade 4?

---

---

1.8 Where and when are you teaching (Location) and (Time allocation) Mathematics in Grade 4?

---

---

1.9 How do you assess learning (Assessment) of Mathematics in Grade 4?

---

---

## 7. Annexure G: Observation analysis

1. Rationale- Personal reason  
Professional reason  
Social reason
2. Goals- Aims  
Objective  
Outcomes
3. Resources- Hard-ware resources  
Soft-ware resources  
Ideological-ware resources
4. Assessment- Assessment as learning  
Assessment for leaning  
Assessment of leaning
5. Content – International  
African  
Local
6. Accessibility- Physical  
Financial  
Cultural
7. Teacher role- Instructor  
Facilitator  
Researcher
8. Time- Weeks  
Days  
Hours



9. Teaching environment- Face to face

Group work

Blended learning

10. Learning activities- Teacher-centred

Learner-centred

Content-centred

## 8. Annexure H: Semi structured interview

**Exploring teachers' reflections on the teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre.**

Question 1:	<i>Why do you have an interest in the teaching of Mathematics in Grade 4? (reasons)</i>
Sub- questions	<ol style="list-style-type: none"> <li>1. What personal rationale/reason that made you to teach Mathematics?</li> <li>2. What social rationale/reason that made you to teach Mathematics?</li> <li>3. What professional rationale/reason that made you to teach Mathematics?</li> </ol>

Question 2:	<i>What resources do you use when teaching Mathematics? (resources)</i>
Sub- questions	<ol style="list-style-type: none"> <li>1. What software resources do you use when teaching Mathematics?</li> <li>2. What hardware resources do you use when teaching Mathematics?</li> <li>3. Which learning theories or theories that guides your teaching in Mathematics?</li> </ol>

Question 3:	<i>Who are you teaching Mathematics, in terms of financial, cultural and physical aspects?(accessibility)</i>
Sub- questions	<ol style="list-style-type: none"> <li>1. What is the Cultural background of the majority of Mathematics teachers?</li> <li>2. What is the financial state of the majority of Mathematics teachers?</li> <li>3. What is the physical state of the majority of Mathematics teachers (physical ability)?</li> </ol>

Question 4:	<i>How do you ensure justice when teaching Mathematics lesson? (goals to be achieved)</i>
-------------	---

Sub- questions	<ol style="list-style-type: none"> <li>1. What are your aims of teaching Mathematics?</li> <li>2. What are the objectives of teaching Mathematics?</li> <li>3. Indicate learning outcomes in the teaching of Mathematics?</li> </ol>
----------------	--

Question 5 :	<i>What content are you teaching in Mathematics? (content)</i>
Sub- question	What module content do you cover in Mathematics? <i>(you can provide me with the module outline)</i>

Question 6 :	<i>What are teaching activities do you use when teaching your Mathematics lessons?</i>
Sub- questions	<ol style="list-style-type: none"> <li>1. What Mathematics activity do you use to engage learners?</li> <li>2. What Mathematics activities do you use in to unpack the content?</li> <li>3. What Mathematics activities do you use in to ensure the attendance of learners in your teaching?</li> </ol>

Question 7 :	<i>How do you perceive your character when teaching Mathematics lesson? (teachers' role)</i>
Sub- question	<ol style="list-style-type: none"> <li>1. Is your role seen as the instructor, assessor or facilitator when teaching Mathematics?</li> </ol>

Question 8 :	<i>Where do you teach Mathematics lesson? (location/environment)</i>
Sub- questions	<ol style="list-style-type: none"> <li>1. Is group work conducive, substantiate in the teaching of Mathematics?</li> <li>2. Do you teach Mathematics in classroom, (face to face interaction)?</li> <li>3. Is blended learning possible in Mathematics lesson?</li> </ol>

Question 9	<i>What is the time allocation for each Mathematics concepts? (time)</i>
Sub- questions	<p>How is time allocation to teach Mathematics concepts?</p> <ol style="list-style-type: none"> <li>1. Number of weeks</li> </ol>

	<ol style="list-style-type: none"> <li>2. Number of days</li> <li>3. Number of hours</li> </ol>
--	---

Question 10	<i>How do you assess your Mathematics lessons?(assessment)</i>
Sub- questions	<ol style="list-style-type: none"> <li>1. What activities do you use during assessment for learning?</li> <li>2. What activities do you use during assessment as learning?</li> <li>3. What activities do you use during assessment of learning?</li> </ol>

## 9. Annexure I: Turnitin Report

is a repetitive of activities of what need to be taught in the classroom? The Minister of basic education, Angie Motshekga introduced Curriculum Assessment Policy Statements (CAPS) as a new intended curriculum in the Republic of South Africa after National Curriculum Statement (NCS). Carl (2014) asserts that for curriculum disparity of curriculum changes at different levels (macro and micro) for mathematics implementation in grade 4, hence this study explore teachers' reflection on the teaching of mathematics in grade 4 in Nongoma Circuit Management Centre and to check which reflections teachers are using and why they reflect in a particular way.

**1.2 Title**

Exploring Teachers' Reflections on the Teaching of Mathematics in Grade 4 in Nongoma Circuit Management Centre.

**1.3 Focus and purpose of the study**

The purpose of this study is to explore teachers' reflection on teaching of mathematics in grade 4 in Nongoma Circuit Management Centre.

**Match Overview**

**8%**

1	Submitted to University... Student Paper	6%
2	Cedric Bheki Mpungos... Publication	1%
3	mathexcellence.co.za Internet Source	1%

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2:04 PM 11/26/2018

## 10. Annexure J: Letter from the Editor

Christine Davis  
5A Denys Reitz  
Roosevelt Park  
Tel: 0716850170  
Email: christinem4c@gmail.com

Bonginkosi Lincoln Zulu  
Ivuna Area  
Usuthu Traditional Council  
Nongoma  
3950

11 December 2018

To whom it may concern

**Re: Thesis: Teachers' reflections on the teaching of Mathematics in Grade 4 in Nongoma  
Circuit Management Centre**

This letter serves to confirm that I edited Bonginkosi Lincoln Zulu's paper before submission.

No content was added and very little was changed by me during the process. Changes were limited to spelling and grammar, while content changes were identified and submitted to Mr. Zulu for review.

Please feel free to contact me should you have any further questions.



Christine Davis