

THE EXPLORATION OF TEACHING STRATEGIES FOR  
GRADE 5 MATHEMATICS CAPS IN THREE PRIMARY  
SCHOOLS AT KWANDENGEZI CIRCUIT IN PINETOWN  
DISTRICT

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By

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## **ABSTRACT**

This study presents a qualitative case study within the interpretive paradigm of four teachers who reflected on their teaching strategies of teaching grade 5 Mathematics at KwaNdengezi Primary schools in Pinetown circuit. Data generated from a reflective activity, one-on-one semi-structured interviews and a group discussions were used to explore their teaching strategies. Purposive and convenience sampling was used in selecting the most accessible four teachers. I selected these teachers, because they needed to be involved in mathematics in order to help in addressing challenges that are facing South African mathematics teachers in the implementation of CAPS teaching strategies. This study concluded that the teachers were not aware of the teaching strategies that underpin their Mathematics CAPS using the ten concepts of the curricular spider web. The study also reveals that teachers experience problems as to how and why they use the teaching strategies in a particular manner. The concepts of teaching and learning are presented for discussion with regard to the important activities for teaching. This study consequently recommends the application of the ten concepts of the ten curricular spider web as the teachers' reflective framework.

## SUPERVISOR'S STATEMENT

This thesis has been submitted with/without my approval

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Dr S. B. Khoza

## DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge and confidence, it contains no material previously published or written by another person (except where clearly defined in the acknowledgements), no material which to a substantial extent has been submitted for the reward of any other degree or diploma of the university or other institution of higher education.

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## **DEDICATION**

I would like to dedicate this work to my parents, firstly my dad Jim Mangalane who was responsible for all my education fees and a special thanks to my mother, Fikile Mangalane who gave me the foundation of education and encouragement to learn and become a better person, and who was with me through thick and thin, Thank you MaMngadi.

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## **TABLES AND FIGURES**

<b>TABLES</b>	<b>PAGE</b>
Table 1: Table structure of a curricular spider web.....	23
Table 2: The participants' profiles.....	59
Table 3: Study's concepts, questions and expected responses.....	63
Table 4: Data generation plan.....	71
Table 5: Themes, questions and categories from curricular spider web.....	80

<b>FIGURES</b>	
Figure 1: Conceptual framework.....	21

## **LIST OF ABBREVIATIONS**

AMESA- The Association or Mathematics Education of South Africa

ANA- Annual National Assessment

CAPS- Curriculum Assessment Policy Statement

C2005- Curriculum 2005

DBE- Department of Basic Education

DOE- Department of Education

ET- Education Technology

FET- Further Education and Training

HOD- Head of Department

HW- Hardware

IQMS- Integrated Quality Management System

IW- Ideological-ware



NCS- National Curriculum Statement

NGOs-Non Governmental organizations

NQF- National Qualifications Framework

OBE- Outcome Based Education

RNCS- Revised National Curriculum Statement

SW- Software

SMT- School Management Team

TIE- Technology in Education

TIMSS- Trends in International and Science study

TOE- Technology of Education

TPACK- Technology Pedagogical Knowledge

UKZN- University of KwaZulu Natal

## **TABLE OF CONTENT**

### **CHAPTER ONE: INTRODUCTION AND OVERVIEW**

1.1 INTRODUCTION.....	1
1.2 BACKGROUND OF THE STUDY.....	2
1.3 RATIONALE.....	3
1.4 FOCUS AND PURPOSE OF THE STUDY.....	3
1.5 PROBLEM STATEMENT .....	3
1.6 SIGNIFICANT OF A STUDY.....	4
1.7 DEFINITION OF THE TERMS.....	4
1.8 LOCATION OF THE STUDY.....	4
1.9 OBJECTIVES OF THE STUDY.....	5
1.10 RESEACH QOUESTIONS.....	5
1.11 LAY OUT OF THE STRUCTURE.....	6
1.12 CONCLUSION.....	6

## **CHAPTER TWO: LITERATURE REVIEW**

2.1 INTRODUCTION.....	8
2.2 TEACHING STRATEGIES.....	11
2.3 CURRICULUM PERSPECTIVE.....	14
2.3.1 INTERNATIONALE CURRICULIM CONTEXT.....	14
2.3.2 ESTONIAN CURRICULUM DEVELOPMENT.....	15
2.3.2 GERMAY CURRICULUM DEVELOPMENT.....	16
2.3.4 SOUTH AFRICAN CURRICULUM CONTEXT.....	18
2.4 THE COMPETENCE VERSUS THE PERFORMANCE CURRICULUM.....	19
2.5 THE CONCEPTS OF CURRICULAR SPIDER WEB.....	21
2.5.1 WHY ARE THEY TEACHING? .....	28
2.5.2 WITH WHOM /WHO ARE YOU TEACHING? .....	30
2.5.3 TOWARDS WHICH GOALS ARE YOU TEACHING? .....	34
2.5.4 WHAT CONTENT ARE YOU TEACHING? .....	39

2.5.5 WHAT ACTIVITIES ARE YOU TEACHING? .....	41
2.5.6 HOW ARE YOU TEACHING? .....	45
2.5.7 WITH WHAT ARE YOU TEACHING? .....	48
2.5.8 WHERE AND WHEN ARE YOU TEACHING? .....	49
2.5.9 HOW ARE YOU ASSESSING? .....	53
2.6 DEBATES ABOUT CONCEPTUAL FRAMEWORK.....	54
2.7 CONCLUSION.....	56

**CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY**

3.1 INTRODUCTION.....	55
3.2 RESEARCH PARADIGM.....	56
3.3 CONCEPTUAL FRAMEWORK.....	57
3.4 RESEARCH APPROACH.....	58
3.4.1 SAMPLING.....	59
3.4.2. PURPOSIVE SAMPLING.....	59
3.4.3 CONVENIENCE SAMPLING.....	60

3.5 DATA GENERATION.....	61
3.5.1 REFLECTIVE ACTIVITY.....	65
3.5.2 ONE-ON-ONE SEMISTRUCTURED INTERVIEWS.....	67
3.5.3 SEMI-STRUCTURED FOCUS GROUP.....	71
3.6 DATA ANALYSIS.....	73
3.7 ETHICAL ISSUES.....	74
3.8 TRUSTWORTHINESS, CREDIBILITY, TRANSFERABILITY, DEPENDABILITY AND CONFORMABILITY.....	77
3.9 LIMITATIONS AND DILIMITATIONS.....	78
3.10 SUMMARY STATEMENT.....	77
<b>CHAPTER FOUR: RESEARCH FINDINGS AND DISCUSSIONS</b>	
4.1 INTRODUCTION.....	79
4.2 FINDINGS AND DISCUSSIONS.....	80
4.2.1: THEME: 1 Rationale.....	88
4.2.2 THEME: 2 Accessibility.....	194
4.2.3 THEME: 3 Goals.....	101

4.2.4 THEME: 4 Content.....	107
4.2.5 THEME: 5 Activities.....	111
4.2.6 THEME: 6 Teacher role.....	120
4.2.7 THEME: 7 Resources and Materials.....	129
4.2.8 THEME: 8 Location and Time.....	135
4.2.9 THEME 9 Assessment.....	145
4.3 CONCLUSION.....	145

**CHAPTER FIVE: SUMMARY AND RECOMMENDATIONS**

5.1 INTRODUCTION.....	147
5.2 RESEARCH QUESTIONS.....	147
5.2.1 WHAT ARE TEACHING STRATEGIES FOR TEACHING GRADE 5 MATHEMATICS? .....	150
5.2.2 HOW AND WHY DO GRADE 5 TEACHERS USED TEACHING STRATEGIES IN A PARTICULAR MANNER? .....	153
5.3 SUMMARY.....	153

5.3.1 INTRODUCTION.....	153
5.3.2 RATIONALE.....	155
5.3.3 ACCESSIBILITY. ....	158
5.3.4 AIMS, OBJECTIVES AND OUTCOMES.....	159
5.3.5 CONTENT.....	160
5.3.6 LEARNING ACTIVITIES.....	161
5.3.7 TEACHER’S ROLE.....	163
5.3.8 RESOURCES AND MATERIALS.....	164
5.3.9 LOCATION AND TIME.....	165
5.3.10 ASSESSMENT.....	167
5.3.11 CONCLUDING STATEMENT.....	168
5.4 RECOMMENDATION.....	171
5.5 CRITIQUE OF THE CURRICULAR SPIDER WEB.....	171
5.6 CONCLUSION.....	171
REFERENCES .....	179
APPENDICES.....	180-181

# **CHAPTER ONE**

## **THE OVERVIEW AND CONTEXT OF THE STUDY**

### **1.1 Introduction**

Mathematics is dealt with within the current South African curriculum, which is Curriculum Assessment Policy Statement (CAPS). The South African curriculum was oppressed under the apartheid education system over a period of seventeen years. As a result the curriculum has experienced significant changes in the post-apartheid era (Hoadley & Jansen, 2012). Since 1994, and democracy in South Africa, the curriculum has undergone various changes. In 1997 Outcome-Based-Education (OBE) was introduced to overcome the curricular division of the past (DoE, 2011). OBE experienced many challenges, and as a result it was revised to Revised National Curriculum Statement (RNCS) and National Curriculum Statement (NCS). There was another review of the curriculum in 2009 due to on-going implementation challenges. In 2012 the RNCS and NCS were combined to form the Curriculum Assessment Policy Statement (DoE, 2011). According to Van den Akker et al. (2009) a curriculum involves five divisions, namely: supra (international); macro (national system); meso (school); micro (classroom); nano (pupils). Therefore, teachers are the implementers of an intended curriculum such as Mathematics at a meso and micro level. As a result, this study intends to explore teaching strategies for teaching grade 5 Mathematics in three schools at KwaNdengezi circuit. This chapter focuses on the rationale of this study, the summary of the literature review, the research questions, research methods, data generation methods, data analysis, ethical issues, data production and limitations.

### **1.2 Background to the study**

The implementation of Bantu education under Apartheid deprived black children of access to quality Mathematics education. Mathematics was a school subject in black primary schools (Goliomee, 2009). Bantu education took a direction of a performance curriculum where the teacher dominated the teaching and learning. Teachers were unqualified and teaching of mathematics was inadequate, as a result learners failed Mathematics. In secondary schools Mathematics was taught in Afrikaans so black children found it incredibly difficult to understand Mathematics lessons. Consequently failures in black schools were further increased. As a result, there was a rise in Soweto boycotting to learning mathematics in Afrikaans. After 1997 there was



a drastic change in the education system where black and white learners were free to go to any school.

Furthermore, in the democratic era the minister of education Sibisi Bhengu introduced Curriculum 2005 (C2005) with the aim of balancing education and meeting the changing demands in the market place arising from the need for a more skills based workforce (Velupillai, Harding, & Engelbrecht, 2008). However, most teachers were struggling to implement Curriculum 2005 due to the new terminology and the jargon in the curriculum (Hoadley & Jansen, 2012). In addition, Hoadley and Jansen (2012), further state that some teachers did not shift their teaching strategies to fit C2005; they were using strategies like telling methods, where the teacher does a lot of talking instead of allowing learners to participate in group discussions. This indicates that teachers were confused, they seemed not to understand the principles of the competence curriculum. Teachers were still confused with the NCS because it resembled so closely to C2005, which was blamed for much of the failure of the Education System to produce respectable educational outcomes (Hoadley & Jansen, 2012). Many teachers claimed to be using OBE methods when in fact they were still using traditional strategies where teachers dominated the learning process (Moodley, 2013). As a result NCS was reviewed and amended to Curriculum Assessment Policy Statement. This study is concerned with the move from NCS to CAPS. I have been observing teachers teaching grade 5 Mathematics using the same teaching strategies that they were using in NCS.

### **1.3 Rationale**

I have been teaching Mathematics for the past five years and I have taught learners whom have not performed well. I have been observing teachers teaching Mathematics in order to identify any problems that could be influencing learners' poor performance. It appeared that teachers are confused by the continual changing of the curriculum. The confusion is most clear when I asked teachers about CAPS and the strategies that they should be using; they seem confused by the Curriculum change which is not something unique to South Africa, it occurs internationally on an ongoing basis (Moodley, 2013). As the curriculum changes it requires teachers to change too. After 1994 South Africa has experienced multiple changes in the curriculum. The curriculum has changed from Bantu Education to C2005, then to RNCS and NCS and due to further

complications the curriculum has been reviewed to CAPS. Every curriculum comes with its own principles. Therefore, the move from NCS to CAPS requires teachers to shift from competence to performance curriculum (Hoadley & Jansen, 2012). A shift from competence curriculum to performance curriculum, demands that teachers change their teaching strategies too. I have observed that the move from competence curriculum to performance curriculum results in teachers being confused. Teachers do not understand the principles of performance curriculum. Consequently they end up using incorrect teaching strategies. I have therefore decided to conduct a study exploring teaching strategies for teaching grade 5 Mathematics CAPS.

#### **1.4 Focus and Purpose of the study**

The purpose of this study is to explore teaching strategies for teaching grade 5 Mathematics at KwaNdengezi. The current curriculum required the teachers to change the way they teach and the new teaching strategies (Msibi & Mchunu, 2013). As a result, teachers are struggling to employ the relevant teaching strategies required for the implementation of the intended curriculum. CAPS as a prescribed curriculum takes a direction of the performance curriculum, therefore teachers need to understand the teaching strategies that are in line with CAPS. This study might prove helpful to teachers.

#### **1.5 Statement of the problem**

The problem of this study was to explore teaching strategies used by teacher in teaching grade5 Mathematics in the following aspects: Operations and relationship, Patterns, Functions and algebra, Space and shape (geometry), Measurement, and Data handling.

#### **1.6 Significance of the study**

The study might be valuables to teachers, the Department of Education, curriculum developers and to the University of KwaZulu-Natal. This study may also assist the curriculum developers in looking into all aspects that pertain to teaching and learning. The next section presents the location of the study.

#### **1.7 Definition of the terms**

Below are the definitions of the terms as used in this study.

**Teaching strategies:** teaching strategies are the teaching methods that are used to deliver the lesson during teaching and learning.

**Mathematics:** “Mathematics is a language that makes use of symbols and notations to describe numerical, geometrical graphic relationship. It is a human activity that involves observing representing and investigating patterns and quantitative relationships in physical and social phenomena and between mathematical objectives” (DoE, 2011, p, 8).

**CAPS:** CAPS is the Curriculum Assessment Statement Policy for all approved subjects listed in the document (DOE, 2011, p. foreword).

**Primary school:** Primary school is the level of school which provides educational instruction for learners between the age of five and fourteen. In South Africa the primary school begins in Grade 1 up to Grade 12.

### **1.8 Location of the study**

The study was conducted in three primary schools at KwaNdengezi circuit area under the Pinetown district in Durban, KwaZulu-Natal. All the schools are located in KwaNdengezi circuit and the surrounds. Learners are all Africans and taught by black African teachers. The majority of learners live with their grandparents and come from poor families and child headed households. The schools cater for learners from grades R to grade 7. Most learners speak isiZulu as their home language. The medium of instruction from grade R to grade 3 is isiZulu; Mathematics is taught in isiZulu. The medium of instruction from grade 4 to grade 7 is English thus, Mathematics is taught in English.

### **1.9 Objectives of the study**

The purpose of the study is to:

1. Identify teachers’ strategies for teaching Mathematics in KwaNdengezi;
2. Understand how teachers use teaching strategies in teaching grade 5 Mathematics in KwaNdengezi.

3. Understand the reasons for grade 5 teacher's use teaching strategies in a particular way in teaching Mathematics in KwaNdengezi circuit.

## **10. Research questions**

- What teaching strategies are used by teachers in teaching grade5 Mathematics in KwaNdengezi circuit?
- How do grade 5 teachers use teaching strategies in teaching Mathematics in KwaNdengezi circuit?
- Why do grade 5 teachers use teaching strategies in a particular when teaching Mathematics?

## **1. 11 Layout of the Structure**

### **Chapter 1: background and overview of the study**

This chapter outlines the background information about education. The rationale includes the purpose of the study, location of the study, objectives, research questions, research methodology, limitations and delimitations.

### **Chapter 2: Literature Review and conceptual framework**

This chapter focuses on the literature review and includes an introduction, then goes on to explore teaching strategies, curriculum perspective, international curricula, Estonian curriculum development, German curriculum development, South African curriculum context, the competence curriculum versus performance curriculum is discussed and; concepts of the curricular spider web and conclusion are presented.

### **Chapter 3: Research design and methodology**

This chapter focuses on the research design and methodology and includes an introduction, objectives, research questions, research paradigm, research approach, sampling, purposive sampling, convenience sampling, data generation method, reflective activity (open-ended questionnaire), one-on-one semi-structured interviews, semi-structured focused group discussion (interviews), data analysis, ethical issues, trustworthiness, credibility, transferability, dependability, conformability, limitations and delimitations.

#### **Chapter 4: Data analysis and discussions**

This chapter discusses research findings of the study, following the ten themes of the curricular spider web; based on the literature review and grade 5 Mathematics document and conclusion.

#### **Chapter 5: Summary and recommendations of the study**

This chapter discusses the findings answering the research questions and looking at the objectives of the study based on chapter four. A summary is provided and recommendations are made using the table and the graphs by comparing the literature review, CAPS and the data generated followed by a conclusion.

#### **1.10 Conclusion**

This chapter presents historic context of the study, the introduction of the chapters and provides the research questions which the study plans to answer. The purpose of the study plans to understand teaching strategies used by teachers in teaching Mathematics. The background to the study and statement of the problem then followed. The chapter also provides the objectives of the study to address the research problem which is supported by the research questions. The rationale, significance of the study were discussed in this chapter. Afterwards the outline of the study was offered. The study intended to explore teaching strategies of grade 5 Mathematics.

## CHAPTER TWO

### The Literature Review

**2.1 Introduction** This chapter presents the literature review and articulates different studies conducted around the concepts of teaching strategies for mathematics within Curriculum and Assessment Policy Statement (CAPS) in grade 5. This study attempts to explore the teaching strategies of teaching grade 5 Mathematics, in order to have insight into the teaching strategies employed by teachers. The aim is to review literature that is available that deals with both South African and international studies to identify the gaps that led to need for this study. The table of concepts, propositions, studies and gaps will provide a guide for summarising the issues that emerge from different studies around the concepts that are framed by the curricular spider web. The literature also reviews the background related to the curriculum, explores competence curriculum versus performance curriculum, and discusses international curriculum and South African curriculum. Hence, this chapter lays the theoretical foundation that frames this study; a foundation build up on the use of the ten concepts of a curricular spider web as a conceptual framework.

These concepts are called the ten components of a curricular spider web by Van den Akker et al. (2009) or learning signals according to (Khoza, 2015c). These concepts are the rationale, goals (aims, objectives and learning outcomes), content, teaching activities, teacher role, resources and grouping, location and time, and assessment. A study conducted by Berkvens, Van den Akker, and Brugman (2014), introduces another concept called accessibility in 2014, which replaced grouping in the curricular spider web. It should be noted that the curricular spider web is used in this study in the form of questions as a conceptual framework in exploring teaching strategies for teaching Mathematics for grade 5.

According to Ndlovu (2011) South African students' performance in internationally benchmarked mathematics studies has been disconcerting. For example, South African 8th graders performed worst in Mathematics and Science in 2003 out of cohorts from 50 countries that participated in the Trends in International Mathematics and Science Study (TIMSS) (Reddy, 2006). The studies of (Ndlovu, 2011; Reddy, 2006) indicate that both the local and international performances appear to be a threat to the country's global competitiveness. Thus, the less

scientifically and mathematically literate citizens of a society are, the more externally dependent that the society becomes for critical skills. In essence, it means that our country needs to look deeply to design a strategy that will help in teaching Mathematics to our learners in grade 5 with the hope of getting positive results. Hypothetically speaking, grade 5 was chosen in this research because it appears that if we can get it right at that stage it will also be right at a later stage in the learners' schooling.

## **2.2 Teaching strategies used by teachers to teach Mathematics**

Teachers cannot run away from the teacher-centred approach because each lesson needs to be introduced and directed by the teacher whilst at the same time. Teaching strategies are based on research that ranges from teacher-centred, learner-centred to content-centred approach (Cangelosi, 1992). A study conducted by Lee and Ng (2010) reveals that among the three types of teaching strategies namely teacher-centred, content-centred and learner-centred, the teacher-centred approach was found to be the strongest of the three. It is where the teacher uses the drill method, rote teaching, explanation and demonstration techniques once a concept has been experienced fully in teaching Mathematics (Westwood, 2011). In addition to this approach, a study conducted by Tan (2011) and Uibu and Kikas (2014), indicate that the teacher dominates the lesson in whole class teaching by talking more than learners due to several factors like curriculum coverage, instructional goals, examinations pressure and time constrains.

A collective case study conducted by Cross (2009) shows that the teacher uses demonstration teaching strategy especially for low-achieving learners who are struggling to learn during teaching and learning. This means that direct instruction is most effective in helping under-achieving learners and such learners learn more through teacher demonstration and practice during the teaching of Mathematics. According to these findings inclusive education is necessary in order to cater for all learners in the classroom, both under-achievers and gifted learners, and to cover the curriculum. An article by Khoza (2014b) indicates that teachers have to use the teacher-centred approach in order to finish the curriculum which is presented by the CAPS document.

In addition, a qualitative study conducted by Valenzuela (2013) suggests that teaching practice is constructed around and focused on understanding the rules of the subject. Kiray (2012), states that instructional method is one of the important vehicles which are adapted for implementation. Teaching strategy is determined by what teachers want to achieve as Khoza (2013b), argues that if they want to measure any amount of the content to be given to learners they should use a content-centred approach. Furthermore, Kiray (2012) states that the teaching methods, techniques and strategies to be used are determined by taking into consideration the content and skills required for Mathematics. Valenzuela (2013), argues that it does not mean the content-centred approach promotes passive teaching, but the content is organised in a way as to facilitate the teaching. Westwood (2011) concurs with Valenzuela (2013) that content-oriented strategy is defined as a set of facilitative interaction strategies used to facilitate collaboration with learners in the classroom.

The debate that is shown by the above studies depict that content-centred approach is important when delivering a subject in order to keep teaching running smoothly and at the same time teaching should be based on the specific skills required for the teaching to be effective, thus teaching strategies should vary in order to sustain teacher motivation and interest (Ndlovu, 2011). This suggests that a content-centred approach has no intention to instil rote teaching, rather it is there to convey the information that is research based since CAPS is a performance curriculum. As Hoadley and Jansen (2012), indicate that in the classroom, performance curriculum should be considered and is based on subject knowledge (Hoadley & Jansen, 2013). These studies seem to disagree with Cenenda (2012) when claiming that content-based education dominates the lesson as the teacher rushes into content. However the teacher amongst all the partners in education plays an important role, therefore all teachers need to be exposed to teaching that is learner-centred and teacher controlled (Cenenda, 2012).

The learner-centred approach can be considered as having a strong focus on the learners' collective participation in order to solve problems (Valenzuela, 2013). In short, the above studies recommend that the learner-centred approach should dominate in the teaching and learning situation, where learners are offered full opportunity to communicate in the form of group or pair works in the Mathematics classroom. As a study conducted by Lerkkanen et al. (2012) shows



that in the classroom in which teachers predominantly apply learner-centred teaching practice, learners show more interest in Mathematics. It is therefore important to use co-operative teaching to increase the learners' communication skills and promote autonomy in learners which include group discussions, critical questions problem solving and self-discovery (Cenenda, 2012) and (Gupta & Pasrija, 2012).

A research conducted by Speer, Smith, and Horvath (2010) reveals that other instructional activities examined for their effectiveness on teachers teaching and engagement, including small group, cooperative teaching and problem solving proves effective. The above studies indicate that in the classroom situation the teacher cannot use only one teaching strategy to make teaching most effective or to promote rich interaction among learners and teachers (Roschelle et al., 2010). After reviewing the above studies it becomes apparent that three teaching strategies need to be combined, namely teacher-centred approach, content-centred approach and learner-centred approach in order to balance the teaching practice. The study conducted by Khoza (2014a) which supports the idea of combination of the three approaches in implementing the curriculum. In support of this, a study conducted by Ndlovu (2011) reveals that teaching strategies should vary in order to sustain teacher motivation and interest.

Moreover, Van den Akker et al. (2009), emphasise that for the teaching strategies to be effective teachers must be aware that all the components of the curricular spider web are connected to each other in order to provide consistency and coherence in the content knowledge. In order to achieve different instructional goals teachers should combine different management practices and various teaching strategies (Uibu & Kikas, 2014) and also employ the teaching strategies that will be framed around concepts of the curricular web for effective curriculum delivery in schools (van den Akker, Fasoglio, & Mulder, 2010). In support of the above statement, a study conducted by Lerkkanen et al. (2012) indicates that the teacher's management of the mixed instructional features for advancing both learners' academic skills and motivation is essential, as some teaching strategies seem to be more suitable than others in achieving various goals.

In the South African context, the curriculum changed from competence curriculum (NCS) to performance curriculum (CAPS). When teachers do not teach mathematics CAPS according to theories, or do not behave like professionals and do not reflect on their teaching practice, CAPS

implementation may vary in each school. Teachers' reflections or perceptions play a vital role as is outlined in the study conducted by Msibi and Mchunu (2013), that teachers' professionalism may play a major role in the recent curriculum revision (CAPS). In conclusion teachers should act professionally and they should always be aware of alignment between teaching practice and their curriculum by reflecting on their teaching strategies (Khoza, 2014b). After discussing the teaching strategies, it is vital to give a brief background of the curriculum.

### **2.3 Curriculum in perspective**

Curriculum studies address distinct and important issues related to education and these issues transcend the various areas of educational inquiry as they impact the design, implementation, and evaluation of educational programs. Curriculum, has no universally accepted definition, however, it is a much contested field because some authors are concerned with delimiting what the term means while others are busy giving new meanings to the term (Kehdinga, 2014a) . Ornstein and Hunkins (2004), define curriculum as the subject matter or content of subjects like mathematics, history or art performance innate in a specific subject or learning area. This suggests that most theorists are saying the same thing in different ways. Smith (2000), defines curriculum as a declaration of what learners should know and be capable of doing, how the material is to be taught and assessed, and how the educational system is to be organized. This encompasses is more than learning outcomes as his definition is not relevant to learning outcomes alone. It goes beyond the outcomes. Marsh and Willis (2003), provides alternative definitions by seeing curriculum as “permanent” subjects such as grammar, reading, logic, rhetoric, mathematics, those books of the Western world that best embody essential knowledge, and as all the experiences that learners have in the education system as well as life.

However, “curriculum is defined as a plan for learning” (Van den Akker et al., 2009, p. 9). Kelly (2009, p. 8), believes that “curriculum is the totality of experiences the pupil has as a result of the provision made”. According to Hoadley and Jansen (2012) curriculum can be called curriculum-as-plan, the prescribed curriculum or the intended curriculum, since the view of the curriculum concentrates on the official curriculum. According to Kehdinga (2014b), the curriculum is a political document, it always carries the principles of the government. Hoadley and Jansen (2012) concur with Kehdinga (2014b) by arguing that curriculum is not ever neutral, that instead

it carries the values and assumptions that reflect the interests of certain sectors of society and discourage others. Therefore, teachers have no choice other than to implement the teaching strategies that are intended for teaching mathematics. Pinar (2012), brought a new dimension to the curriculum debate by arguing that by writing the American school curriculum and aligning it with standardised tests, politicians silence the complicated conversation about the curriculum, which is the core of education in a social democracy. All these definitions have highlighted the curriculum is a an official document that fulfil the values of a certain sectors that are in favour of them and still others describe the curriculum as a plan for instruction specific to a particular school or student population (Lunenburg, 2011).

Hoadley and Jansen (2012), state that within the school context each teacher devises their own explanations when defining curriculum. This is broadened in the book using a cartoon dialogue; different teachers discuss and explain curriculum as what is taught in school, as a plan, as an official plan, and as a document from the department. Van den Akker et al. (2009) extend this argument by revealing that the term curriculum has as many definitions as there are authors, but then goes on specifically defines it briefly as a plan for learning. This further reinforces that there is no standard or a fixed definition of the word curriculum but that an individual's definition changes dependent on the context in which the term is used. The focus of this study then places the word curriculum in the context of the school, amongst learners, through which the teachers and learners are directly involved in the teaching and learning process. The definition then in the study that curriculum is a teaching guideline policy through which aspects such as assessment and content are described while including other features such as the period that should be spent on content for each phase.

This suggests that the National Curriculum Assessment Policy Statement is a comprehensive guideline policy document which describes and outlines specific subject content and on how it is to be taught at specific times and to what extent it is to be assessed. According to Van den Akker et al. (2009) curriculum involves five divisions namely; supra (international); macro (national system); meso (school); micro (classroom); nano (pupils). An empirical study conducted by Ramatlapana and Makonye (2012) on FET educators' adherence to implementation of Curriculum and Assessment Policy Statement (CAPS) from twelve schools in Johannesburg

2012 indicates that it is the teacher who implements the macro curriculum at the micro level. Therefore, since teachers implement the curriculum at the micro level they should be involved in designing the curriculum policies, but unfortunately they are omitted from the process. They are operators, passive agents, or technicians rather than professionals and are supposed to carry out policies designed for them elsewhere by others (Kelly, 2009).

Nevertheless, Hoadley and Jansen (2012) opined that the intended curriculum guides the teacher in the CAPS curriculum. Hence, teachers as technicians struggle with both the intended curriculum and the enacted curriculum when implementing teaching strategies during teaching and learning (Hoadley & Jansen, 2012). It is the responsibility of the government to conduct adequate in-service programmes to develop teachers' skills in order to successfully implement CAPS. According to Ramatlapana and Makonye (2012) teachers are aware of the different learners' needs, interests and talents and also make decisions in response to their different characteristics of their learners, but lack the capacity to effect a change. Therefore, it is important to use a variety of teaching strategies during teaching and learning in order to accommodate different learners in the classroom. One size fits all curriculum cannot be appropriate for all learners (Ramatlapana & Makonye, 2012). Examining both CAPS the American curriculum, both continue with the false assumption that if theorists only make the appropriate adjustments to the curriculum, teaching, administration, counselling, and the establishment of standards, then the test scores will rise (Pinar, 2012). This means that the curriculum developers need to examine the issues more closely in order to ascertain the causes for low test scores, and subsequently adequate teaching strategies to be employed by teachers in the implementation of a particular curriculum in Mathematics. It is also important to discuss International curriculum with a focus on Estonia and Germany.

### **2.3.1 International curriculum context**

Curriculum reforms occur all over the world in order to suit the current educational trends. A study conducted by Sahlberg (2011), reveals that in most countries, including Estonia, Germany, Netherland, Canada and developing countries, the "evidence based policy agenda" has been adopted in their educational reforms. This clearly shows that curriculum is being developed all

over the world. In the 1980s the global landscape of education looked different than today, the standardized teaching and curriculum set a clear, high, centrally prescribed performance standard for all schools, teachers and learners with goal of improving the quality and equity of outcomes in order to have logic and common criteria for measurements and information (Sahlberg, 2011). This movement changes the nature of teaching from open-ended, non-linear, which promote mutual inquiry and exploration to that of a linear process with casual outcomes (Sahlberg, 2011). This demonstrates that curriculum reform is a continuous process. In the next section the Estonian curriculum development is discussed.

### **2.3.2 Estonian curriculum development**

Estonia is a Scandinavian country in Europe and boast one of the finest educational systems on the continent. A comparative analysis study conducted by Krull and Mikser (2010), reveals that every curriculum can be characterized by extent to which learners attain its objectives, or at least by the measures implemented by teachers to achieve its objectives. In the Estonian National Curriculum for basic and secondary education, the guidelines for organising instruction at school level became extremely detailed, prescribed and formal (Krull & Mikser, 2010). This suggests that it will be not easy for teachers to implement, because they are told exactly what to do. It did not give teachers a chance to use their discretion in the classroom. Van den Akker et al. (2009), state that a curriculum should give teachers clear guidelines that have been decided upon after thoroughly research about what it is that teachers need in order to teach and further states that the best way to do this is by providing a clear set of objectives. This means that a transfer to a research-based strategy is necessary in Estonian curriculum development for general education (Krull & Mikser, 2010). In addition, the Estonian curriculum in 1994 was subject-centred (Krull & Mikser, 2010). This means that during 1994, the curriculum was based on school knowledge (Hoadley & Jansen, 2012), which in turn suggests that Estonia is driven by a content-centred approach and strategies and this is not assisting teachers in discharging their duties. In the content-centred method there is much rote learning and passivity on the part of learners (Cenenda, 2012). In other words, teaching in the classroom must change from content-centred strategy to a learner-centred strategy (Gupta & Pasrija, 2012). The content-centred method as a “transmission model of teaching offers very little opportunity for learners to express themselves or think for themselves” (Cenenda, 2012, p. 3). This indicates that a curriculum is designed

based on a research, depending on the government who is ruling at that particular time who chooses the curriculum that they think is suitable for the country. This suggests that the curriculum will always depend on the political leaders or the policy makers. The next section will present some of the changes that have taken place in the German curriculum.

### **2.3.3 Germany Curriculum Development**

Germany is a country in central Europe that has also witnessed changes in their curriculum. Germany is a highly industrialised country and the majority of their curriculum promotes mathematics and science. A study incorporating the analytical perspective compiled by Kuiper, Nieveen, and Berkvens (2013), indicates that there is one difference that is noticed in German curriculum and that is a shift towards national central standards of education whereby the German leaders amend and administers high school graduation examinations, as opposed to the individual schools having that responsibility. This is important in Germany where curricula with compulsory subject content are modified by the state (Baumert et al., 2010).

On the other hand, a study conducted by Hofstein, Eilks, and Bybee (2011), indicates that teachers in Germany teach mainly pure mathematics concepts by content-structure-driven and teacher-centred approaches, which involve teaching strategies that focus on explanation, teachers actively, and learners passively learning and tend to abandon the student-centred approach for teaching relevant societal facets. Although Germany is teaching pure mathematics, a comparative approach study conducted by Tatto and Senk (2011), reveals that Germany has a low coverage in teaching functions, probability calculus and structure. This suggests that there are mathematics topics that are not included in the curriculum. This shows that there is a gap in terms of the above mentioned topics in mathematics. Furthermore, teachers are obliged to set tests four to six times at the end of each instructional unit (Baumert et al., 2010). On the other hand, the curriculum design places activity-oriented, inquiry-based components at the centre of the curriculum and learners are expected to explore the world Kuiper et al. (2013), which requires teachers to employ teaching strategies in teaching mathematics such as observation, experimentation, analysis and discovery. These studies indicate that Mathematics is regarded as one of the important subject in Germany, therefore teachers have to keep up with the demands of the state changes (Kehdinga, 2014b) and teach what is required by the state. In order to teach

effectively teachers need support from the state in terms of professional development, likewise this is necessary in the South African context. As a South African teacher it is very important to explore the South African curriculum.

#### **2.3.4 South African curriculum context**

South Africa has experienced many curriculum changes since 1994. It is attempting to recover from the apartheid regime and greatly improve the education sector. According to the study of Kehdinga (2014b), every new minister of education in South Africa introduces a new curriculum. It is found that since the beginning of democracy in 1994, the South African government has instituted a number of curricula changes designed to bring about quality education for all learners in South Africa (DoE, 2011). After 1994 the education system changed to the principles of Outcome Based Education (OBE) (Killen, 2007). The Department of Education introduced the national curriculum as an attempt to transform the curriculum left behind by apartheid (DoE, 2011). In 1997 OBE was introduced to overcome the curricular divisions of the past. A qualitative study conducted by Velupillai et al. (2008) on General Education and Training in Mpumalanga investigates how to go about teaching problem solving in South Africa and it indicates that OBE was implemented in 1998 under the new curriculum 2005.

In the light of the above statement, Hoadley and Jansen (2012), argue that the Curriculum 2005 was intended to be the reverse of Bantu Education. Therefore, OBE and Curriculum 2005 focused strongly on competence and skills and all the documents on OBE and curriculum 2005 refer to learner-centred strategy for teaching mathematics in grade 5, whereby the focus is on learners' questions and discussion, group work, and pair work teaching strategies (Hoadley & Jansen, 2012). Due to the complex language of the curriculum, as well as inadequate resources and teacher preparation, many problems had arose in all major assessment areas of the curriculum especially to complication of implementation. As such outcomes-based education was reviewed (Kenton, 2002). According to Velupillai et al. (2008, p. 56) while the OBE was implemented: "some complications with the new curriculum and C2005 were reworked into the Revised National Curriculum Statement (RNCS), which was introduced into grades 1, 2 and 3 in

2004, grades 4, 5 and 6 in 2005, grades 7 and 10 in 2006, grades 8 and 11 in 2007 and 9 and 12 in 2008”.

The RNCS and NCS were also reviewed due to on-going implementation problems. As a study by Ramatlapana and Makonye (2012) indicates that during the time of RNCS and NCS teachers were allowed too much independence and freedom to teach the curriculum as they saw it fit. In addition, they argue that this freedom did not produce the desired results as learners’ results were consistently poor in natural school assessments and also in the international comparative achievement tests. Furthermore, a qualitative study conducted by Bantwini (2010), reveals that teachers were still using teacher-centred strategies during RNCS and NCS curriculum. Too much independence and freedom for teachers’ may have been caused by incorrect usage of teaching strategies required by RNCS and NCS. In addition, Hoadley and Jansen (2012) argue that the NCS is a mixed model of curriculum that retained many aspects of a competence model of curriculum for example a learner-centred teaching strategy. This means that teachers had to ensure that learner-centred teaching strategies dominated the teaching and learning in order to ensure the effectiveness of the curriculum. As a result the RNCS and NCS curricula were revised to Curriculum and Assessment Policy Statement (CAPS).

According to CAPS (DoE, 2011) there were difficulties that were experienced in the implementation of the RNCS and NCS. In addition, the two national curricula were revised in 2009 to produce a single curriculum for grades R-12 called National Curriculum Statement (DoE, 2011, p. foreword). These curricula were revised to produce a single Curriculum and Assessment Policy Statement for grades R- 12. The grade R-12 document intends to build up on the previous curriculum, but also updates it’s aims to provide clearer specifications of what is to be taught and learned as follows: (a) Curriculum and Assessment Policy Statement (CAPS) for all approved school subjects listed in the documents; (b) The policy document, National policy pertaining to the programme, and promotion requirements of the National Curriculum Statement grades R-12; (c) The policy document, National Protocol for Assessment Grades R-12 (DoE, 2011).



According to Hoadley and Jansen (2012) the CAPS document does not tell teachers how they must teach. They further stated that CAPS and the apartheid curriculum are driven by the traditional teaching strategies which are the teacher-centred approach. However, there are other concepts that influence the curriculum. These concepts are framed around the curricular spider web in order to detect relevant teaching strategies that one has to deal with; these concepts are called components by Van den Akker et al. (2009) and learning signals by (Khoza, 2015c). This suggests that the National Curriculum Assessment Policy Statement is a comprehensive guideline policy document which describes and outlines specific subject content as well as the way that it is to be taught at specific times and to what extent it is has to be assessed. On the basis of this assumption, we will look at the various categories of curriculum and how it will impact the teaching strategies used when teaching mathematics in grade 5. After the South African curriculum has been briefly discussed, it is important to African curriculum has been briefly discussed, it is important to discuss the competence curriculum versus the performance curriculum.

#### **2.4 The competence curriculum versus the performance curriculum**

It is important to understand that curricula are divided into competence curricula and performance curricula (Hoadley & Jansen, 2012). According to Hoadley and Jansen (2012) a competence curriculum places attention on the learner, while a performance curriculum places the attention on the content that is to be taught. A competence curriculum focuses on everyday knowledge while a performance curriculum focuses on school knowledge (Hoadley & Jansen, 2013). Similarly, Hoadley and Jansen (2012) opines that everyday knowledge is randomly learnt from discussions that are overheard, from the media, from watching parents and from punishments and praise, whilst school knowledge is grouped into specific subject studies, like mathematics, science, or geography, which cultivate their own language. The curriculum shifted from a competence curriculum (RNCS and NCS) to a performance curriculum (CAPS) (Hoadley & Jansen, 2012). A competence curriculum can be described as learner-centred while a performance curriculum is described as content-centred and teacher-centred (Hoadley & Jansen, 2013).

According to Ramatlapana and Makonye (2012, p. 20) “CAPS curriculum is more content-oriented,” and CAPS is a performance curriculum (Hoadley & Jansen, 2012). The study conducted by Ramatlapana and Makonye (2012) indicates that the CAPS curriculum is rather prescriptive to the point of stimulating consistency in implementation across the nation. The above studies indicate that a curriculum is either a competence or a performance curriculum. Since CAPS is a prescribed curriculum according to Ramatlapana and Makonye (2012) it can be said that it is a performance curriculum. Therefore, CAPS should follow the criteria of the performance curriculum as indicated by the above studies.

According to Mathematics CAPS document DoE (2011) mathematics curriculum for Grade 5 show relevance and consistency as it indicates that it consists of approved school subject and the document clearly specifies some of the ten components of the curricular spider web (Berkvens et al., 2014). The content-centred and teacher-centred approach were considered as document noted more general aims and specific aims than specific skills and there are also teaching guidelines that show what teachers teach and the learning outcome for coherence and effectiveness (Berkvens et al., 2014). In term of practicality and sustainability there is doubt because the policy document does not indicate that the decisions, policies and materials used by teachers fit the settings of the designed curriculum and that are constructed with a view to the future are likely to remain successful when support and budget fade over time (Berkvens et al., 2014). “All in all implementation significantly depends on teachers” (Chisholm & Wildeman, 2013, p. 96), because they are the ones who are essential in implementing the intended curriculum in practice (Berkvens et al., 2014). A shift from competence curriculum to the performance curriculum means that teachers too need to shift from learner-centred approach to teacher-centred approach (Hoadley & Jansen, 2012).

Therefore, as a teacher teaching within the Curriculum and Assessment Policy Statement (CAPS) framework, the degree of control that teachers have is limited and could influence the creative thinking skills development of learners. This has been shown to influence learner performance in mathematics in grade 5. For example, group work is a good teaching strategy in competence curriculum while the proper use of teaching aids is good for performance curriculum. The curriculum that place emphasis on acquisition of factual knowledge to emphasize on process oriented curriculum that will teach how to learn, organize, study, judge

and solve problems. On the other hand, competence versus performance curriculum could not be clearly understood without the concepts of curricular spider web.

## **2.5 The Concepts of curricular spider web**

The literature review is discussed under the concepts that are framed around the curricular spider web. Van den Akker et al. (2009); Khoza (2015b), argue that these are the basic foundation concepts to any curriculum. The curricular spider web was originally developed by Van den Akker et al (2009) for the purpose of curriculum development. In this study, the curricular spider web is used as a conceptual framework. These concepts are important in such way that they contribute in the implementation of the relevant teaching strategies for teaching mathematics. The concepts of curriculum spider web are used in the exploration of the teaching strategies of mathematics performance curriculum locally and internationally. However, Van den Akker et al. (2009) do not specify the learning outcomes which are also important when it comes to measuring learners' performance as indicated by Khoza (2015b) and in mathematics CAPS document learning outcomes are indicated as specific skills. As indicated earlier in the literature review that there is another concept introduced by Berkvens et al. (2014) that will address the limitation and replaces a grouping frame around the curricular spider web. These are important to determine the relevant teachers' strategies, which will be explored for teaching Grade 5 Mathematics. So this study uses the curricular spider web by Van den Akker et al. (2009), as the strong conceptual framework based on mutual understanding processes (Berkvens, Kalyanpur, Kuiper, & Van den Akker, 2012), which also involves four criteria that rotate around the curricular spider web of quality education.

Figure 1 below displays a curricular spider web that will be used in this research study.

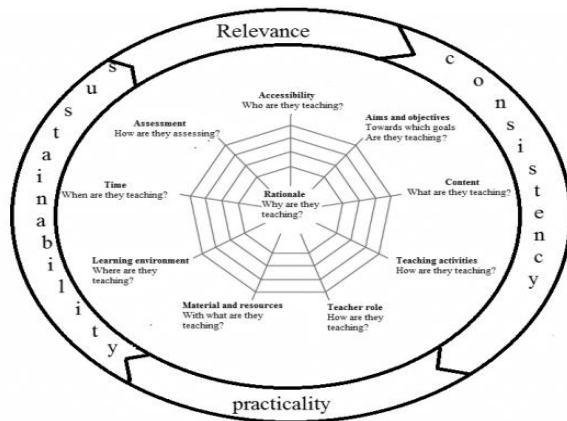


Figure: 1 Conceptual framework (based on curricular spider web drawn from Berkven, Van den Akker and brugman, 2014, p. 8).

The conceptual framework is used to link to concepts of a curricular spider web to provide consistency and coherence (van den Akker et al. 2009). The concepts of a curricular spider web are written in a question form in order to be meaningful. The concepts are as follows: who are teaching (accessibility)? Why are they teaching (Rationale/vision)? Towards which goals are they teaching (Aims/objectives)? What are they teaching (Content)? How are they teaching (Teaching activities)? With what are they teaching (Resources)? How are the teachers teaching (Teacher role)? Where are they teaching (Location)? When are they teaching (Time)? How are they assessing teaching (Assessment)? In addition, Berkvens et al. (2014) argue that the quality also covers the facets such as relevance, consistency, practicality and sustainability. These facets could be applied mostly to the entire of education and evolve around the concepts of curricular spider web (Berkvens et al. 2014). Therefore, it means that relevance, consistency, practicality and sustainability are useful for the effectiveness of the curriculum. However, this study will position curricular spider’s web concepts as in the table below.

**This table is presented in terms of concepts, propositions, questions, studies and gaps.**

Concepts	Propositions	Core questions	Studies	Gaps
Rationale	Personal pedagogical Content knowledge Societal preparation	Why are they teaching?	Van den Akker et al. (2009) Berkvens et al. (2014)	Reflective activity Convenience sampling

			Leendertz et al. (2013) Hutchison and Woodward (2013) Ono and Ferreira (2010) <sup>1</sup>	
Accessibility	Physical Financial Cultural	Who are they teaching?	Berkvens et al. (2014) Dello-lacovo (2009) Vithal (2012) Barrett (2011) Gebrielmichael, Goodchild and Nygaard (2011)	Convenience sampling Reflective activity
Goals	Aims, objectives and learning outcomes	Towards which goals are they teaching?	Kennedy, Hyland and Ryan (2006) Khoza(2013) Khoza (2014) Berkvens (2014) Kuiper and Berkvens (2013)	Convenience sampling Limited studies on reflective activity
Content	Number Operations and Relationships Patterns, Functions and Algebra Space and Shape Measurements Data Handling	What content are they teaching?	Ball, Thames and Phelps (2008) Brumer et al. (2010) Silver et al. (2009) Khoza (2013) Long and Dunne (2014) Radford (2008)	Convenience sampling Reflective activity Measurement Data handling Space and shape
Activities	Teacher-centred Content-centred Learner-centred	How are they teaching?	Kehdinga (2014) Facts (2014) Chamber (2008) Cengiz, Kline and Grant (2011) Sherin and Drake (2009)	Convenience sampling Reflective activity
Teacher Role	Instructor Facilitator Assessor	What activities are they teaching?	Liebermann 2009 Khoza (2014) Buddo (2013) Kehdinga (2013) Kehdinga (2014) Kullberg (2010)	Limited convenience sampling Reflective activity

Resources And material	Hard-ware Soft-ware Ideological-ware	With what are they teaching?	Khoza (2012) Khoza (2015) Long and Dunne (2014) Leendertz et al. (2013) Wood and Ashfield (2008)	Few studies on Reflective activity Convenience sampling
Location and Time	Inside the classroom Outside the classroom Inside and outside the classroom Weekly Days Hours	Where and when are they teaching?	Garet et al. (2001) Ballet al. (2008) Kajander (2009) Valli and Buese (2007) Van den Akker et al. (2009)	Convenience sampling Reflective activity
Assessment	Assessment of Teaching Assessment for teaching Assessment as Teaching	How are they Assessing?	Kennedy at al. (2006) Yee (2010) Boud and Falchikov (2006) Buddo (2013) Ross and Bruce (2007) Khoza (2013)	Convenience sampling Reflective activity Critical thinking Disposition

**Table 1: Table Structure of the curricular spider web preceded**

### 2.5.1 Introduction

The following section presents the literature review based on the teaching strategies following the ten concepts of the curricular spider web. Each section is divided into three levels.

#### 2.5.1.1 Why are they teaching? (Rationale)

This section presents the literature on rationale of teaching Mathematics. According to Van den Akker et al. (2009, p. 11) “the rationale serves as a central link, connecting all other curriculum components.” Mathematics is a language that makes use of symbols and notations to describe numerical, geometric and graphical relationships. There are three main reasons that people need to participate in education, namely: pedagogical (personal talent and character development); content (knowledge and metacognition development); societal preparation (Berkvens et al., 2014). In addition, a case study conducted by Khoza (2015b) on 22, reveals that mathematics is

taught as to ensure that every learner possesses mathematical knowledge and skills that enable them to solve problems in their lives outside of school.

A qualitative approach study conducted by Sullivan and Wood (2008), indicates that teachers are being prepared so as to be capable of teaching all content subjects including mathematics in primary school, despite the fact that they did not specialise in mathematics. The above studies highlight the importance of professional teachers in teaching mathematics. Professional teachers should, therefore, be qualified and continue to improve themselves with regard to teaching, learning and technology (Msibi & Mchunu, 2013). It is a qualified and professional teacher who is capable of imparting knowledge to learners and building upon what they already know by employing effective teaching strategies, in order to teach mathematics and it is the teacher who is able to effectively integrate Information and Technology (Leendertz, Blignaut, Nieuwoudt, Els, & Ellis, 2013). There are some teachers who maintain their passion for teaching and who strive to help learners to achieve knowledge and skills that are suitable to be applied to real world situations (Khoza, 2015b). Some teachers are compelled to teach only mathematics despite primary schools clinging to the belief that teachers in a primary school are capable of teaching all subjects. However, a study conducted by Msibi and Mchunu (2013), indicates that teachers who are not qualified to teach mathematics should not be allowed to teach mathematics as they lack both the subject content knowledge and the appropriate pedagogical content knowledge. This means that forcing teachers to teach mathematics in primary schools without adequate knowledge of the subject and content could be detrimental to learners as they would lack the 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 strategies of teaching mathematics.

Van den Akker et al. (2009), argue that for education to adequately engage with a variety of social interests in curriculum development, there needs to be three main sources for selection and for prioritising aims and content areas. These three main sources for selection are: (a) knowledge-academic and cultural heritage for learning and future improvement; (b) social preparation-issues relevant for inclusion from the viewpoint of societal developments and needs; (c) personal-development elements of importance for teaching and development from the

personal and educational needs and interests of learners themselves. Additionally, a case study conducted by Ono and Ferreira (2010) reveals that the professional development programme should be learner-centred, knowledge-centred, assessment-centred and community-centred to optimise teaching trends.

This clearly shows that teachers should be well versed in how to teach as well as in what to teach. However, an interview-based qualitative study conducted by Mncube and Harber (2010) reveals that a learner-centred approach involves a teaching strategy for teaching mathematics of experimental investigation where learners are given projects and then come back to report to the class. This also encourages the use of inquiry-based teaching and promotes self-discovery teaching and content teaching (Bantwini, 2010). These studies reveal that the education system should consider the values and customs of a society when a curriculum is developed, because teachers and learners belong to that society. In the selection and prioritising of aim and content areas, the personal and educational needs should meet the interest of the society. Kehdinga (2014b), concurs with Van den Akker et al. (2009) by stating that: teachers' professional development is about belonging to a social community where their activity and ideas are recognized as valuable and important and that teachers' professional identity has become an understanding of how teaching and learning within the community affects and shape them.

On the other hand, the government is limiting professional development programmes in South Africa, so there is a slim chance that most teachers have adequate knowledge of a learner-centred, knowledge-centred, or an assessment-centred and community-centred approach in order to optimise teaching trends. This could pose a serious challenge when attempting to achieve any meaningful improvement in our schools. In support of the above statement, the study of Msibi and Mchunu (2013), state that much of the failure in South African schools has to do with the governments pre-occupation with the curriculum as opposed to the teachers and their abilities. This implies that if the government would focus more on what teachers know and what they can teach as well as provide teachers with support programmes, then teachers might utilise inquiry-based teaching and thus promote self-discovery where learners will carry out research to obtain information.



Van den Akker et al. (2009), believe that Tyler's underlying principle emphasises the significance of a rationale and goal-directed teaching strategy. They argue that a curricular product can be improved by systematically answering the four main questions based on factual arguments, validity and internal consistency. It is believed that every lesson taught in the classroom should be driven by goal-directed teaching strategies so that the teaching strategies for grade 5 mathematics are focused on achieving those objectives (Van den Akker et al., 2009). In addition, a quantitative study conducted by Li and Ma (2010) reveals that there are two pedagogical approaches, namely traditional and constructivist teaching strategies. The study also defines the traditional approach as an approach to teaching that is teacher-centred whole class teaching, where the teacher is the most active, speaks too much and provides a great deal of explanations, whereas the constructivist approach is defined as learner-centred teaching that stresses strategies such as discovery-based teaching, problem-based teaching and situated cognitive-based teaching, where learners dominate the lesson and the teacher facilitates the lesson. This means that learners solve problems on their own with a little help from the teacher if necessary.

The mathematics CAPS document concurs with Van den Akker et al. (2009) by noting that “CAPS is based on credibility, quality and efficiency and providing an education that is comparable in quality, breadth and depth to those of other countries” (DoE, 2011, p. 5) . CAPS curriculum is balanced according to Berkvens et al. (2014) and Van den Akker et al. (2009) where the vision of the education department assists the school management team (SMT) to develop a mission for a specific school (Van Deventer & Kruger, 2011). Mathematics CAPS document indicates that “the National Curriculum aims to provide clearer specifications as to what is taught and what is learned on a term per term basis. It also indicates that the National Curriculum Statement grade R-12 represents a policy statement for learning and teaching in South African schools and includes CAPS for all acknowledged subjects listed in the CAPS document, National policy relating to the programme, promotion requirements of the National Curriculum Statement grade R-12 and National protocol for assessment grades R-12” (DoE, 2011, p. foreword). According to Van den Akker et al. (2009) the curriculum's effectiveness will depend on the practicality, whether it can be implemented as intended and on the relevance and consistency of the intended objectives and content components. According to a collaborative

strategy of involving all stakeholders on curriculum development would make sure that the implemented change is relevant to the nation, consistent with international and local policies and takes into account important local needs and wishes.

The CAPS document seems to be relevant to the nation, consistent with international and local policy standards, but less concerned with local needs as it is subject driven (DoE, 2011). In terms of practicality and sustainability, there is doubt, as the mathematics document does not indicate the importance of teacher development in terms of content knowledge nor does it deal with how teachers can put the curriculum into practice. The mathematics document put a strong emphasis on the content knowledge where it involves the “ general focus of the content area and the specific focus of the content area per grade” (DoE, 2011, p. 9). It also indicates the specification of the content which shows progression in terms of concepts and skills as well as the clarification of the content which provides guidelines as to how progression should be addressed (DoE, 2011). The mathematics document also provides the curriculum implementers with teaching guidelines (DoE, 2011). There is little room for sustainability. It means, mathematics document does not specify the provision for sufficient budget nor are that materials provided in order to achieve results in the long term (Berkvens et al., 2014). As a result, there is no balance in the quality criteria. The strategies that are produced by personal, everyday experience are that teachers should always think outside the box to come up with ideas to deal with any challenges they face in the classrooms, alternately teachers are members of the society in which the school is situated, so they should not look further than the context in which the teaching takes place in order to find solutions to any challenge. Teachers should be professional in discharging their duties and they should always be able to teach what is in the curriculum.

Another reason that learners should be taught mathematics is that it allows them to understand and analyse some of the social issues around them in which there are directly involved. Some of these daily uses include working with figures or numbers such as in business, as a teller in a bank, map work, agricultural economics and foreign exchange departments. This allows me to suggest that mathematics is a highly useful subject that is applied daily in real life situation. This can only happen if teachers are qualified enough to master the content in order to deliver and that CAPS document has got the relevancy, consistency, practicality and sustainability (Berkvens et

al., 2014). The above studies indicates that there are few studied that are conducted using the reflective activity. Therefore, there is a need for a study to be conducted using reflective activity for teachers to be able to reflect on their reasons for teaching mathematics. After the rationale has been explained we need to know who they are teaching.

### **2.5.1.2 With Whom /Who are they teaching? (Accessibility)**

According to Berkvens et al. (2014) accessibility of education is determined by many aspects including physical, financial and cultural. There is a difference in physical, financial and cultural attributes in each context. This is confirmed by a holistic approach study conducted by Dello-lacovo (2009) as part of the Centre for Asian Studies at the University of Adelaide; in summary in an examination of the Chinese government's attempt to promote a revised school curriculum, the study concludes that the three aspects physical, financial and cultural are influential in determining the outcome of any curriculum. This study also reveals that in China compulsory education was enforced and the access to a primary school education was said to be universal and access to higher education has increased, but secondary schools are inadequate. Furthermore, the government has identified that the workforce needs skills, which it sees as critical in sustaining its drive towards modernisation and that rote teaching is still dominating in Chinese schools (Vithal, 2012). This is similar to the South African context where the government is trying to make primary school education compulsory, but without providing adequate infrastructures this will not be an achievable goal (Dello-lacovo, 2009). In addition qualitative study conducted by Vithal (2012) reveals that many different kinds and levels of resources and infrastructure are required for the successful implementation of the new curriculum.

In addition, South Africa has the challenge of increasing access to education for its economically and socially disadvantaged population in order to attain the millennium development goals (Ramatlapanana & Makonye, 2012). Vithal (2012), argues that the main lever is the quantity and quality of competence and confidence in teachers to convey the new mathematics curriculum to learners. Therefore, schools should work on producing high quality results so as to attract different stakeholders, as shown by a study conducted by Barrett (2011) in the field of development studies where UK-based academics proposed a new form of development goal for

after 2015. He further reveals that donors are increasingly turning to measures of learning outcomes as the most reliable indicators of quality education.

This also happens in the South African context, whereby NGOs have financed the Uwezo programme, which measures children's mathematics capacity in order to increase quality of education (Barrett, 2011). On the other hand, different countries have their own cultures concerning education. A pilot study conducted by Gebremichael, Goodchild, and Nygaard (2011) reveals that it is a common phenomenon in Ethiopia that mothers do not go to a formal school, some might have gone to a traditional school where they learn numerals which range from 1 to 1000. This may suggest that in Ethiopia education is not free and compulsory, unlike other countries. In contrast with the Chinese curriculum, the CAPS document DoE (2011) states that active and critical teaching encourages an active and critical approach to teaching, rather than rote teaching of the given facts. Furthermore, a sequential, explanatory and mixed method study conducted by Kloppers and Grosser (2014) on, indicates that teachers need to teach learners the value and meaning of critical thinking and teachers need to model teaching strategies so as to enhance learners' critical thinking skills when teaching mathematics. A critical thinking approach encourages teachers to use learner-centred teaching strategies for teaching mathematics, which involves group discussions and debates to improve learners' critical thinking skills.

The above studies reveal issues surrounding who the learners are, but did not consider who the teachers are. These studies include learners' background and cultural makeup, including their language and identity. These aspects should be considered by teachers when they are developing strategies for teaching mathematics in grade 5. However, they should also be considered as they are the implementers of the curriculum. In addition, there are few studies that were conducted using reflective activity and focus group discussions. This suggests 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 strategies for teaching mathematics and to consider their accessibility as well.

On the other hand, CAPS document DoE (2011), notes that government provides access to higher education, facilitating the transition of learners from education institutions to the work place and providing employers with sufficient profile of a learner's competences. This means that, these are just the curriculum planners' wishes because presently this is not yet practiced (Berkvens et al., 2014). According to Berkvens et al. (2014) Children should have access to upper secondary and higher education and this should also ensure jobs for future graduates (Berkvens et al., 2014). In addition, the curriculum promotes knowledge in local context, while being sensitive to global imperatives (DoE, 2011).

There is consistency shown by the Mathematics document whereby it equips learners, irrespective of their socio-economic background, race, gender physical ability or intellectual ability, with the knowledge, skills and values necessary for self-fulfilment and meaningful participation in society as citizens of a free country (DoE, 2011). Practicability is indicated by the policy which assists in removing national and local constraints on accessibility while the mathematics document indicates that the curriculum principles are based on social transformation, ensuring that the educational imbalances of the past are addressed, and that equal educational opportunities are accessible for the whole population (DoE, 2011). It means that, there is little room for sustainability since the CAPS document does not specify the provision of sufficient budget nor that materials are provided in order to achieve results in the long term (Berkvens et al., 2014). This suggests that education can only be successful if the following three aspects are taken into consideration: physical; financial; cultural. As a result there is no balance in the quality criteria.

### **2.5.1.3 Towards which goals are they teaching? (Aims, objectives and learning outcomes)**

According to Kennedy, Hyland, and Ryan (2006, p. 5) "the aims of a content are broad general statement of teaching intention, they indicate what the teacher intends to cover in a block of teaching, while objectives of a module are usually a specific statement of a teaching purpose". Such as indicating one of the specific areas the teacher intends to cover in a chunk of learning (Kennedy et al., 2006). They further state that learning outcomes are defined as statements of what a learner is supposed to know, understand and be able to show after completion of a process

of learning. This suggests that the teacher has to clearly understand the outcomes to be achieved by learners at the end of each lesson.

It becomes imperative to declare that the Mathematics document does have aims, objectives and learning outcomes, but that its aims are general aims, its objectives are specific aims and its learning outcomes are specific skills (DoE, 2011). A case study conducted by Khoza (2014a), indicates that learning outcomes are attained by means of a learner-centred approach, which means that a competence-based curriculum and the problem solving strategy is used to attain the intended learning. Berkvens et al. (2014), reveal that the aims and objectives of learning outcomes and of what is to be taught can be presented in three S models namely learner, society and subject. These models will assist teachers in deciding what is most worthwhile as a teaching strategy from the perspectives of learners, society and subject (Berkvens et al., 2014).

On the other hand Mathematics as a subject within the CAPS document has eight specific aims which include: problem solving and cognitive skills; to show mathematics as a human creation by including the history of mathematics and to develop fluency in computation skills without relying on the usage of calculators. A slight comparison from NCS and CAPS in mathematics reveals that the objectives listed in NCS appear also within the CAPS document and are termed specific skills because they are short and more precise and learners should be working towards achieving those goals. These include the use of spatial skills, properties of shapes and objects, and to identify, pose and solve problems creatively and critically. These aims are appropriate in describing the goals which learners should achieve. It is of vital importance that when teaching any topic you first plan what your aim will be in teaching that specific topic chosen and then you set objectives, or rather specific skills, for the learners to achieve and be able to carry out; these skills are assessed normally towards the end of the lesson. However, Van den Akker et al. (2009), state that teachers should have knowledge of teaching strategies that are of most value for teaching aims, objectives and learning outcomes; the teacher has to follow the clearly defined aims and objectives in implementing teaching strategies that he/she is expected to deliver to the learners, as well as making sure that the teaching is relevant to the learner.

Van den Akker et al. (2009), states that teachers should do their best to use teaching strategies that are within the aims and objectives contexts in which they have to teach. For example, the teacher must use a step by step teaching strategies to achieve aim and objectives like providing a recipe (Van den Akker et al., 2009). This also involves teacher-centred approach such as tutorial lecture and class discussions strategies that could be used to cover the aim and objectives (Kennedy et al., 2006). Further to this, Khoza (2014a), argue that learning outcomes are achieved by means of the following strategies: application of the acquired knowledge; demonstrating knowledge at the end of a lesson; showing understanding by answering the questions at the end of a lesson. Kennedy et al. (2006), reveal that Bloom's taxonomies are offered within the framework of cognitive taxonomy (domain) where the six cognitive levels are categorised from low order to high order levels. This means that teachers should plan learning outcomes that will engage learners and encourage them to apply the following strategies: recalling mathematics terminology; identifying the properties of a square and a rectangle; describing the process of construction of a chess board (Nkopodi & Mosimege, 2009). However, the CAPS curriculum does not discuss Bloom's taxonomy which is used for the writing of the learning outcomes which offers the following structure: knowledge; comprehension; application; analysis; synthesis; evaluation. It does not, however, specify cognitive domain, called cognitive levels, which are only applied on formal assessment. In the teaching process teachers are required to apply teaching strategies that expect the learner to participate in the setting of goals for their teaching (Kuiper et al., 2013).

Teachers should teach with aims and objectives in mind in order to deliver the lessons, which is a teacher-centred approach and falls under performance curriculum Khoza (2013b), whilst bearing in mind that there are learning outcomes that should be achieved by learners. This suggests that in a country that was driven by learning outcomes, but that is now attempting to utilise the aims and objectives as indicated by Khoza (2013b) and (Kennedy et al., 2006), argue that teachers should combine both teacher-centred strategy and learner-centred strategy in order to balance the aims, objectives and learning outcomes. Hoadley and Jansen (2012), argue that in teaching and learning there is a combination required of a teacher-centred approach and a learner-centred approach in order to sustain the curriculum. In that way the prescribed curriculum will be strongly integrated and combine well with the relevant teaching strategies when teaching

mathematics. The mathematics CAPS document DoE (2011) does meet the criteria indicated above when developing goals and objectives as it indicated as follows:

### **General aims**

(a) “The general aims of the curriculum gives expression to the knowledge, skills and values worth learning in South African Schools...; (b) CAPS serves the purpose of equipping 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 as citizens of a free country..., (c) The CAPS curriculum is based on the principles of social transformation, active and critical learning, high knowledge and high skills...; (d) The Curriculum aims to produce learners that are able to identify and solve problems and make decisions using critical and creative thinking and work effectively as an individual and with others as members of a team” (DoE, 2011, pp. 4-5). Mathematics CAPS stipulates specific aims. This clearly shows that the goal of teaching learners mathematics should be to develop them into good citizens that can think critically and solve problems using mathematical concepts.

### **Specific aims**

The mathematics curriculum aims to develop a critical awareness of how mathematical relationships used social, environmental, cultural and economic; confidence and competence to deal with any mathematical situation without being hindered by a fear of Mathematics and acquisition of specific of knowledge and skills necessary for; the application of Mathematics to physical, social and mathematical problems, the study of related subject matter and further study in Mathematics (DoE, 2011, p. 8).

### **Specific skills**

“To develop essential skills the learner should develop the correct usage of the language of mathematics in developing number vocabulary, number concept, calculations and application skills, the ability to learn and listen, to communicate and think reasonably logically in order to apply the mathematical knowledge gained, build an awareness of the important role that mathematics plays in a real life situation including the personal development of the learner” (DoE, 2011, pp. 8-9).



The only problem with the CAPS document is that it does not note the teaching strategies that are to be implemented in teaching general aims, specific aims and specific skills. The mathematics document is balanced because it is relevant with regards to the general aims specific and specific aims because the emphasis is more on general aims and specific aims since CAPS is a prescribed curriculum. The above makes sense in light of Mathematics, where there more general and specific aims rather than specific skills that expand the vision and form a logical connection with content that is prescribed in detail. Practicality features where teachers are monitored by the school management team (SMT) and the school is in turn monitored by government officials in order to be certain that the overarching goals are achieved and teachers implement useful and worthwhile content.

The overarching aim, objective and learning outcomes show sustainability as the CAPS document indicates thought to the future and long term sustainability (Berkvens et al., 2014). In addition, Berkvens et al. (2014) state that consistency is revealed by means of the set goals connected for all levels. This implies that mathematics document shows relevancy, as Berkvens et al. (2014), state that it sets achievable goals if the aims of the curriculum is to ensure that children acquire and apply knowledge and skills in ways that are meaningful to their own lives. However, the relevancy, consistency, practicality and sustainability of the curriculum depends on the teachers and their ability to instil their subjective ideas into the professional and curricular expectations of what it means to be a teacher (Kehdinga, 2014b). This suggests that there is a need for a study to be conducted using reflective activity so that teachers are enabled to reflect on their goals when developing their teaching strategies to teach mathematics. Further teaching goals cannot ever be achieved without subject content.

#### **2.5.1.4 What Content are they teaching? (Content)**

The word content in this context means a list of sections or chapters that needs to be dealt with. According to Ball, Thames, and Phelps (2008) “content refers to a wide range of aspects of subject matter knowledge and teaching of subject matter, and indeed, have used it differently across, and even subject areas”. The mathematics document notes that the content area in grade 5 mathematics involves Numbers, Operations and Relationship; Patterns, Functions and Algebra;

Space and Shape (geometry); Measurement; and Data handling (DoE, 2011, p. 9). These are the areas as teachers should focus on. According to Baumert et al. (2010), the three content areas of elementary school mathematics are remarkable namely: numbers/operations; patterns/functions; algebra. In addition, a study conducted by Silver, Mesa, Morris, Star, and Benken (2009) analysing mathematical features in America, reveals that mathematics instructional tasks tend to emphasise low level rather than high level cognitive processes, which translates as memorising and recalling facts and procedures with learners working alone in silence rather than reasoning and connecting ideas or solving complex problems in groups with the opportunity for discussion and collaboration. This focuses attention on a narrow band of mathematics content, which is simply arithmetic in elementary and middle grades and does little to help to develop understanding of mathematical ideas as well as rarely asking for explanations using physical modes or calling for connection to real world situations (Silver et al., 2009).

A qualitative case study conducted by Shulman (1987) suggests that a teacher is a scholar who must know all aspects of the subject. Interviews and document 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 (content) and teaching ends with new understanding by both the teacher and learners. Thus a teacher has a responsibility pertaining to the content knowledge. This suggests that a teacher serves as a primary source of content for a subject during teaching. Teachers cannot be judged by observing their performance without referencing their content; one of the types of knowledge a teacher has is "the content and the curriculum knowledge" (Shulman, 1987, p. 7).

Furthermore, Shulman (1987) suggests that content knowledge encompasses knowledge of the subject and its structures or parts, whereas curricular knowledge is characterised by certain programs for teaching the subject. This implies that each and every mathematics subject teacher must possess both content and curriculum knowledge. Furthermore, Hoadley and Jansen (2012) indicate that the intended curriculum (CAPS) is often not contained in one document, but rather it is set out in a number of documents that outline the content for learning areas and subjects and these documents apply to different levels of curriculum. It is suggested by CAPS (DoE, 2011), that the mathematics syllabus, annual teaching plan, lessons plans and the textbooks are all

curriculum documents at different levels of the curriculum. Hoadley and Jansen (2012), outline that Tyler's approach to curriculum suggests that, based on the curriculum content, the department or the school must decide which subjects to teach and what content to teach. In other words, teachers must be provided with a syllabus setting out the content to be taught or covered in order to fulfil the objectives. Curriculum content should be systematic, logical and mechanical and this will help educators know what to teach as prescribed.

The study conducted by Khoza (2013a) indicates that if teachers use content to deliver the lesson it means they are applying a content-centred approach. He further states that a teacher-centred approach involves strategies like actual presentation and if teachers want to measure any part of the content that is to be given to learners then they should use the content-centred approach. These studies indicate that there are some content areas that are regarded as more important and one wonders how this is measured. Teaching that is based upon recalling and memorising teaching strategies tend to limit opportunities for interaction between learners.

School based research conducted by Long and Dunne (2014) on curriculum coverage and cognitive depth in a primary school in Gauteng, reveals that a topic approach underlies the design of CAPS 2011; the order and progression of the topics are carefully planned, so that the conceptually preceding concepts are presumably taught prior to the more advanced topics. This shows that the content is in a chronological order starting with concrete topics before proceeding to abstract topics. However, fractions are taught in grade 5 to prepare learners for the next grade; the teacher should ensure that common fractions with denominators of multiples of ten are covered and that the relationship of one tenth to ten hundreds is understood. Therefore, teachers should use a mentalistic teaching strategy that involves written questionnaires, interviews and drawing exercises to get an indication of what is going on in the mind of the learner (Radford, 2008). In addition, teachers should use teaching strategies that allow learners to play games like morabaraba in the mathematics curriculum to develop the language and vocabulary of mathematics, develop ability with mental mathematics, and skill with device problem-solving strategies; to be the generator of mathematical activity at a variety of different level (Nkopodi & Mosimege, 2009).

Another study conducted by Paramore (2011), reveals that data handling could be used as a starting point to realise a more comprehensive strategy which incorporates a range of under-used notions concerning the practice of a dialogical and critical mathematics education. Therefore, a mixed method study conducted by Wessels and Nieuwoudt (2011), reveals the following types of graphs in data handling: bar; line; pie. Moreover, an action research study conducted by Suherman et al. (2011) indicates that the finger technique proved to be a more successful teaching strategy when teaching multiplication of numbers between six and ten as well as two digit numbers. Furthermore, the study conducted by Baumert et al. (2010) shows a limit in the content of elementary school mathematics as it left out measurement and data handling. Fortunately here in South Africa Mathematics content includes measurements and data handling as indicated above, but which the teacher can hardly teach (DoE, 2011).

Furthermore, Bennie and Newstead (1999) identified teachers' content knowledge as an area of concern, since this has an influence over the quality of the learners' experiences in the mathematics classroom. The Curriculum and Assessment Policy Statement introduced new content and traditional content. There is, therefore, a need to understand how South African educators have coped with these changes, and examine their experiences in the classroom. Graven (2001), argues that the roles that teachers play in the implementation of the new curriculum are conflicting and not complementary. Curriculum implementation should be a process of engaging the curriculum so that it 'becomes part of the teacher's way of being' and will result in teachers adjusting their opinions and modifying their approach to suit the way curriculum should be provided (Graven, 2001). This means that teachers should be included in curriculum development so as to choose sustainable content suitable for their teaching career. On the other hand, Mathematics DoE (2011) content proves to be relevant, as it covers all the components and basic concepts regarding what is worth teaching and learning in mathematics, while a possible extended Curriculum and Assessment Policy Statement (CAPS) prepares for local life, lifelong learning and possibilities in the world of work. Mathematics shows consistency because it has a vision, overarching goals and objectives and its meaning, skills and knowledge are interrelated (DoE, 2011). Each content area contributes to the acquisition of specific skills, the general focus of the content area as well as the specific focus of the content area (DoE, 2011).

There is little practicability in the mathematics curriculum because it does mention the local context, achievable policy and supporters' opportunities for localising the curriculum, but when it comes to putting it into practice then problems arise. The high rate of failures in South Africa is consistent which might indicate that teachers are selecting teaching strategies that are inadequate for the transmission of particular skills (Kehdinga, 2014b; Machisi, 2013), therefore there is a demand to move away from the old teaching strategies so that teachers will adapt to the demands of the curriculum change. This was proved by the poor 2014 matric results in mathematics. This suggests that the curriculum needs to take a closer look at teaching strategies used in South Africa, as it is currently silent on this issue. Therefore, teachers need to be aware of the expectation to make an important educational paradigm shift (Cenenda, 2012).

Furthermore, the CAPS document DoE (2011) meet the quality criteria by Berkvens et al. (2014), specifies that the general focus takes into account. Furthermore, the CAPS document specifies that:

“the development of the meaning of different kinds of numbers, the relationship between different kinds of numbers, the relative size of different numbers, representation of numbers in various ways, the effect of operating with numbers and the ability to estimate. Algebra is the language for investigation and communicating most of Mathematics and can be extended to the study of functions and other relationship between variables. The study of Space and Shape improves understanding and appreciation of the pattern, precision, achievement and beauty in natural and cultural forms. Measurement focuses on the selection and use of appropriate units, instruments and formulae to quantify characteristics of events, shapes, objects and the environment and it relates directly to the learner's scientific, technological and economic world. Data handling involves asking questions and finding answers for the purpose of describing events on the social, technological and economic environment” (DoE, 2011, p. 11).

The sustainability of the curriculum is doubtful; unless teachers reflect on the relevant teaching strategies and adapt themselves to changes. These topics are vital because many areas of the economy in South Africa require mathematics and if we have to compete with other major countries within the continent and internationally we need to improve our rankings and increase

the number of our own mathematicians able to compete with the international trend of content areas covered in the subject that are common. However, the above studies show that there are limited studies that were conducted using the use of reflective activity. Therefore, there is a need for a study to be conducted using reflections in exploring teaching strategies for teaching grade 5 Mathematics. Moreover, content cannot ever stand alone in order to achieve teaching and learning goals, but rather teaching activities are also very important.

### **2. 5.1. 5 What teaching activities are they teaching? (Teaching activities)**

The study conducted by Kehdinga (2014b) reveals that lesson delivery involves teaching activities, strategies, skills, and resources used by the teacher in the teaching and learning process. An interpretive study conducted by Facts (2014) on the foundation phase teachers using discussions and doing daily mental activities encouraged by CAPS, reveals that mental activity games can be used by teachers to get learners to begin thinking. The starter activity in mathematics is often referred to as an oral and mental starter (Chambers, 2008). He also suggests that activities that involve partnership between the teacher and the learner are encouraged in order for learners to work mentally and explain verbal thinking. This suggests that it will be ideal for teachers to start from known concepts and to move to unknown concepts. Furthermore, a qualitative study conducted by Cengiz, Kline and Grant (2011), indicates that teachers provide the riddle activity, for example “the difference between 100 and me is 45, what number can I be?” The teacher first creates a whole group discussion teaching strategy that has potential for prolonging learner thinking in order to make the link between different representations and a story problem so as to show the mathematical term difference (Cengiz, Kline, & Grant, 2011). It also suggests that it is good to introduce activity with something that the learners are familiar with.

Another documentary analysis of study conducted by Graven, Venkat, Westaway, and Tshesane (2013), reveals that in an addition activity given to learners, for example  $397+65+3$ , the teacher uses the self-discovery teaching strategy then moves around helping learners to use the quicker method of addition by using guiding questions, for example “what might happen if you check this by first counting in 1s from 397 then come to the last number?” The learner might be able to get an answer quickly (Graven et al., 2013). This suggests that children should be allowed to

discover their own learning and become part of the learning process. An analysis study conducted by Bolden, Harries, and Newton (2010) on pre-service teachers, exploring and documenting their conceptions of creativity in mathematics teaching in the UK, reveals that a teacher can use a mathematics Bingo strategy for teaching the 6 times table, a more interactive and fun way of teaching tables. This shows another strategy of teaching multiples in mathematics.

Another mixed method study conducted by Sepeng and Webb (2012), indicates that teachers will benefit from helping learners to develop the skills to know when and how to apply classroom mathematical knowledge as well as helping learners when solving problems on their own. Problem solving promotes a change from traditional practice to practice that emphasises inquiry and discovery; this involves the learner-centred approach (Machisi, 2013). Engaging learners on inquiry and discovery teaching encourages learners to be independent with teacher guidance. Teachers are encouraged by instructional reform efforts to use hands on teaching activities to increase learners' engagement with mathematical tasks and understanding of concepts (Silver et al., 2009). Furthermore, an investigatory study conducted by Sherin and Drake (2009), indicates that a teacher who has a good subject matter knowledge can substitute a new activity in place of one recommended in the curriculum, for example instead of using a paper folding activity described by the curriculum to assist learners to explore fractions, the teacher may ask learners to shade in different portions of a square, because when the teacher holds up those little shapes for the class to see learners may not be able to see where they are to fold.

Therefore, teachers are encouraged to use creative strategies by getting learners to be creative through the use of practical things such as engaging learners on working with shapes such as hexagons, pentagons, circles, squares and triangles (Bolden et al., 2010). At the same time this could be a challenge to those teachers who do not have sufficient content knowledge, skills innovation and experience to effectively put the progressive curriculum to good use (Msibi & Mchunu, 2013). Learners could be given tasks such as making pictures using their own shapes like spaceships, Christmas trees and animals (Bolden et al., 2010). It clearly shows in the studies that these activities might motivate some learners to become the artists of the future. However, Paramore (2011) reveals that data handling can be approached in the form of a dialogical

strategy, firstly, whereby the teacher starts by framing a question to the class that learners have agreed upon during the previous discussions, for example it might be a case, a story, a problem or a game. Secondly, let learners decide how they could collect and interpret data. Thirdly, the teacher allows learners to share their findings, and lastly the teacher opens the debate to the class so learners are able to evaluate their findings. This teaching strategy directs learners step-by-step through the lesson. As Hoadley and Jansen (2012) argue, experienced teachers will follow logical steps and also present clear sets of objectives. Furthermore, the following strategy may be used in teaching the pie graph activity: a teacher may give learners a pie chart depicting grocery market shares and ask learners to explain what the chart is about and to say what they notice about the pie chart (Wessels & Nieuwoudt, 2011).

The CAPS document provides the teaching activities that are to be taught under concepts and skills, for example write a number sentence to describe a problem. Solve and complete number sentences by inspection, trial and improvement and check the result by substitution (DoE, 2011). In terms of CAPS there is relevancy in teaching activities because there is flexibility; the teacher is allowed to use many methods and to allow the learner to choose the one he or she likes best. It is up to the teacher to create interesting teaching activities, for example teaching activities can be in the form of games. The CAPS document offers teaching guidelines that are aligned with curriculum policy. This implies that the relevancy depends on the teacher and how well the learner is engaged in the teaching environment and that it is well thought out and fits current beliefs within the social context (Berkvens et al., 2014). In terms of consistency the CAPS document provides the teaching guidelines that are in line with the vision on education and the overarching goals and objectives, as indicated in the Curriculum and Assessment Policy Statement document, it was developed for learning programme guidelines and subject assessment guidelines in grades R-12 towards the acquisition of general aims, specific aims and specific skills (DoE, 2011). To show practicality, teachers should design teaching activities that are practical for the local context.

In addition, the teacher is guided by the teaching guidelines to adapt practical teaching strategies for teaching mathematics in grade 5 and to apply them in his/her own settings as indicated by (Berkvens et al., 2014). Teaching activities that are applied in CAPS are sustainable teaching



strategies as they are driven towards general aims, specific skills and specific skills within the local context of the learner. Further discussions on teaching activities are important, but we also need to know the role of a teacher.

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

According to Kehdinga (2014b) the term teacher refers to a person who is in charge of education and guiding learners in schools. This implies that being a teacher means that is should be open to scrutiny, to ensure that teachers are thinking critically about the lesson plan (Lieberman, 2009). The teacher is in control over what is taught and how that information that has to be learned is delivered (Killen, 2007). According to Khoza (2014a), mathematics should be taught by an experienced teacher who is capable of explaining all the content areas. In support of Khoza (2014a) recommendations a variation theory research conducted by Kullberg (2010) into eight teachers and sixteen groups of students exploring whether insight gained in studies about critical features can be shared by other teachers and used to improve the learning of other students. The study reveals that a characteristic of excellent teachers is knowledge of how to identify, represent and explain key concepts in mathematics. In other words, teachers need to know the content that they are expected to teach and that learners are expected to master (Ball et al., 2008). This means that it is possible for an experienced teacher to select an effective teaching strategy for teaching grade five mathematics using previously gained knowledge to explain all the content areas. Furthermore, a qualitative case study conducted by Kehdinga (2014b) concurs with Khoza (2014b) that the teacher uses his experience to construct and reconstruct his teaching strategies over time because meaningful teaching only builds upon previous knowledge. The responsibility lies with the experienced teachers, as managers of the class, to select the perfect teaching strategy for each moment.

According to Leendertz et al. (2013) a perfect teacher is able to incorporate knowledge of technology, mathematics, content and pedagogy, and knows in which teaching and learning situations ICT use is suitable. Currently, technology is in demand and teachers are required to take computer lessons to meet these demands, conversely technology can replace the role of the teacher. Hence, due to rapid changes, the teacher's professional identity cannot be considered fixed, but rather it is negotiated, open, confusing and shifting (Kehdinga, 2014b). Therefore, this

suggests that the teacher is compelled to learn different teaching strategies that involve technology. Furthermore, the role of a teacher in the instruction of problem solving is to create a teaching environment that is engaging and provide learners with an opportunity to explain multiple teaching strategies for solving mathematical problems (Machisi, 2013).

The teacher may also use a learner-centred approach by employing a group work teaching strategy by allowing groups to practice the magic finger technique (Suherman et al., 2011). This means that the teacher should allow learners to interact with one another in groups and practice calculations by using their fingers until they understand the finger counting technique. Encouraging group work in teaching will help shy learners to open up and learn at ease with their peers rather than with the teacher. On the other hand, Buddo (2013) indicates that the teacher uses the whole class teacher-centred strategy by means of an expository method as a norm by completing the examples on the chalkboard, while learners are required to duplicate. There are situations that allow the teacher to guide the lesson in progress, where the teacher has to explain the steps in order that need to be followed by using a chalkboard to writing up the corrections then learners copy them on their exercise books.

In addition, argues that the teacher accommodates individual differences in the mathematics classroom by engaging learners in a higher level of thinking through reasoning, communicating, making connections and a problem solving approach. This means that in the classroom environment learners are unique and the teacher should engage learners through different activities ranging from lower to the higher levels of thinking by means of reasoning, discussions, problem solving. This connecting teaching strategies for teaching Mathematics in grade 5 to accommodate all learners. It is further suggested that the teacher should combine both the learner-centred approach and the teacher-centred approach since the two depend on one another in teaching and learning. The teacher assesses learners by testing them on activities ranging from lower level to the higher level in order to provide balance and accommodate all learners. Furthermore, an Icooper project approach conducted by Crespo et al. (2010) proposed capturing the influence of teaching learning outcomes within Europe, reveals that the assessor assesses the assessee if he or she has attained the intended knowledge, skills and competence.

On the other hand, the mathematics document does not indicate the role of a teacher whereas it is as important as one of the concepts that are framed around the curricular components. In addition, the teaching strategies that are to be used by teachers during the implementation of grade 5 mathematics are not stated. This suggests that mathematics document considers the learners needs only and takes for granted the importance of the teacher's role and the teaching strategies for teaching grade 5 Mathematics. Furthermore, the mathematics document does not indicate that there are developmental programs that are in place to equip teachers with the knowledge and skills to teach learners with barriers. Moreover, mathematics CAPS indicates that to address the barriers, teachers should use various differentiation strategies that are included in the Department of Basic Education's guidelines for inclusive teaching and learning (DoE, 2011). This shows that the mathematics document is biased as it does not consider all learners as equal since it does not specify the teaching strategies for teaching learners who are not experiencing barriers to learning.

This is in contrast with the argument of Berkvens et al. (2014) that there is ongoing service training provided for teachers that are in line with the curriculum vision and the main goals and objectives, that are teaching grade 5 Mathematics. The mathematics document does not indicate that there are any in-service training programmes that are conducted for teachers to develop with relevant teaching strategies that are in line with the Mathematics curriculum the teacher's role. This suggests that teachers have insufficient content knowledge to implement the intended curriculum as Msibi and Mchunu (2013) argue that the large number of do not know their content knowledge. Therefore, this indicates that there will be no relevancy, consistency, practicability and sustainability if Mathematics is taught by teachers with insufficient content knowledge. In addition, teachers do apply teaching strategies that they think are relevant for teaching grade 5 Mathematics under the supervision of the school management team and the departmental officials, as the Minister of education states that Education and the curriculum have a significant role to play in realising these aims (DoE, 2011), but it does not specifying the relevant teaching strategies to achieve teaching activities.

This suggests that there is no practicality in the intended curriculum in the mathematics document, teachers are offered inadequate in-service training and the sustainability of the

curriculum cannot be guaranteed. However, the above studies show that there are limited studies conducted around convenience sampling and reflective activity. This implies that there is a need for studies to be conducted around convenience sampling the reflective activity in order to explore teaching strategies of teaching grade 5 mathematics. As a result, a teacher cannot perform his or her role without resources.

#### **2.5.1.7 With what and whom are they teaching? (Material and resource)**

A case study conducted by Khoza (2012), reveals that any person or thing that communicates teaching becomes a teaching and learning resource. Therefore, an interpretive case study conducted by Khoza (2015c), reveals that Technology in Education (TIE) and Technology of Education (TOE) are the main components of Educational Technology (ET) as one of the teaching resources. TIE is divided into hardware (HW) and software (SW) (Khoza, 2012). Hardware (HW) is any machine or tool used in teaching and learning, but in the context of the e-teaching environment HW is used to reach the internet or web e.g. desktop computers, laptops, cellular phones and others Khoza (2015b) to support teaching strategies employed in the teaching of grade 5 mathematics. Software is any material that is produced for the hardware to display information, for example transparencies, PowerPoint slides, worksheets and others (Khoza, 2012). TOE is also known as ideological ware (IW), is any teaching resource that one cannot see or touch (Khoza, 2012), for example learning theories, teaching philosophy, experiences, curriculum knowledge and others (Khoza, 2014b).

However, Berkvens et al. (2014) argue that there is no way of defining when teaching and learning materials are adequately considered useful. Hence, a study conducted by Long and Dunne (2014) indicates that teachers need to be encouraged to create their own resources that they consider useful that will fall within the context of the learner in the interest of professional development. There is also a need to combine effort by publishers and people working in mathematics education to contribute to a bank of project ideas that are appropriate in different contexts (Long & Dunne, 2014). A study conducted by Leendertz et al. (2013) indicate that Information Communication Technology has a positive effect in supporting interactive lessons and it offers teachers confidence when using a variety of teaching strategies that best achieve the outcomes of the curriculum. Therefore, technology is likely to become a central resource in most

schools (Wood & Ashfield, 2008). Drijvers, Doorman, Boon, Reed, and Gravemeijer (2010), argue that teachers who do not recognise the use of technology in their teaching as valuable for their educational goals are able to avoid it, unless they are forced to do use it by curriculum constraints. In addition, the study conducted by Khoza (2014b) argues that TIE promotes teacher-centred strategy in teaching. In support of this argument the study by Nkopodi and Mosimege (2009) indicates that in the teacher-centred approach, the teacher can use a video recorder to film the games in lessons, then replay and pause it so that games can be analysed. It also reveals that the learner-centred approach is utilised by engaging learners to construct games similar to chess and morabaraba on their own using their everyday knowledge. Moreover, an investigative study conducted by Lazakidou and Retalis (2010) on twenty four students about the effectiveness of a proposed computer-based instructional method in primary education for self-regulated problem-solving in Greece indicates that collaborative teaching strategies are required in order to create a framework for increasing their effectiveness.

A qualitative case study by Yee (2014) reveals that in some countries textbooks are produced officially or semi-officially while some leave it to the private publishers (Yee, 2014). A study conducted by Mercer and Sams (2008) revealed that teachers should create opportunities for working in pairs or groups to involve learners in interactions which are more symmetrical canons. A mixed method study conducted by Valli and Buese (2007) reveals that grouping of students is done according to the availability of the resource. Van den Akker et al. (2009), argue that as teachers become real team players, their activities become more unified, and they are capable of entering into difficult curricular conversations. They also state that teachers can use materials when working with groups of learners.

According to Berkvens et al. (2014) designing the most beautiful teaching experience is not a problem as most wonderful teaching experiences can be found on the internet, but if these experiences are not relevant to the type of teaching intended nor consistent with the desired vision, aims and objectives nor practical to use in the given setting, then teaching will not be effective. Despite the fact that technology is not yet that popular in many African schools, it is suggested that in the next few years the level of technology will be much higher and the internet will be used to improve teaching strategies for teaching grade 5 mathematics.

In supportive of the statement above, a study of Leendertz et al. (2013) state that teachers should to be competent with Technology Pedagogical Content Knowledge (TPACK) theory to contribute towards teaching mathematics effectively. Pedagogical knowledge refers to the proficiency of teachers in choosing appropriate methods of teaching particular content to learners. Pedagogical content knowledge becomes visible when teachers are capable of building up on learners' prior knowledge and accordingly adjust their teaching strategies to facilitate the new content. Moreover, they state that Technological knowledge is defined as ability and skills to use the diversity of technologies like books, chalk and chalkboard, as well as technologies such as computers, the internet and digital resources to teach the required content. In support of the above statements, a case study conducted by Khoza (2013a), reveals that the teaching and learning process has to shift for a good reason to be dominated by a combination of the three types of teaching and learning resources (HW, SW and IW).

An study investigating patterns conducted by Sherin and Drake (2009), reveals that it is believed that teachers and instruction can be changed as a result of using new materials which are in line with CAPS. The mathematics document does indicate some types of material that can be used during a particular lesson under clarification or teaching guidelines. For example, it specifies that counting should not only be thought of as verbal counting, rather learners should count using apparatus such as: “counters, number grids, pictures of objects, number names and number words, place values or flash cards and Dienes blocks” (DoE, 2011, pp. 124-126). There are also reading books and the Department workbooks (DBE) that are CAPS aligned, the problem with the DBE workbooks is that there is no teacher's guide, and there some mistakes concerning calculations. Schools are also compelled to order textbooks from the publishers recommended by the Department (DBE C S10 circular of 2014).The CAPS curriculum materials given to schools are relevant to the type of teaching intended, consistent with the expected vision aims and objectives and are practical to use in the given setting teaching (Berkvens et al., 2014). The welfare extended by the department in providing charts to schools is neglected and some do not last long.

This means that there are small chances of sustainability from the charts to some schools. Expensive materials can be given to schools, but it depends on the teacher whether or not to use them during teaching (Berkvens et al., 2014). However, there are few of the above studies that are conducted using reflective activity. This indicates that, there is a need for a case study to be conducted using reflective activity to help teachers to reflect on the resources they are using in order to develop an interest in using technology resources. Conversely, although resources play a vital role in teaching and learning, there is also a need to know when and where teachers are teaching.

#### **2.5.1.8 Where and when are they teaching? (Place and time)**

A study conducted by Garet, Porter, Desimone, Birman, and Yoon (2001), shows that location in this case is a place where teaching and learning occurs. According to Killen (2007) a teaching environment is much more than just the classroom in which the teacher presents a lesson, it is also made up of the school grounds, the library, and the immediate neighbourhood of the school. Garet et al. (2001), indicates that teachers should be allowed to try out new teaching strategies in the classroom and obtain feedback about their teaching.

Another study conducted by Ball et al. (2008), asserts that during a classroom discussion the teacher has to decide when to ask for more clarification, when to use a learner's remark to make a mathematical point and when to pose a new question or set a new task to further the teaching. Therefore, it is up to the teacher to decide whether he or she needs to teach inside or outside the classroom depending on the lesson at that particular time. Berkvens et al. (2014), indicate that teaching takes place anywhere inside or outside the school building, and the layout of the teaching environment appears to be more influential than assumed. In addition, they argue that at school and classroom levels nearly all concepts of the curricular spider web play a role, therefore the study explores whether teaching strategies for teaching grade five mathematics that are applied in the classroom consider all the concepts of the curriculum during the teaching. In addition, a study conducted by Kajander (2010), reveals that time is a challenge. Furthermore, a study conducted by Ball and Forzani (2009) reveals that the teacher decides how much time to use in each lesson. The study also reveals that because of the limited time during each lesson, the

teacher gives the struggling learners extra work while the rest of the class continues discussing other aspects of the problem.

This means that the teaching strategies implemented in the classroom are determined by the time factor. Valli and Buese (2007), argue that the school extended its time block from 60 minutes to 90 minutes, because teachers wanted to conduct 60 minutes of teaching the whole group followed by 30 minutes of differentiated instruction on the previously taught lesson. As a result, other teachers spend more time on the topics that they think are more important as well as on teaching strategies like whole-class discussion in order to save time. A study conducted by Westwood (2011) state that, in countries like Japan, Korea and Singapore most of the time in mathematics lessons is spent in problem solving and whole-class discussion strategies for problem solving. In the CAPS document six hours per week are allocated for teaching grade 5 Mathematics CAPS. The time is divided as follows: ten minutes for mental every day then time allocated to cover each given topic (DoE, 2011). In addition, each and every topic is allocated time to be taught per term. For example term 1:

“mental mathematics (8 hours);whole numbers (2 hours);number sentence (3 hours);whole numbers: addition and subtraction (5hours); numeric patterns (4hours); whole number multiplication (6 hours); time (6 hours); data handling (10 hours); properties of 2-D shapes (7hours); capacity/ volume (5 hours); revision (4 hours)” (DoE, 2011, p. 122).

According to Berkvens et al. (2014), teachers need time to understand how to use the materials and preparation time to ensure that the materials are relevant, consistent, practical and sustainable in the classroom. In addition, most teachers do not use their time well and as a result they feel that they do not have enough time for preparation (Berkvens et al., 2014). Moreover, the CAPS document does not include the teaching strategies to be used in the classroom nor details as to where Mathematics should be taught. This suggest that there is a need for studies which will help teachers to reflect on their teaching and revisit the location of mathematics since the mathematics document is less concerned about the location where Mathematics should be taught. However, teaching time and place will not serve a purpose if learners are not assessed.



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

According to Kennedy et al. (2006) assessment is defined in terms of formative assessment or summative assessment. They added that formative assessment is defined as being assessment for teaching, while summative assessment is defined as assessment of teaching. This means that learners should be assessed both during and after teaching. The study conducted by Yee (2014) agrees with the previous study that assessment was meant to be assessment of teaching; people started promoting assessment for teaching, in past years a term assessment as teaching was discovered. These terms may sound different all in all they have the same purpose, they all emphasise that assessment should be rooted in teaching, as well as on teaching strategies and provide opportunities for informative feedback to both teachers and learners (Suurtamm, Koch, & Arden, 2010). In fact assessment is primary used to give feedback to teachers as well as learners on their teaching and learning and to check their progress (Boud & Falchikov, 2006). A survey study conducted by Buddo (2013) reveals that the core purpose of assessment is to explain what the learners know and what they can do and to offer feedback to learners on their areas of strength and weaknesses. Therefore, it is necessary to use various teaching strategies of teaching grade 5 Mathematics to monitor the teaching progress. Teachers should also be professional enough and assess their own teaching to get feedback on their areas of strength and weaknesses to improve teaching. A case study conducted by Ross and Bruce (2007) indicates that the provision of a self-assessment tool base on well-defined teaching standards strengthen in service session that offer chances for teachers to observe one another and discuss about classroom efforts to be made to improve teaching.

In this study we look at both the formal assessment which is termed Assessment of Learning and informal assessment which is termed as Assessment for Learning. Assessment of Learning will include only the tasks which are formally assessed as per the formal learning program, while Assessment for Learning is done on a day to day routine where the teacher inspects the progress of learners based on his or her teaching strategy and on how learners show progression in content. Further to this, self-assessment will assist teachers to reflect on teaching strategies of teaching grade 5 Mathematics as well as various methods of assessment they are using. It is necessary to use a variety of assessment like day to day observations, demonstrations, and conversations, to balance the teaching. While using these different methods of assessments, a

qualitative study conducted by Khoza (2013b) caution that teachers should always align aims, objectives, intended learning outcomes, teaching methods, teaching activities, and assessment strategies in order to do justice to teaching.

However, the study conducted by Long and Dunne (2014) reveals that in a process approach the assessment drew on interviews and observation to identify action and processes rather than the repetition of written tests. It further indicates that the topic approach inspired the design of mathematics document DoE (2011) and its operation, where teachers are to follow the curriculum and teach the topic on a weekly basis in the order prescribed; some proficiency in mathematics will be attained, especially when one is assessed by Annual National Assessment (ANA). A study conducted by Kanjee and Sayed (2013), reveals that the action plan 2014 recommends the use of ANA as a key mechanism to enhance quality through assessment, monitoring and supervision. In order to prepare for teaching ANA, teachers need to design teaching strategies for teaching grade 5 mathematics in order to improve critical thinking dispositions in assessing learners (Kloppers & Grosser, 2014). On the other hand, there is a danger of ignoring other concepts while focusing on only one aspect of the curricular spider web and that is Assessment. South African education should focus on all the concepts that are framed around the curricular spider web in order to sustain the quality of education.

Kennedy et al. (2006), assert that in theory, continuous assessment combines summative and formative assessment. They further state that in practice, continuous assessment often amounts to repeat summative assessments with marks being recorded but little or no specific feedback being given to learners. According to the Mathematics CAPS document DoE (2011) assessment is a continuous planned procedure for identifying, gathering and interpreting information regarding the performance of learners, using several forms of assessment. The Mathematics document indicates that the following types of assessment are very valuable in mathematics and teachers are encouraged to utilise these types of assessment to serve the purpose associated with each, namely: baseline assessment, diagnostic assessment, formative assessment and summative assessment (DoE, 2011).

According to the mathematics document DoE (2011) formative assessment is defined as assessment for teaching and is used to assist the teaching and learning processes. It can be used in different teaching strategies at any time during a mathematics lesson, for example, short class work sessions including verbal questioning during the lesson or at the end of a lesson (DoE, 2011). Summative assessment is carried out at the end of a mathematics topic or a cluster of related topics; it is therefore an assessment of teaching, as it mainly focuses on the product of teaching (DoE, 2011).

CAPS document DoE (2011) notes that assessment is an intentional process of identifying, gathering and interpreting information regarding the performance of learners, using several forms of assessment. Mathematics document it requires teachers to use assessment strategies that are performance-based. The formative assessment is based on a teacher-centred approach and informal assessments are not recorded, but they prepare learners for formal assessment. The teacher uses short class work strategy during and at the end of a lesson and lets learners give verbal answers during the lesson (DoE, 2011). Summative assessment favours a teacher-centred approach. The teacher assesses the teaching by using the intended forms of assessment. These forms of assessment are tests, examinations, assignments, investigations and projects that are assessed (DoE, 2011). Kloppers and Grosser (2014), argue that assessment rubrics and checklists should be improved to informally assess learners' thinking dispositions.

In addition, the Mathematics documents DoE (2011) summative assessment is also known as formal assessment, which contains School-Based Assessment (SBS). Formal assessment contains the individualised assessment strategies with questions that are carefully spread to cater for the different cognitive levels of learners (DoE, 2011). Informal assessments are linked to daily assessments that are conducted through observations, discussions, learner-centred discussions and informal discussions of teaching strategies in grade 5 (Kanjee & Sayed, 2013). The assessment on Mathematics CAPS document DoE (2011) shows relevance as it indicates. As indicated by Berkvens et al. (2014) standards and tests are based on contemporary insight into the evaluation of teaching and that formative assessment is applied in order to improve teaching. Furthermore, Kennedy et al. (2006) argue that it is not easy to develop links between learning outcomes, teaching strategies, teaching activities and assessment tasks. The mathematics

document DoE (2011) indicates that assessment tasks should be designed to cover the content of the subject and to achieve the broad aims of the subject. In addition, the CAPS document also states that the following cognitive levels need to be followed by teachers when learners are assessed in each term, namely: “knowledge (25%), routine procedures (45%), complex procedures (20%) and problem solving (10%)” (DoE, 2011, p. 294). Similarly, Kennedy et al. (2006) agree with CAPS by stating that when teaching and assessing learners a teacher should bear in mind that learning is a process and that the teacher should try to get the thought processes of the learners in order to move up into the higher ordered stages of synthesis and evaluation. In addition, Van den Akker et al. (2009) state that in evidence-based strategy schools and teachers formulate clear goals and systematically work towards achieving these goals by making use of specific assessment information.

However, the issue of teachers struggling to effectively use assessment for improving teaching in the classroom needs to be effectively addressed if the key goal of improving quality of education for all learners is to be achieved (Kanjee & Sayed, 2013). Therefore, assessment development programs are required to equip teachers with assessment strategies with an aim of achieving teaching goals and improving the quality of education. The mathematics document DoE (2011) shows consistence because the examinations and tests for teaching are geared towards the curriculum’s broad aims (DoE, 2011). In the mathematics document the curriculum does not note that standards and tests are unequivocal and contextualised to the real life of learners as indicated by Berkvens et al. (2014), nevertheless since CAPS is a performance curriculum its focus is on school knowledge (Hoadley & Jansen, 2012).

## **2.6 Debates on Conceptual framework**

A theoretical article conducted by Burnard and Bhamra (2011) to explore and develop a comprehensive understanding of the dynamics of organisation resilience, reveals that conceptual framework can be used to offer an understanding of the underlying dynamics of a concept, through this the developed conceptual framework will form the basis for upcoming research activities. Furthermore, van den Akker et al. (2010), argue that when the teacher has to keep in mind operational curriculum in the classroom level, then all the ten elements have to be logically addressed to expect successful implementation and continuation. This study is framed around the

ten concepts when exploring teaching strategies used by teachers in teaching Mathematics in grade 5. In addition, a randomly chosen study conducted by Berkvens et al. (2012) indicates that a weak conceptual framework is the basis of poor mutual understanding of processes.

This study is framed around the strong conceptual framework of ten concepts of curricular spider web at the base of understanding processes (van den Akker et al., 2010). The study intends to explore the teaching strategies in teaching Mathematics in grade 5 surrounded by the ten elements of curricular spider web: rationale, aims and objectives, learning outcomes. As revealed by Khoza (2013a) that content, teaching activities, teacher role, material and resources, grouping, location, time and assessment are framed around the curricular spider web (Van den Akker et al., 2009). Further to this, Berkvens et al. (2014) introduced a new concept in 2014 referred to as accessibility. This suggest that the in order for the teaching strategies that are used by teachers for teaching mathematics in grade 5 to be successive, curriculum seek relevance, consistency, practicability and sustainability around ten components of curricular spider web (van den Akker et al., 2010). In conclusion relevancy, consistency, practicability and sustainability are the four criteria involved around the curricular spider's web and each criterion could be applied to each component of the spider web in the middle or to the web as a whole (Berkvens et al., 2014).

## **2.7 Conclusion**

The literature review has indicated that the curriculum is constantly changing internationally. Every curriculum is transformed according to the needs of that particular country. As the curriculum changes, there is a strong demand to also shift the teaching strategies to those that are aligned with the current curriculum. Therefore, there is a need for a study that will explore teaching strategies that are used in the mathematics curriculum. The literature study indicated that it is important to explore teaching strategies for teaching mathematics making use of learning signals. The literature review has revealed that there are four criteria that evolve around the issues of the curricular spider web. The next chapter will focus on the methodology.

## CHAPTER THREE

### RESEARCH DESIGN AND METHODOLOGY

#### 3.1 Introduction

This chapter introduces the research methodology and research design adopted in the study. The focus of the study is to explore teaching strategies for teaching mathematics in grade 5, in the KwaNdengezi circuit. A research design defines the processes for conducting the study, including when, from whom and under what conditions the data will be obtained (McMillan & Schumacher, 2010). The research design according to Wahyuni (2012) becomes significant to connect a methodology and a suitable set of research methods in order to address research questions and/or hypotheses that are established to examine social phenomena. Therefore, this research intends to achieve the following objectives:

- To identify teaching strategies for teaching grade 5 mathematics in the KwaNdengezi circuit.
- To understand how teachers use teaching strategies in teaching grade 5 mathematics in KwaNdengezi.
- To understand the reason why grade 5 teachers use teaching strategies in a particular way when teaching Mathematics in the KwaNdengezi circuit.

This study will also address the following questions:

- What are teaching strategies used by grade 5 mathematics teachers in the KwaNdengezi circuit?
- How do grade 5 teachers use teaching strategies in teaching mathematics in the KwaNdengezi circuit?
- Why do grade 5 teachers use teaching strategies in a particular way when teaching mathematics?

The research described in this study used qualitative design research and the interpretive paradigm to explore teaching strategies for teaching grade 5 mathematics in the KwaNdengezi circuit. The curricular spider web concepts were used in the form of questions as a conceptual framework to evaluate the relevance, consistency, practicality and sustainability in exploring teaching strategies for teaching grade 5 mathematics (Berkvens et al., 2012). The data generated contains generation methods, reflective activity, one-on-one interviews, semi-structured interviews and focus group discussion, data generation, trustworthiness/authenticity, data analysis, ethical issues and study limitation.

### **3.2 Research Paradigm**

Christiansen, Bertram, and Land (2010), state that a research paradigm represents a particular worldview that defines, for researchers who carry this view a particular worldview that defines what is acceptable to research and how. This study used the interpretive paradigm. The interpretive research paradigm seeks to understand the values, beliefs, and meanings of social phenomena, thereby obtaining a deep and sympathetic understanding of human activities and experiences (Tuli, 2011). The purpose of the study was to explore teaching strategies for teaching mathematics in grade 5. Therefore, this paradigm is not suitable for generalisation, but it is suitable for the result of this study because this study is not about generalising, but rather it is about understanding the phenomenon by generating the in-depth description of what is happening. Wahyuni (2012), states that to understand a social world from the experiences and subjective meanings that individuals attach to it, interpretive researchers favour working together and dialogues with the study's participants.

The study allowed the participants to tell their story about their teaching strategies that provide meaning to their teaching practice. Teaching strategies used will also provide the context in which to understand issues surrounding the teaching of Mathematics in grade 5. The purpose of working within the interpretive paradigm is to advance a greater understanding of how individuals make sense of environments in which they live and work. On the other hand, one of the limitations of the interpretative paradigm is that it is not suitable for generalisation. Thus, this study is not about generalisation, but it is about understanding and generating the in depth description of the teaching strategies used by teachers in teaching grade 5 Mathematics (Wahyuni, 2012). Furthermore, Tuli (2011) states that any research has a framework that contains beliefs about the nature of reality and humanity, the theory of knowledge that informs the research and that this knowledge maybe obtained. This study adopted the conceptual framework that is framed around the ten concepts of the curricular spider web. In addition Berkvens et al. (2012) state that feeble conceptual frameworks are of poor understanding. The following conceptual framework study is based on a strong conceptual framework, which provides clear understanding of the research.

### **3.3 Conceptual frameworks**

The conceptual framework of this study was framed around the ten concepts of the curricular spider web according to Van den Akker et al. (2009) and called learning signals by (Khoza, 2015c) The ten concepts are: reasons for teaching mathematics; aims, objectives and learning outcomes they are teaching; content and learning outcomes they are teaching; the teacher's role; resources used in teaching; accessibility in teaching; location of teaching; time of teaching; assessment of teaching with the purpose of improving the teaching strategies of the intended curriculum. In generating the data the reflective activity also took into consideration the one-on-one interview, focused group discussion and the curricular spider web. The research methodology of this study is a case study. A case is the three primary schools located at KwaNdengezi circuit.

### **3.4 Research Approach**

McMillan and Schumacher (2010), define the case study of individuals bound in time and place. According to Creswell (2013) a case study is a design of examination found in many fields, especially evaluation in which the researcher develops an in-depth analysis of a case which is often a program, event, activity or one or more individuals. I used the case study to investigate teaching strategies for teaching grade 5 mathematics in three primary schools to develop an in-depth analysis in KwaNdengezi circuit. Gray (2013), argues that if a case study is carefully planned it can provide a powerful means of exploring situations where there is uncertainty or ambiguity about phenomena or events. The case study was carefully planned to provide influential teaching strategies for teaching grade 5 mathematics where there is uncertainty in the implementation of the current South African curriculum. According to Chaboyer, McMurray, and Wallis (2010), case study research asks question of what, how and why in a non-controlled environment to analyse existing, real situations with all their difficulties. The purpose of this study was to understand how and why grade 5 mathematics teachers implement teaching strategies in a particular way. Even though its results cannot be generalised, a case is a study that studies a bound system or a case over time in depth, using multiple sources of data found in the setting (McMillan & Schumacher, 2010). However, this study is not intended to generalise. According to Hakim (2000) a qualitative approach is used for exploratory studies leading to more structured studies; he added that qualitative researcher is rooted in empiricism, that is, the



philosophical tradition that suggests that knowledge is obtained by direct experience through the physical senses. The case study is suitable for my study because it provides an opportunity to explore how grade 5 teachers use teaching strategies in teaching mathematics in the KwaNdengezi circuit. According to Ritchie, Lewis, Nicholls, and Ormston (2013) qualitative research has reflected this in the use of methods, which attempts to provide a holistic understanding of participants' views and actions in the context of their overall lives. The study is based on a qualitative design because it offers opportunities for discussions, observations and listening as teachers reflect on their everyday teaching strategies.

The case study data is based strongly in reality because the reader relates to it and the case study provides accurate results (Cohen, Manion, & Morrison, 2011). The strength of case studies lie in their attention to the refinement and complexity of the case in its own right. The case study perceives the situation through the eyes of participants, though this is not always the case. Certainly one of the strengths of case studies is that they observe effects in real situations, recognising that context is a powerful determinant of both causes and effects, and that in depth understanding is required to do justice to the case (Cohen et al., 2011). The best case studies are capable of offering some support to alternative interpretations. While case studies are useful there are, however, limitations that the researcher is expecting in that the findings cannot be generalised to other cases, that there are no relative dimensions within the study and that the bias of the researcher might influence the results. The aim of the study is not to generalise, but rather to generate rich information. Furthermore, I do not intend to make comparisons in this study and I did not interfere during the research.

### **3.4.1 Sampling**

Sampling involves making decisions about which particular individuals, settings, events or behaviours to observe (Cohen et al., 2011). Precisely what will be studied in a particular study depends on the unit of analysis. The sample is decided by the researcher bearing in mind the data generation methods and the styles of the study. Mcmillan and Schumacher (2010), state that the researcher then seeks out information: rich key informants; groups; places; or events to study. These factors often prevent researchers from using the entire sampling and involves making decisions about which individuals, settings, events or behaviours to observe (Cohen et al., 2011).

### 3.4.2 Purposive sampling

In purposive sampling the researcher chooses particular elements from the population that will provide enlightenment about the topic of interest (Mcmillan & Schumacher, 2010). The study followed purposive sampling whereby four grade 5 teachers who are teaching mathematics from three schools in the KwaNdengezi circuit participated in the study. I selected four teachers who are currently teaching mathematics in grade five. The four selected teachers revealed their teaching experiences and their professional qualifications during the process of purposive sampling. I selected these teachers due to their teaching experiences and their professional qualifications and that their participation is trusted to provide the best information about the teaching strategies they are using in their teaching practice. Therefore, the data was obtained from a smaller group of four teachers in such a way that knowledge gained is representative of the whole group (Cohen et al., 2011). The purposive sampling cost less and it saves time. In addition, the table below represents a purposive sample of four teachers from different schools. Their names are represented by alphabets A-D and their schools are represented by numbers 1-3 next to each participant. The table 3.1 below shows the profile of the participants that were used for generating the data of this study.

Participants	Years in Experience	Subject	Grade	Qualification	Gender	Race
Participant A1	27 years	Mathematics	4-5	M+4	Female	African
Participant B1	20 years	Mathematics	5-6	M+4	Male	African
Participant C2	14 years	Mathematics	5	M+4	Female	African
Participant D3	28 years	Mathematics	5	M+4	Female	African

**Table 3.1 the participants' profiles**

However, Mcmillan and Schumacher (2010), argue that one of the weaknesses of purposive sampling is that the results depend upon unique characteristics of the sample. In dealing with this issue I used multiple methods to generate the data for the research. In conclusion, purposive sampling and convenience sampling are methods used in educational research.

### 3.4.3 Convenience sampling

Purposive sampling is supported by convenience sampling to select the most accessible four grade 5 mathematics teachers in KwaNdengezi primary schools. According to Farrokhi and Mahmoudi-Hamidabad (2012) the group chosen by convenience sampling is favourable to self-

selection, administrative decision time of the class, or the number of years of exposure. The study used mathematics teachers who have adequate qualifications; a minimum of three years teaching mathematics in grade 5 was a pre-requisite and that assisted with providing the varied responses. The purpose of the study was to explore teachers' strategies for teaching grade 5 Mathematics in the KwaNdengezi circuit. To understand how teachers use teaching strategies for teaching grade 5 mathematics in the KwaNdengezi and to understand the reason that grade 5 teachers use teaching strategies in a particular manner in teaching mathematics in the KwaNdengezi circuit. I chose schools and teachers who are easily accessible and available.

According to Mcmillan and Schumacher (2010) in convenience sampling a group of subjects is selected on the basis of being accessible. I selected the group of four teachers who are teaching grade 5 mathematics because they were easily accessible and also met the requirements of the research. This type of sampling is far less difficult to set up and it is less expensive (Cohen et al., 2011). In addition, the study used convenience sampling because it was easy to access the participants in a familiar school setting and it was inexpensive. The distance between the two schools was not too far which became easier for me to travel from one school to another. I used convenience sampling techniques to record the responses of four grade 5 mathematics teachers whom were accessed quite easily and conveniently (Danish & Usman, 2010). On the other hand the drawbacks in convenience sampling, is that it is less representative of an identified population (Mcmillan & Schumacher, 2010). As a result the purpose of the study was not focused on an identified population, rather it was about obtaining a better understanding of any similarities and differences that may exist between the teaching strategies used by teachers who are teaching grade 5 Mathematics in KwaNdengezi circuit.

### **3.5 Data generation method**

The data generated in this study was in the form of primary data (Wahyuni, 2012). This study used primary data to explore teaching strategies for teaching grade 5 mathematics. Cohen et al. (2011), state that a case study uses a range of methods for data gathering depending on the case studied and the purpose. The qualitative researcher is capable of using different techniques for gathering information such as field notes, participant observation, journal notes, interviews, life history, documents, audio recording and video recording (Cohen et al., 2011). This case study

used three data generation techniques which include reflective activity, one-on-one semi-structured interviews and semi-structured group discussions. An interview is described as a distinctive research technique that is used as the main means of generating information having a direct focus on the research objectives (Cohen et al., 2011). The next paragraph discusses the three techniques that were used for generating the data of the study.

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

Ovens and Tinning (2009), define reflection as a tool that can be applied in different ways across a range of contexts in order to unpack teachers' own experiences, beliefs, knowledge and philosophies and to help them understand how these shape their identities and actions. A reflection activity was conducted with all the participants reflecting on teachers' strategies before the interviews and discussions. In this study the teacher reflection activity was conducted with all the participants in the form of a short questionnaire influenced by the ten strands of the curricular spider web, reflecting on their teaching strategies for teaching grade 5 Mathematics. In this study teachers reflected on and wrote about their teaching strategies for teaching grade five Mathematics. The account of participants and their willingness to engage in the study where they reflect on their teaching practice indicates that these teachers have a commitment to improving their teaching (Gordon & Nicholas, 2010). I clarified everything about the reflective activity to the participants before they answered. They were given enough time to read it thoroughly and then return it in three weeks' time. In this study four grade 5 mathematics teachers had an opportunity to reflect on their teaching strategies by writing them down following the ten concepts of the curricular spider web which forms the conceptual framework of the study.

This reflection allowed mathematics teachers to describe their teaching strategies in their own time without the pressure of my presence. Through reflective activity teachers were able to involve themselves in introspection and also recorded their teaching strategies of teaching grade 5 mathematics to inform their future practice (Khoza, 2015a). It seems that teachers benefit from such studies that assist them in becoming more skilful in examining and reflecting on their teaching strategies (Silver et al., 2009). It is very important for teachers to reflect on their teaching strategies for teaching grade 5 Mathematics in order that they check whether they are still aligned with current curriculum demands. This reflection activity was conducted on four

mathematics teachers reflecting on their teaching strategies before the interviews commenced. The reflective activity was done in the form of questions which were completed following the ten strands of the curricular spider web that saw the teachers reflecting, in their own time, on their teaching strategies for teaching grade 5 Mathematics. The reflective activity was used in order to give the participants free space to reflect on their teaching practice without being observed (Khoza, 2015b). Teachers were supposed to use their conscious mind in teaching in order to be aware of the teaching strategies they apply in teaching practice (Khoza, 2015b). During the one-on-one semi-structured interviews and focused group discussions I used the same questions that I used in the reflective activity following their response from it. I designed the reflective activity as shown in table 3.2 below, with concepts, questions and expected responses from the participants. The table below was given to the participants to use for the reflective activity based on their teaching strategies.

<b>Concepts</b>	<b>Questions</b>	<b>Teachers are expected to reflect as Follows:</b>
Rationale	Why are you teaching Mathematics CAPS?	Personal rationale (pedagogical), Societal/social rationale, and Content knowledge rationale.
Accessibility	With who/whom are you teaching Mathematics CAPS?	Physical access Financial access Cultural access
Goals	Towards which goals are you teaching Mathematics CAPS?	Aims Objectives Outcomes
Content	What content are you teaching in Mathematics CAPS?	Number operations and Relationships Patterns, Functions and Algebra Space and shapes Measurements Data handling

Teaching activities	Which activities are you using to teach Mathematics CAPS?	Informal assessment task Formal assessment task Continuous activities
Teaching role	How do you facilitate your teaching?	teacher-centred (instructor) learner-centred (facilitator) content-centred approach (assessor)
Material and Resources	With what are you teaching Mathematics CAPS?	Hard-ware Soft-ware Ideological-ware
Location	Where are you teaching Mathematics CAPS?	Teaching space/venue
Time	When are you teaching Mathematics CAPS?	Time allocated Weekly Days Hours
Assessment	How do you assess your teaching of Mathematics CAPS?	Assessment of learning Assessment for learning Assessment as learning

Table 3.2: study's concepts, questions and expected responses.

Using reflection activity framed around the ten concepts of the curricular spider web it was hoped that critical thinking around teaching practice was promoted as a result of applying the conscious mind. The reflection activity covered the following questions:

1. Why are they teaching (rationale) Mathematics? In this question the teachers' reasons were supposed to be based around the three prepositions (personal, social and content knowledge). In personal reasons they were expected to express their passion for teaching mathematics. Social involvement was supposed to be shown in their teaching practice. In content knowledge, the school knowledge based on teaching practice was expected to be shown.
2. Who are they teaching (accessibility)? Accessibility involves the physical, financial and cultural therefore teachers were supposed to state how they physically accessed the school and whether

or not the school is easily accessible, how much they spend to access the school, and how they are affected in terms of beliefs, religion, language and traditions.

3. What are goals towards which they are teaching Mathematics? In this question teachers were expected to reflect on the long term aims which promote the curriculum knowledge in local contexts (DoE, 2011), in their teaching, teachers were also expected to reflect on the objectives for the teaching and learning of mathematics objectives (DoE, 2011) and to reflect on the learning outcomes, where they indicate the understanding of observable and measurable learning outcomes that are to be achieved by learners (Khoza, 2014b).
4. What content are they teaching in Mathematics? Here teachers were expected to focus on what content areas they were teaching as indicated in the mathematics document.
5. What activities are they teaching in mathematics? In this question teachers were supposed to position their reflections into teacher-centred activities, content-centred activities and learner-centred activities. For example explanatory, demonstration, classwork and homework, discussions, group work and individual work.
6. How do they perceive their role as a teacher? As instructors (teacher-centred approach), facilitators (learner-centred approach) or assessors (content-centred approach)? Teachers as instructors, in most cases, dominate during the teaching and learning while learners follow the instructions; during the facilitating process teachers facilitate the teaching and learning, while learners are busy discovering the knowledge themselves. As assessors, teachers assess the content areas that are taught according to the Mathematics document in the form of informal and formal assessment during teaching and learning.
7. What materials and resources do they use during teaching and learning? In this question teachers' responses were expected to be based on their resources and materials around hardware, software and ideological-ware. Hardware resources are any machines they used in schools for teaching practice, software resources are any materials used with hardware to show the information and ideological-ware is anything that we cannot see and touch in education which includes teaching strategies (Khoza, 2013b).

8. Where and when are teachers teaching Mathematics? Here teachers were expected to reflect on places where they teach Mathematics, for example, outside and inside the classroom, and to name places like school grounds, at home and in the shops. They were also expected to reflect on the time they are allocated by and note that they do weekly planning, then divide topics into subtopics fitting it in according to the days allocated by the current mathematics curriculum and then do lesson plans for a certain time.
9. How do they as teachers assess mathematics? In this question teachers were expected to reflect on how they assess their teaching of mathematics. They were expected to position their assessment into the assessment for learning, assessment of learning and assessment as learning. In assessment for learning they were expected to note that they assess informally by means of class work, oral assessment and group discussions where they prepare learners for formal assessment. In assessment of learning they were expected to indicate that they assess by means of projects, tests, assignments, investigations and examinations which determine the progress of learners. For assessment as learning they were expected to indicate that they do peer assessment to get feedback about their strengths and weaknesses in order to improve the quality of their teaching.

It cannot be expected that teachers know what it means to reflect on their teaching strategies since not all of them are used to reflecting on their teaching (Stecker, 2008). As a result the participants were not sure of what to write on their reflective activity. Almost all teachers kept repeating: “I do not know whether this is the kind of information you needed”. For this, most teachers provided limited information when responding to the reflective activity without critically thinking about their previous experience in terms of how they were trained during their training practice. That is are they still using the same teaching strategies as when they were trained? The aim of using reflective activity was to assist teachers in the development and implementation of the improved teaching strategies through reflection on their teaching strategies for teaching grade 5 Mathematics. The reflective activity was collected from the participants a week before the interviews then we set the dates for the one-on-one interviews. One week before the interviews enough time for me to examine the participants’ reflective



activities. However, one of the drawbacks of reflective activity is that participants might not have answered the questions sincerely (Rivera-Pelayo, Zacharias, Müller, & Braun, 2012). In addressing that issue I continued to refer to each participant's reflective activity during the one-on-one interviews in order to check whether what the participant was saying in the interview correlated with what was written on the reflective activity.

### **3.5.2 One-on-one semi-structured interviews**

The purpose of these one-on-one semi-structured interviews was to gain access into the participants' minds and encourages them to describe their teaching strategies that shape their teaching practice toward mathematics (Aruwa, 2011). The one-on-one (individual) semi-structured interview process followed the sequence and the wording of the questions (Cohen et al., 2011), that were framed around the ten concepts of the curricular spider web. The four teachers each chose the place and time for the interviews. The interviews were conducted in a quiet place and the teachers were recorded as agreed. As Wahyuni (2012), states that with the participant's authorisation each interview should be recorded. The reflective activity was used to compare the response of each teacher to cross check the consistency whether what was said in the interview was the same as what was written on the reflective activity. The participants were allowed freedom to use the language they are comfortable with to respond to the questions. As stated by Mcmillan and Schumacher (2010), that the use of in-depth interviews will help understand the situation in which mathematics teachers operate, therefore understanding their teaching strategies. The interviews were conducted in a less structured manner to allow the participants to relax and give information freely.

The one-on-one (individual) semi-structured interview took 1 hour per participant. I used the interviews because I wanted to ask the questions that were not covered in the first interviews. During one-on-one semi-structured interview, each participant told a story about the teaching strategies he or she uses following the strands of the curricular spider web. On the second round of one-on-one semi-structured interviews, each participant retold his or her story about teaching strategies covering the ten concepts of the curricular spider web. The only questions that were asked were those questions of the ten concepts that were not being covered during the story telling. Participants were allowed to independently use isiZulu and English whenever they chose

so that they were comfortable to respond to the questions. The same questions that were used on the reflective activity were posed during the one-on-one (individual) semi-structured interviews in order to avoid being judgmental. The one-on-one semi-structured interviews assisted me in facilitating the interviewees to share their perceptions, stories and experiences regarding the teaching strategies they are using in teaching grade 5 Mathematics (Wahyuni, 2012). During individual semi-structured interview, the participants shared their experiences through storytelling and answering the probing questions concerning the teaching strategies of teaching grade 5 mathematics and why they are teaching in that particular manner during the interview process. The one-on-one semi-structure interview questions were based on the participants' experience, opinion, values and background (Mcmillan & Schumacher, 2010). These interviews assisted in the research by producing the in-depth knowledge and the first-hand knowledge concerning the teaching strategies that are used in teaching grade 5 mathematics.

- In attaining the first-hand information the interview questions were enlisted from the conceptual framework which followed the ten components of the curricular spider web, where I, the researcher, ensured that every participant covered concepts containing the ten components of the curricular spider web. The questions were as follows: Why are you teaching mathematics? Who are you teaching mathematics? Towards which goals are you teaching mathematics? What content are you teaching? What activities are you teaching? How do you perceive your role as a mathematics teacher? What materials and resources do you use and how do group these resources? Where do you teach mathematics? When do you teach mathematics? How do you assess mathematics? The participants were asked to define the teaching strategies that they are using for teaching grade 5 mathematics and why they are teaching in that particular manner in each of the above questions. I also requested that each participant explain how they use teaching strategies they have mentioned in that particular way in each of the concepts of the curricular spider web. Most of the participants did not see the reason for the interview and they said that I must obtain the information from the reflective activity. I explained to the participants that reflective activity goes hand-in-hand with interviews. Throughout the interview process I tried to establish and maintain good relationships with the participants by being clear, polite, friendly and personable and I also conducted the interview process considerately and professionally (Cohen et al., 2011). The participants were assured that they should feel at ease because the

interaction between them and the interviewer will benefit both the researcher and the participants and that there are no wrong or right answers. The interview questions were designed in such a way that answers such as yes or no were avoided. Questions were asked in such a way that there was no room for suggestions, so that the participants provided responses that reflect their genuine experience (Aruwa, 2011). Furthermore, the probes were used not only to maintain smooth conversations but also to clarify some conversation points by asking for more details or examples related to what had been said (Wahyuni, 2012). This assisted me in making sure that the responses from four participants are fair.

In addition, Aruwa (2011) argues that the researcher must try to speak in a tone that does not show a position of being superior to the participant. During the interviews I tried to be at the same level as the participant so that they felt at ease at and thus enabled them to give in-depth information. According to Cohen et al. (2011), the interviewer needs to establish an appropriate atmosphere so that interviewees can feel secure to talk freely. Participants were permitted to speak freely on the question that had been asked without any disruption. The participants were also allowed to ask for clarity if they did not understand a question. During the interview process the participants were given a chance to speak more while I listened attentively. The one-on-one semi-structured interviews respected how the participants framed and structured their responses accommodating flexibility according to what emerges. As Cohen et al. (2011), argue that the research is reactive to participants' own frame of references and replies.

All the conversations were recorded to ensure that the data analysis was based on accurate recorded transcript, which also allowed the researcher to interact with the participants during the interview process. In conducting the interview I was sufficiently knowledgeable about the subject matter and that is why I conducted the interviews in an informed manner so that the interviewee did not feel threatened by the shortage of knowledge and so there was a need to address the reasoning aspect of the interview (Cohen et al., 2011). Nevertheless, one of the constraints of one-on-one semi-structured interviews is that the huge amount of data generated maybe lost while I was listening and taking notes during the interviews. In addressing that problem I used a voice recorder and made transcripts to prevent the potential for massive data loss, distortion and the reduction of complications (Cohen et al., 2011).

### **3.5.3 Semi-structured focused group discussion (interviews)**

A semi-structured focus group discussion was used with the mathematics teachers to gain a mutual understanding of the teaching strategies they use in teaching grade 5 Mathematics. A variation of an interview was the focused group interviews that was used to obtain a better understanding of teaching strategies that are used in teaching mathematics. The teaching strategies that were discussed by mathematics teachers were framed around the concepts of the curricular spider web. The semi-structured focus group discussions (interviews) were conducted with four grade 5 mathematics teachers. It took place in a classroom in one of the primary schools chosen by the participants after school hours.

During the focus group participants told a story about their teaching practice and the teaching strategies they use and the reasons why they use that particular method. Focus group discussions were used to attain a better understanding of teaching strategies used by teachers in teaching Mathematics (Mcmillan & Schumacher, 2010). In the focused group discussions the participants interact with each other, rather than with the interviewer, sharing ideas cornering their teaching experience (Cohen et al., 2011). Therefore, the focus group discussions were dominated by the participants sharing ideas concerning the mathematics curriculum and the teaching strategies they employ in their teaching practice. I only came in through probing questions and open-ended questions to gain more information. As Cohen et al. (2011), state that the participants' agenda should predominate during focus group discussions rather than the researcher. Furthermore, Cohen et al. (2011) suggest that focus groups need adept facilitation and management on the side of the researcher. The focus group interviews were managed to ensure that all the participants received an opportunity to share their ideas. During the focus group discussions the quality and richness of data was increased through a more efficient strategy than one-on-one interviewing by creating a social environment where participants were encouraged by one another's cognitions and ideas (Mcmillan & Schumacher, 2010).

The study used four mathematics teachers to generate quality and rich information where they were stimulated to share their views and experiences about the teaching strategies they are using to implement Mathematics. A higher quality of information was gained here than in the one-on-

one interviews. In addition, this method therefore offers information that different to that obtained from reflective activities and one-on-one interviews because the data represents the group. Cohen et al. (2011), believe that focus group interviews operate more effectively if they are composed of relative strangers, like in this study the participants were only connected to the purpose of the teaching strategies they use in teaching mathematics. As a result, this method was successful. The data generated provides a common understanding of teaching strategies used by teachers in teaching Mathematics.

In addition, the teaching strategies were framed around the ten concepts of the curricular spider web. The questions were as follows: Why are you teaching mathematics? Who are you teaching mathematics? Towards which goals are you teaching mathematics? What content are you teaching? Which activities are you teaching? How do you perceive your role as a mathematics teacher? What materials and resources do you use and how do you group these resources? Where do you teach mathematics? When do you teach mathematics? How do you assess mathematics? In each question the participants had to indicate the teaching strategies they are using as related to each concept of the curricular spider web, why they are teaching in that particular manner and also to explain how they use teaching strategies they have mentioned in that particular manner.

Moreover, Mcmillan and Schumacher (2010) believe that interview recording compels the interviewer to be attentive, can help pace the interview and legitimises the writing of the research insights during the interview. As a result, the focus group discussion was recorded upon agreement with the participations to guide and pace the interview, paying attention to the interviews and for the purpose of data analysis based on correct recorded transcription. Detailed hand notes and voice recordings from a cell phone were done. The voice recordings of the focused group interviews were transcribed from the cell phone. On the other hand, Cohen et al. (2011), state that one of the drawbacks in focused group interviews is that the number of participants involved might be too few and cannot yield generalizable data. The use of focus group discussions in this study had no intention of generalising, but rather it was to obtain in-depth data about the teaching strategies used by the participants in teaching mathematics in the KwaNdengezi circuit. Table 3.3 shows how the data was generated.

	<b>Objective 1</b>	<b>Objective 2</b>
<b>Why was data generated?</b>	Identify and understand teachers' strategies of teaching grade 5 Mathematics CAPS in primary schools at KwaNdengezi Circuit.	Understand why grade 5 teachers use teaching strategies in a particular manner in teaching mathematics.
<b>What was the research strategy?</b>	The reflection activity, one-on-one semi-structured interview and focus group discussions.	The reflection activity, one-on-one semi-structured and focus group discussions.
<b>Who were sources?</b>	Four grade 5 Mathematics teachers from different schools.	Four grade 5 mathematics teachers from different schools.
<b>How often was data generated?</b>	Teachers were given the reflective activity which they had to complete for the researcher to collect after a week.  The one-on-one semi-structured interviews were conducted, this took about an hour for each participant.  Lastly, semi-structured focused group discussions were conducted, also lasting an hour.	This was conducted through the use of one-on-one semi-structured interviews which lasted for 1hour each followed by semi-structured focused group discussions which also took about an hour.
<b>Justification plan used for data generation.</b>	The teacher reflective activity enabled the mathematics teachers to reflect on their teaching practice as well as on the teaching strategies without the pressure of the researcher thus permitting them freedom to express themselves.  One-on-one semi-structured interviews and the focus group discussions assist the researcher to obtain a detailed and in-depth understanding of teaching strategies used by teachers in teaching the mathematics curriculum.	One-on-one semi structured interviews and the focus group discussions assist the researcher to obtain a detailed and in-depth understanding of teaching strategies used by teachers in teaching the mathematics curriculum.

Table 3.1: data generation plan

The data generation plan in table 3.1 helped me getting the information successfully in all the three data gathering methods. The participants in this study were very helpful, supportive and approaching. A voice recorder was used for one-on-one semi-structured interviews and focus group discussions in order to confirm that the data generated was consistent across the sources of data and multiple methods (Khoza, 2015a). I therefore undertaken the data analysis phases with the generated data analyse the gathered information.

### 3.6 Data analysis

In qualitative research, data analysis starts during the data gathering process (Cohen et al., 2011). Therefore, I started data analysis during the process of reflective activity, semi-structured interviews and focused group discussions. Data analysis involves the drawing of inferences from the raw data (Wahyuni, 2012). Thus, the raw data was gathered from the participants by means of reflective activity, semi-structured interviews and focused group discussions, in order to understand the teaching strategies used by teachers in teaching mathematics in order to interpret and analyse the data. Data analysis is mainly an inductive procedure of organising information into categories and identifying patterns and relationships amongst those categories (Mcmillan & Schumacher, 2010). Therefore, I read notes and listened to the voice recorder repeatedly and the transcripts were also read several times to avoid losing and misrepresenting meaning of the data generated from the participants. I identified similarities and differences from the reflective activity, interviews and stories told by the participants about the teaching strategies they used during the teaching and learning. I wrote the ten concepts of curricular spider web in order to create categories and theme. I started the coding procedure by allocating the information from the reflective activity, interviews and stories told by the participants. The study used the ten concepts of the curricular spider web where categories developed a prior, subsequent analysis guided and categories modified through interaction with the information (Dhunpath & Samuel, 2009). Therefore the data analyses procedure commenced at the beginning of the research and the participants were aware that the research was about the reflection of the teaching strategies used for teaching Mathematics. Questions that were asked were those that were not covered during the story telling from the participants. I then wrote the responses of all participants to the same question on the relevant concept.

Thus, in this study I interacted with the generated data by means of sorting, organizing, adjusting, revising and interpreting the information trying to make sense of the teaching strategies used by teachers in teaching mathematics as well as attempting to understand why they teach in that particular way. The aim was to make meaning by describing, interpreting data, discovering patterns, commonalities, differences and similarities, understanding individuals and groups and summarising the findings (Cohen et al., 2011). The curricular spider web was used as a conceptual framework in order to categories the data into the relevant concepts. I opened coding by dismantling writings and distinguishing different themes found in the information as

explained by (Wahyuni, 2012), in order to position the information in the relevant concept of the curricular spider web. I further grouped the parts of information based on their relevant content into categories (Wahyuni, 2012). I then selected coding by making clear links between the main categories to make sense of understanding the teaching strategies used by teachers in teaching mathematics. I gave each response from participants a description as I was guided by the concept of the curricular spider web. The conclusions made were constantly upheld by the data thus strengthening the excellence of the findings. Qualities of the researcher, such as understanding of the field being studied and experiences in the research, can influence the data gathering process. Avoiding this interference I kept my knowledge and experience to myself in order to gather the effective data. I made prior arrangements with the participants and conducted informal discussions to familiarise myself with the participants before issuing formal reflective activities, one-on-one semi-structured interviews and focused group discussions. In dealing with this issue I ensured that I made an appointment with the participant to have an informal discussion and explained ethical issues and handed out a concern form which was collected before the research process, in order to familiarise myself with the participants.

### **3.7 Ethical issues**

McMillan and Schumacher (2010), state that it is important that researchers adopt ethical principles, which include policies regarding informed consent, confidentiality, anonymity, privacy and caring. Cohen et al. (2011), state that ethical issues may stem from the kinds of problems explored by social scientists and the procedure they use to acquire authentic and dependable data. It is important to update the participants about the whole process of the research and confirm their protection against any harm that may have happened during the research. The clear update allows the participants to decide whether they wish to be part of the research. The ethical clearance to conduct research was obtained from the University of KwaZulu-Natal. The permission to conduct the study was approved by the Head of Department in the KwaZulu-Natal Department of Education Institutions.

The permission to conduct this research and interviews at the three primary schools was obtained from the principals of the schools after I requested it. As soon as I got permission from the principals, I visited each participant in their school to ask them to participate in the research. I



briefly explained the purpose of the research, which is an exploration of teaching strategies for teaching grade 5 Mathematics in KwaNdengezi circuit in the Pinetown district. A consent letter was given to the participants and it contained the following information. The interviews were not going to disturb the teaching time as they were conducted after school hours. They have a right to withdraw from and re-join in the study at any time (Cohen et al., 2011). I explained that there were no material benefit from participating in the research. The participants were expected to answer all the questions by responding to each question according to their own reflection, as there is no wrong or right answer. They were guaranteed of confidentiality and anonymity by signing the consent form. The participants were allowed to select the places and times to conduct the study (Mcmillan & Schumacher, 2010). I made sure that the participants were protected from any harm as it was my responsibility as stated by (Cohen et al., 2011). The real names of the participants were not used. Their names were represented by letters of the alphabet. The voice recorder was used with the permission of the participant. The participants were free to answer their calls during the interviews, I paused the voice recorder while the participant was answering a call. The participants were told that any information they provided will be confidential, and that it will be only used for the study. One of the limitations surrounding the ethical issues is that the participants might withdraw from the study at any time. To try and avoid this problem I ensured that I had more participants than the required number in case there were any withdrawals. In addition, disloyalty occurs when the researcher reveals the data generated in public with a purpose of causing suffering to the participant (Cohen et al., 2011), as this could spoil the name of the participant as well as the school. I assured the participant that the research information will be confidentially kept by myself, my supervisor and by the university library and that it will be demolished after a period of five years.

### **3.8 Trustworthiness, credibility, transferability, dependability, and conformability.**

In a qualitative approach the following concepts are used for issues of trustworthiness as to ensure the quality of the study: credibility; transferability; dependability; conformability (Cohen et al., 2011). Trustworthiness is any effort to increase dependability involving a force or artificial consensus and conformity in the analysis of the data, which is usually at the expense of the meaningfulness of the findings (Rolfe, 2004). Issues of trustworthiness were considered at the data gathering stage, data analysis stage and will be considered at the data interpretation stage.

This confirms that the findings of the study accurately reflect what happened so that readers will trust the findings. The fact that the study uses reflective activity, one-on-one semi structured interviews and focused group discussions to generate the data ensures the issue of trustworthiness in my findings. Furthermore, to guarantee trustworthiness in this study the interviews were recorded and transcribed. When dealing with trustworthiness it is noted that it is difficult to prove absolute exactness of research. To overcome this, I identified several strategies in the literature review to improve trustworthiness (Kolb, 2012).

### **3.8.1 Credibility**

Credibility deals with accuracy of data to reflect the observed social phenomena data (Wahyuni, 2012). In order to ensure the credibility of the study I practically gathered data by conducting reflective activity, one-on-one semi-structured interviews and focused group discussion. Credibility is an organised process in that the reviewer writes an analysis after carefully studying the documentation provided by the research (Creswell, 2013). I submitted the transcribed documents to my peers for evaluation and to identify some information that I might have ignored (Wahyuni, 2012) . I also submitted the transcribed documents for review to enrich the credibility of the research findings (Wahyuni, 2012). However, one of the shortcomings in establishing credibility is the researcher's personal world view and individual biases that may influence the study. It would be better to be cognisant of this factor and guard against interposing bias within the research (Kolb, 2012). I avoided interference between the interviews, interview transcriptions and data analysis of the research when interpreting teaching strategies for mathematics teachers.

### **3.8.2 Transferability**

According to Wahyuni (2012), transferability is the level of applicability into other settings or circumstances. Furthermore, in transferability evaluation findings can be utilised in similar program settings, with the same characteristics (Phillips, 2013) . So, the research findings of this study guaranteed transferability by generating rich and thick descriptions of the teaching strategies explored from teachers who are teaching grade 5 Mathematics in the KwaNdengezi circuit. As a result, the teaching strategies drawn from four teachers who teach grade 5 Mathematics in the KwaNdengezi circuit can be transferred and applied to teachers who are

teaching mathematics in the same circuit and contexts. In addition, this case study was interested in obtaining a more in-depth understanding of teaching strategies used in teaching grade 5 Mathematics, with no intention of generalising. Furthermore, I provided clear descriptions of the literature review, conceptual framework, case study, sampling, data generation, methods, the selected schools, teachers, themes used and data analysis so as to ensure that the findings can be transferred and applicable to teachers who are teaching mathematics from other circuits and districts.

### **3.8.3 Dependability**

Dependability is connected with the idea of trustworthiness, which promotes reliability or repeatability (Wahyuni, 2012). Enhanced dependability was achieved by presenting a full explanation of the research processes undertaken, as well as providing the main methods used to gather empirical data. This was proved by the evidence obtained from the reflective activity, the one-on-one semi-structured interviews and focused group discussions that were each conducted twice alternatively. This ensured that the gaps that were identified during the first round of reflective activity, one-on-one semi-structured and focused group discussions were covered during the second round of one-on-one semi-structured interviews and focused group interviews. The interview questions consisted of ten questions which were framed around the ten concepts of the curricular spider web. The use of reflective activity, one-on-one semi-structured interviews and focused group discussions and recordings led to more valid, trustworthy and diverse construction of realities (Golafshani, 2003). In addition, in qualitative research the study must accurately describe the findings of the phenomena being researched (Cohen et al., 2011). I then listened to the recording repeatedly and wrote the information as it is in order to be accurate about the teaching strategies used by the participants. In addition, after I had completed the transcriptions, I returned them to the participants for cross checking and verification before writing the final findings of the research study. I have done this in order to have the same understanding of concepts as the participants in order to ensure dependability. In that way I avoided bias, by using the quotations of the participants to provide the empirical evidence.

### **3.8.4 Conformability**

Wahyuni (2012), states that conformability refers to the extent to which others can confirm the findings in order to check that the results reflect the understandings and experiences from explored participants, rather than the researcher's own preferences. The records of reflective activity, and voice recordings during interviews assisted in gathering the evidence in which the whole process can be verified. Teacher's reflective activities and interview recordings prove that the results reflect the teaching strategies employed by participants who teach mathematics. This study also proves honest because it used the same questions for the all the participants in generating the data, using reflective activity, one-on-one semi-structured interviews and focused group discussions. These records are to be kept in the form of research notes and temporary summaries as parts of the ongoing research workbook for examination (Wahyuni, 2012). The kept records of the research provide a chance for examining the process. The study acquired valid and credible as well as multiple and diverse realities, through multiple methods of gathering data. On the other hand, as the head of the department (HoD) in the primary school, participants may give false information, trying to please me, thinking that I am tracking their work or I am spying on them to improve the performance of my school. Providing false information might affect the accuracy of this study. In dealing with this issue I clearly explained the purpose of the research and that the findings of research will benefit myself, participants and the Department of Education before generating the data.

### **3.9 Limitations and delimitations**

This case study was conducted from four grade 5 mathematics teachers in three primary schools in the KwaNdengezi circuit. It has its own limitations in matters relating to the application of the case study. Two primary schools are not far from each other and the third school is slightly farther away from the other two schools. At the same time it takes less than fifteen minutes to reach the third school if travelling by car. The three schools serve children from the same community and they are all under-resourced. Therefore, the results of this study may not display the teaching strategies used by all teachers in teaching grade 5 mathematics and the findings cannot be generalised to other school contexts. This study is interested in exploring and understanding participants' views and teaching strategies that they use when teaching mathematics (Ritchie et al., 2013), rather than just generalising. There is also a potential problem

in displaying a systematic bias during the conducting of the research. I tried to avoid that behaviour by being fair when generating data and relied on the information generated during the interpretation and presentation of data. In addition, participants kept on postponing the interviews because they have a fear of the unknown. I addressed this issue by assuring the participants that they should not stress themselves because the interviews were about what they do daily in their classrooms. Another problem that might have affected this study is that as a HoD, the participant may provide false information in an attempt to please me as they think that I am tracking their work or that I am doing this research in order to improve the work performance of my school on their behalf. I avoided that by clearly explaining the purpose of conducting this research on the first day we met and before I started to generate the data.

### **3.10 Summary statement**

This chapter showed the research methodology that is suitable for the qualitative study. The chapter defined the research paradigm, research style, sampling, data generation methods, data analysis, ethical issues, matters of trustworthiness and limitations. The abovementioned steps provided a clear guideline of the manner in which this case study was conducted in order to fulfil the aims and the purpose of the study. This chapter also identified the strengths and the weaknesses of using the selected approaches, styles and methods. The next chapter will focus on the data analysis of data gathered using the abovementioned research methods. The main focus of the next chapter is to present the findings that arose from the data gathered in this chapter.

**CHAPTER FOUR**  
**RESEARCH FINDINGS AND DISCUSSIONS**

**4.1 Introduction**

This chapter presents the findings that resulted from the data generation process. The data were generated using three methods, namely: reflective activity, one-on-one semi-structured interviews and focused group discussions which were each conducted twice. The data were generated from four grade 5 Mathematics teachers in three primary schools at KwaNdengezi. This chapter is framed around using the concepts of the curricular spider web as a conceptual framework. As a result the data that came from this study were analysed using the curricular spider web where the themes emerged.

Further to this, the two participants from the same school were referred to as participant A1 and B1, participants from different schools were referred to as participant C2 and D3 as shown in the table 3.1 in chapter three to fulfil the promise of confidentiality and for the purpose of encoding. The direct quotations generated from the participants interview will be used produce the truthful findings. In addition, the literature review is used to compare and analysed the findings, the grade 5 Mathematics document is also used to check whether the teaching strategies employed by the participants are in line with the intended curriculum.

**4.2 Findings and discussions**

The findings and discussions of this research are presented relative to the concepts of the curricular spider web. The themes and categories emerged from the data gathered in response to the questions following the concepts of curricular spider web as guided analysis, as shown in the table 4.1

<b>Themes</b>	<b>Questions</b>	<b>Categories in levels</b>
Rationale	Why are you teaching Mathematics using particular teaching strategies?	Personal rationale(pedagogical), Societal/social rationale and Content knowledge rationale.
Accessibility	Who are you teaching grade Mathematics using particular teaching strategies?	Physical access Financial access

		Cultural access
GOALS	Towards which goals are you teaching Mathematics in a particular way?	Aims, Objectives Outcomes
Content	What content are you teaching Mathematics using particular teaching strategies?	Number operations and Relationships Patterns, Functions and Algebra Space, shapes and Measurements Data handling
Teaching activities	Which activities are you using to teach Mathematics using particular teaching strategies?	Content-centred (activities) Teacher-centred (activities) Learner-centred(activities)
	How do you facilitate Mathematics using particular teaching strategies?	Content-centred ( assessor) Teacher-centred (instructor) Learner-centred (facilitator)
Material and Resources	With what are you teaching Mathematics using particular teaching strategies?	Hard-ware Soft-ware Ideological-ware
Location	Where are you teaching Mathematics using particular teaching strategies?	Face-to-face (inside) Community (outside) Blended (inside and outside)
Time	When are you teaching Mathematics using particular teaching strategies?	Hour Day Week
Assessment	How are you assessing Mathematics using particular teaching strategies?	Assessment of teaching Assessment for teaching Assessment as teaching

Table 4.1 themes, questions and categories from curricular spider web.

#### **4.2.1 Why are you teaching Mathematics using particular teaching strategies?**

##### Theme 1: Rationale (Reasons)

The reflective activity, the one-on-one semi-structured interviews and focus group discussions were conducted using the questions framed around the ten concepts of the curricular spider web. In addition, the participants' reflections on rationale for teaching Mathematics during the reflective activity were mostly based either on their personal rationale, societal rationale or on both personal and societal rationale. Two participants narrated on content knowledge during interviews and focus group discussions.

In reflective activity all the participants A1, B1, C2 and D3 indicated that they love Mathematics. They teach Mathematics because they want to develop creative and logical thinking citizens. They introduce a lesson to the whole class, they engage learners on practical activities. For example, in Data handling they use question and answer method, explanatory method, and discussion method. Explain what project the learners will do in the classroom. For example they request each learner to say how they come to school, then write what learners say on the board. They would then ask the challenging questions that would make learners think critically for example questions like, now you have such numbers of learners who use a bus, train, tax and those who walk a long distances to school. The participants engage learners in discussions in different groups at times according to their abilities or mixing the higher achievers, average and lower achievers together depending on what they want learners to do they let learners try the problem first either in groups, pairs or individually.

The data generated from the four participants during reflective interviews and discussions indicated that these teachers teach for the societal rationale in teaching grade 5 Mathematics CAPS. A1, indicated that she teaches learners to become creative and logical thinking citizens by using content which is based on what they use in their daily life. This indicates that she dominates the lesson by using question and answers, writes on the board what learners say and asks learners questions that require learners to think critically. This indicates they use of the



teacher-centred approach as indicated on the literature review. This shows that A1 is in line with CAPS as a performance curriculum.

Furthermore, B1 and C2 indicated that they use the same teaching strategies to instil the love of Mathematics in learners. For example they use teaching strategies like demonstration, question and answer, explanation, and discussion methods and that they both divide learners in different groups. The problem is that they use the same methods for preparing learners for societal reasons. This indicates that these participants are not aware that there are relevant teaching strategies that are used for teaching mathematics for the personal reasons. Furthermore, data generated indicate that B1 wanted to give learners knowledge and skills for Mathematics and also prepare them for their future and adulthood (societal rationale)

C2 wants learners to be confident and competent and to deal with any mathematical situation without being hindered by any fear of mathematics (societal reasons). These two participants have indicated they use the above mentioned teaching strategies for both personal and societal reasons without differentiating which ones are for personal and for societal reasons. Moreover, D3 indicated that she attempts to instil passion in learners by using a cooperative strategy which is more of a learner-centred approach. For example, she indicated that the learner-centred approach emphasises strategies such as discovery-based teaching, problem-based teaching and situated cognitive based teaching, as she indicated that she allows learners to solve the problem first and that intervene after they have tried on their own. This indicates that she is using a competence curriculum, instead of using a performance curriculum which is what the current curriculum requires (Hoadley & Jansen, 2012).

In addition, the strategies that should dominate in teaching Mathematics are content-centred approach since CAPS is more a content-oriented (Ramatlapana & Makonye, 2012) and teacher-centred approach as a performance curriculum (Van den Akker et al., 2009). Therefore, this indicates that it was only A1 who was able to reflect the teaching strategies that were based on a content-approach, and dominated by teacher-centred approach. For example, all the participants show that they dominate the lesson by telling learners what to write, and asking questions that challenge learners to think critically. Learners had to answer questions that that are challenging

and participants B1, C2 and D3 seemed to use the teaching strategies without understanding why they were using those specific teaching strategies.

In addition, one-on-one semi-structured interviews and focus group discussions, all the participants said, they enjoy teaching Mathematics (personal rationale): When they started teaching, teaching in a primary school meant I had to teach all subjects. Almost all training colleges offered mathematics content and Mathematics didactic that is where they developed started to enjoy Mathematics. On the other hand A1 and B2 said that they are registered with the Association for Mathematics Education of South Africa (AMESA) to upgrade my knowledge and skills and to acquire different teaching methods (content knowledge) like telling, questioning, demonstration, pair work and discussion methods.

All the participants account about the teaching strategies she uses to achieve the above rationale for teaching grade 5 Mathematics during the interviews and indicates that: In most cases the participants 'accounts is the same as what they reflected on their reflective activity. The participants said that they engage learners on practical activities. Learners learn better when they do hands on activities and they love to do practical activities. To achieve my rationale depends on the content or a lesson they want to teach. Usually, they first introduce the lesson by using question and answer method in order check learners understanding. Or by presenting, give explanation of lesson then give examples depending on what content they want to achieve. There are concepts that they cannot give learners without doing example especially if they introduce a lesson. The participants give individual activities so that they would give reflection of how much learners understood on a delivered lesson. Then they would divide learners according to what they got, they usually give extra activities to those learners who showed that they understand while they are helping those who did not understand also keep on checking the groups who work on their own. They pair learners in order that they learn to assist one another if one did not understand, while they introduce a lesson. Individual activities most of the time reflect the learner's performance.

The programs are in line with CAPS. All the participants introduce a lesson, at times by asking questions. Learners' response will determine how much they know. If it means they should do

more examples than they do it on the board and do explanation. At times learners understand their peers more than a teacher because they are not afraid to ask if they do not understand. In group discussion or in a pair work there are learners who can give certain examples which could be easier for a learner who did not understand the examples they used and at the end each learner must be able to work independent to check how much individuals has to understand.

D3 said that she uses cooperative method. In most cases she use the cooperative method which involves learners in groups. Co-operative method involves a child in the subject, in most of the time she allow learners to try the sum on their own. She added that learners come up with different methods, she give learners an opportunity to go in front and share with the whole class the different methods they have used.

The data generated from the participants indicate that A1 and B1 do not wait for in-service training to take place but they try to develop themselves professionally. These participants' develop themselves through AMESA in order to gain more skills and knowledge that they pass on to learners. It is pleasing that there are teachers who still have a passion for teaching learners in order to achieve knowledge and skills that are suitable to be applied in the real world (Khoza, 2015a). Furthermore, the data show that participants like A1 and B1 act like professionals as, Leendertz et al. (2013) argue that it is a professional teacher who is capable of employing effective teaching strategies for teaching grade 5 Mathematics by building on what learners already know and, there is no doubt that teachers who develop themselves will stay abreast with content knowledge rationale for Mathematics and their teaching practice will be in line with current curriculum.

Participants C2 and D3 are not developing themselves now and again, which means they rely on the workshops that are conducted by the Department of Education in order to develop them, which is good. However, this could be a problem if the department takes long to put in place in-service training to develop teachers. As indicated in the literature review that the department tends to be pre-occupied with the curriculum instead of with teachers and their capabilities (Msibi & Mchunu, 2013). Nevertheless, teachers who do not upgrade themselves are not doing any justice to their teaching profession. Professional teachers will always develop themselves to

improve their teaching strategies for teaching Mathematics. As Msibi and Mchunu (2013) indicate, professional teachers should be qualified, and upgrade themselves as far as teaching, learning and technology are concerned. This indicates that they are teaching for societal reasons and they are still influenced by a competence curriculum.

This shows that as the curriculum changes the teaching strategies changes. The mathematics document DoE (2011), confirms this statement by stating that since beginning of democracy in 1994, the South African government has instituted a number of curricula changes designed to bring about quality education for all in South African learners. Furthermore, D3 indicates that in most of the times she uses cooperative teaching methods. This means that D3 is still using the competence curriculum, which was based on everyday knowledge, and has since been perceived as unsuitable in South Africa. Therefore, if there are still teachers like C2 and D3 who do want to develop themselves to be up to date with the curriculum changes, they will continue to dwell on the same teaching strategies that were not effective in teaching grade 5 Mathematics.

D3 indicated that she teaches Mathematics because of the passion she has for Mathematics and that she possess knowledge and skills (personal rationale), while B1's account indicates that he teaches Mathematics to impart knowledge and skills to learners. Therefore B1's reflection is based on societal reasons while D3's reflection is based on personal reasons. Getting further, findings generated from the participants' rationale for teaching Mathematics show that personal rationale dominates in the participants' conscious minds. All the participants indicated that they have a passion of teaching Mathematics. This indicates that participants' personal reasons were driven by their previous experience and the teaching strategies that they were taught from the college.

The data generated indicate that Mathematics was a compulsory subject during their training and it prepared teachers with teaching strategies to teach in primary schools. The participants' accounts concur with Sullivan and Wood (2008) that teachers are being prepared to be capable of teaching all content subjects including Mathematics in primary schools. C2's account indicates that she teaches grade 5 Mathematics for critical awareness of how it relates with economics or economic culture and social relations. In addition, A1 and B1 indicated that they

teach learners to become creative and logical thinking citizens in order to prepare them for their futures. D3 did not make reference to societal rationale. Furthermore, B1's account concurs with the (Khoza, 2015a) , mentioned in the literature review, that mathematics is taught to ensure that every learner possesses mathematical knowledge and skills that enable them to solve problems in their real life situation. This indicates that the participants are aware that learners are part of society, so they teach learners by preparing them to face the real world without fear. Van den Akker et al. (2009), argue that the department should do justice to a variety of social interests in developing the curriculum by selecting and prioritising aims and content of the society. Therefore the government should support teachers in developing Mathematics curriculum by speeding in-service trainings which will include teaching strategies that are relevant to learners and social needs, so that teachers could keep up with the demand of the curriculum (Kehdinga, 2014a). This may develop learners to be creative and become critical thinkers by using relevant teaching strategies.

In addition, Hoadley and Jansen (2012) and Kehdinga (2014a) state that the curriculum carries the values and assumptions that reflect the interests of certain sectors of the society, so every curriculum carries the politics of a particular sector that is ruling at that particular time. In other words, if teachers are not driven by content/professional reasons for teaching, then they will always be operators, passive agents, and technicians who are simply carrying out policies designed for them by others (Kelly, 2009; Khoza, 2015b). In the mathematics document DoE (2011) the Minister of Education indicates that when they took over, their personal rationale for teaching Mathematics was to transform the curriculum left by the apartheid. This statement concurs with Kehdinga (2014a) that every new Minister of Education in South Africa introduces a new curriculum, trying to bring about quality education for all in South African learners (DoE, 2011). This means that these teachers are using their personal rationale in implementing Mathematics curriculum for grade 5 without consulting the current mathematic document's rationale because they did not refer to it when they were reflecting on their rationale for teaching grade 5 Mathematics.

This indicates that Mathematics will continue to be a subject often failed since CAPS is a performance curriculum which needs the curriculum implementers to focus on the school

knowledge (Van den Akker et al., 2009). In the literature review Ramatlapana and Makonye (2012) argue that teachers are too independent and free to use the curriculum as they see it fit. In addition, Van den Akker et al. (2009) argues that personal development is of importance to teaching and learning for the sake of developing the educational needs and interest of learners themselves.

The participants were requested to account on the teaching strategies they use, how they use those teaching strategies and why they use the teaching strategies in that particular way. The data generated from all the participants indicate that they used more or less the same teaching strategies, like telling method, explanation, demonstration and observation. They also indicated that the above mentioned teaching strategies save time, and enable them to cover the curriculum.

The participants indicate that the teaching strategies they use in their teaching and learning practice comes from their previous experience, especially C2 and D3, who specialised in something that is not connected to Mathematics. It has been more than ten years C2 and D3 last developed themselves without depending on the workshops and in-service training organised by the department. Therefore, the data indicate that all participants use teaching strategies such as introductions, presentations, explanations and demonstrations during their teaching of the Mathematics CAPS. They justified why they use each teaching strategy in that particular way, saying that it is important to use the above mentioned teaching strategies when it is a new lesson and when learners' performance indicates that they did not understand a lesson. It is important to give more explanations and do more examples.

Hutchison and Woodward (2014), argue that one of the critical elements that affects teachers' instructional planning includes success or failure of the resulting classroom instruction. According to Ono and Ferreira (2010), in order to achieve various goals for teaching Mathematics, the professional development program should be knowledge-centred, assessment-centred and community-centred to improve teacher teaching trends. In support of the participants' account, Van den Akker et al. (2009) recommend that every lesson taught in the classroom should be driven by goal-directed teaching strategies that are based on achieving those objectives. It means that the participants are using the goal-directed teaching strategy to when

implementing Mathematics. In addition, Li and Ma (2010) describe a classroom situation whereby the teacher is the most active one the teacher is talks a lot much and give lots of examples—as being a teacher-centred approach. This approach is supported by Lee and Ng (2010) when arguing that the teacher-centred approach was found to be stronger if the environment promotes the teacher-centred approach. In the teacher centred approach, the teacher uses the drill method, rote teaching, explanations, and demonstration techniques once a concept has been experienced in full (Westwood, 2011). This means that the participants are using a teacher-centred approach when they introduce, present and write examples on the board and that the participants are using the content that is prescribed by CAPS. This indicates that they are implementing a performance curriculum which is based on school knowledge Van den Akker et al. (2009), since they teach using the teaching plan and the mathematics document.

Moreover, Mncube and Harber (2010) argue that learner-centred approach involves teaching strategies like experimental investigation where learners are given projects to do and come back to report to the class how they went about doing those projects. Bantwini (2010) supported by Mncube and Harber (2010) stating that learner-centred approach encourages the use of inquiry-based teaching and also promotes self-discovery teaching and content teaching. Again the data generated indicate that the participants also use a learner-centred approach by pairing and grouping students together depending on what objectives and learning outcomes of the content they want to achieve teachers at that particular time. They also indicate that group work or pair work teaching strategies allow learners an opportunity to explore their learning experiences by sharing ideas and learning from one another. In addition, this indicates that they also use a competence curriculum which is described as a learner approach Van den Akker et al. (2009), which means learners are given a chance to solve problems on their own and learn from their mistakes and thereby giving them a chance to use their everyday knowledge (Hoadley & Jansen, 2012).

The participants often refer to the CAPS document when they talk about the teaching strategies they use to teach and they also indicated that they give individual work to check the individual performance. The study by Khoza (2013a) concurs with what all the participants are doing when arguing that if teachers want to measure the content to be given to learners they should use the

content-centred approach. This view is additionally supported by the study of Kiray (2012) in stating that teaching practice is constructed around and focus on understanding the rules of the subject. As a result, the teacher-centred approach, learner-centred approach and content-centred approach are all significant, so teachers should be combining them in a teaching and learning situation, as the four participant do.

In conclusion it comes down to practicality, and it all depends significantly on teachers (Chisholm & Wildeman, 2013), and whether they are practically using the relevant teaching strategies to achieve their rationale for teaching Mathematics.

#### **4.2.2 With whom/who are you teaching Mathematics using particular teaching strategies?**

##### **Theme 2: Accessibility**

During the reflective activity all the participants reflected on physical access. They were not aware of financial and cultural access. They were also not aware that accessibility involves cultural issues like religion, cultural beliefs, sports, and extension reading, stakeholders and politics as well as transport fees. During, one-on-one interviews and focus group discussions the participants were made aware of cultural issues and financial issues through the use of leading questions.

In terms of accessibility participants responded as follows:

A1, B1, and C2's reflections were very brief during the reflective activity while D3's account gave some details about her situation of going to school as her school is isolated from the road. The data indicate that only A1 walks when she go to school, B1 and C2 use their own transport when they go to school, while D3 use public transport and lifts when she goes to school. All the participants were able to respond about the physical and financial accessibility during interviews and focus group discussions. Participant responded as follows:

All the participants narrated that their schools are accessible, A1, walks when she goes to school. B1 and C2 use the own transport when they go to school, they spend about R1000, 00 a month. D3 use a double public transport when she go to school, she spend about R500, 00. In addition all the participant said that they use lecture method, to explain to about the homework that will be done at home ,especially when they are absent from school because of transport or heavy rain.



Since, some learners do walk a long distance when they come to school some use taxis and vans. All the participants said that they do corrections on the board with the whole class. After corrections they proceed with teaching depending on the lesson, whether learners write more activities from the previous lesson as individual. If it is a new lesson they present, demonstrate, and do examples on the board. Then, give learners class activities to do as individuals.

They also narrated that there are also projects and investigations that learners have to do as individuals at home after school or when they are not at school. In addition, A1, B1 and C2 narrated that their schools are easily accessible there steps and ramps for everyone. D3, said that her school is not accessible for everyone as it has steps all over.

The reflective activity, interviews and focus group discussions revealed that all the participants give learners homework projects investigations and assignments. Furthermore, the findings indicate that teacher uses the 'telling method' by giving an individual learner homework projects, investigations and assignments at home to have access to learning in case they are absent from school. This shows that learners do have access to some form of education even if they are at home. Moreover, DBE workbooks play a significant role because every learner is able to have access to their curriculum at home. As participants have indicated that Mathematics workbooks are in line with CAPS, it means that the participants do cover the curriculum, as all the participants indicated that they give learners homework in order to cover the curriculum by using the lecture method. In addition, the data indicate that a telling or lecture method is quicker to accommodate the whole class at one time and it is a quicker method to explain the homework to learners who come late in class.

Furthermore, the data generated reveal that B1 and C2 have to pay plus or minus R1000 a month in order to reach their schools. This indicates that teachers use individual strategies in terms of finance. It also indicates that other learners walk as individuals, others club together in taxis and vans in order to have access to school. This indicates that some teachers work for a transport. This means that the government should subsidise teachers' transport in order to implement grade 5 Mathematics curriculum effectively and be able to identify and explain how and why they

are teaching Mathematics CAPS using particular teaching strategies, to attract different stakeholders by producing good results (Barrett, 2011).

Different countries have their own cultures (Gebremichael et al., 2011), like in South Africa; there are schools that celebrate school holidays as part of the culture which is good. The data indicate that all the participants' schools celebrate most of the activities that are in the South African calendar. In addition, it is revealed that teachers tell learners to prepare for a specific day or activity. This indicates that teachers use telling and explanatory strategies to prepare learners for cultural activities.

During the interviews and focus group discussions, the participants responded as follows on accessibility:

### **Culture of religion**

A1 said that,

The assembly takes about 10 minutes, when it is my turn to conduct prayers I use a lecture method to tell learners to sing a religious song, read a scripture reading and tell them to recite. A1 defended her school by saying that, "it is important to start a school day with a prayer to thank God that by His grace we are safe. It is also important to start a day with a moral lesson".

B1, C2 and D3 has given the same account as that of participant A1 concerning the culture of religion. This suggests that prayer is seen as a powerful strategy that comes first before any teaching strategy can be implemented to the grade 5 Mathematics CAPS.

### **Cultural activities**

It also came out during the interviews and focus group discussions C2 and D3 celebrate the same activities in the same way as participant A1 and B1. They described this saying that in the classroom situation learners have to be exposed to South African cultures to learn more about different cultural activities. They added that group work strategy allow learners to learn different cultures, different way of doing things as well as different values. On the other hand, the literature review reveals that the rote learning teaching strategy is still dominating in China (Gebremichael et al., 2011). This is also supported by the findings generated from the four

participants who are teaching grade 5 Mathematics at KwaNdengezi circuit, whereby the assembly is dominated by teachers who is conducting prayers.

The teacher is more active in telling learners to sing, and giving them a choral verse. This indicates that learners are inactively listening and follow the instruction given by the teacher. This is in line with CAPS since it is a performance curriculum that is dominated by the content and the teacher who reads a Bible during prayers. Furthermore, Kloppers and Grosser (2014) argue that teachers need to teach learners to know the values and meaning of critical thinking disposition. This is proved by the participants when they give learners opportunities to come up with their own activities when celebrating different cultural holidays. Hence, these teachers prove that they model teaching strategies that enhance learners' critical thinking skills in teaching grade 5 Mathematics. In addition, in support of this statement Vithal (2012), argues that the main lever is the quantity and quality of competence and confidence teachers who can deliver the new Mathematics curriculum and should go hand in hand with relevant teaching strategies.

The CAPS document DoE (2011) concurs with Dello-lacovo (2009) when stating that the government provides access to higher education, facilitating the transition of learners from education institution to the workplace and this should also ensure jobs for future graduates (Berkvens et al., 2014). This statement indicates that learners from higher education are prepared for work, which is not reflected in South Africa as there are many learner from higher education and graduates who are jobless. There should be teaching strategies that are used to make sure that leaners are fit for jobs when they complete at higher education. In addition, CAPS document DoE (2011) notes that learners are equipped with knowledge and skills and the values necessary for self-fulfilment and meaningful participation in society as citizens of a free country. The CAPS document further states that the knowledge and skills are provided regardless of socio-economic background and physical ability and does not state relevant teaching strategies to be used to teach these knowledge and skills. Considering the data generated from the participants, what is stated by CAPS document is not the case in other schools in KwaNdengezi circuit. The data reveal that there are some schools that are depriving learners with physical disabilities to get skills and knowledge.

The CAPS document DoE (2011) specifies that active and critical teaching encourages an active and critical strategy in teaching grade 5 Mathematics rather than rote and uncritical teaching. This is supported by Kloppers and Grosser (2014) who indicate that teachers need to teach learners to know values and meanings of critical thinking dispositions. They further state that teachers need to model teaching strategies to enhance learners' critical thinking skills in teaching Mathematics. In addition the findings gathered from the four participants reveal that these teachers do teach learners values during the cultural activities they celebrate in school. The data also reveal that learners are actively involved in developing their critical thinking disposition. Teachers give learners guide line on the cultural activities, then learners, on their own, decide on the activities they will do.

These activities are done in groups, pairs and individually. As Kloppers and Grosser (2014) indicate, that critical approach encourages teachers to use a learner-centred approach for teaching grade 5 Mathematics. These teaching strategies for teaching mathematics involve group discussions, and debates to improve learners' critical thinking skills. Therefore, this shows that some schools do have an idea that the intended curriculum also relates to the social dimensions of schooling since learners are part of the society. That is why they teach learners the cultural and the morals values of the society (Kehdinga, 2014a). As CAPS document DoE (2011) notes, the curriculum principles are based on social transformation, ensuring that the educational imbalances of the past are addressed and that equal educational opportunities are accessible for all the population. Furthermore, this indicates that the CAPS document is relevant since it encourages the need of implementing active and critical approaches rather than rote and uncritical teaching strategy.

In terms of cultural religion, the findings reveal that the teaching strategy is an uncritical strategy in the teaching and learning situation. The findings generated from the four participants reveal that the teaching of moral values is delivered in a teacher-centred approach (the teacher dominates in the prayers). Learners are not given opportunities to read from the Bible or to share moral values among themselves. In this case CAPS places the importance on the learner, ignoring the teacher and content. This indicates that the CAPS document confuses teachers since Mathematics CAPS is prescribed it should place the importance of the content-centred approach

and teacher-centred approach more than learners. This indicates that CAPS document promotes a competence curriculum and every day knowledge rather than performance curriculum and school knowledge (Hoadley & Jansen, 2012), in terms of cultural religion. In conclusion, the Mathematics document does not indicate which strategies are relevant for teaching grade 5 Mathematics in terms of accessibility in education, therefore there is no relevancy, consistency, practicality and sustainability (Berkvens et al., 2014), in the mathematics document.

#### **4.2.3 Towards which goals are you teaching Mathematics using particular teaching strategies?**

Theme 3: Goals

The data generated from the reflective activity, interviews and focus group discussions indicate that participants are aware that there are goals to be achieved when teaching grade 5 Mathematics. The problems is that they are not aware that they are three levels of goals namely: aims (general aims); objectives (specific aims); and learning outcomes (specific aims). The participants were unable to differentiate between the aims, objectives and learning outcomes. The participants reflected as follows;

As said that,

I want to develop learners who are critical and logical thinking citizens (aims). To equip learners with life skills for example, so that are able to manage their budget. I give them a problem sum where they have a budget of R200, using this R200 they have to make a list of thing they like to eat at school and write the price down. In all this they must make sure that there is some change left for them to save at the bank.

...For the first time I let them work in pair so that they share ideas.

To teach learners to acquire different measuring skills, for an example if they want to take medicine with a spoon they are taking 2 teaspoons. I do it practically then let learners to do practical measurements. Practical activities are not easily forgettable. I let learners to use 250ml of container to fill up 1litre of cool drink container as they count how many times they used 250ml container. I allow learners to work in groups of 8s so that they share ideas and help one another if someone is using a wrong method of measuring.

B1 said that,

‘I learners want to acquire knowledge and skills and also have an understanding of working with numbers. To achieve these goals, I write numbers like 145, 140, and 135 on the board and ask learners to write the next 10 numbers. They do this as individuals so that I can check who has a problem of working with numbers. Then, I am able to help them either in groups or as individual. To help learners face the daily life situations and solve problems especially in calculations (learning outcomes). For example, I would tell the whole class to listen to the story so that they can help Tumi to do the calculations. Then I tell a story like a book has 236 pages. If Tumi read 72 pages, how many pages does he still have to the end of the book? I let learners to find the solution of the problem as individuals. I use this method so that learners are able to solve problems on their own’.

C2 said that,

‘I want learners to understand the content and to use it in their daily basis. I want learners to have a critical awareness of how it relates with economic culture, environment and social relations. To make sure they are able to solve the problems on their own. I give learners on problems that would challenge them. I would give them problems to solve. Like if I bought 100 x15g packet sherbet for R10.00. How much profit I would make if I sell R1, 50 per packet? I would allow learners to work in pairs. There after I would give more similar activities for an individual learner to do. To engage learners in pairs first help those learners who are slow to think on their own. Only to find that when they have work with their desk mate they would understand and they would it become easier when they have to work individually’.

D3 said that,

‘...to enable learners to develop confidence and competence without fear of the subject, curiosity and love for Mathematics. I want learners to understand the language of Mathematics. I explain the terms of mathematics make sure that learners understand the language that is used mathematics. Learners do many examples so that I gain their confidence. Then I give learners sums with terms so that they understand them like, finding the difference between the two numbers; find the product of the two numbers. Learners would do the

above example as individuals so that I could evaluate who did not understand and help them in groups. To help learners in groups saves time because I am able to assist'.

The participant reflective activities indicated that they were using their previous experiences during the first round of reflective activity. All the participants were able to identify the teaching strategies like explanation, group work, pair work, whole class and self-discovery method they use for teaching grade 5 Mathematics. What I noticed is that they are unaware that there are teaching strategies that are relevant when they want to achieve aims, objectives and learning outcomes. The data also show that the participants do not refer to their documents in order to understand the difference between the aims, objectives and learning outcomes of teaching grade 5 Mathematics CAPS. Therefore, Mathematics is in danger of being not successful, if there are teachers who do not understand the difference between the aims, objectives and learning outcomes for teaching Mathematics. This means that they are teaching without focus of whether they teach because they want to achieve aims, objectives or learning outcomes. This indicates that teachers might encounter difficulties in implementing the relevant teaching strategies for teaching grade 5 Mathematics in order to achieve a particular goal. It might also be difficult to relate correctly how and why they are using particular strategies in teaching.

Kennedy et al. (2006) in the literature review indicate that the aims of the Mathematics content are broad general statements of teaching goals, that direct what the teacher aims to cover in a chunk of learning, while objectives stipulate the specific areas that the teacher aims to cover in a section of teaching and learning, and learning outcomes stipulate what a learner should be able to achieve at the end of a learning activity. Furthermore, in the teaching and learning situation teachers should aim to teach towards aims and objectives (Khoza, 2013b), as well as learning outcomes that are supposed to be achieved in teaching strategies of teaching grade 5 Mathematics. In addition, Van den Akker et al. (2009) argue that teachers should do their best to employ teaching strategies that are within the aims and objectives contexts. In addition, Kennedy et al. (2006) argue that learning outcomes are defined as statements of what a learner is supposed to know, understand and be able to show after the completion of process teaching and learning at school. Further expanding on this, Kennedy et al. (2006) recommend Bloom's taxonomy for

writing learning outcomes that involve knowledge, comprehension, application, analysis/synthesis and evaluation.

The data generated from the four participants reveal that they all had goals towards which they were teaching that involve Bloom's taxonomy since in their accounts they have mentioned words like 'knowledge', 'understanding' and 'evaluate'. In addition, C2 indicated that she wants learners to develop critical awareness of how Mathematics relates to economic culture, environment and to social relations. C2 also indicated application of learning outcomes where she indicated that learners will be able to apply Mathematics CAPS in their daily lives. In addition, D3 reflected on objectives generally which showed that she was also not aware of all the three goals. The participants seemed to confuse the different goals and were unable to distinguish between the aims, objectives and learning outcomes. This is shown in their reflective activities because they should have clearly stated the three goals. Therefore, the four participant are fortunate to be part of this research because during the research process they were able to unpack their own experiences, beliefs, knowledge and philosophies to help them understand their identities and actions (Ovens & Tinning, 2009). As a result the four participant will improve their teaching strategies of teaching grade 5 Mathematics. They will also be able to apply the relevant teaching strategy when want to achieve aims, objectives or learning outcomes. Their participation proved that their commitment was to improve in their teaching practice (Gordon & Nicholas, 2010). This indicates that in South African Mathematics is still going to be a heavily failed subjects, if there are teachers who cannot reflect the understanding of observable and measurable learning outcomes to be achieved by learners (Khoza, 2014b).

In terms of CAPS document DoE (2011) it clearly specifies the general aims of the curriculum which are to express the knowledge, skills and values worth learning in South Africa. In addition, these goals also indicate that CAPS curriculum equips learners regardless of socio-economic background, race, and gender, physical ability with knowledge, skills and values necessary for self-fulfilment and participation in the society as citizens. It also states that the curriculum aims to produce learners that are able to identify and solve problems using critical and creative thinking. According to the data generated during the reflective activity, interviews and focus group discussions the four participants are not aware that these goals are divided into



aims, objectives and learning outcomes. There were no participants who referred to these aims in CAPS. In addition, Kennedy et al. (2006) stated the importance of Bloom's taxonomy when specifying the learning outcomes which offers the structure of knowledge, comprehension, application, analysis, synthesis and evaluations. Even though CAPS did not specify Bloom's taxonomy when describing the goals to be achieved, it does consider it, because the specific skills have the relevant key words that show the range of cognitive levels on formal assessment. The participants responded as follows during the interviews and focus group discussions in term of teaching strategies used during the teaching of the accessibility of Mathematics education.

A1 said that:

'I use measuring instruments. I do it practically then let learners to do practical measurements. I show learners techniques of measuring, so that their reading are accurate. I tell them that to get accurate reading they must look in a position, an eye must not be below or above. I tell them that when they measure they must measure in their eye position it must not be below or above an eye; I allow learners to do measurements on their own. They discover that when using the wrong method to measure the answer will be wrong and vice versa. I sometimes use group work, the main reason is to help those who are failing to cope. They get help from those who understand, they share ideas, discuss the topic that was presented. My job then will be to move around in groups facilitating learners. I also use individual method, to find out if learners have gained any knowledge. I give individual class activities and by means of homework. Then I am able to see where I should offer an individual attention'.

B said that:

'...in groups the learners together...discuss and share knowledge and ideas. Group work help the slow learners to grasp from gifted learners. Learners become free in their groups to explore different ideas, is where they show their strength while others gain more. Using an individual method help me to see if each learn has gain something while I was explaining or presenting the lesson. So individual activities give a clear picture of an individual performance. It is where I found out the learners' weaknesses, and then I assist the learner according to his or her weaknesses. In pair work both learners to share ideas

and they help one another. A learner discovers how much he or she has grasps and how much he she needs to correct’.

C2, said that,

‘I think is to let learners understand the content, be able to use it in their daily bases. Everybody is involved that is myself and learners as a whole class, learners as pairs, groups and learners as an individuals. In a whole class, at the beginning of a lesson I sometimes use question and answer method, trying to link the previous work with the new work. Or I start by doing corrections with learners. Sometimes, I let individual learners do corrections on the board facilitating them, checking if the corrections are done correctly. From there I present a lesson for the whole class, then I give learners individual class activities, class activities give me feedback how the learner has understood. Then I will be able to group them according to what they got while they were doing class activities. I give them different activities, they discuss, choose one to write for the group and one learner who is going to present for a group. I also let learners work in pairs, at time some learners are shy to with other learners so the learner would prefer to work with a partner in order to learn or share ideas on one on one. A pair work allows learners to discover their strengths and weaknesses’.

D3’s account is that same as all other participant, except that she also names teaching strategy, she said,

‘I use cooperative methods, I involve learners in most of the time I use group method, let them share ideas and they learn better. I do use question and answer method when I introduce the lesson and at the end of the lesson to check if the learners did understand the lesson presented. At times I conclude the lesson by giving learners some activities to do on the board to check their understanding. In that way I am able to see if I have to repeat the lesson the following day’.

All four participants agreed with one another during the focus group discussions that they all use whole class, individual, pair and group work strategies to teach grade 5 Mathematics. They also narrated that they use the whole class method when they introduce a lesson, and they do

examples on the board to give learners a guidance. They also use the question and answer strategy in a whole class to link the previous lesson with the new lesson and at the end of the lesson to check whether the learners did understand the content taught. It was also indicated that group work is used for discussions and sharing ideas when individuals find difficulties in their class activities and then they will be grouped according to their performances. All the participants agreed with one another that in a group and in pairs, learners are free to share ideas and help one another. They also claim that in group and pair work learners are able find out how much they know and what is it that they need know in achieving the learning outcomes.

As mentioned in the literature review Van den Akker et al. (2009) state that teachers should have knowledge of teaching strategies which is particularly the case for teaching aims, objectives and learning outcomes. The four participants do have an idea that they are teaching towards certain goals and am not convinced that they exactly understand which goals are for teachers and which goals are for leaners. In addition, in the teaching process, teachers have to apply teaching strategies that will expect a learner to participate in the setting goals (Kuiper et al., 2013). According to the findings generated from four participants it seems as if they do not set any goals for their teaching because they did not mentions that they come to class with any goals prepared beforehand. Furthermore, the participants revealed that whatever method they use is determined by the performance of the learners. This is in contrast with the study of (Khoza, 2013b), who argues that teachers should teach towards aims and objectives in delivering the lessons, which is the teacher-centred approach and falls under the performance curriculum. Moreover, the participants did not mention any aims and objectives in the implementation Mathematics content that they are expected to deliver to learners nor that their teaching is relevant to learners (Van den Akker et al., 2009). This proves that the participants do not consult their CAPS document to check toward which goals they want to achieve.

The data gathered from the four participants indicate that they use question and answer strategy to introduce a lesson, during the lesson or at the end of the lesson. This is supported by Khoza (2014b) who states that the teaching of the learning outcomes is achieved by means of following teaching strategies like application of the acquired knowledge, demonstrating knowledge at the end of the lesson and getting the learners to answer questions at the end of a lesson to check

learner understanding of the lesson. The difference is that the participants did not mention that they use question and answers in the teaching of the learning outcomes. Nkopodi and Mosimege (2009), argue that teachers should plan learning outcomes that will engage learners to apply teaching strategies like recalling mathematics terminology, identifying the properties of a square and a rectangle and describing the process of construction of the chess board. As A1 indicated that, she involves learners in practical activities in the process of measurements, like using a spoon and two tea spoons. Learners discover that 2 teaspoon is equals to 1 spoon.

This means that the participants employ everyday knowledge in implementing the goals of Mathematics curriculum while the current Mathematics curriculum is based on school knowledge (Hoadley & Jansen, 2013). They are not using the prescriptive document, the CAPS document, provided to them (Hoadley & Jansen, 2012). In addition, Khoza (2014a) states that learning outcomes are attained by means of a learner-centred approach that is based on a competence curriculum and problem solving strategy is used to attain the intended learning outcomes. This indicates that there are teachers who are just teaching without understand towards which goals they are teaching. In conclusion, Kennedy et al. (2006); Khoza (2013b) state that teachers should combine teacher-centred, content-centred and learner-centred approach in order to balance aims, objectives and learning outcomes. As a result, Hoadley and Jansen (2012) concur with Kennedy et al. (2006) and Khoza (2013b) that in teaching and learning there is a combination of teacher-centred approach and learner-centred approach to sustain the curriculum.

On the other hand, CAPS is not relevant, consistent and practically sustainable because the document does not specify the teaching strategies for teaching grade 5 Mathematic (Berkvens et al., 2014). This indicates that teachers have no direction of which teaching strategies should be employed, if teachers want to achieve general aims, specific aims or specific skills (Khoza, 2014b). That is why teachers are unable to explain clearly how they teach grade 5 Mathematics using particular teaching strategy. Therefore, the results of the above discussion indicate that there was a need for an exploration of specific teaching strategies for teaching grade5 Mathematics.

#### **4.2.4 What content are you teaching Mathematics using particular teaching strategies?**

Theme 4: Content

All the participants were able to narrate the content during the reflective activity, interviews and focus group discussions. In addition, they all reflected that the content they teach is stipulated in the CAPS document. Furthermore, they all agreed during the focus group discussions that the CAPS document clearly specifies the content area, topics, concepts and skills and they also indicated that they are given some teaching guidelines of what to be taught. For example all the participants reflected that they teach: Numbers, Operations and Relationships; Patterns, Functions and Algebra; Space and Shapes (Geometry); Measurement and Data handling.

The participants reflected as follows in the reflective activity concerning mental activities they teach. A1 said that,

...each term CAPS guide us with mental activities including additions and subtraction for units, multiples of 10, 100, and 1000. Calculations techniques like doubling and halving, multiplication and division. Every morning let learners say a times table depending which times table I want them to learn, starting from 2 times table up to 10 times table. They do it orally as whole class, in groups or as individual.

B1 said that,

CAPS give us the mental calculation includes building up and breaking down numbers, rounding off, comparing, odd and even numbers. At times I do mental mathematics by means of question and answer method, orally or in a written form.

C2 and D3 said that CAPS stipulate that mental activities should be taught daily.

C2 added that,

CAPS stipulates mental activities to be taught includes time table, multiplication of whole numbers, addition and subtraction, number bond, ordering numbers, counting. I include mental Mathematics during class activities as well as in formal tasks. Mental activity fits in when I ask questions in a whole class. It is included in formal and informal assessment when ask them to fill in the missing numbers, put the numbers in order.

The participants' accounts as follows during the interviews and focus group discussions were as follows. A1 said that,

...in oral counting learners develop thinking skills. Whole class counting saves time since mental Mathematics is allocated 10 minutes a day. Question and answer method gives me a clear picture if learners are able to count appropriately. They learn to think fast.

B1 said that,

'Group counting allows me to identify those learners who cannot count mentally'. C2 and D3 indicated that in most of their teaching, they do not teach mental mathematics separate from the content. They indicated that they fit mental mathematics in the content by means of a question and answer method and in a written form. This shows teachers think in different ways about teaching grade 5 mental Mathematics. A1 and B1 allow learners to count every day for 10 minutes, in an oral method, which indicates that they use rote learning. All the participants during focus group discussions agreed that CAPS document guides them on what mental activities should be taught and they do mental mathematics orally, by asking questions as well as in a written form. The data generated from four participants indicated that all the participants teach the mental activities as indicated in CAPS document'.

In addition, concerning the content the four participants accounted as follows during the one-on-one semi structured interviews: A1 said that,

To teach content for the first time I teach them as whole class, it is better to introduce a lesson to the whole to save time, it is where I explain the terms of mathematics. I do examples, demonstrate on the board. I ask questions and follow up. From the questions I can see if learners did understand. Learner's responses determine whether I have to repeat the lesson the following day or group them according to their understanding. I would then give more work to the group that showed that they understood the lesson better, while I work with the group that showed that they did not understand. In groups it is where they teach one another, by sharing ideas and they are not shy to ask questions based on the lesson that was taught. From group work I give them individual activities to check individual performance. Beyond that I do remedial work to those who are backward.

B1's, C2's and D3's accounts indicate that they use almost the same teaching strategies except that A1 also accounted about remedial work during one-on-one semi-structured interviews.

C3 said that,

'I use the whole class method. Group work, pair work and individual method to teach the content. In pairs learners compete with one another, no one wants to be defeated. I find them talking to themselves that they do not want to beat so and so. That is how I encourage them to love Mathematics. She used the same explanation in defending herself how and why teaching strategies is in that particular manner'.

This indicates that the four participants teach the content using the same teaching strategies for the same reasons. According to Ball et al. (2008), the content refers to a wide range of aspects of subject matter, knowledge and teaching of subject matter. In addition, Baumert et al. (2010) argue that the three remarkable content areas in elementary school are numbers/operations, patterns/functions and algebra. Baumert et al. (2010), argument is in contrast with South African Mathematics because they left out content areas like space and shape (geometry); measurement; and data handling. These mentioned content areas are also important in the South African curriculum as indicated on the Mathematics document (DoE, 2011). This shows that in South Africa Mathematics is balanced since it touches all parts of Mathematics content areas. Furthermore, Shulman (1987) argues that in implementing the Mathematics content it requires a teacher who knows all aspects of the subject. He further states that content knowledge entails knowledge of the subject matter and its structures or parts, whereas curricular knowledge is characterised by certain programmes for the teaching the subject and employing different strategies.

Hoadley and Jansen (2012) argue that the intended curriculum is often not contained in one document, but rather that it comes in a number of documents that outlines the content for learning areas and subjects and these documents apply to different levels of curriculum as it is suggested by CAPS document DoE (2011) that the Mathematics syllabus, annual teaching plan, the lessons plans and the textbooks are all curriculum documents at the different levels of the curriculum. In addition, the findings generated from the four participants of this study indicated earlier that in teaching grade 5 Mathematics, they use a teaching plan which is in line with the

Mathematics 2011 document. This indicates that the lesson plan and the textbooks used by the participants for teaching grade 5 Mathematics are also curriculum documents at the different levels of the curriculum. Hoadley and Jansen (2012), argue that traditional approach to the curriculum suggests that, based on the curriculum content, the department or the school must decide which subjects to teach, what content to teach and what teaching strategies should be used. The Mathematics document DoE (2011) concurs with Hoadley and Jansen (2013) as it stipulates the subject to teach and the content that is to be taught. This is also supported by the study of Long and Dunne (2014) which reveals that a topic approach underlies the design of CAPS 2011, and the order and progression of the topics are carefully planned. In addition, they further state that topics are planned so that the conceptual preceding concepts are presumably taught prior to the more advanced topics. A result, grade 5 Mathematics guide teachers on the weighting of content areas, topics to be taught, time needed for each topic and the spread of content in the examination in each term DoE (2011), but does not guide teachers on which teaching strategies should be used.

Khoza (2014b), argues that if teachers place most of the focus on content when delivering the lesson, it means they are applying a content-centred approach. Therefore, the findings gathered from the four participants indicate that all the participants use content-centred approaching order to deliver their lessons. In addition, Radford (2008) states that teachers should use a mentalistic teaching strategy which involves written questionnaires interviews and drawing exercises to get an indication of what is going on in the mind of the learner. Furthermore, this shows that the four participants are adhering to what is required of them when they test learners 'understanding of the content orally and in written form since grade 5 Mathematics document does not indicate how they should teach the provided mental content. Moreover, teachers should use teaching strategies that allow learners to play games like morabaraba (a strategic board game) in the mathematics curriculum to instil the language and vocabulary of mathematics, develop ability with mental mathematics, and introduce device problem-solving strategies and to be the generator of mathematical activity at a variety of different levels (Nkopodi & Mosimege, 2009). However, they is no indication that learners are engaged in any games strategies in mental activities that motivate learners to develop their mental skills and increase their language



vocabulary. This shows the participants' weaknesses where they do not indicate that they engage learners in games to make their teaching and learning more fun.

Silver et al. (2009), state that mathematics instructional tasks tend to emphasise lower level, rather than high level, cognitive processes in which memorising and recalling facts and procedures. The findings of this research support Silver et al. (2009) argument when indicating that learners are taught to memorise the times table and recall it by saying it every day. This indicates learners that learn the times table and the rules of the content without reasoning and connecting ideas or solving complex problem, required learners to work alone and in silence, with little opportunity for discussion and collaborations. As the findings indicate, teachers introduce a lesson by means of doing examples, demonstrations and lots of explanations rather than giving the students a chance to solve problems on their own which shows that the teacher tends to dominate the classroom. The participants are confused since the roles that they play in the implementation of the new curriculum are conflictual and not complementary (Graven, 2001). In addition, Graven (2001) recommends that Curriculum implementation should be a procedure of engaging the curriculum so that it 'becomes part of the teacher's way of being' and will result in teachers adjusting their beliefs and modifying their approach to suit the way curriculum should be conveyed. Therefore, this shows that teachers out there are confused, on one hand they are given the intended curriculum to teach, on the other hand they are not given the teaching strategies to be implemented in an enacted curriculum.

Moreover, grade 5 Mathematics content proves to be relevant as it provides teachers with the content area to be taught and it covers the different content areas. In addition, the findings generated from the four participants indicated that they follow the prescribed curriculum to teach the content. This shows that they are aligned with Mathematics and that they are using school knowledge (Hoadley & Jansen, 2013). The problem here might lie with the teaching strategies that are used by teachers for teaching grade 5 Mathematics, since CAPS does not indicate the teaching strategies for the teaching content. There might be a danger that teachers are using particular teaching strategies for a wrong purpose because they are using familiar (everyday knowledge) instead of unfamiliar (school knowledge) (Henderson & Rodrigues, 2008). Nevertheless, the findings indicate that the participants use a combination of teacher-centred,

content-centred and learner-centred approaches which is recommended in the literature review. Furthermore, the data generated indicate that the participants could not identify the aims, objectives and outcome, as specified by (Khoza, 2014b), for teaching a particular content they should use particular strategy for, aims, objectives or learning outcomes in a particular manner. Therefore the high rate of failures in South Africa might remain the same if teachers are selecting teaching strategies for teaching grade 5 Mathematics that are suitable for particular content (Kehdinga, 2014b; Machisi, 2013).

#### **4.2.5 What teaching activities are you teaching Mathematics using particular teaching strategies?**

Theme 5: activities

The participants during the reflective activity reflected as follows: A1 said that,

I use formal and informal activities, which involves word sums, data handling projects, patterns, 2D and 3D shapes, measurements activities, operations classwork activities and homework activities. I use whole class discussions when I introduce a lesson, explain, demonstrate and do presentations before I give learners an informal class activity. In data handling learners collect the waste in groups, analyse, interpret, do recommendations in groups and give feed an individual's representing their groups. In formal activities a just tell learners to write formal activities as individuals. Learners read instructions on their own as individuals.

B1 said that,

The CAPS document guides me to teach the following activities: mental activities, classwork activities, homework activities and assessment tasks. This involves: whole numbers which involve ordering, comparing, representing numbers and place value of digits; number sentences; and problem solving including operations, numeric patterns, fractions time, capacity, mass and length, geometric patterns, properties of 3D objects and data handling projects. I use question and answer, introduction, explanation and presentations. I do demonstration when I teach about fractions. Then let learners do it practically what learners do practical they do not forget easily. I do presentation if it is a new lesson. Thereafter I would give learners class activities either as individuals or in groups. I use

group method when I want to assist them in groups, at times divide the groups according to their abilities and work with them accordingly.

C2 and D3 reflected more or less the same as A1 and B1, but C2 was specific in terms of formal activities she uses by indicating

C2 said

...the formal activities I give learners are assignments tests, projects, investigations, half yearly examinations and final examinations as indicated in the CAPS documents. Learners do these activities as individuals in order to have a picture of individual performance. We discuss 2Ds and 3Ds shapes, to engage learners in discussions so that they are free to ask questions if they do not understand.

D3 said

I do mental activity for 10 minutes, orally in a whole class. I give learners formal and informal activities. I introduce, demonstrate, and explain, to learners in a whole class, when starting a new lesson. I demonstrate new activities to learners by doing examples before I give learners class activities they have to do. Some activities are done in groups and in pairs where they do measurements, so that they can share ideas and help one another. They also do individually at the end of the day each and individual has to work independently. I use question and answer method to evaluate the learners understanding. I also give learners homework activities so that they get a practice of what we were doing in class.

During the semi structured interviews and focus group discussions all participants indicated that they use that are linked to the content. Furthermore, the participants named the strategies they use for teaching grade 5 Mathematics. They were also requested to explain how and why they are using these teaching strategies. The participants' responses were almost the same since as they seemed to follow the CAPS guidelines.

A1 said that,

I use question and answer method and observation, for an example in observation I instil knowledge in learners' minds so that they recall the things they have seen before, I ask

questions like, have you ever seen a smallest container of milk? If they say yes. I ask them what it is written on it. They say 250ml, then I would Use 250ml and an empty container of 500ml. I then use 250ml with water to fill in 500ml container. Learners count how many 250ml of water fill in 500ml container. Then I divide learner in groups, let them fill water in the 1l, 2l and 5l containers using 250ml container. They would write down in a flip chart what they had found. At the end, one member from each group would give a report. I also allow learners to build different 3D shapes cubes, rectangular prism, cylinder, as individuals so that they know the different between 2D and 3D shapes.

B1 said that,

I use demonstration method, for example when teaching fractions. I demonstrate with...paper, I let learners do as I do. I fold a paper into two, show and tell learners that now the paper is divided into two. Then tell them that the two parts, three, depending which fraction I am teaching and tell them that one part of that particular fraction is called halves third, quarter, and each part is written as  $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{1}{4}$ , etc. but the learners do the rest while I facilitate them. I use question and answer method to draw the attention of learners. I also explain to learners that in fractions the number above the line is called the numerator the line between the two numbers is means divide and the number is below the line is called the denominator. This method helps learners to master the fraction very well. It not easy to forget what you did with your own hands. I would then give learners individual class activities. If learners experience difficulties, I attend them in groups, give them a chance to share ideas, I come in as a facilitator. Learners learn better when sharing ideas with other learners. In multiplication I also do demonstration I group the objects into equal parts. I ask learners how many marbles in each group for example 5 groups of 4 then explain that the sum of all those objects is called the product.

B1 further explains the methods used for measuring length:

‘I start by showing a ruler, meter ruler, and a tape measure instruments, tell learners that we use these instruments to measure the length. Why do you tell them? Learners need to have direction of what they are taught. I cannot just jump into giving learners activities. I have

to explain, give examples, demonstrate first then give learners activities. Then distribute rulers to learners divide them in groups’.

B1 also describes the strategies used for teaching addition and subtraction she use breaking down method, horizontal and vertical method, for an example when adding or subtracting 6 digit numbers. She uses place values: HTH TH H T U do many examples with learners. Explain that she start from right to left. She use question and answer method to a whole class tracking learners understanding. Then let learners work in groups to share ideas and boost those learners who did not understand while I was explaining.

C2’s account concerning data handling was the same as the other three participants. She said that...

We also do a tally based on the data collected. They draw a table, with the headings, that is tally and frequency. Under tally they write four strokes and cross every fifth stroke so that the information is grouped into 5s. And so on depending on the number represented. I explain to learners that a tally is the shortest way to represent the data. After a tally, they with learners. We discuss that 2D shapes have length and breadth and 3D shapes have length, the breath and the height and also focus on how they are shaped. And how we measure them and focus on the angles, vertex and the edges. In problem solving I sometimes come with a problem, I let them to solve, sometimes I put them in a fractional type, there are those fractions that are related, so most of the time it comes in questions where they have to answer the questions and find that the problem is solved. It is not easy some time I come with a problem taken from the CAPS document and we are also compelled to use the department workbooks. So I let them solve problem, sometimes I put them in a fractional type, there are those fractions that are related, so most of the time it comes in questions form where they have to answer the questions and find that the problem is solved, either in groups or individually.

D3, said that,

...the activities that I teach are from CAPS document and the department workbooks. I start by mental mathematics for 10 minutes every day orally. To teach measurements for instance, measuring a mass, I bring a balance-scale and a bathroom scale from home learners bring in empty pockets

sugar, beans, rice, with different measurements like 250g, 500g, 750g 1kg, 2kg, 3kg etc. I allow learners to measure different object using the provided scale. I point learners at random to come and measure in front of the class. Then I would rotate the scale in groups so that they all get opportunities to use a scale, in groups it is where they find their strength and witnesses. After all the groups have used the scale, I would ask learners to say which object has more or less weight. D3 further explained about teaching multiplication/division to teach multiplication

She said that,

I first let learners do the times table orally in groups. The times table helps enable learners to calculate big numbers. I do examples and demonstrate on the board. Then I give them multiplication sums; if they fail, I repeat the lesson. I also teach learners to check the answer by using inverse operation of multiplication. I group those who got the answer correct and show them how to check an answer by using a division sign. While other groups check their answers by using inverse operations I go around assisting those who are struggling. I also give individual activities to find out how much knowledge they gained.

The data generated from the four participants indicate that they use activities that guide them, as indicated on the CAPS document along with activities from the Department of Basic Education's workbooks. During the group discussions, the four participants agreed that they are compelled to use activities that are in the DEB workbooks which are CAPS aligned. They added that their heads of departments (HoD) do monitor that DBE workbooks are used, and marked. The data generated also indicate that the four participants use almost the same teaching strategies and they give the same reasons for doing so. During the focus group it also came out that the participants use a group method so that learners may share ideas and that learners are free to ask questions of one another so that at the end all learners can work independently. It was also revealed that all the participant do teach data handling the same way. Kehdinga (2014b), states that lesson delivery involves teaching activities, strategies, skills and resources used by teachers in the teaching and learning situation. This is also revealed in the findings that the participants use activities from the CAPS documents, and DBE workbooks that are CAPS aligned, different teaching strategies like question and answer, explanation, group work, pair and individual strategies and different resources like the department workbooks in delivering grade 5

Mathematics CAPS lessons. In addition, Chambers (2008) argue that the starter activity in mathematics is often referred as an oral and mental starter. Furthermore, Facts (2014) teachers states that teachers can use games to get learners thinking. In addition, teachers are encouraged to create mental activities that involve partnership between them in order to engage learners to work mentally and explain verbal thinking of learners. Moreover, the data generated indicate that Bland D3 do mental activities at the beginning of each mathematics lesson using the oral method, by counting and question and answer. In addition, the participants stated that they do mental activities as this is required by CAPS. They do not mention that they do mental activities to motivate learners' thinking ability. Furthermore, there is no indication that participants use games to get learners thinking. This creates a problem because the participants seem unaware that using games in teaching mental mathematics may motive learners' thinking.

Moreover, the data generated during reflective activity, interviews and focus group discussion indicated that most of the time the participants use the telling method when teaching addition which is a teacher-centred approach. Even if they discuss the subject with learners, it shows that learners are bored. They use the usual methods like horizontal and vertical methods as well the breaking down method. In addition, teachers need to create a fun atmosphere in their teaching and learning when teaching addition or subtraction. As Graven et al. (2013), recommend that in doing addition(e.g.  $397 + 65 + 3$ ), teachers should use the self-discovery strategy for learns and then move around helping learners to use the quick method of addition by using guiding question.

Furthermore, the participants are showing their strength when moving around, helping learners while they are working in groups. Getting further, Cengiz et al. (2011), states that in teaching story problems, a teacher gave the distance riddle activity, for an example the distance between 100 and me is 45. What number can I be? The teacher opened a whole group discussion strategy that prolonging learner thinking to make a link between representation and a story problem. The distance riddle activity is another strategy of teaching story problems. Teachers need to have knowledge of how and why they are using a particular strategy. As it is, the participants don't seem to have good reasons for using a group discussion strategy teaching for teaching problem

solving. A1 and C2 indicated that they teach word sums but they are unable to give sound reason for using this discussion strategy.

In addition, Sepeng and Webb (2012) indicate that using discussion as a strategy for teaching and learning of mathematics benefits learners to develop skills of knowing when and how to apply classroom mathematical knowledge as well as when solving problems on their own. Machisi (2013), further argues that problem-solving promotes a change from traditional practices to practices that emphasise inquiry and discovery teaching, which involves the learner-centred approach. Furthermore, the participants did not indicate that they use the self-discovery method when teaching word problems, instead A1 and C2 indicated that they engage learners in word problems in a form of a question and answer strategy which limits learners to the self-discovery method. Moreover, the participants use traditional practices, which are content-centred and teachers-centred, and they are on the right track because CAPS is a performance curriculum (Hoadley & Jansen, 2012).

Furthermore, the study of Bolden et al. (2010) reveals that in teaching times tables, for instance the 6 times table, teachers can use a Bingo strategy, which is a more interactive and a fun way for teaching tables. None of the participants have indicated that they teach the times table by means of games which is proved to be a fun way of interacting with learners, rather than teaching the times table orally or by means of question and answer. This indicates that there are new teaching strategies of the teaching times table, which the participants are not aware of. This indicates that the participants are still using the old teaching strategies that they learned from college. This shows that these teachers lack subject-matter knowledge for grade 5 Mathematics CAPS and substitute their old teaching strategies. This is confirmed by Sherin and Drake (2009) when they state that teachers with subject-matter knowledge can substitute a new activity in place of one recommended in the curriculum. They further state that, instead of using the paper folding activity described to assist learners explore fractions, teachers may ask learners to shade in different portion of a square.

It is better this way because when a teacher holds up those little shapes, learners may not see where they are folding (Sherin & Drake, 2009). In the case of teaching fractions B1's account,



supported by other participants, indicates that they are still using a paper folding of shapes which Sherin and Drake (2009), are not in favour of, although B1 indicated that learners themselves do paper folding after he has done the demonstration. Therefore, B1s' learners are able to see how fractions are done because they are engaged in a hands on activity, unlike the other participants' accounts. This indicates that there are other teachers out there who are facing challenges as far as teaching strategies for teaching grade 5 Mathematics CAPS fractions.

Bolden et al. (2010), state that learners could be given tasks of making their own shapes like spaceships, animal shapes and Christmas trees when teaching space and shapes. It is unfortunate that teachers are expected to teach the intended curriculum without specific teaching strategy guidelines of how to implement the documented activities. One can see that teachers are trying their best to teach using teaching strategies gained from their previous experience. As indicated in the data generated, learners are not taught to make their own pictures but instead A1 accounted that learners are taught to build cubes, rectangular prisms from the net given from the CAPS document. Furthermore, C2 accounted that she teaches learners about vertex, edges and angles as on 3D shapes and how are they shaped, as well as measuring the length, and breadth of 2D shapes. Instead of using the self-discovery strategy by letting learners build their own 3D shapes so that they can see the real vertex, edges and angles as recommended by (Bolden et al., 2010).

The study of Paramore (2011), reveals that in teaching data handling, a teacher may use a dialogue approach, framing questions for learners to engage with during discussions. In the next step, the teacher allows learners to collect data. Then learners come back and share their findings, followed by the open debate to evaluate their findings. Furthermore, the findings indicted that all the participants follow the same approach that is in the form of dialogue strategy, as revealed in the study conducted by (Paramore, 2011). The only thing that is lacking on the part of the participants are the reasons for using the strategies in that particular manner. In addition, the participants cannot explain whether the strategies they are using for teaching the content are linked with the aims, objectives or the learning outcomes. This indicates that the participant do not link the activities to aims, objectives and outcomes (Khoza, 2015a). This indicate that this is a challenge to teachers especially to those who do not have sufficient content

knowledge, skills innovation and experience to effectively put the progress curriculum to good use (Msibi & Mchunu, 2013).

This further indicates that currently the implementation of the relevant strategies is a challenge to these participants to effectively put the progress curriculum to good use because the Mathematics CAPS document does not specify the teaching strategies to be used for teaching grade 5 Mathematics CAPS activities. However, the combination of the content-centred, teacher-centred and learner-centred approach for teaching grade 5 Mathematics CAPS shows the strength on the part of the participants. In addition, all the participants indicated that they deliver the activities that are linked to the content (Khoza, 2015b). On the other hand, Mathematics document is comprehensive in terms of the activities that are taught in grade 5 Mathematics. This is confirmed by all the participants during data gathering who said that they all use Mathematics document guidelines to teach activities that are linked to the content. However, the Mathematics document's weaknesses are by providing limited teaching strategies to be used by teachers. As a result, the participants are not aware that there are particular teaching strategies to be used to achieve aims, objectives or learning outcomes for teaching grade 5 Mathematics. This indicates that grade 5 Mathematics does not show relevancy, consistency, practicality and sustainability (Berkvens et al., 2014).

#### **4.2.6 How do you perceive your role as teacher for teaching Mathematics using particular strategies?**

##### **Theme 6: Teaching role**

During the reflective activity the participants were aware of what they were expected to note down. As a result their reflective activity were a bit more informative.

A1 indicated that, as a teacher I teach, mark a register calling an individual learner, I am a counsellor, I control teaching and learning. I present a lesson, explain terms and meanings, and then tell learner to open in their exercise books. I play a parental role, I manage the classroom. I discuss class rules with learners. I also group learners according to their abilities and facilitate them in their groups. I also involve learners in class discussions.

B1, C2 and D3's reflective activity were the same as A1, B1 added that I use diagnosis assessment in a form of question and answer, before I start to teach. This assist me know each and individual ability. I introduce a lesson from known to unknown.' I use question and answer method to involve learners in a lesson. I control lesson by asking questions, so that there is a smooth running of teaching and learning.

C2 indicated that,

I engage learners on question and answer method'. I write corrections on the board while learners give answers. Learners have to know where they did go wrong and correct that so that next time they do not repeat the same mistake. I guide learners by giving them class work to do either as individual or groups.

D3 also indicated that,

...as a teacher it depends what I am teaching if I am teaching to compare numbers I write the relationship symbols,  $<$ ,  $>$  and  $=$  on the board. I tell learners to copy and write the correct sign for an example  $65 > 56$ . Then I let them discover for themselves which numbers are bigger, smaller or equals, so that they are able to solve the problems in the real world.

This indicates that all the participants were using a combination the teacher-centred approach where they control the classroom learning, the content-centred approach where they explain the terms and meanings and comparing numbers and the learner-centred approach by facilitating groups. This shows the participants' strength because none of the three approaches can work alone as indicated in the study conducted by (Khoza, 2013a).

During the interviews and discussions the participants narrated as follows: A1 said that,

At times I do examples on the board then give learners some activities and follow the example on the board. And again I give challenging work to the ones who are doing well, like problem solving in fractions so that they do not disturb the ones that I am helping in different groups, helping learners in groups assists me to quickly pick up those who are not contributing in a group. Then I would assist those individuals as they indicate that they did not understand the concept. I teach the whole class during the introduction and presentation and when I give explanations of a

lesson. It saves time to introduce and present a lesson for the class in order to cover all the lessons for each term.

B1 said that,

I use question and answer method trying to find out where learners got I lost either in groups. When there is time I involve learners than talking, explaining to them. To make sure that I teach a learner to understand, if not succeeding try other teaching strategies, I write meanings of the term on the board and explain each and every term to learners in a whole class. To teach problem sums I let learners solve the problem in groups, share ideas, debate about it and come up with a solution, while I walk around and facilitate them.

C2 said that, as a teacher I have to lead by examples, teaching learners, by giving learners some work, tell learners to corrections on the board. I do explain during presentation of my lessons as a teacher I am there to guide learners, when they solve problem facilitating them, individually or in their groups, especially those who encounter any problems in the subject. Group work assists the shy ones to learn from their peers and get a chance to ask where they do not understand because at times they are afraid to ask a teacher.

D3 said that,

I use the whole class discussions to discuss the class rules. We share ideas, debate on which class rules are acceptable to all of us. I assess learners as individuals to check if each learner did understand the lesson which was taught and to give them an opportunity to demonstrate their competency. I also assess groups to get a feedback about my methods of teaching so that I can try other alternative methods.

The above data generated during the reflective activity indicate that teachers play more than one role, besides teaching grade 5 Mathematics, the teacher is faced with many challenges of being a controller, counsellor, parent, and assessor; it is clear that teachers possess many personalities (Kehdinga, 2014b). Therefore teachers need to be professional in order to familiarise themselves to such situations in their teaching practice. In addition, this shows that being a teacher means opening their practice to scrutiny, and thinking critically about the lesson plan (Lieberman,

2009), as well as thinking critically about teaching strategies to be employed in a lesson. This indicates that teachers should behave as professionals bearing in mind that they are teaching learners with different challenges. So, it means that when teachers plan a lesson for teaching grade 5 Mathematics, they should be sensitive to strategies they employ in their teaching practice. In addition, the findings indicate that the participants use the teacher-centred strategy by means of expository method as a norm by doing the examples on the chalkboard, while learners are required to duplicate it (Crespo et al., 2010).

In addition, Crespo et al. (2010), states that when the participants do examples on the board then give learners activities to follow they are using teacher-centred approach. Khoza (2014b), argues that it is an experienced teacher who is capable of explaining all the content areas. To be an excellent teacher, teachers must be able to know how to identify, represent and explain key concepts in Mathematics (Kullberg, 2010). In addition, it is an experienced teacher who will be able to control what is taught and how to deliver the information that has to be learned (Killen, 2007). According to the data provided by the participants they each have more than ten years of experience of teaching grade 5 Mathematics. In addition, the data indicates that the participants are in control of the teaching and learning, for example, when participant A1 and D3 tell learners to fill in signs like  $<$ ;  $>$ ; or  $=$  between the two numbers. In addition, the participants' accounts indicate that they do some explaining when teaching grade 5 Mathematics content. This proves that the participants are also using a content-centred approach. In support of this, Khoza (2014b), states that if the teacher wants to cover the curriculum they have to use the teacher-centred approach. Unfortunately, the findings show that the participants are unable to give the relevant reason as to why they use the teacher-centred approach, which shows a gap on the part of the participants' understanding of how they teach.

Teachers need to know the content they teach and what learners are expected to master (Ball et al., 2008). The fact that the four participants kept on referring to the content when accounting about the teaching strategies during the reflective activity, interviews and focus group discussions, indicates that they know the content. They also indicated that they use a teacher-centred approach in teaching grade 5 Mathematics. Moreover, the findings also show that the participants assess individuals or groups to check whether the content taught has been

understood (objectives) and they are also using content-centred approach. This proves that the participants are using unfamiliar knowledge (school knowledge) (Henderson & Rodrigues, 2008) because they are guided by the Mathematics document. The findings also indicate that they are using the CAPS document to employ a content-centred strategy for teaching Mathematics CAPS. In addition, this is supported by the study by Khoza (2013b) which states that if teachers want to measure any amount of the content to be given to learners they should use a content-centred approach. However, it is unfortunate that the participants are not aware that the reason for using a content-centred approach for teaching grade 5 Mathematics is for measuring the amount of the content they are teaching.

The data generated also shows that teachers are in charge of education and also guide learners during teaching and learning (Kehdinga, 2014b). In addition, the generated data indicate that teachers facilitate the teaching and learning. It is revealed that the participants guide learners in group work discussions when they are teaching problem solving, while they move around to the groups facilitating the students. Suherman et al. (2011), supports this view by arguing that a group work strategy gives learners the opportunity to practice magic finger techniques for example using fingers when reciting a times table. However, the participants need to develop themselves in order learn a variety of techniques because so far they did not indicate that they use any games or magic techniques for teaching grade 5 Mathematics. Furthermore, Machisi (2013) supports Suherman et al. (2011) viewpoint by stating that teachers should create a teaching environment that provides learners with opportunities to explain multiple strategies when engaging in mathematical problems.

In addition Buddo (2013) concurs with Machisi (2013); Suherman et al. (2011) by stating that a teacher accommodates individual differences in the mathematics classroom so that learners are engaged in a higher level of thinking through reasoning, communicating, making connections and a problem solving approach. Furthermore, the data generated during interviews and discussions indicated that the participants do engage learners in group discussions whereby they are given opportunities to solve problems on their own. In addition, the data generated also show that learners are engaged in higher levels of thinking, especially those who are higher achievers. The participants were not aware, however, that the learners are assessed to evaluate if they have

attained the intended knowledge, skills and competence (learning outcomes) (Crespo et al., 2010). The above studies indicate that the participants are able to identify the teaching strategies they use for teaching grade 5 Mathematics.

Furthermore, the data also indicate that the participants use a combination of the teacher-centred approach, content-centred approach and learner-centred approach. This is supported by the view of Ndlovu (2011), who argues for the importance of varying teaching strategies in order to sustain teacher motivation and interest. This is also supported by Khoza (2013b), when stating that none of the three approaches should be used alone.

However, the data generated indicate that the participants are not aware that there are particular teaching strategies that are to be used for achieving aims, objectives or learning outcomes when teaching mathematics in grade 5. As Khoza (2015b) states, that if teachers use aims or objectives to initiate the lessons they are using teacher-centred approach, if they use the content to drive their lessons it means they apply the content-centred approach and if they use learning outcomes to drive their lessons it means they are applying learner-centred approach. In addition, the CAPS document for grade 5 Mathematics does not indicate the teaching strategies should be used by teachers when teaching grade 5 Mathematics. CAPS document is silent about the importance of the teacher's role as one of the ten concepts of the curricular spider web. As a result it is impossible for teachers to know why they are using specific teaching strategies in a particular manner. In conclusion, the above discussions indicate that there is no relevancy, consistency, sustainability and practicality.

#### **4.2.7 What material are you using to teach Mathematics using particular teaching strategies?**

Theme 7: Recourses and materials

The data generated from the participants during the reflective activity the participants reflected as follows. A1 indicated that,

I use number cards, worksheets, standard scale, bathroom scale, number grid, number line, workbooks, and tape measure. I use number card with an individual learner because I do number cards with learners, survey and word sums, I do worksheets that are equal to the number of learners. Learners do individual activities on a worksheet. I use measurement

instruments, like standard scale I group learners according to the number scale that I have. Usually I use 1 standard scale for weighing the mass of object like sugar, rice samp and beans. I do enlarge number grid from learner's workbook so that I have mine for demonstrating, when teaching numbers. Mathematics instrument, each leaner has his or her mathematics instrument, I move around into pairs showing learner how to measure angles because I cannot attend an individual learner to save time. I give class activities to do individually using their textbooks (software), I demonstrate with a tape measure in a whole class, because there is only one tape measure in a class. Meter ruler learners take turns to measure their height.

B1 indicated he used similar resources as A1 but he added that,

I use the board to write terms, do examples and write corrections (ideological-ware) for learners, waste material bottles containers plastic bottles, rulers, tape measure and pictures. I use right angles around the classroom pointing them at random so that they see what right angles are. I use pamphlets to teach learners rates, I let learners work in groups so that they can discuss real life issues. I use workbooks to give (ideological-ware) class activities and homework activities because all learners have their workbooks to work independently.

C2 added on top of what A1 and B1 have said,

I use learners workbooks and learner activity books, when I give them class activities and homework so that they get practice even at home, I use real objects like instruments to measure the angles learners have their own instruments to measure angles. I group (ideological-ware) learners in 10s when I teaching 3D shapes because the blocks that I use are not enough.

D3 also add that,

I uses place value cards in groups since they are not enough when I teach additions and subtractions, learners also share scale measurements materials like jugs, baking cups with measurement, I demonstrate (ideological-ware) with my big abacus, while learners use their individual abacus when I teach counting and calculations, I give learners classwork using their individual workbooks (software). Learners share newspapers in groups when they discuss about that prices



of items sold from the shops. They calculate the total of items they bought and calculate the change.

The above data generated from the participants indicate that the participants were only aware of software resources and ideological-ware resources. None of the participants were aware of hardware resources. The data gathered also indicate that the participants use the teaching strategies driven by the availability of the resources. In addition the data generated indicate that the participants use a combination of the three approaches. This shows that the participants use a content-centred approach when they refer to the content before they talk about the resource. They use a teacher-centred approach when they demonstrate for the whole class using a visible resource for the whole class and they use a learner-centred approach when they allow learners to work in groups because of the inadequate resources.

During the interviews and discussions, all the participants indicated that the CAPS document specifies the resources and material that could be used. They also agreed that in most cases they improvise, since their schools are under resourced.

A1 added that,

I improvise so that the teaching and learning may go on. I cannot wait for the school to buy the resources as it may take years. I request learners to bring empty containers of 250ml, 500ml, 750ml, 1l 2l 5l and 10l. I then group learners to measure the capacity dividing them according to the number of containers we have. Fortunately this year the school was provided by 20 laptops (hardware). I am able to set task questions and memorandum (ideological-ware) typing them in the laptop and make learners copies from the photocopy machine (hardware). Each learner is gets his or her question paper.

B1 accounted the same as A1 during the interviews, saying that,

I improvise because the school is very poor when it comes to the resources. I use laptop (hardware) provided by the department to set assessment task questions and to compile the schedule for each term.

C2's accounts were the same with A1 and B1's accounts which indicates that

All the participants refer to CAPS document in terms of what material to use for teaching grade 5 Mathematics.

C2 said that,

“Towards the end of each term I prepare tasks questions and memorandum (ideological-ware) from the computer (hardware) to be written by an individual learner”. D3’s account was also the same except that she says they bring resources from home together with learners.

She said that,

I also use objects around the classroom. We improvise with learners, we bring learners bring sugar for measuring, empty containers, beans, rice, scales, stones and tape measure. I also use a laptop (hardware) when I set a question paper and writing a memorandum (ideological-ware), there after I do copies (software) on the copy machine (hardware). I also compile record sheets and schedules for each term using the laptop.

All the participants agreed during the focus group discussions that they use laptops or computers and (hardware) when they set their assessment tasks and set their question papers, and they all do copies (software) from the photocopying machine (hardware). They also agreed that they do record sheets and schedules for each term using computers or laptops. In addition, all the participants were also not aware that the ideological-ware is one of the resources, as it is the one that drives any education lesson because learning falls within this category (Khoza 2015b). Furthermore, ideological-ware is any teaching resource that one cannot see or touch, for example learning theories, teaching philosophy, experiences, curriculum knowledge and others (Khoza, 2014). This is supported by the study conducted by Khoza (2012) who argues that any person or thing that communicates teaching becomes a resource.

The participant became aware of hardware resources during the first and second round of the interviews and focus discussions, when they requested that I identify and explain how and why they are using teaching strategies for teaching Mathematics in a particular manner, with the resources they have. During the interview A1 responded as follows:

If the materials are scarce, I give learners different activities with different materials in groups but related to what we are doing. I use number line, to the whole class how to round off to the nearest 5, 10, 100, 1000 and 10 000. I draw in big chart so that all learners could see

it. I also use Individual method when using number cards to test if they know numbers and understand numbers. In most cases I give learners homework using their workbooks which are CAPS aligned and provided by the department because each learner has his or her own workbook.

B1 said that,

After I have explained to the whole class what is a right angle. I let learners identify right angles around the classroom pointing them at random. I do this because I want learners to see the right angles what I am talking about so that it make sense to them when they are required to measure angles in theory. I tell learners to bring pamphlets, with shop items and prices to teach about the rate. Learners in groups will identify objects from the pamphlets and calculate how much per kg or calculate how much if they buy 2kg, 3kg, so that they may realize that mathematics is used in real life. I also use workbooks to give learners classwork activities as well as homework, to work independently.

C2 said that, 'I first demonstrate to the whole class how to measure angles using instruments, showing learners that they start from this point to that point. I also show learners how to measure the right angles using a protector. When resources are not enough I group learners, maybe in a group of 10, they share one or resources depending on resources we have at that particular time. For example I group learners when I am teaching 3D shapes using the blocks that are not enough. We use blocks of rectangles, squares, triangle, pyramid and prisms. The resources that I use for individuals are DBE workbooks and the learner activity books which are ordered by the school from the publishers who work with the department. I give learners class work and homework so that they get practice even at home. They share textbooks in pairs because they are not enough for each learner. The problem with the DBE books is that they is no teacher guide that guide a teacher with answers. As a result we end up uncertain whether the answers are correct.

D3, said that,

I explain to the whole class what 3D Shapes are. I explain the differences between the prism and the pyramid, Allow learners to build their own prisms and pyramid, individually using cut outs from their workbooks, so they find it easier to identify the edges and the faces of 3D shapes and to differentiate. When teaching graphs I teach learners how to make table with collect, analyse interpret and report from the collected information using the board. Explain to the whole class what they are supposed to do then give learners individual activity to go home and collect waste. Then group them in six, put the waste in place, start to separate tins, newspapers, plastics, card boxes, cartoons, plastics containers and paper chip. Put the similar waste together, count it, record, draw a bar graph, interpret and draw the conclusion. I group learners if the resources are limited, I group them according to the availability of the resources. Like when I am using a bath room scale, I group learners in fours to measure their weight while others are recording the weight of their group members, because I have one scale that I brought from home. If the resources are enough I give each his or her own resource like the DBE workbook, each learner is having his or her work book. So that each learner may take a workbook home and do homework. The workbooks are so helpful because a learner is able to do homework because they take it home every day even though the workbooks do not come with the expected answers.

During the discussions it was revealed that there are schools that are given the privilege to order books from the private publishers, but some schools are forced to order textbooks via the department especially the black schools. The data indicate that there are schools at KwaNdengezi Circuit that are under resourced, which was indicated during the focus group discussions when all the participants agreed that to teach mathematics effectively they have to improvise. An example of this was when D3 indicated that these participant view themselves as professionals because when they feel that there is a need to improvise with the materials, they do so and are able to fit in their teaching strategies according to the availability of the resources. They indicated that they group learners when using the waste collected by learner when doing data handling. In addition, A1 indicated that she requests learners to bring empty containers to do measurements on capacity. Being a successful teacher, requires one to be creative; teachers cannot fold their arms and wait for the school or the department to provide the teaching materials. In support of this statement, Long and Dunne (2014) state that teachers need to be encouraged to create their own resources that will be within the context of the learner in the

interest of professional development when they consider the resources to be useful for particular teaching strategies. In addition, Berkvens et al. (2014), argue that there is no definition of when teaching and learning material are adequately considered useful. Therefore, teachers are not restricted about when they should use the resource, as long as the resource is useful in a particular teaching strategy.

Leendertz et al. (2013), indicate that Information Communication Technology has a positive effect in supporting interactive lessons and it offers confidence in using a variety of teaching strategies to best achieve the outcomes of the curriculum. The generated data indicates that teachers are provided with laptops or computers but the participants do not indicate that they use laptops or computers as one of their teaching resources during teaching and learning. Instead the data indicates that the participants use laptops and computers during the assessment process, when they set questions and compile record sheets and schedules. In addition, this behaviour of the participants is reinforced by Drijvers et al. (2010), who argue that teachers who do not recognise the use of technology in their teaching as valuable for their educational goals are able to avoid it. These days, technology is likely to become a central resource in the most schools (Wood & Ashfield, 2008). Furthermore, Khoza (2015a) argues that TIE, and TOE are the main components of educational technology, that benefit the learners as well. In addition, TIE promotes teacher-centred approach in teaching (Khoza, 2014b), if there are not enough resources. Therefore, teachers can use computers or laptops and download relevant resources that are suitable for a particular lesson and employ a teacher-centred approach. Furthermore, teachers should bring in the games that learners play outside the school environment (Nkopodi & Mosimege, 2009). They further state that, in the teacher-centred approach, the teacher can use video recorder to record the play action, then replay and pause it so that games can be analysed. Modern laptops and computers do have video players that can be used in classroom while learners are playing games like morabaraba or chess.

The data generated shows the participants use a whole class strategy when they demonstrate how to round off to the nearest 5, 10 100 and 1000 using the drawn number line, when they demonstrate on the board, and explain the differences between the 3D shapes. However, none of the participants are aware of the importance of linking the ideological-ware with hardware and

software. It is clear that the participants are unable to state why they use a particular teaching strategy with a particular resource to achieve the desired aim and objectives. As Berkvens et al. (2014) state that, the most wonderful teaching experiences can be found on the internet but if these experiences are not relevant to the type of teaching intended or consistent with the desired vision aims and objectives and practical to use in the given setting, teaching will not be effective.

In addition, the data in focus group discussions show that due to the shortage of the resources for teaching grade5 Mathematics, all the participants choose to use a group teaching strategy. Valli and Buese (2007), agree that grouping is done according to the availability of the resources, like A1 has indicated that she divides learners into groups giving them different activities using different materials that are in line with the concept that is being taught. In addition, this action concurs with Van den Akker et al. (2009) by stating that as teachers become real team players, their activities become more unified, and they become capable in entering into difficult curricular conversations, in order to keep teaching and learning in progress. This indicates that teachers sometimes work under difficult conditions but because they are professional, they find means to overcome those difficulties. In addition, the data generated also indicate that the textbooks are insufficient, they cover half of the class and the participants have to use a pairing up strategy for teaching. Teachers may see this as a challenge but at the same time they are opening opportunities of working in pairs by involving learners in interactions which are systematic (Mercer & Sams, 2008). In addition, the data generated indicate that the department of education is doing a good job by providing schools with workbooks to supplement the textbooks. The only thing that needs to be taken care of is the teacher guide that goes with the workbook, as the participants agreed during the group discussions that there is a need of a teacher guide that will guide them with answers.

The data generated indicates that the schools do order textbooks from publishers that are in line with CAPS for teaching of Mathematics, therefore it important for the publishers and people working in Mathematics education to contribute to a bank of project ideas that are appropriate to different contexts (Long & Dunne, 2014). Furthermore, the data generated from the interviews and focus group discussions revealed that there is a concern about the procedure that is used to order textbooks. The data generated indicate that some schools are restricted to ordering

textbooks from the publishers recommended by the department, whereas some schools are given funds to place of any materials they might need including textbooks from other private companies. This indicates that South Africa has adopted system that is used some countries like Indonesia where textbooks are produced officially or semi-officially while Some leave it to the private enterprises (Yee, 2014). The Department of Education provide workbooks for learner while textbooks are left to publishers to supply schools with textbooks. Furthermore, the study of Leendertz et al. (2013) in the literature review indicates that South Africa is continuously changing towards improving the quality of education. As it changes, it needs to question every educational practice, explore the unexplored concepts and dig deep into the schooling and curriculum (Kehdinga, 2014a), in order to address the inequality that occurs between the schools. As the curriculum changes, teachers should also develop the strategies they use for teaching grade 5 Mathematics. In addition, teachers should be competent with Technology Pedagogical Knowledge (TPACK) theory to contribute towards teaching Mathematics effectively (Leendertz et al., 2013). Seemingly teachers are not aware that the teaching strategies for teaching grade 5 Mathematics involve hardware, software, and ideological-ware resources. In addition, the findings prove that teachers use the computers and laptops for their own benefit but not for the benefit of learners. Khoza (2013a), believes that the teaching and learning process needs to include a combination of the three types of teaching and learning resources (HW, SW and IW). Moreover, Sherin and Drake (2009) state that teachers and instructions can be changed as a result of using new materials. Thus, the data indicate that teachers have not adapted in order to use the new materials. Teachers are provided with new resources like laptops and computers but they do not utilise these laptops and computers during class. Laptops or computers can be useful when employing a teacher-centred approach for teaching grade 5 Mathematics.

Furthermore, most of the learners are exposed to technology these days; therefore teachers need to have the skills to adapt their teaching strategies using technology. A study conducted by Leendertz et al. (2013), states that teachers need to be developed so that they are capable in building on learners' prior knowledge and adjusting their teaching strategies to facilitate the new content. The data generated during the reflective activity, interviews and focus group discussions revealed that the Mathematics document indicates some types of resources and materials that the can use by the teachers. Most of the resources mentioned by the participants are the same as

those that are indicated in the CAPS document. The data indicated that the department does provide schools with the workbooks that are CAPS aligned. It is clear that teachers rely on the intended curriculum in such a way that they fulfil the needs of the curriculum, therefore, the teachers need not be blamed because Mathematics CAPS document does not promote the use of technological knowledge. As Leendertz et al. (2013) recommend that teachers have the ability and skills to use a diversity of technologies like books, chalk and chalkboard, as well as technologies such as computers, the internet and digital resources to teach the required content. Furthermore, the CAPS document does not indicate the importance of the selecting the relevant ideological-ware for teaching Mathematics. That might be the reason why teachers are not aware of the relevant technological resources that can be used for teaching Mathematics. In addition the problem still remains that the participants are not aware why each strategy is used to achieve the aims, objectives or learning outcomes of the curriculum. It clear that without the combination hardware, software and ideological resources there will be no relevancy, consistency, practicality and sustainability in Mathematics (Berkvens et al., 2014).

#### **4.2.8 Where and when are you teaching Mathematics using particular teaching strategies?**

##### **Theme 8: Location and time**

All the participants during the reflective activity, semi-structured interview and focus group discussions indicated that mathematics is taught inside and outside the classroom. They indicated that they use the time that is allocated by the CAPS document which is 6 hours a week.

A1, B1, C2 and D3 narrated that.

They teach inside and outside the classroom. They use the time that is allocated by CAPS document. Inside and outside the classroom they are controlled by the time table for the day. They teach Mathematics for 1 and ½ hour for 2 days and 1 hour for 3 days to make 6 hours. Inside the classroom they introduce a lesson by demonstrating and doing examples on the board if it is a new lesson...If it is not a new lesson, they start by doing the corrections of the previous work on the board with the whole class. Those individuals who got the sums wrong they would write corrections for 10 to 15 minutes with the whole class. Those learners who got the sums correct, would do more activities that are similar to the previous sums but with different numbers. Outside the classroom they usually take those days that have 1 hour 30 minutes so that



we would have enough time to walk to the school ground or to the parking. All the participants do corrections for about 30 minutes.

In most cases when they introduce a lesson, do explain to learners, do examples. They agree during the focus group discussions that it is better to introduce a lesson in a whole class than in groups or in pairs to cover the given time. They use group work when they want to help those learners who are struggling, while others are working independently. They use question answer method in the classroom. They alternate the teaching strategies so that learners may see that everybody in the class should be able to count and know his/her times table. They alternate the teaching strategies with an aim of picking up the learners who hide within the others when doing the oral counting. There are lessons that they teach in the classroom. For example, they introduce a lesson, do presentations, give examples and demonstrate, in a whole class. All the participants observe whether learners are doing corrections correctly, but that depends on the time we have for a day inside the classroom. They also agree during the focus group discussions that those learners who do not understand are accommodated during revision as CAPS give us time for revision. CAPS gives us 4 hours for revision per 1<sup>st</sup> and the 4<sup>th</sup> terms and 3 hours per 2<sup>nd</sup> and 3<sup>rd</sup> term which makes 14 hours a year, they do teach Mathematics outside. They usually take those days that they teach for an hour.

A1 added that ‘in most cases learners, work in groups in the field for example to measure the perimeter of the field. I group learners in the classroom and tell them what they are going to do so that there will be no time wasted when they get to the field. Learners have to get an idea that they are taught Mathematics so that they can use it outside the world’.

B1 said

‘Before I take learners outside I explain in classroom what they are going to do outside. For example I take learners outside the parking and I group those in 8s to add cars number plates, others subtract it. I usually give them 30 minutes outside the classroom, and then take them to the classroom to give feedback on addition and subtraction of number plates for 30 minutes. I prepare learners to be able to solve mathematics problems in groups outside the classroom’. I

start with...mental mathematics for 10 minutes depending on the lesson for the day. I teach mental activity in a whole class, groups and individually, alternatively for 10 minutes every day as indicated in that CAPS document. At time I told them that those who would go for shopping to bring sale pamphlets shopping sale or check how much would be a kg of beef, chicken and fish they do the activity for 30 minutes inside the classroom’.

C2 added that,

‘I teach in the classroom and anywhere within the school premises. I teach mathematics in the garden, the plant seeds, they measure the distance of seeds. While in the classroom, I tell them what they are going to do in the garden, I group them according to the number of garden tools we have. In the garden I allocate them the places they are going to plant; they mark the plots or seed beds. For the first time I use 1hour 30 minutes so that they would have enough time. I also take learners in the school/sport ground for 1hour 30 minutes we also use measurements when we measure the ground or I let them play and count the number of goals to show learners that mathematics does not apply in the classroom only but, even outside the classroom we apply mathematics. I usually use the days that have 1 and half hour to teach outside the classroom. There is time when I have 1 hour 30 minutes to teach, then divide the group according to their abilities, working with individual groups helping them where they find difficulties for another 30 minutes’.

D3 said

‘When learners have to do projects and investigations they do it in the community by collecting waste materials. At times they do survey in the community to find how many people in the community use long drop toilets, flush toilets do not have toilets. In the classroom, I do examples on the board when I introduce a lesson, I do mental mathematics for 10 minutes orally in a whole class, or at times ask the questions in a whole class. Then give learners class activity for 30 minutes as individual learners need to show how much they know as an individual. Sometimes I could feel that a particular lesson can be done outside like viewing. Where I would take learners outside the classroom let each learner draw front, side and the top view of a cottage as individuals for about 30 minutes. By the time they do their individual activities for 30 minutes it would easier for them to identify the different views from their workbooks. This activity allows learners to realize that

Mathematics is all over world. Then we will go back to the classroom check in pairs and see whether their views are the same for 30minutes. By the time they do their individual activities for 30 minutes it would easier for them to identify the different views from their workbooks. This activity allows learners to realize that Mathematics also happens in real world I do informal task and informal tasks in the classroom as an individual. I use 1 and ½ hour to give learners enough time to write formal and informal tasks.’

The data generated during the semi-structured interviews and focus group discussions indicated that all participants teach Mathematics in the classroom and outside the classroom. They teach Mathematics 6 hours a week as per CAPS document. I teach Mathematics for one hour and half for 2 days and 1 hour for 3 days to make 6 hours. There are lessons that allow us to teach in the classroom for instance if I have to use aboard to write example, demonstrate and introduce a lesson for 30 minutes in a whole class. They do corrections for 15 minutes with the whole class then give learners 15 minutes to write corrections as individuals, then give learners activity to do in a whole class for 30 minutes measure the distance around the classroom. Then give them homework to do if there is no time to do class activities. Garet et al. (2001), support the data generated by stating that that location is a place where teaching and learning occurs. In addition, Killen (2007) concurs with the data generated from the participants when arguing that the teaching environment is much more than just the classroom in which the teacher present a lesson, it contains the school grounds, the library, and the immediate vicinity of the neighbourhood of the school. However, the data indicate that the participants are not aware that teaching environment also involves the library and neighbourhood schools. It was only participant D3 who added that teaching of mathematics also happens in the community. In addition, D3 indicated that she uses a teacher-centred, content-centred and a learner-centred approach by telling learners to do a survey of people who use different kinds of toilets in the community. This shows that D3 is aware that mathematics also happens outside the school premises, even though she did not mention neighbourhood schools and the library.

However, the data indicate that the participants are not aware that teaching environment also involves the library and neighbourhood schools. It was only participant D3 who added that teaching of mathematics also happens in the community. In addition, D3 indicated that she uses a

teacher-centred, content-centred and a learner-centred approach by telling learners to do a survey of people who use different kinds of toilets in the community. This shows that D3 is aware that mathematics also happens outside the school premises, even though she did not mention neighbourhood schools and the library.

Furthermore, the data generated reveal that each participant uses his or her own decisions on whether the lesson is to be taught inside or outside the classroom. It is clear that the participants made good choices when they conducted the lessons outside the classroom. Looking at the lessons that are taught by the participants outside the classroom, it is important that they are taught outside the school building. For example, B1 indicated that he teaches addition and subtraction of the car number plates to enable learners to work with numbers in groups. A1 and C3 teach learners to measure the field, the garden plots in groups and to engage learners in playing soccer and counting the number of goals using a group work strategy. D3 indicated that she lets learners draw different views of a cottage using pair work strategy. In addition all the participants indicated that they teach learners outside the classroom so that they realise that mathematics is applied in real life situations. In support of the above generated data, Van den Akker et al. (2009), state that the layout of the teaching environment appears to be more influential than assumed.

As a results the participants realised that the above mentioned lessons were not suitable to be taught inside the classroom, and then they decided that they should be taught outside the classroom. In addition, all the participants target days that have 1 hour 30 minutes to teach outside the classroom. They justified this decision saying that outside activities need more time. It was also revealed that all the participants used group work and pair work teaching strategies outside the classroom in order to share ideas. In addition, to save time, the participant's group learners while they are still in the classroom and tell them what they are expected to do outside the classroom. Kajander (2010), agrees with the findings generated from the participants that time is a challenge.

Valli and Buese (2007), agrees that teachers spend more time on teaching strategies like whole-class discussions to save time. Furthermore, the findings indicate that the participants divide

learners according to their abilities so that all learners are accommodated. It is revealed that participants give gifted learners extra work while they are busy helping those learners who are struggling in order to save time during the teaching of Mathematics. However in the literature review Ball and Forzani (2009) state that because of the limited time during teaching, the teacher gives the struggling learners extra work while the rest of the class continues discussing other aspects of the problem. The participants might feel that the struggling ones would not cope doing extra work on their own therefore they assist them.

In addition, data generated indicate that there are projects that have to begin in the classroom in a whole class, and then proceed outside the classroom as groups and collect the information, come back in the classroom, sort the information accordingly, count the collected data, do the recordings, interpret analyse and do the recommendations. It was also revealed that if time allows, the representative from each group do a presentation. This indicates the strengths on the side of the participants' behaviour which concurs with the study conducted by Garet et al. (2001) when arguing that teachers should be allowed to try out new teaching strategies in the classroom and obtain feedback on their teaching.

The above generated data indicate that the all participants use a combination of teacher-centred, content-centred and learner centred approach which is approved in the literature review that teachers should combine different management practices and various teaching strategies (Uibu & Kikas, 2014). On the other hand, the study of Westwood (2011) reveals that that in countries like Japan, Hong Kong, Korea and Singapore, most of the time in mathematics is spent in problem solving and in whole-class discussing strategies for problem solving. In contrast to these countries, South Africa has perceive all mathematics content areas important. As the CAPS document has stated, all the content areas are included and each content area is allocated its specific time to be taught. In addition, the strength of the Mathematics document is that it has allocated teachers 6 hours a week to teach mathematics and specifies how much time to be spent is a particular concept.

The data generated show that the CAPS document has indicated the revision time for each term, which totals 14 hours a year. However, the Mathematics document does not guide teachers on

teaching strategies for teaching grade 5 Mathematics. As a result, teachers are not aware why they are using particular teaching strategies. In addition, the Mathematics document does not indicate the environment (location) where Mathematics should be taught. It shows that the environment as one of the concepts of the curricular spider web is lacking in the Mathematics document. Therefore Mathematics document leaves out the important concept as Van den Akker et al. (2009) argue that in school and classroom levels, nearly all concepts of the curricular spider web play a role. As a result of the above discussion there is no balance in Mathematics.

#### **4.2.9 How are you assessing Mathematics using particular teaching strategies?**

Theme 9: Assessment

The data generated from the participants during the reflective activity, one-on-one semi-structured interviews and focus group interviews was collected twice to generate the rich information. During the reflective activity B1's, C2's and D3 reflective activity responses are in line with A1 when they indicated that,

They assess classwork activities which are informal. Learners write class activities as individuals in order to check their understanding about the lesson that was taught. Informal activities assist me to check if the lesson was successful. They also ask questions in a whole-class to draw learner's attention and to check whether the method they are using is effective while they are presenting a lesson. These activities are not for progression. They give learners practice for formal tests. There are also formal activities like projects, investigation, assignments tests and examinations. All formal tasks are assessed in individuals. So that they see every learners' performances. They assess to find out learners' strength and weaknesses and to find interventions. Individual learners are given questions in a form of worksheet during formal tasks.

B1said

'I assess in group while learners are doing class activities discussing like when there are given a problem. There are informal assessments that are not recorded like written tasks like individual class activities and group activities so that each learner in a group is encouraged to participate. I also do peer assessment so that they learn to assess one another and to motivate one another to work harder'.

C2 said

‘I also assess using group work. In groups, quick thinkers dominate in the group [and] to avoid that I encourage them that they must all say something so that they do not let the group down because, I tell them that I allocate marks according to each member in a group. So they try by all means to think for an answer...If one member of a group does not answer he or she will know that he or she let the group down. I assess them to get...a feedback about my lesson whether it is successful or not...and to assess my lesson and my teaching methods’

D3 stated

‘I give learners class activities in a written form as individual, groups or in pairs. I assess individual learners to get a reflection of how much they understand. I assess learners in groups to make them confident enough to help one another. At times, I assess the groups according to their abilities so that they work on the same pace and talk at the same level where no one dominates in a group. At times I do self-assessment where each learner assesses his or her own work, I want learners to assess themselves so that they realise their strengths and weakness. Learners do write corrections of informal assessment. ANA is also written as part of revision and weighing learners’ performance and the results of learners are compared nationally’.

From the data generated during interviews and focus group discussions, all the participants agreed that the CAPS document specifies the type of assessment tasks to be done per term. They also agreed that the CAPS document specifies examples of concepts and skills to be assessed for informal assessment as well as for formal assessment. In addition, the participants also agreed with A1 that they do IQMS which they claim is a peer assessment.

A1 said that,

‘I use diagnostic assessment, it is where I try to find out what the learners know then develop my lesson based on that information. I give learners common tests and write on the given work sheet as individuals. I also assess them monthly, these tests assist me in term of checking if the lesson was successful or not. I also test them informally to evaluate how much knowledge learners gained. Learners write the common tests on given answer sheets. Corrections are done with whole class so that learners could see where they go wrong and correct that so that they do not repeat the same mistake during test and examination. I assess learners by asking questions at random while I am presenting a

lesson and after presentation, to evaluate if learners are following the lesson or not. She added that formal assessment she added that CAPS specify the types of assessments to be conducted per term’.

A1 further added

‘...during the first term she assess by means of 1 test and 1 assignment. Second term 1 test and 1 examination. Third term 1 test and 1 project and fourth term 1 assignment, 1 investigation and end of the examination all these marks are considered for the progression at the end of the year as indicated by CAPS document. All these assessments are assessed individually. To find out learners’ strengths and weaknesses and to track how much learners have grasped. In addition, to get a feedback about my methods she uses when teaching and to try use other alternative methods and to find interventions. Learners are given question...papers in a form of worksheet, they answer on that question paper. Each and every learner is given a problem to solve on the board then the rest of the class check or evaluate the method used, whether all steps are shown and if not they try to help that particular learner to find out where he or she did go wrong (peer assessment). If they encounter any problem they go to their colleagues and ask for help then they go to teach that lesson with confidence.

Peer assessment happens when they are assessed for IQMS, a School Developmental Team SDT observe my lesson, then they give feedback about the lesson they presented, they give feedback about my strengths and weaknesses and give me a two week period to rectify my weaknesses. The aim is to improve my quality of teaching, after two weeks the SDT comes back for observation again to check if the last lesson they observed has been improved as recommended’.

B1’s comments that,

‘Assessment is a continuous processes where you want to find out how much of the content has been taught does an individual learner know. There are three type of assessment Diagnostic assessment, Informal assessment, and Formal assessment. In diagnostic assessment, an individual assessment is done whereby learners write a common test; I usually do it at the beginning of the year. I do also do group assessment where each member of the group has to participate/ contribute. The groups are given a certain task to do as group where they should share ideas, I usually encourage...those who are shy to



speak to be made scribes for the first two activities, until they get used to it. The groups write their activities on the flip chart, choose a presenter to present for them in the class. Groups would comment on each group presentation and say which method they understood best from what has been presented (peer assessment).

He added that the department has introduced ANA as an informal assessment. An individual learner writes ANA paper set by the department. There are strict procedures that are followed, learners read instructions on their own and it is strictly 60 minutes paper. As mathematics I am not supposed to invigilate I rather invigilate language papers. This assessment is not for progression. It is done to up lift the standard of mathematics nationally.

Formal assessment includes projects, investigations, assignments, four tests and two examinations. These assessments are individual assessment, and they are done under my supervision. Learners are given a project to write in the classroom in order to make sure that they do it on their own. The marks are then recorded for progression. During one-on-one semi-structured interview and focus group discussions B1 mentioned all the tasks that have been mentioned by A1. He added that, the HODs moderate all the assessment tasks questions and memoranda before any tasks are written.

C2 added to what she said in the reflective activity,

‘One can stand in the front ask the questions and others give answers taking turns, making it as if it is a game while I am listening to them maintaining the order in the class. Learners will assess the one who was doing the sum on the board. I just write sum to be solved they had to go on the board then learners do solve problems on their own and debate the answers written on the board until they come with a solution. This assessment motivates learners to develop confidence when doing mathematics. I also assess homework activities for an individual learner so that they realise the importance of doing homework in order to get... practice of what they were doing in the classroom’.

D3 said,

‘I then allow them to work in groups, work in groups make them confident enough to help one another. They share ideas solve problems on their own, come up with solutions, write

them on a flip chart and choose one member to present in front of the class, while others assess whether that particular group has done the sums correctly’.

She added ‘I assess the individual learner by means of class activities; it is where I get a true reflection of an individual learner and whether the learner has achieved what was taught. It is where I evaluate my teaching methods, whether I need to change my teaching method or redo a lesson. I assess informally to prepare learners as a whole class doing a revision to evaluate if learners are prepared for tests and examinations. Informal assessments are continuous; learners are assessed daily by means of individual classwork. I also allow peer assessment from learners...to encourage learners to learn to ask constructive questions and to be critical thinkers. ANA is written by an individual learner as part of informal tasks. ANA is treated seriously even though it is not recorded for progression. ANA is invigilated as if it is a serious examination, no charts are required to be on the wall when ANA is in progress. We are required to mark ANA and there is a time frame to submit the results of ANA. ANA includes questions that encourage learners to use their thinking skills which I was not aware of’.

The data generated from the reflective, semi-structured and focus group discussions indicate that the four participants assess by means of informal (formative) and formal (summative) assessment. According to Kennedy et al. (2006) assessment is defined in terms of formative assessment or summative assessment. They added that formative assessment is defined as being assessment for teaching, while summative assessment is defined as assessment of teaching. This indicates that the participants assess their teaching and learning during and after teaching. For example C2 and B1 agreed with A1 and D3 that they do assess learners in a whole class during and after teaching by asking questions. The participants said that they use this type of assessment so that they can check whether their lessons were effective or not. This teaching strategy is supported by CAPS document DoE (2011) when stating that formative assessment is defined as assessment for teaching and is used to assist the teaching and learning processes and it can be used in different teaching strategies at any time during a Mathematics lesson, for an example, during a short class during verbal questioning, during the lesson, or at the end of a lesson.

This indicates that the participants assess learners while they are teaching so that they do not leave learners behind. In other word the participants are doing what is called assessment for teaching (Kennedy et al., 2006). Data generated from the reflective activity, interviews and focus group discussions indicate that learners are given individual class activities in a written form. It is also revealed that, it is where the participants assess whether their teaching methods are effective or not and whether the learners have understood what they were taught. In addition, Suurtamm et al. (2010) supported this by stating that assessment provides opportunities for informative feedback to both teachers and learners. Furthermore, Boud and Falchikov ( 2006) concur with Suurtamm et al. (2010) that assessment is used to give feedback to teachers as well as learners on their teaching and learning and to check their progress.

The data generated indicate that teachers do corrections to give feedback on the activities that they were given, either as individuals or in groups. In addition, the findings reveal that those learners are assessed in groups where the participants agreed with D3 where she indicated that a member from each group does presentations of the sums that they were given. The rest of the class observe the presented sums and, whether are they correct if not, assist the group to reach the solution. This indicates that the participants are aware that assessment is not about writing class activities or informal tests only. As a result the participants change their teaching strategies from pen and paper to observation teaching strategies. In support of this statement, Long and Dunne (2014) states that assessment is also done by means of interviews and observation rather than the repetitive of paper-and pen test only.

Furthermore, A1 and C2 agreed with B1and D3 during the focus group discussions that they administer ANA as another form of assessment. The generated data indicate that although ANA is not for progression, ANA is taken seriously by the department. It shows that the department decided to develop an ANA document for mathematics to improve the quality of mathematics and create strict rules to be followed when ANA is in place. It was also indicated that teachers who are teaching mathematics are not supposed to invigilate when the mathematics ANA paper is written. This proves that the department is aware that mathematics is one of the subjects that are failed by learners. It is clear that the department of education is trying other means to uplift the standard of mathematics in South Africa by introducing ANA.

Kanje and Sayed (2013), agree that the action plan 2014 recommends the use of ANA as a key mechanism to improve quality through assessment, monitoring and supervision. In addition, the data also reveal that ANA involves questions that develop learners' thinking skills. The study of Kloppers and Grosser (2014), states that in order to prepare teaching for ANA, teachers need to design teaching strategies for teaching grade 5 Mathematics to improve critical thinking dispositions in assessing learners. However, paying attention to one concept of the curricular spider web (assessment) might not solve the high rate of failure; all the concepts of curricular spider web are important and they all need attention. Furthermore, the study of Ross and Bruce (2007) reveals that self-assessment offers a chance for teachers to observe one another and discuss their classroom efforts to improve teaching. None of the participants indicated that they engage themselves in self-assessment. Instead, D3 reflected that she allow learners to assess their own work so that they realise their strengths and weaknesses. D3 did not indicate that she does assess her own work so that she can improve her teaching strategies if it is necessary. It is clear that the participants do not assess their own teaching in order to know their strengths and weakness in order to improve their teaching practice and their teaching strategies. This indicates that the participants are not worried about their quality of teaching.

In addition, the data generated indicated that all the participants claimed that they do peer assessment when they are being appraised on IQMS. In addition, teachers confuse IQMS and peer assessment where they are appraised by a peer and the head of the department. It means the department has done a good by introducing IQMS as another strategy to motivate teachers to improve their teaching. This indicates that if the IQMS was not introduced, teachers would not have been aware about their strengths and weaknesses lies, so that their teaching is improved. However, during interviews A1 accounted that she does encounter problems during teaching. Instead of inviting a peer to observe her lesson while she is teaching, she goes to a colleague and ask for advice. This might not be a solution because a colleague might not know exactly where the problem lies. The best way is for a colleague to observe the whole lesson. In that way a colleague might find out whether A1 needs to change her teaching strategies or she needs to master the content. In other words peer assessment is the best way for teacher to improve their

teaching practice. As Hoadley and Jansen (2012), state that the assessed curriculum offers feedback to and input for the intended curriculum .

All the participants indicated that they assess learners informally so that they are prepared for formal assessment tasks. In addition, the findings indicate that the participants assess according to the CAPS document. Furthermore, it is also revealed that the CAPS document indicates which assessment tasks should be written in each term and that the marks obtained are recorded for each learner. Moreover, the participants agreed during the focus group discussions that the CAPS document specifies examples of concepts and skills to be assessed for formal assessment. In addition, the data indicated that formal assessment tasks the participant to use are tests, projects, assignments, investigations and examinations.

In addition, the participants indicated that they use an individual teaching strategy whereby each learner writes in his or her worksheet. Each learner is supposed to show his or her own performance in order to qualify for progression. It is clear that if learners do not perform according to the requirements, that particular learner will not progress to the next grade. Data generated indicate that each and every formal assessment task and memorandum is moderated by the head of department before it is written. This indicates that the HoD do their job as trusted by the department. However, the participants did not indicate that they do corrections with learners after they have done formal tasks. Kennedy et al. (2006), argue that in practice, continuous assessment often amounts to a repeat of summative assessments with marks being recorded but with little or no specific feedback being given to learners. This indicates that learners end up not knowing how they should improve their performance in order to meet the requirements for progression. It is clear that the participants are not aware that even in formal assessments should offer feedback on what learners do or know in relation to what they should do or know (Hoadley & Jansen, 2012).

In addition, the above discussions indicate the strength of the participants that they combine the three approaches during the assessment process. The data generated indicate that the participants used the content (content-centred approach) specified by the CAPS document, where teachers have to control, and observe (teacher-centred approach) learners when they are discussing and

writing the informal and formal assessment tasks (learner-centred approach). However, the participants' weaknesses are that they are not aware that they should always align aims, objectives, intended learning outcomes, teaching methods, teaching activities, and assessment strategies in order to do justice to teaching (Khoza, 2013a), during the process of assessment. This indicates that participants are not clear why they are using particular teaching strategies for teaching grade 5 Mathematics.

In addition, the CAPS document provides teachers will all types of assessment, namely: baseline assessment, diagnostic assessment, formative assessment and summative assessment. The findings indicated that none of the participants have used baseline assessment as recommended by the CAPS document. It is unclear if the participants were aware that the baseline assessment is important or they ignored it purposeful. This type of assessment could assist teachers to plan their lessons according to the levels of their learners. It would be easier for them to have the relevant programs that are suitable for the learners they are teaching. In addition, this shows that the Mathematics document requires teachers to assess learners every time they teach a new topic or a lesson. It is obvious that this type of assessment requires teachers to also plan the relevant teaching strategies that will suits the level of learners. The CAPS document makes it clear that teachers are not compelled to use this type of assessment which is why the participants are not viewing this type of assessment as important.

Furthermore, A1 and B1 stated that, they used diagnostic assessment at the beginning of the year to assess learners' abilities to be aware of learners' problems at an early stage, as CAPS document states. The two participants indicated that all learners write a common test as individuals in order for the teachers to judge their abilities. This shows that A1 and B1 plan their lessons and teaching strategies with learners' levels of performance in mind and try to address the difficulties they encounter. In addition the generated data show that, C2 and D3 are not doing justice to the learners they are teaching as required by Mathematics. How can a teacher start teaching without knowing the levels of learners they teach? This also indicates that the participants are not using the relevant teachings strategies for teaching grade 5 Mathematics.

The Mathematics document has specified clear guidelines for the formative and summative assessment to be used for teaching grade 5 Mathematics. This shown in the CAPS document whereby teachers are given guideline of the teaching strategies to be used during the assessment process as well forms of assessment to be used for assessing Mathematics. It is clear that the participants are in line with the Mathematics document. In addition, the findings show that the participants consult the CAPS document, as they have indicated that they are all aware of informal assessment referred to in the CAPS document. Furthermore, the data generated indicate that they use different teaching strategies like discussions, observations, question and answers, group and individual assessment strategies. Kanjee and Sayed (2013), state that informal assessments are linked to daily assessments that are conducted through observations, discussions, learner-centred discussions and informal discussion teaching strategies. Moreover, the Mathematics document specifies that teachers should use 3 tests, 2 examinations, 2 assignments, 1 investigation and 1 project a year. The data generated prove that the participants are assessing according to the specifications in the CAPS document. The data generated indicates that the participants record the marks according to CAPS document and it shows that the participants consider all the forms of assessment at the end of the year for progression as is required by the CAPS document.

Moreover, the CAPS document has specified the cognitive levels and description of skills to be demonstrated during the assessment process, namely: 25% of knowledge, 45% of routine procedures, complex procedures and 10 % problem-solving. The findings generated indicate that none of the participant considers the given cognitive levels when they conduct informal and formal assessment. Van den Akker et al. (2009) Van den Akker et al. concurs with the Mathematics document by stating that when teaching and assessing learners, one should bear in mind that learning is a process and that the teacher should try to get the thought processes of the learners to move up into the higher order stages of synthesis and evaluation. However, the findings indicate that all formal assessment tasks and memoranda are moderated by the HOD before they are conducted. This indicates that the HoD check whether the questions cater all the cognitive levels as required by Mathematics document. The CAPS document is supported by Kloppers and Grosser (2014) Klopper and Grosser when arguing that an assessment rubric and checklist should be improved to informally assess learners' thinking dispositions

This indicates that indicate that the HODs have to make sure that the strategies that are used by teachers when conducting assessment are a true reflection of each learner. Therefore, the Mathematics CAPS document has specific assessment information, and it is up to the schools and teachers to work towards reaching the assessment goals, as Van den Akker et al. (2009) state that in an evidence-based strategy, schools and teachers formulate clear goals and systematically work towards reaching these goals by making use of specific assessment information. In addition, the Mathematics CAPS document appears to be relevant in terms of assessment and the fact that the document specify the importance of informal and formal tasks and that all formal tasks are moderated for the purpose quality assurance and ensure that appropriate standards are maintained as indicated by (Berkvens et al., 2014).

In addition, the Mathematics document specifies the teaching strategies that are to be used during the process of assessment. Furthermore, the document also states that the assessment should be designed to cover the content of the subject and to achieve the broad aims of the subject (DoE, 2011). However, CAPS document is too general when specifying the broad aims to be achieved. This appears to be the reason why the participants were not aware that there should be a link between the aims, objectives, learning outcomes and the teaching strategies during the process of assessment. This implies that the Mathematics document does not clearly specify which strategies are effective for achieving the aims, objectives or learning outcomes during assessment. It is not easy for teachers to develop links between learning outcomes, teaching strategies, teaching activities and assessment tasks (Kennedy et al., 2006). This indicates that the issue of teachers struggling to effectively use assessment for improving teaching in the classroom needs to be effectively addressed if the key goal of improving quality for all learners is to be achieved (Kanjee & Sayed, 2013). The above discussions indicate that the Mathematics document is not balanced if the participants are unable to state why they use a particular teaching strategy for assessing grade 5 Mathematics.

### **4.3 Conclusion**

The data presented in this chapter was framed using the methodology in chapter three. Conclusion were drawn from the data generated from reflective activity, one-on-one semi-



structured interview and focus group discussions. Data generated was transcribed grounded around the ten concept of the curricular spider web, which was later developed into themes.

## CHAPTER FIVE

### Summary and Recommendations

#### 5.1 Introduction

This chapter summarises the findings by answering the research questions based on the literature, Mathematics document and the data generated grounded on the ten concepts of the curricular spider web. It also discusses the findings comparing the literature review, CAPS, and the data generated and recommendations following the concepts of curricular spider web. The study was conducted using the reflective activity, one-on-one semi-structured interviews and the focus group discussions. The study explores teaching strategies for teaching grade 5 Mathematics with the intention to respond to the following research question:

- What are teaching strategies for teaching grade5 Mathematics at KwaNdengezi circuit?
- How do grade5 teachers use teaching strategies in teaching Mathematics at KwaNdengezi circuit?
- Why do grade 5 teachers use teaching strategies in a particular way in teaching Mathematics?

#### 5.2 Research questions

##### **5.2.1 What are teaching strategies for teaching grade5 Mathematics at KwaNdengezi circuit and how do grade5 teachers use teaching strategies in teaching Mathematics at KwaNdengezi circuit?**

Based on the literature review and the data findings indicate that the participants were aware of the teaching strategies for teaching grade 5 Mathematics. The studies in the literature review indicate that the teacher-centred approach involves drill method, rote learning, explanation and demonstration, whole class teaching, where the teacher dominate the lesson by talking more than the learners because of several factors like covering the curriculum, instructional goals examinations pressure and time limits; (Cross, 2009) and (Uibu & Kikas, 2014). Furthermore, in the literature it is indicated that content-centred approach involves the understanding the rules of the content where by the teacher is focuses on the content to convey the information to learners. In addition, the learner-centred approach involves teaching strategies like group and pair work for teaching Mathematics. This approach also involves co-operative teaching where learners are involved in group discussions, problem solving and self-discovery in problem solving. This type of teaching strategy allows learners to communicate with one another. This shows that the

literature is dominated by content and societal reasons where the emphasis is stressing the teaching strategies that are content based dominated by teacher-centred approach, followed by the societal reasons where the learner-centred was applied when learners are involved in group discussions to solve the problem on their own. This approach is following the competence curriculum.

The findings indicated that the participants were able to identify the teaching strategies they used for teaching grade 5 Mathematics in all the ten concepts of curricular spider web. The participants indicated that they used teaching strategies like the telling method by introducing a new topic to learners in order to cover the curriculum. They used this teaching strategy for explaining the different terms of the content being taught and they also do demonstration by doing examples of the given content on the board to cover the lesson for the day. This indicates that the participants are used teaching strategies that are in line with the performance curriculum. However the participants are using every day knowledge since the Mathematics document does not indicate the teaching strategies to be used by teachers. This then suggests that their teaching strategies are based on the competence curriculum for implementing the intended curriculum. The competence curriculum follows the direction of the enacted curriculum which is based on everyday knowledge and this knowledge does not fit with Mathematics. This paragraph shows that the participants rationale for teaching Mathematics were based on content reasons since they indicated that they refer from the Mathematics document. In addition the teaching strategies used were framed around the content and teacher-centred.

Furthermore, the data generated indicates that the participants used the content-centred approach where they demonstrated the understanding of the content as revealed in the literature review. The participants indicated that they use the content that is CAPS aligned when they keep on referring to the CAPS content while they were discussing about the teaching strategies they are using for teaching Mathematics. For instance the participants indicated they used a telling method by explaining the homework that the learners are supposed to do using the workbooks which are CAPS aligned. Furthermore, the participants indicated that they use question and answer method for informal and formal assessment. They further state that they use question and method orally or in a written form. This indicates that the teaching strategies used by grade 5

teachers are directed to the performance curriculum to implement the intended curriculum which agrees with CAPS. Therefore this paragraph shows it is dominated by content reasons. However their teaching strategies are dominated by their personal reasons since they used their conscious mind, thinking about teaching strategies to be used. Therefore the personal reasons also applied on the participant.

In addition, the participants indicated that they use teaching strategies like group discussions and pair work inside and outside the classroom. All the participants indicated that they either use the pair work by pairing learners with the same or different abilities depending on what the participant want to achieve like working in pairs on an informal task based on CAPS content. In addition the participant that they use the self-discovery teaching strategy by giving learners problem solving sums to do on their own. This indicates that the learner-centred approach is dominating followed by a competence curriculum since the teaching is dominated by learners worked in groups and in pairs to using self-discovery method. This indicates that the participant used the teaching strategies based on competence curriculum where by learners use their everyday knowledge which is against the intended curriculum. More over the participants using the teaching strategies based on everyday knowledge since CAPS does not specify the teaching strategies to be used by teachers. The above discussions indicate that the participants used societal /personal reasons.

The participants are not guided with the teaching strategies that are supposed to be used in the implementation of the mathematics CAPS and how they are supposed to use a particular teaching strategy. As a results the participants employed the teaching strategies by using their everyday experience which has no place in the school curriculum (Hoadley & Jansen, 2012). Therefore, this indicates that the participants used teaching strategies driven by competence curriculum which is not line with CAPS as a prescribed curriculum. However, assessment is the only concept in the curricular spider web that covers terms of teaching strategies. The CAPS document specifies the different teaching strategies to be used by teachers for teaching grade 5 Mathematics. Mathematics document stipulates that informal assessment is done through observations, discussions, practical demonstrations, learner-teacher conferences and informal classroom interactions. This is done during the lesson to observe learners or to discuss how

teaching and learning is progressing. This was also highlighted from the data generated that the participants assessments during and after the lesson by discussions and by also using a question and answer method. In addition the participants indicated that they discuss their teaching and learners progress. Furthermore, the findings indicate that the participants are in line with CAPS document. It is clear that the participants are assessing the intended curriculum by using teaching strategies that are directed towards performance curriculum in this case. Based on the above discussions CAPS document emphasise a lot of content dominated by content and teacher centred approach where teachers asked questions in class discussions based on the content during and after the lessons to monitor the progress of learners during the assessment process. The Mathematics document also specifies a little bit that the government personal interest for the CAPS was to balance the education of the pre-1994. This concludes by stating that CAPS teaching strategies are dominated by content/societal reasons while the participant's teaching strategies are dominated by personal/societal reasons compared to the literature review which is dominated by content/ societal reasons. This indicates that there is danger in teaching and learning of Mathematics if teaching strategies are dominated by personal and societal reasons, which means that the teacher are driven by everyday knowledge instead of content knowledge. This suggests that teachers are implementing an enacted curriculum instead of the intended curriculum, due to the CAPS document that does not guide teachers on teaching strategies to be used by grade 5 Mathematics.

### **5.2.2 How and why do grade 5 teachers used teaching strategies in a particular manner in teaching Mathematics?**

Based on the literature review, the reason of using the goal-directed strategy is that it is believed that every Mathematics lesson is taught to achieve the goals of that particular lesson (Van den Akker et al., 2009) (content reasons). Therefore teachers should use mentalistic teaching strategy which involves written questionnaires interviews and draw exercises to get an indication of what is going on in the mind of the learner (Radford, 2008) (content reasons). The literature review reveal that the group discussions improve learners critical thinking skills (Kloppers & Grosser, 2014) (societal reason). The studies indicate that question and answer methods are used at the end of a lesson to achieve the learning outcomes (Khoza, 2014a) (content reason). In addition, it

the indicated that the reason of using the problem solving strategy is to attain the intended learning outcomes (content reason). Furthermore, Khoza (2013b), states that the actual presentation strategy is used to cover a content. In literature it was also revealed that teachers may use Bingo to make it fun for the learners while they are learning (Bolden et al., 2010), for teaching content reasons. The above studies are dominated by teacher-centred and content-centred approach and the teaching strategies are used to achieve the goals of the intended curriculum. Therefore the above studies indicate that teaching and learning was dominated by content/ societal reasons, which are based on performance curriculum. However the study conducted by (Kloppers & Grosser, 2014), state that learners were engaged in group discussions using their critical thinking during the teaching and learning process which is directed to societal reasons. This teaching strategy is based on competence curriculum.

Based on findings the participants used the same teaching strategies and the same reasons to cover all the concepts of curricular spider web. In addition, the findings the indicated that the participants used teaching strategies such as the telling method in order to cover the curriculum (content reason). In addition the findings indicate that the telling method was used in introducing a new topic to learners in order to save to the stipulated time (content reasons). It was also indicated that the telling method was used for explaining the different terms of the content (content reason). The findings also indicate that the participants use the telling method because it is quicker to accommodate the whole class at one time. It was also revealed that this method was used to instruct learners to do homework so that learners have access to education even if they are absent from school. In addition, the findings reveal that the participant used teaching strategies like presentations, explanations and demonstrations when the new lesson is introduced and when the learners performance it indicate that they did not understand. Furthermore the findings reveal that teachers use whole the class teaching by doing examples on the board while learners are copying from the board in the classroom situation.

The data generated reveal that the participants use the question and answer method to assess the whole class to get a feedback about the lesson taught and the feedback about the teaching strategies the used. The above discussions indicate proof that the participants followed CAPS document in content during the implementation of the intended curriculum, which was based on

content reasons. However the teaching strategies used were based on societal/personal reasons because the participants used their everyday knowledge and their conscious mind to employ the teaching strategies they thought was suitable for the given content. Getting further, the study of the literature review reveals that the findings also indicate that the learners were engaged in group and pair work and the content connects a teacher and the learner. In addition the findings reveals that the question and answer method was used to link the previous lesson and the new lesson and to check whether the learners did understand the content taught (content reason). It also indicated that group or a pair work was used to control the availability of the resources for teaching a particular concept in mathematics classroom (content/societal reasons). Furthermore, the participants reveal that they use group and pair work to allow learners to explore their learning experiences by so that they were able to share their ideas and to learn from one another (societal reasons).

The above discussions indicate that the participants teaching strategies that are dominated by societal/personal reasons. This suggests that the participants are having a problem because they used the group and the pair work strategies that were controlled by societal and personal reasons when teaching content following the competence curriculum. This suggests that these findings are the wake up call to the curriculum developers if they really want Mathematics to be on the same standard with international Mathematics. This also suggests that Mathematics Curriculum is still going to be a failing subjects if there are teachers who have not changed the teaching strategies to fit the current curriculum which is a performance curriculum. This indicates that teachers out there who are teaching like these participants might produce learners who are not fit for international Mathematics curriculum and that might place the South African Mathematics curriculum at the bottom when compared to other countries.

Furthermore, the participants indicated that they use self and peer assessment to monitor their progress so that learners may find out about their strengths and weaknesses and correct their mistakes, where learners assessed their own work (content reasons). In addition, the data generated indicates that learners are assessed as individuals in a written form during the formal assessment, this assists the participants to record learner performance (content reasons). The generated data also indicates that these strategies give both learner and the participants a chance

to weigh their teaching and learning, trying to see if the learners understood the lesson. This indicates that the participants were in line with CAPS since they use the teaching strategies and the reasons that are more or less the same as those that appear from the CAPS document. For example the participants indicated that they assessed by means of observing however, the participants are unaware that all the concepts of curricular spider web are taught either to achieve the aims, objectives or the learning outcomes. As a study conducted by Khoza (2013b) states that that teachers should always align aims, objectives, intended learning outcomes, teaching methods, teaching activities, and assessment strategies in order to do justice to teaching.

In addition, CAPS document indicates that the teaching guidelines provided are in line with the vision on education and the overarching goals and objectives. The problem with the mathematics document does not clearly define the goals to be achieved in each concept of the curricular spider web. This suggests that teachers will experience a range of obstacles in trying to implement curriculum due to their own beliefs and ideas and this may results in selecting insufficient teaching strategies (Kehdinga, 2014b). Therefore above generated data indicates that the participants used their everyday knowledge based on their personal and societal reasons. The participant did not refer to CAPS document when they were reflecting on how and why they used particular teaching strategies in a particular manner. This is an indication that Mathematics is in danger since the participants are unable to reflect on why they are using particular teaching strategies in a particular manner. Therefore the results of the above discussion suggested that there was a need of an exploration of teacher's strategies for teaching grade5 Mathematics. The next section presents the summary of the findings.

## **5.3 Summary**

### **5.3.1 Introduction**

This section presents the summary of the findings generated from the data following the ten themes of the curricular spider web.

### **5.3.2 Rationale**

Based on the literature review the rationale for teaching Mathematics approve that Mathematics curriculum should be dominated by the content reason, whereby the teacher focuses on content



during the teaching and learning. In addition, the societal reason for teaching Mathematics came in second, the studies indicated the content taught in school should assist the learner to solve problems in their outside of the school (Khoza, 2015a). The studies indicate that the personal reasons for teaching Mathematics are not much important. Therefore, teachers are prepared so that they are capable of teaching the subject content. As a result, the above studies indicate that the rationale for teaching Mathematics are in favour of teaching strategies that are based on content-centred and teacher-centred, for example teaching strategies like the drill method, rote learning, explanation and demonstration techniques (Westwood, 2011). In addition, the literature indicates that the lesson should be driven by goal-directed teaching strategies that are based on achieving objectives for example, the content that is taught. It is where the teacher uses talks a lot and gives more examples. This indicates that the studies emphasise the importance of the performance curriculum.

According Mathematics document, content/professional rationale for teaching Mathematics is dominating followed societal rationale and the personal rationale is less important for teaching Mathematics. This indicates that the CAPS document was designed in terms of research following the guidance of scholars on what was expected on the prescribed curriculum. This implies that teachers were expected to teach the content which is based on school knowledge. CAPS document indicated to be less concerned about the personal reason for teaching Mathematics, the intention of Mathematics is on teaching Mathematics so that learners are capable of competing internationally. Even though CAPS document does not specify the teaching strategies to be used by teachers, it shows that it is dominated by the content-centred approach as well as by teacher-centred approach since the teacher is the driver of the content. The research indicates that CAPS is a prescribed curriculum and is based on performance curriculum (Hoadley & Jansen, 2012). The curriculum that is based on a performance curriculum is dominated by a content-centred and teacher-centred approach like whole class teaching, telling method, explanation and demonstrating method (Li & Ma, 2010), in implementing the intended curriculum, therefore CAPS has the principles of the intended curriculum.

Based on the data generated from the participants, the findings indicate that all the participants' have a passion for teaching Mathematics which is based on personal reasons. This showed that

there is a huge gap between the finding revealed by the studies and the CAPS document. The findings also indicated that the participants taught Mathematics for societal reasons. This indicated that participants were aware that learners belong to the society. As they indicated that they want learners to be confident and competent and to deal with any mathematical situation without being hindered by any fear of mathematics. This shows that teachers' professional identity is constructed by individuals under the influence of the society (Kehdinga, 2014b). This showed that the participants were not aware that CAPS is a performance curriculum and their rationale for teaching Mathematics were supposed to be dominated by the content knowledge. As a result, the content/professional rationale for teaching Mathematics was less important to them, instead of being their first priority. This indicated that the participants were not referring to the CAPS document in order to have a better understanding of the rationale for teaching Mathematics. As a result, the participants used everyday knowledge when employing teaching strategies for teaching Mathematics.

The participants indicated that they use question and answer method, writing examples on the board and demonstration to save time. They also indicated they use discussions where by learners are allowed to solve problems on their own while they are facilitating. In this strategy, the participants follow the competence curriculum which is not in line with CAPS as an intended curriculum. On top of that the participants used the teaching strategies that were based on their everyday knowledge, since CAPS document is silent about the teaching strategies for teaching grade 5 Mathematics. The studies show that everyday knowledge is based on the competence curriculum (Hoadley & Jansen, 2013). It is therefore, not surprising that the findings from the data on rationale for teaching Mathematics have shown a huge difference compared to Literature review and the CAPS document. That is the reason why the participants were not aware that the rationale for teaching mathematics and teaching strategies are to be linked with the content/professional rationale. This suggests that the Mathematics is in danger of being a failing subject, since the participants are not clear about the rationale for teaching Mathematics and the relevant strategies to be used in the implementation of the intended curriculum.

### 5.3.3 Accessibility

The studies on the literature review had shown that the physical access to education is compulsory, especially in the primary schools (Dello-lacovo, 2009) and (Vithal, 2012). Where by teachers are compelled to work on producing high quality results (Barrett, 2011). The accessibility to cultural education differs depending on a particular country what should be learnt at school is. As it is revealed in the literature that in Ethiopia mothers do not go to a formal school, some might have gone to a traditional school where they learn numerals which range from 1 to 1000 (Gebremichael et al., 2011). The cultural accessibility is also indicated in a South African University whereby teachers had to teach the values of and the meaning of critical thinking (Kloppers & Grosser, 2014). A critical thinking approach encourages teachers to use learner-centred teaching strategies for teaching mathematics, which involves group discussions and debates to improve learners' critical thinking skills.

In addition, the financial accessibility came last. This indicates that the physical accessibility to education is centred around the content where the school knowledge is provided. The studies in the literature indicate that it is important that the educational institutions have all the facilities that will enable these institutions achieve the goals they are meant to achieve (Vithal, 2012). The studies indicate that teaching of culture is important and teachers should be respectful and sensitive to all cultures. The literature review reveals that the schools should have resources and infrastructure are required for the successful implementation of the new curriculum (Vithal, 2012), all that depends on the school's finance. The literature is dominated by the teacher centred approach where drill, lecture, explanation and rote learning was emphasised followed by learner-centred approach where learners are encouraged to be critical thinkers (Kloppers & Grosser, 2014). They further mentioned that in group discussions learners are engaged in debates to improve their critical thinking skills.

The CAPS document places physical access to education as number one priority. This appears that, physical access to Mathematics is more important than cultural and financial access to education. As a results, CAPS document specifies that it equips learners to education, irrespective of their socio-economic background, race, gender physical ability or intellectual ability, with the knowledge and skills and the values necessary for self- fulfilment and

meaningful participation in society as citizens of a free country (DoE, 2011). In addition the CAPS document encourages active and critical teaching. However, CAPS document does not specify the teaching strategies to encourage learners to active and critical teaching. (DoE, 2011). This indicates that CAPS is more concerned with physical access to education where the school knowledge is taught but left out the importance of teaching strategies.

Based on the data generated, the findings indicate that the participants were aware that physical access to education was most important. The second priority was cultural access to education, followed by financial access. As a result the participants demonstrated the importance of physical access to education for Mathematics. The participants indicated that circumstances such as heavy rains, and transport problems forces teachers and learners to be absent from school. To overcome that problem the participants give learners homework using the workbooks which are aligned to CAPS so that they provide learners with access to education. In addition they use teaching strategies like, telling method to explain what is required from the homework.

The data generated indicated that cultural religious to education was based on the lecture method where teachers dominated and read the scripture reading during prayers. However, this cultural religious access to education does not link to the teaching of Mathematics. More especially because mathematics document are not clear about the accessibility for teaching Mathematics. In terms of teaching strategies for teaching Mathematics, the literature review, CAPS and the data generated are all dominated by the content-centred approach followed by the teacher-centred and place learner-centred approach last. This showed that the accessibility was dominated by school knowledge which is performance curriculum as required by CAPS. However, Mathematics document showed weaknesses as it does not indicate the teaching strategies for teaching Mathematics.

This suggests that teachers seemed to be implementing enactment curriculum instead of implementing the intended curriculum (Hoadley & Jansen, 2012). In addition, the CAPS document also does not clearly show the accessibility for teaching Mathematics. In order to find accessibility teachers have to read the CAPS document repeatedly and there is no time for that. Therefore, the above discussions indicate the reasons why the participants do not reflect on their

practice of whether they are using the teaching strategies to achieve aims, objectives or the learning outcomes on accessibility.

#### **5.3.4 Aims, objectives and learning outcomes**

The studies indicates that teaching the aims are important, as the aims indicate the general content and the direction of the Mathematics followed by the objectives of the lesson that teacher intends to cover (Kennedy et al., 2006). Based on the literature review the learning outcomes came as the third priority whereby the teacher directs learners on the projects they should participate in (Van den Akker et al., 2009). This indicates that the literature review is in favour of content-centred and teacher-centred approach whereby the teacher dominates in the teaching and learning. This is proved by Van den Akker et al. (2009) where they indicate that to achieve aims and objectives a step by step method was used, including answering questions at the end of a lesson (Khoza, 2014a). The teaching strategies for achieving the learning outcomes are group work and pair work where learners are engaged on questions and discussions to problem solving (Hoadley & Jansen, 2012).

CAPS document showed that the general aims of teaching Mathematics are dominating. The general aims are directing teachers with the content to cover during the teaching and learning (Kennedy et al., 2006). The general aims are followed by the objectives to be covered by the teacher during the teaching of Mathematics CAPS. Lastly is the learning outcomes. The teacher clearly specifies what the learner is expected to achieve and how the learner is expected to demonstrate the achievement (Kennedy et al., 2006). The above discussions indicate that Mathematics is dominated by content-centred and teacher-centred approach since CAPS is a performance curriculum (Hoadley & Jansen, 2012). However, CAPS does not specifies the teaching strategies for teaching general aims, objectives and the learning outcomes.

The findings from the data generated showed that the participant are dominated by the objectives, followed by the learning outcomes. The learning outcomes and the general aims were less important when they were teaching Mathematics. However, this indicated that the teaching is dominated by the teacher-centred followed by content-centred approach and lastly the learner-centred approach. The content-centred approach was not dominating in the teaching and

learning. This indicated that the participants used the teaching strategies that were based on everyday knowledge, since CAPS does not specify the teaching strategies to be employed during teaching and learning.

The findings indicated that the participants were not aware that every teaching starts with the teaching of the general aims. Therefore the literature review and CAPS document is based on school knowledge and are grounded on performance curriculum. On the other hand, the data generated are controlled by objectives followed by learning outcomes and the aims showed to be less important for teaching Mathematics. This suggests that there is a serious problem concerning the aims, objectives and learning outcomes to be achieved during the teaching and learning of Mathematics. It means teachers are doing the opposite of CAPS as an intended curriculum and this suggests there should be a closer look in the implementation of Mathematics in schools.

The studies in the literature review state that teachers used strategies like written questionnaires, question and answer method, problem solving strategy to attain the intended learning outcomes. Furthermore, the data generated indicates that they used telling method like presentations, explanations and demonstrations in a whole class to introduce a new topic to learners in order to save to the stipulated time and they also indicated that this type of method is quicker (Tan, 2011); (Westwood, 2011) and (Uibu & Kikas, 2014). In addition, the data generated indicates that group discussions, critical questions, problem solving and discovery (Cenenda, 2012) and (Gupta & Pasrija, 2012), teachers are used to allow learners to explore their learning experiences so that they are able to share their ideas and learn from one another. This is because CAPS does not specify the aims, objectives, and the learning outcomes to be achieved per topic, but the document specifies the general aims, specific aims and the specific skills for teaching grade 5 Mathematics on the background page. In addition, the CAPS document does not specify the teaching strategies for teaching grade 5 Mathematics. As a result the participants used their everyday knowledge to employ the teaching strategies for teaching grade 5 Mathematics, which are based on the competence curriculum. This shows the reason why teachers did not understand whether they used particular teaching strategies to achieve the aims, objectives and the learning outcomes.

### 5.3.5 Content

The literature review in the teaching of the content is dominated by the content-centred approach, followed by the teacher-centred approach and lastly by the learner-centred approach. The literature review indicate that the content-centred approach and the teacher-centred approach dominated during the teaching and of Mathematics. In addition, Mathematics document in the teaching of the content was dominated by content and teacher centred only. Even though CAPS did not specified the teaching strategies to be used by teachers, the studies indicate that the performance curriculum is dominated by content-centred and teacher centred approach. Data generated showed that the content was dominated by content-centred approach, followed by the teacher-centred approach and the learner centred approach.

The content seems to be dominated by content-centred and teacher-centred in the literature review, CAPS document and in the data generated. This indicates that the content that is clearly defined on the CAPS document and that Mathematics is based on the research from the scholars as it followed the principles of the performance curriculum (Hoadley & Jansen, 2012). In addition, the data generated indicates that the participants followed the CAPS document which is based on a performance curriculum (Van den Akker et al., 2009). In addition, the participants indicated that the CAPS document specifies the content to be taught and the content is organised in a particular way as indicated by (Hoadley & Jansen, 2012), for example numbers/operations; patterns/functions and algebra; space and shape (geometry); measurement; and Data Handling. It is clear that the participants are following the direction of the performance curriculum. The studies concur with the data generated that teaching strategies to be used for teaching Mathematics curriculum favours a performance curriculum. As the participants indicated that those teaching strategies are lectures, question and answer, oral counting, demonstrations, whole class discussions and the explanation method. In addition, the data generated indicated that group work and pair work were used to give learners opportunities to explore their experiences, share ideas and help one another. The Mathematics document showed weakness in terms of specifying the teaching strategies to be used for teaching grade 5 Mathematics. This indicates that the Mathematics document encourages everyday knowledge which is based on competence curriculum.

### **5.3.6 Learning activities**

Based on the literature review the teaching activities are dominated by content-centred approach, followed by of the teacher-centred followed by learner-centred approach. In the CAPS document the teaching activities are dominated by the content-centred and the teacher-centred. However, the CAPS document showed to be silent about teaching strategies for teaching activities for Mathematics. Therefore CAPS as a prescribed document has no room for learner-centred approach (Hoadley & Jansen, 2012). The data generated showed that the teaching activities were dominated by the content centred approach, followed by the teacher-centred and the learner-centred approach was the last.

The findings indicate that, the literature review and the data generated appears to be controlled by a content-centred and teacher-centred approach, while the learner-centred activities were not very active like the CAPS document that did not consider the learner-centred approach. The data generated proved that mathematics document provides the participants with the teaching activities to be taught in Mathematics. The participants indicated that they teach informal activities like classwork, homework and informal tasks. In terms of formal activities like projects, assignments, investigations, tests and examinations. This indicates that the participants empower learners with a powerful knowledge, which is a specialist knowledge obtained at school (Hoadley & Jansen, 2012). In addition, the findings indicate that the CAPS documents and the data generated appeared to be in line with the studies from the literature as it was indicated that the teaching activities were dominated by a content-centred and teacher-centred approach. According to research the Mathematics document appears to be in the right direction since CAPS is a prescribed curriculum based on the performance curriculum. According to the findings Mathematics does not cover the aspect of teaching strategies to be used by teachers in order to implement the intended curriculum (Hoadley & Jansen, 2012). The data indicates that the participants used teaching strategies like questions and answers, lecture methods, oral counting, whole class discussions, group work and pair work. This indicates that the participants used their everyday knowledge since they do not refer to CAPS document or any research. It means that the participants still use the competence curriculum in terms of the teaching strategies they used for teaching grade 5 Mathematics.



### **5.3.7 Teacher's role**

Based on the literature review the teacher's role is supposed to be more of an assessor followed by an instructor and do less of the facilitation in the teaching and learning of Mathematics. In the mathematics document the teacher's role showed to be an assessor throughout the teaching and learning. However, the mathematics document does not specifies the teacher's role. According to the studies the teacher's role was dominated by the assessor and the instructor during teaching and learning. As Crespo et al. (2010) indicate that the assessor, assesses the assessee if he or she has attained the intended knowledge, skills and competence. In addition, a teacher is a person who is in charge of education and guiding learners in schools (Kehdinga, 2014b). Even though the mathematics document showed to be silent about the role of a teacher. The data generated indicate that the teacher's role was of being an assessor, followed by being an instructor and lastly of being a facilitator during teaching and learning of Mathematics. According to the literature review, this indicates that the participants were aware of the teacher's role during teaching and learning, however they used their everyday knowledge, since CAPS does not specifies the teacher's role which is not in line with the intended curriculum.

According to the literature review the teacher's role involves the assessor, instructor and facilitator. The literature review states that an assessor uses teaching strategies like textbook method and content based method. An assessor sticks to the content and assesses if the content taught is being achieved. In addition, the instructor uses the teaching strategies like the question and answer method, the telling method, and the whole class discussion method. The data generated concurs with literature that the participants as indicated that they used the telling method when doing examples on the board, introducing a lesson and during presentation of a lesson (Buddo, 2013). Furthermore, the facilitator uses teaching strategies like group discussions and pair work, accommodating individual differences in the mathematics classroom by engaging learners in a higher level of thinking through reasoning, communicating, making connections and a problem solving (Buddo, 2013).

The literature review recommends that the teacher's role should be dominated by the content-centred approach followed by the teacher-centred approach. The learner-centred approach showed to be weak in the literature review. In addition, the findings showed that the data

generated concurs with the literature review. This indicates that the participants are following the CAPS document which is based on the performance curriculum. Mathematics document does not specify the importance of the teacher's role and the teaching strategies to be used. It is clear that the participants used their previous experience to identify their roles and teaching strategies which are driven by everyday knowledge. In other words, teachers are confused because they had to adhere with the intended curriculum when teaching, but on the other hand they have to decide about the roles they should play and the teaching strategies they should use for teaching.

### **5.3.8 Resources and materials**

The studies in the literature review indicate that the hardware resources are most important followed by the ideological-ware resources and then the software resources during the teaching and learning of Mathematics. In terms of CAPS document the software resources are the only resources that are most important during the teaching and learning in Mathematics. According to the findings the data generated indicate that participants use software resources the most, followed by ideological-ware resources and then the hardware resources. The CAPS document does not specify any use of hardware and ideological-ware resources. This shows that there is no balance in the usage of the resources for teaching Mathematics. The participants indicated that the teaching strategies used are determined by the availability of the resources. In addition, they also indicated that they demonstrate for the whole class using a visible resource like a big chart, chalkboard, bathroom scale measuring tape and number line. This implies that they follow CAPS since they indicated that CAPS specifies the resources they used. In addition, the participants also indicated that they used teaching strategies like, group and pair work when the resource are inadequate. In that way the learners share ideas and resources like textbooks, blocks, a bathroom scale and a clock.

In conclusion, the participants agreed that they are provided with laptops and computers but they use them to plan lessons and not for the benefit of learners. This indicates that the participants were not aware that the computers or laptops are used as a teaching resource. It showed that teachers have a problem in terms of hardware resources because, Mathematics does not indicate the hardware resources and the teaching strategies to be used for teaching grade 5 Mathematics.

This indicate that technology is in demand to be used as one of the important resources to produce a quality education, as indicated in the literature review.

### **5.3.9 Location (Environment) and time**

The literature review indicate that the teaching of Mathematics that took place inside the classroom in most of the time, followed by the teaching that took place outside the classroom then, the combination of the teaching that took place inside and outside the classroom. The Mathematics CAPS document recommended teaching that took place inside the classroom with the time allocated, followed by teaching outside the classroom using the time allocated. Lastly CAPS document showed teaching that takes place inside and outside the classroom alternatively using the time allocated. The data generated showed teaching that took place inside the classroom with the time allocated, followed by teaching that took place outside the classroom with the time allocated and then the teaching that took place inside and outside the classroom alternatively depending on the time allocated by CAPS document for teaching Mathematics. The findings indicate that the literature review, CAPS document and the data generated agree with one another that in most cases that teaching and learning took place in the classroom, even though CAPS showed to be very low compared to the literature and the data because location is not considered the most important. The findings in the literature review indicated that there are times where the teaching and learning took place outside the classroom, like in a school ground, library and in the neighbourhood schools (Killen, 2007).

The findings also indicate that the participants are allocated 6 hours a week to teach Mathematics and 14 hours a term for revision. In addition, even though the participants were aware that Mathematics is taught outside the classroom, they were only aware of the school premises. This shows that the participants are not guided by CAPS curriculum, as a results they used their everyday knowledge, which is based on the competence curriculum. Furthermore, the participants indicated they used teaching strategies like the telling method when presenting a lesson, doing examples and corrections, demonstrations, whole class discussions inside the classroom to save time. This was confirmed by the literature review that the whole class discussions and lecture methods are used in order to save time. They also indicated that they used pair and group work inside and outside the classroom during the implementation of the

intended curriculum, so that learners got opportunities to work together, share ideas and help one another,

Moreover, the participants indicated that they also use pair and group work when teaching the measurements addition inside and outside the classroom, depending on the time they have for the day. In addition, the findings indicate that pair and group work are used so that learners may help one another and share ideas in case they did not understand while the teacher was teaching. However, this method is not in line with CAPS since CAPS is a performance curriculum. As a result, the participants used teaching strategies guided by their previous knowledge which are also based on competence curriculum. The literature, CAPS and the data generated indicate that the combination of teaching inside and outside the classroom is not very important. The findings indicate that the participant use blending when they do investigations and projects. Furthermore, the participants indicated that they use blending when they teach data handling which is inside and outside the classroom alternatively. When the time allows, they comeback in the classroom do tables and plot graphs in groups.

### **5.3.10 Assessment**

The literature review shows that assessment of teaching is dominating followed by assessment for teaching and then assessment as teaching. CAPS document shows that assessment is spent on assessment of teaching, followed by assessment for teaching and the assessment as teaching during the assessment process. The data generated was dominated by assessment of teaching followed by assessment for teaching and then followed by assessment as teaching during the assessment process. In addition, the data generated was strong on assessment of teaching followed by assessment for teaching. Lastly followed by assessment as teaching during the assessment process.

The findings indicate that studies in the literature review concur with the Mathematics CAPS document and the data generated when showing that out of the three types of assessment, assessment of teaching (summative assessment) is most important compared to assessment of teaching and assessment as teaching. Furthermore, the participants indicated that summative assessment was done towards the end of each term. In addition, the findings indicate that CAPS

document provides the participants with forms of assessment to be done in each term. The participants indicated that they conduct the following forms of assessment for a year. Namely: 3 tests, 2 examinations, 2 assignment, 1 investigation and 1 project which are assessed with rubrics or memorandum (DoE, 2011). Moreover, mathematics CAPS document states that the formal assessment should cater all learners by setting the tasks that include cognitive levels and there is a certain per cent to be considered in each level as follows: Knowledge 25%; Routine procedures 54%; Complex procedures 20% and Problem-solving 10% (DoE, 2011).

Moreover, the findings indicate that the participants use the pen and paper strategy to conduct the summative individual tasks. In addition, the participants indicated that this type of assessment allows them to assess their own teaching as well as learners progress. Further to this, they indicated that the summative assessment is done in a written form so that it reflects a learner's performance and for recording purpose as indicated on the CAPS document, as well as on the literature review. The studies in the literature review and the data generated indicate that formative assessment is done on a daily basis to get a feedback about teachers' strategies and to find out whether their teaching has been effective or not. In addition, the findings indicate that the participants accounted that formative assessment inform them if they have to improve their teaching or find some intervention if it is necessary. Furthermore, the findings indicated that the participants do an oral assessment, by asking questions and observing class during and after the lesson. In addition, the participants also indicate that they assess class activities and class discussions as indicated in the literature review and CAPS document. The participants indicate that this assists them to get feedback about their teaching and learning. This show that the participants are in line with the intended curriculum since they indicated that CAPS document provides them with the teaching strategies.

Further to this, the findings reveal that the participants do not assess their own teaching, instead the participants allow learners to do self and peer assessment. The participants defended themselves that they do peer assessment during IQMS where their peers and the HoD observe them and make some recommendations on improvement. In addition, the participants are supported by Mathematics document by indicating that self and peer assessment should be done

by learners. In order to do their own introspection by observing each other. The findings indicate that only D3 allow learners to assess their own work and assess one another during presentations.

In addition to this, CAPS document indicated that self and peer assessment assists learners to learn. However, none of the participants have indicated that when they assess, they link the aims, objectives and the learning outcomes, as indicated in the literature review. This shows that the participants were not aware that in every assessment there are goals to be achieved. In addition, the document is not specific about which aims, specific aims and specific skills are to be achieved during assessment. The above discussions indicate that the participants used teaching strategies that are recorded in the literature review as well as on the Mathematics document. It is clear that they follow the performance curriculum to assess the intended curriculum. The CAPS document seems to be good in terms of assessment, as it specifies all types of assessment, all forms of assessment and it also indicate the teaching strategies to be used by teachers during the process of assessment.

### **5.3.11 concluding statement**

Based on the data generated, the findings indicate that the participants were aware of the teaching strategies as they can identify them. All the participants indicated that they use teaching strategies like telling method, explaining, demonstrating, and content-based method, like textbook method in order to cover the curriculum. The findings also indicate that the participants were able to identify the learner-centred approach. They indicated that they use teaching strategies like group work, pair work and the co-operative method. This indicate that the participants do involve learners during the teaching and learning. This means that the participants are aware that specific skills are for learners as indicated on the policy document. The participants indicated that they use self-discovery teaching strategy where by learners are given the opportunity to solve mathematics problems on their own first.

The above discussions indicate that the participants do combine the content-approach, teacher-centred approach and learner centred approach. As they have indicated that the first introduce a lesson for the day, then allow learner to discover for themselves. The findings, indicate that the at times the participants alternate the teaching strategies depending on what they want to measure

for that day. For an example they indicated that they use content-centred approach if they want to the amount of the content, like a textbook method. The findings also indicate that the participants defended themselves when they account on why they are using particular teaching strategies in a particular manner. However, the generated data indicate that the teaching strategies used by teachers were based on everyday knowledge. Since the CAPS document does not indicate the teaching strategies for teaching grade 5 Mathematics except on assessment.

In the absence of teaching strategies teachers are lacking guidance towards their teaching, which results them to use every day knowledge. This means that it is opposing the current curriculum since CAPS is a performance curriculum (Hoadley & Jansen, 2012). It is clear that teachers could not account on content about how and why they used the teaching strategies in a particular manner. Therefore, this suggests that teachers have not shifted their teaching strategies from competence curriculum to performance curriculum.

#### **5. 4 Recommendations**

The recommendations were derived from the above conclusion

##### **1. Rationale**

Rationale is not clearly spelt out on the CAPS document

It is recommended that mathematics document should be reviewed and write the rationale and the teaching strategies for teaching Mathematics in the policy document so that teachers are clear when it comes to the implementation of the intended curriculum. It is recommended that teachers should act like professionals and become lifelong learners to be abreast of the current issues of the curriculum.

##### **2. Aims, objectives and the learning outcomes**

It is also recommended that the curriculum developers should clearly specify the goals and the teaching strategies for teaching Mathematics for each topics. It is suggested that school advisors should do thorough monitoring in schools in terms of teaching Mathematics.

##### **3. Content and teaching activities**

It is recommended that the curriculum developers should review the Mathematics document and include the guidelines of teaching strategies of teaching mathematics content. It is recommended that teachers should develop themselves, research for studies that are in favour of different teaching strategies that focus on the performance curriculum content. It is recommended that teachers are workshoped in terms of teaching strategies that are linked to learning activities to achieve the relevant goals.

#### **4. Teacher's role**

It is also suggested that teachers should develop themselves to show that they chose teaching as profession not simply as an income.

#### **5. Resources**

It is suggested that the Department of Education should specify the hardware resources and ideological-ware for teaching Mathematics. It is also suggested that the Department of Education should find a means to monitor the schools to make sure the hardware resources are used effectively for the learners' sake. It is also recommended that teachers should also develop themselves by attending a short course of computer literacy so that they have a content knowledge of using technology. It is recommended that the CAPS document should specify the use of technology for teaching grade 5 Mathematics. It is also recommended that teachers should be developed on how to use technology so that they are able to apply it fruitfully in their teaching and learning.

#### **6. Location and time**

It is suggested that the CAPS document should be reviewed to include the teaching strategies to be used for teaching in the location in a stipulated time. This also suggest that teachers should be encouraged do develop themselves so that there are aware of the places that Mathematics may be taught. It is therefore, recommended that Mathematics documents should be reviewed to include the information on location so that teachers are aware of the places where Mathematics should be taught.

#### **5. 5 Critique of the curricular spider web**



The curricular spider web addresses all the components that are relevant at a classroom level, as Van den Akker et al. (2009), indicate that at school and classroom level all the components of the curricular spider web play a role. In the literature review it is indicated that if certain threads of the ten components of a curricular spider web are pulled at more strongly than others the curricular spider web will lose the balance (Van den Akker et al., 2009). Therefore curricular spider web shows the balance by including all the ten components of the curricular web that are needed during teaching.

As good as it is, the curricular spider web has its own disadvantages. As Van den Akker et al. (2009), argue that every chain is as strong as its weakness link. The components of the curricular spider web has left out the learning outcomes to be achieved, its specification is on the aims and objectives of what learners are to learn and excluded what the learner should achieve during and after teaching and learning (Berkvens et al., 2014). Therefore the aims and objectives are driven by the content-centred and teacher centred approach only. Quality of education is about teaching and learning not about teaching only. Therefore, the learning outcomes are also important because at the end of each lesson, there are learning outcomes to be achieved by learners. As the study of Khoza (2014a), reveals that “learning outcomes are achieved by digging deeper in the module within the structure created by the aims and objectives provided to them. Therefore, the learning outcomes are very important when it comes to measuring learners’ performance as indicated by (Khoza, 2015b).

In addition, the curricular spider web does not specify the teaching strategies to be used during the application of the ten concepts of the curricular spider web. There are many factors that contributes to quality in education, and teaching strategies are just one of them (Hoadley & Jansen, 2012). Every curriculum is driven by content-centred, teacher-centred and learner-centred approach. Therefore, each and every lesson is delivered by using teaching strategies depending on the goals that are intended to be measured. This indicates that there are times where learners need to be active during the teaching and learning. Therefore, this suggests that teaching and learning is about combining the content-centred, teacher-centred as well as the learner-centred approach, but bearing in mind that CAPS is a prescribed curriculum.

Another drawback of the curricular spider web is that in most cases it refers to learning rather than teaching and learning. As Van den Akker et al. (2009) , state that the core of curriculum and the nine threads of the spider web refer to the ten parts of a curriculum, each concerning of an aspect of learning and the learning programme for pupils. The curriculum involves teaching and learning, whereby the teacher is the director of the curriculum. Therefore the curricular spider web should be concerned about the aspects of teaching and learning programmes for both learners and teachers.

## **5. 6 Conclusion**

This chapter has presented the answers of the research questions generated from using three techniques: reflective activity, one-on-one semi-structured interviews and focus group interviews. The data generated aimed to explore teaching strategies used by teachers when teaching grade 5 mathematics. It also addresses how and why do grade 5 teachers used teaching strategies in a particular manner in teaching Mathematics. The research findings discusses summary of literature review, data generated and CAPS document guided by the ten components of a curricular spider web. The recommendations were made to close the gap that was identified during exploration of teaching strategies used by teachers in teaching mathematics grade 5. Lastly the critique of the curricular spider web that was used as a conceptual framework

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## Appendix A: Reflective activity, Interview and Focus group discussions schedule

1. RATIONALE: why are you teaching Mathematics CAPS in grade 5?
  - (a) Which teaching strategies are you using to teach Mathematics CAPS?
  - (b) How and why are you teaching using the teaching strategies in a particular manner?
  
2. ACCESSIBILITY: With whom/ who are they teaching Mathematics CAPS in grade 5?
  - (a) Which teaching strategies are you using to teach mathematics CAPS?
  - (b) How and why are you teaching using the teaching strategies in a particular manner?
  
3. AIMS, OBJECTIVES AND LEARNING OUTCOMES: Towards which goals are you teaching Mathematics CAPS?
  - (a) Which teaching strategies are you using to achieve Mathematics CAPS goals?
  - (b) How and why are you teaching using the teaching strategies in a particular manner?
  
4. CONTENT: What Mathematics CAPS content are you teaching in grade 5?
  - (a) Which teaching strategies are you using to teach the Mathematics CAPS content?
  - (b) How and why are you teaching using the teaching strategies in a particular manner?
  
5. TEACHING ACTIVITIES: What activities are you teaching in Mathematics CAPS?
  - (a) Which teaching strategies are you using to teach Mathematics CAPS?
  - (b) How and why are you teaching using the teaching strategies in a particular manner?
  
6. TEACHER ROLE: What role do you play in teaching grade 5 Mathematics CAPS?
  - (a) Which teaching strategies are you using to play your role to teach Mathematics CAPS?
  - (b) How and why are you teaching using the teaching strategies in a particular manner?
  
7. RESOURCES AND MATERIALS: What resources and materials do you use to teach grade 5 Mathematics?
  - (a) Which teaching strategies are you using to teach Mathematics CAPS with the resources and the material you have?
  - (b) How and why are you teaching using the teaching strategies in a particular manner?
  
8. LOCATION AND TIME: Where and when are you teaching grade 5 Mathematics CAPS?
  - (a) Which teaching strategies are you using in the location with the allocated time to teach Mathematics CAPS?
  - (b) How and why are you teaching using the teaching strategies in a particular manner?
  
9. ASSESSMENT: How do you assess your teaching in grade 5?
  - (a) Which teaching strategies are you using to assess Mathematics CAPS?

(b) How and why are you assessing using the teaching strategies in a particular manner?



education

Department:  
Education  
**PROVINCE OF KWAZULU-NATAL**

Enquiries: Nomangisi Ngubane

Tel: 033 392 1004

Ref.:2/4/8/434

Mrs TH Zuma  
PO Box 14000  
KWANDENGEZI  
3607

Dear Mrs Zuma

#### PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **"AN EXPLORATION OF TEACHERS' STRATEGIES OF TEACHING GRADE 5 MATHEMATICS CURRICULUM AND ASSESSMENT POLICY STATEMENT (CAPS) IN KWANDENGEZI CIRCUIT"**, in the KwaZulu-Natal Department of Education Institutions has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning the research and interviews.
2. The researcher must ensure that Educator and learning programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Learners, Educators, Schools and Institutions are not identifiable in any way from the results of the research.
5. A copy of this letter is submitted to District Managers, Principals and Heads of Institutions where the intended research and interviews are to be conducted.
6. The period of investigation is limited to the period from 15 June 2015 to 31 July 2016.
7. Your research and interviews will be limited to the schools you have proposed and approved by the Head of Department. Please note that Principals, Educators, Departmental Officials and Learners are under no obligation to participate or assist you in your investigation.
8. Should you wish to extend the period of your survey at the school(s), please contact Miss Connie Kehologile at the contact numbers below.
9. Upon completion of the research, a brief summary of the findings, recommendations or a full report / dissertation / thesis must be submitted to the research office of the Department. Please address it to The Office of the HOD, Private Bag X9137, Pietermaritzburg, 3200.
10. Please note that your research and interviews will be limited to schools and institutions in KwaZulu-Natal Department of Education.

Pinetown District

**Nkosingithi S.P. Sishi, PhD**  
Head of Department: Education  
Date: 09 June 2015

**KWAZULU-NATAL DEPARTMENT OF EDUCATION**

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UNIVERSITY OF  
KWAZULU-NATAL  
INYUVESI  
YAKWAZULU-NATALI

26 August 2015

Mrs T Zuma 982207092  
School of Education  
Edgewood Campus

Dear Mrs Zuma

Protocol reference number: HSS/0286/015M  
Project title: An exploration of teachers' strategies in teaching Mathematics Curriculum and Assessment Policy Statement (CAPS) in Grade 5, in KwaNdengezi Circuit.

**Expedited Approval**


In response to your application dated 07 April 2015, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. Please note: Research data should be securely stored in the discipline/department for a period of 5 years.

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

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

Yours faithfully

  
.....  
Dr Shenuka Singh (Chair)

/px

cc Supervisor: Dr SB Khoza  
cc Academic Leader Research: Professor P Morojele  
cc School Administrators: Ms B Bhengu, Ms PW Ndimande, Ms T Khumalo & Mr SN Mthembu

**Humanities & Social Sciences Research Ethics Committee**

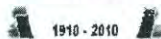
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