

**Teachers' reflections of teaching Geographical Information System (GIS) at grade
11 within CAPS in a township school in the uMhlathuze Circuit**

By

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**A dissertation submitted in fulfilment of the requirements for the degree
of Master of Education in Curriculum Studies**

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Declaration

I, Sphesihle Zuma declare that this Dissertation contains my own work. All sources that were used have been referenced accordingly. This research has not been previously accepted for any degree to any and is not being currently considered for any other degree at any other university.

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As the candidates' supervisor I agree/ do not agree to the submission of this Dissertation

Signature _____

Date _____

Dr. Simon Bheki Khoza

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To you all, I wish to say: "you are the best!"

Dedication

This study is dedicated to my mother (Lindiwe Ndlovu), and my late aunt (Sbongile Ndlovu) and late father (Spirit Mazibuko) may their souls rest in peace. I thank them for their guidance, encouragement, love and support during my formative years. Finally yet importantly, I would like to dedicate this study to my son Lwandile Zuma who was an inspiration and motivation for me to keep going even when I felt like giving it all up.

Abstract

This dissertation presents an action research study of four grade eleven geography teachers. This study utilised a critical paradigm with an aim of exploring teachers' reflections of teaching Geographical Information System (GIS) at grade 11 within CAPS in a township school in the uMhlathuze Circuit. The methods of data generation utilised were reflective activity, semi-structured interviews and group discussion. Purposive sampling and convenience sampling were utilised to select the most accessible participants. This study was framed by the concepts of the curricular spider web, with an aim of answering the following three questions:

1. What are the Grade 11 teachers' reflections on their teaching of Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the UMhlathuze Circuit?
2. Why do the Grade 11 teachers reflect in particular ways on the Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the UMhlathuze Circuit?
3. What lesson can be learnt from the Grade 11 teachers' reflections on their teaching of Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the UMhlathuze Circuit?

The findings from the literature review identified three levels of reflections that are important for teachers to understand curriculum. These levels are technical, practical and critical reflection; these levels were used to frame the responses of the teachers. Furthermore, the study utilised the ten concepts of curricular spider web; these concepts were used to frame reflective activity questions, semi-structured interviews and group discussion. Since this study was based on transforming teachers, data was generated into two phases. In phase one, teachers were reflecting based on technical and practical reflection, most were not aware of the ten concepts of the curricular spider web. In phase two, teachers displayed improvement, and were able to embrace critical reflection with understanding of concepts of curricular spider web.

The study also provided several recommendations regarding teachers' reflection of teaching GIS; these included teachers being equipped with an understanding of three levels of reflections in relation to teaching of CAPS, most importantly critical reflection, as aligned with CAPS. Furthermore, the study recommends that teachers should be aware of the concept of a curricular spider web so that they will understand the rationale for teaching GIS.

List of acronyms

C2005	Curriculum 2005
CAPS	Curriculum Assessment Policy Statement
DOBE	Department Of Basic Education
DOE	Department of Education
FET	Further Education and Training
GET	General Education and Training
GIS	Geographic Information Systems
NCS	National Curriculum Statement
OBE	Outcomes Based Education
SASA	South African Schools Act

Table of contents

Declaration	i
Acknowledgements	ii
Dedication	iii
Abstract	iv
List of acronyms.....	v
Table of content	vi
CHAPTER 1	1
The overview, context and objectives	1
1. 1 Introduction	1
1. 2 Title.....	3
1. 3 Focus and Purpose of Study	3
1. 4 Location of the study.....	3
1. 5 Rationale of the study	3
1. 6 Literature Review	5
1. 7 Objectives of the study	6
1. 8 Research questions	6
1. 9 Research Design and Methodology	6
1.9. 1 Research paradigm	6
1.9. 2 Research approach.....	7
1.9. 3 Sampling	8
1. 10 Data generation methods	8
1.10.1 Reflective activity	8
1.10.2 Focus group discussion	9
1.10.3 One-on-one (individual) semi-structured interviews	9
1. 11 Data analysis	9

1. 12 Ethical clearance	10
1. 13 Trustworthiness	11
1.13.1 Credibility.....	11
1.13.2 Transferability.....	11
1.13.3 Dependability.....	12
1.13.4 Conformability.....	12
1. 14 Limitations of data.....	12
1. 15 Summary of each Chapter.....	13
1. 15.1 Chapter 1.....	13
1. 15.2 Chapter 2.....	13
1. 15.3 Chapter 3.....	13
1. 15.4 Chapter 4.....	13
1. 15.5 Chapter 5.....	14
1.16 Chapter summary.....	14
CHAPTER 2	15
Literature review.....	15
2.1 Introduction	15
2.2 Phenomenon.....	17
2.2.1 Process of teacher reflection.....	18
2.2.2 Rationale for teacher reflection.....	18
2.3 Three levels of reflections.....	19
2.3.1 Technical reflection.....	19
2.3.2 Practical reflection.....	20
2.3.3 Critical reflection.....	20
2.4 Challenges associated with critical reflection.....	22
2.5 Methods of promoting critical reflection to teachers.....	23
2.6 Critical reflection and teachers as agents of change.....	25
2.7 Definitions of the term Curriculum.....	26

2.7.1 Curriculum Presentations.....	26
2.7.2 Change and Curriculum change.....	27
2.8 What is the Curriculum and Assessment Policy Statement (CAPS)?.....	28
2.8.1 Teacher change as the curriculum changes.....	30
2.8.2 Reasons for curriculum change.....	31
2.9 Curricular spider web.....	33
2.9.1 Rationale for of teaching GIS in grade 11 CAPS.....	34
2.9.2 Who are teaching GIS grade 11?	36
2.9.3 Goal: toward which goal are you teaching GIS?.....	39
2.9.4 GIS CAPS content.....	40
2.9.5 Teaching activities.....	44
2.9.6 Teachers' role.....	45
2.9.7 Material and resources.....	48
2.9.8 Time and location of teaching GIS.....	50
2.9.9 Assessing in GIS grade 11 CAPS.....	50
2.10 Conclusion.....	54
CHAPTER THREE	55
Research design and methodology.....	55
3. 1 Introduction	55
3. 2 Research paradigm	56
3. 3 Research approach/style	61
3. 4 Sampling.....	66
3. 4.1 Purposive sampling.....	66
3. 4.2 Convenience sampling	67
3.4.3 Finding participants.....	67
3. 5 Data Generation Methods.....	68
3. 5.1 Reflective activity (Open-ended questionnaire)	69
3. 5.2 One-on-one semi-structured interviews	73
3. 5.3 Focus group discussion	74
3. 6 Data analysis	77
3. 7 Ethical issues	79
3. 8 Trustworthiness	80
3. 8.1 Credibility.....	81
3. 8.2 Transferability.....	81

3. 8.3 Dependability.....	82
3. 8.4 Conformability	82
3. 9 Limitation of data.....	83
3. 10 Concluding	83
CHAPTER FOUR.....	84
Research findings and discussion.....	84
4.1 Introduction.....	84
4.2 Data presentation and discussion.....	84
4.2.1 Experiences of teacher A of teaching GIS.....	84
4.2.2 Experiences of teacher B of teaching GIS.....	85
4.2.3 Experiences of teacher C of teaching GIS.....	85
4.2.4 Experiences of teacher D of teaching GIS.....	86
4.3 Framing of themes.....	86
4.3.1 Why are you teaching GIS?.....	87
4.3.2 Towards what which goals are you teaching GIS?.....	88
4.2.3 What content are you teaching in GIS?.....	90
4.3.4 Which activities are you using to teach GIS?.....	91
4.3.5 How do you facilitating teaching of GIS?.....	93
4.3.6 With what are you teaching GIS?.....	95
4.3.7 Where and when are you teaching GIS?.....	96
4.3.8 How do you assess learning in GIS?.....	98
4.3.9 Is the teaching of GIS accessible?.....	99
4.4 Chapter conclusion.....	101
CHAPTER FIVE.....	102
Summary, conclusions and recommendations	102
5. 1 Introduction	102
5. 2 Summary of chapters	102
5. 2.1 Chapter One	102
5. 2.2 Chapter Two	103
5. 2.3 Chapter Three	104
5. 2.4 Chapter Four	104
5. 3 Major findings	104

5.3. 1 Rationale for teaching GIS.....	105
5.3. 2 Goals	106
5.3. 3 Content.....	106
5.3. 4 Teaching activities	107
5.3. 5 Teachers' role	108
5.3. 6 Resources	108
5.3. 7 Location/ environment and time	109
5.3. 8 Assessment	109
5.3. 9 Accessibility	110
5. 4 Suggestions for further research	111
5. 5 Recommendations	111
5.5. 1 First recommendation	111
5.5. 2 Second recommendation	112
5.5. 3 Third recommendation	112
5.5. 4 Fourth recommendation	112
5.5. 5 Fifth recommendation	113
5.5. 6 Six recommendation	113
5.5. 7 Seventh recommendation	113
5.5. 8 Eighth recommendation	113
5.5. 9 ninth recommendation	113
5. 6 Chapter conclusion.....	114
5. 7 Conclusion	114
References	116
Annexures	120
1. Annexure A – Letter to principal	123
2. Annexure B: Consent form for participants.....	126
3. Annexure C: Letter to the Department of Education	128
4. Annexure D: Permission from the department	131

5. Annexure E: Permission from the University.	132
6. Annexure F: Reflective Activity	133
7. Annexure G: One-on-one semi-structured interview.....	135
8. Annexure H: Focus group discussion.....	135
9. Annexure I: Turnitin report	136

List of figures

Figure 1.1: Chart flow.....	2
Figure 2.3: Model of change.....	25
Figure 2.5 Curricula spider web.....	33
Figure 2.7: Weighting of cognitive levels in grade 11.....	51
Figure 3.2: Education research paradigm.....	57
Figure 3.3: Critical paradigm.....	58
Figure 3.4: Action research.....	62
Figure 3.5: Two phases used to conduct this action research.....	63

List of tables

Table 2.1: Literature review.....	16
Table 2.2: Rubric for teacher reflection.....	24
Table 2.4: Changes between NCS and CAPS.....	29
Table 2.6: GIS content for FET.....	42
Table 2.6: Weighting of cognitive levels in grade 11.....	51
Table 2.7: Programme of assessment.....	52
Table 3.4: Participants details.....	67
Table 3.7: Reflective activity questions.....	70
Table 4.4.1: Data generation plan:.....	76
Table 5.1: Chapter, number and percentage.....	102

CHAPTER ONE

BACKGROUND AND ORIENTATION TO THE STUDY

1.1 Introduction

After long debates around the issues of curriculum reform in South African from Curriculum 2005 (C2005) to National Curriculum Statement (NCS), teachers' unions, political organisations, universities and communities have raised a number of challenges which led to the current minister of Basic Education, Angie Motshekga, introducing the Curriculum and Assessment Policy Statements (CAPS). These reforms suggest that teachers have to change at a macro and micro level (including changes in geography as a subject). C2005 and NCE, teachers were applying a competence curriculum, meaning learners were key role players for their learning, whereas with the introduction of CAPS teachers are moving to a performance curriculum, meaning that teachers are the key role players. This study is an exploration of teachers' reflections of teaching Geographical Information System (GIS) at grade 11 within CAPS in a township school in the uMhlathuze Circuit.

In this chapter, I provide insight into the four chapters below. This action research study focuses on the teaching of GIS as part of geography content for Further Education and Training (FET). Teaching of GIS is an exploration of new available technology by learners, since the world is dominated by technology. The areas of concern are that geography teachers in secondary schools are facing challenges of pedagogy and new terminology in teaching GIS (Clough, 2004). Teachers in South Africa lack professional development in teaching of GIS (Green, 2007). Teachers lack understanding of teaching vision (Khoza, 2015). This study engages in action research to explore the understanding of the four geography teachers chosen.

This chapter is structured according to the following subtopics: purpose of the study; location of the study; rationale of the study; literature review; objectives of the study; critical research questions; research design and methodology, research approach/style, sampling, data generation methods, data analysis, ethical clearance, trustworthiness, anticipated problems or limitations; and lastly, a summary of each chapter contained in this thesis. The following is a flow chart of chapter one.

Flow chart of chapter one

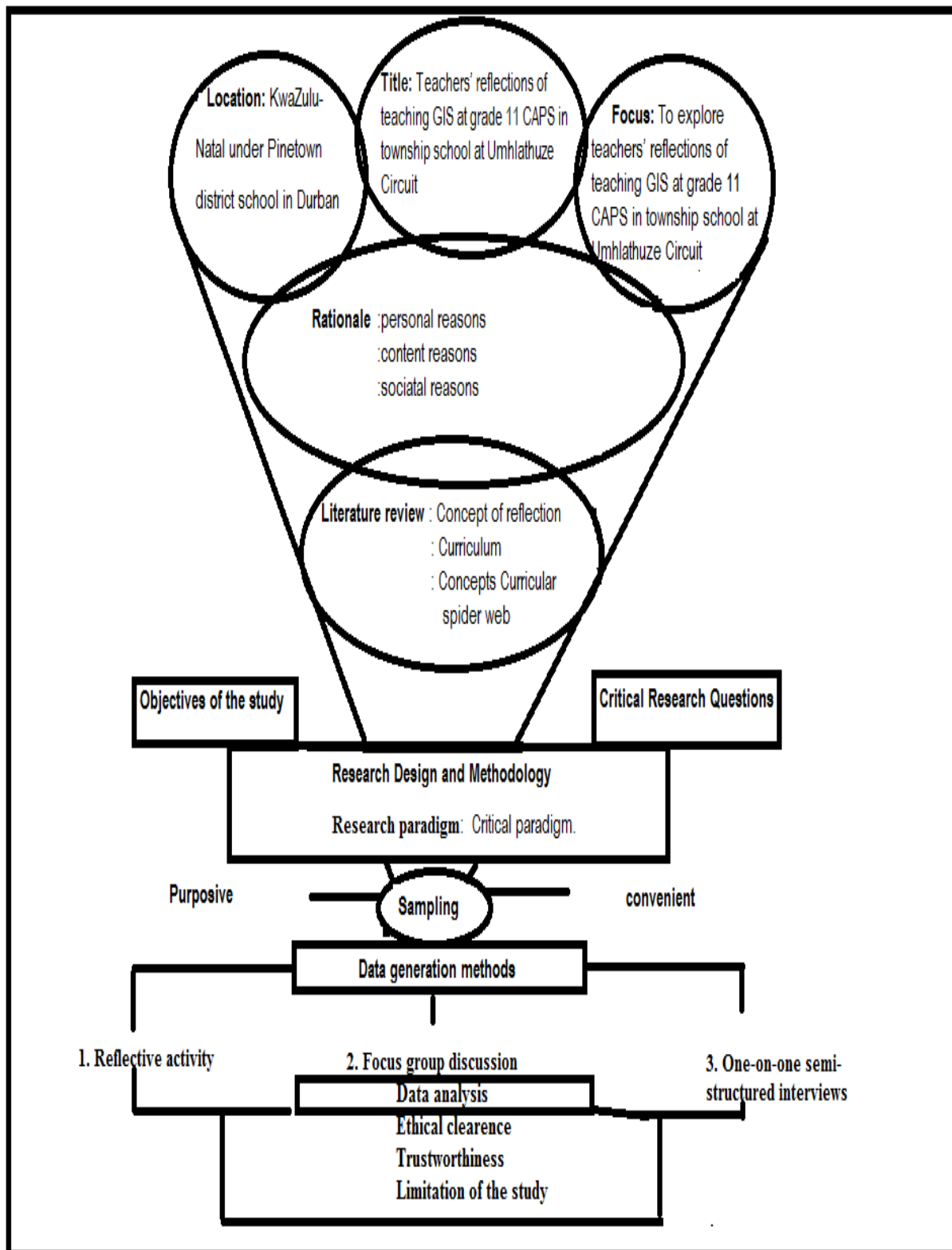


Figure 1.1 chapter one flow chart

1.2 Title

Teachers' reflections of teaching Geographical Information System (GIS) at grade 11 within CAPS in a township school in the uMhlathuze Circuit.

1.3 Focus and Purpose of the study

The purpose of this study is to explore teachers' reflections of teaching Geographical Information System (GIS) at grade 11 within CAPS in a township school in the uMhlathuze Circuit.

1.4 Location of the study

This action research study was conducted in a secondary school situated at KwaZulu-Natal under the Pinetown district. One school was used, and four grade 11 geography teachers were used as participants of this study. The school was opened in 1981 and two classes were available at that time; three teachers were teaching including the school principal. The enrolment at that time was about 80 learners. Currently the school has 20 classes with an enrolment of 988 learners and 30 teachers. In the early 1990s, the school was closed down for two years due to political reasons. Zikhalizakho High School (fictitious name) is found in Pinetown South area, and consists of middle-income residents; the school is lacking in resources, and there are few laptops stored in the strong room, which often go unused. Only one computer is used for school administration. Other teaching and support materials are not available.

1.5 Rationale of the study

Teachers' reflections of teaching Geographical Information System at grade 11 CAPS is a topic rooted from my own experiences as a student teacher and as a qualified teacher. In the course of my teaching practice, I have observed that teachers face enormous challenges and also experience difficulties in understanding the purpose of GIS. In addition, teachers experience difficulties in teaching GIS because of its complexity. It seemed that learners, in one of the school I have been to, were never taught GIS. In another schools I had to teach GIS in the third term, and yet according to the CAPS document, it should be taught in the first term. This left me with unanswered questions of what learners wrote in their March and June tests and exams. Are the teachers following the CAPS document or they are doing something else? Through my experiences, as well as the debates with other students and educators about GIS, there are a number of challenges when teaching GIS. As a result, I see the need of conducting this

study in order to contribute towards addressing this problem. From my observation, seemingly teachers do not have time to reflect on their experiences of teaching GIS.

Reflection is a planned activity, an act that can serve as a cognitive mediator, shutting thinking from the heated perplexities of real teaching to the cold logic of perspectives applied from a distance (Dewey, 1922). Dewey further states that reflection is believed to support teachers' understanding of pedagogy as well as their ability to think flexibly and objectively and learn problems from their teaching action. Dewey (1933) pinpointed three qualities of a reflective teacher which are open-mindedness, a sense of responsibility and wholeheartedness. Similarly, Khoza (2015) stated that concepts of reflection may help teachers with a direction to reflect on their experiences before, during and after their teaching practices. Simplifying the reflection language may help teachers to achieve critical reflection. The study conducted by Khoza (2015) on student teachers' reflections on their practice of Curriculum and Assessment Policy (CAPS) concluded that teachers should become aware of the teaching curriculum profession, understand the reasons for teaching the curriculum and be willing to teach and learn in order to always reflect on their teaching before their actions, during, and after their actions.

In addition to the conclusion drawn by Khoza (2015) based on the study conducted by Aldridge (2012) on using a new learning environment, questionnaires for reflection in teacher action research findings were that teachers who use student feedback for improving the learning environment are more likely to be successful when working collaboratively, than working alone. Teachers who reflect are able to implement changes through the eyes of their learners by questioning their teaching. Given the importance of reflection, it is therefore important for the teachers to reflect on their teaching in order to undergo the changes of the curriculum. The curriculum of South Africa has moved from a competence curriculum (Christian National Education, Curriculum 2005 and National Curriculum Statement) to a performance curriculum, CAPS. This shift in the curriculum suggests that teachers should change or transform their teaching style. Different studies have been conducted around the teaching of Geographical Information Systems (GIS) but none of them has been conducted using critical paradigm and action research. Zietsman (2010) conducted a study of GIS in South Africa in an interpretive paradigm which concluded that educators should play an important role to make sure that marvellous tool is used effectively in schools. Another study conducted by Breetzke (2012) indicated that paper-based GIS in developing countries still has the big role to play, since resources to support teaching and learning were limited. The results of these studies suggest that there is a need for a study that is conducted on the teachers' reflections of teaching GIS at grade 11 CAPS since previous studies focused on GIS and resources.

For these reasons, the outcomes of this study are aiming at informing the provincial officers of education, regional officers of education, district management, circuit management, curriculum designers, subject advisers and geography teachers, specifically the participants. Also the outcomes of this study may be valuable to policy makers when effecting changes to the implementation of geography grade 11 CAPS.

1.6 Literature review

Several scholars have provided different meaning of reflection, however, Dewey (1933, p.9) defines reflection as “assessing the grounds (justification) of one’s beliefs” by so doing we are examining the assumptions whereby we justify our convictions. Dewey (1922), states that reflection aims to support teachers’ understanding of subject knowledge, and have the capability to think openly and learn problems from their teaching actions. For Boud, Keogh and Walker (1985), reflection is affective activities whereby the individuals participate in exploring their experiences in order to develop and lead to new understandings. Khoza (2015) states that the concepts of reflection may help teachers with a direction to reflect on their experiences before, during and after their practices.

Given the definition and importance of reflection, it is important for the teachers to reflect on their teaching in order to undergo the changes of the curriculum. According to Van Manen (1977), reflection has three stages, similar to those discussed by Zeichner and Liston (1987), namely technical reflection, practical reflection and critical reflection. While teacher reflection is important for proper implementation of the curriculum, teachers should also be aware of the concepts of the curricular spider web.

Van den Akker (2009) discusses ten concepts of the curricular spider web, whereby rationale is the core of the curriculum. These concepts are driven by questions for each to be understood. The questions are as follow:

- Why are they teaching? (Rationale)
- Towards which goals are they teaching? (Aims and objectives)
- What are they teaching? (Content)
- How are teaching? (Learning activities)
- How do teachers teach? (Teacher role)
- With what are they teaching? (Materials and resources)
- Where are they teaching? (Learning environment)

- When are they teaching? (Time)
- How are they assessing teaching? (Assessment)
- Who are they teaching? (Accessibility)

Khoza (2014) explained these concepts of curricular spider web as e-learning signals.

1.7 Objectives of the study

1. To identify Grade 11 teachers' reflections of teaching Geographical Information System (GIS) for grade 11 within CAPS in a township school in the uMhlathuze Circuit
2. To explain the reasons why Grade 11 teachers reflect in particular ways on the Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the UMhlathuze Circuit?
3. To understand the lessons learnt from the Grade 11 teachers' reflections of teaching Geographical Information System (GIS) for grade 11 CAPS in a township school in the uMhlathuze Circuit

1.8 Critical Research Questions

1. What are the Grade 11 teachers' reflections of their teaching of Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the uMhlathuze Circuit?
2. Why do the Grade 11 teachers reflect in particular ways on the Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school of uMhlathuze Circuit?
3. What lesson can be learnt from the Grade 11 teachers' reflections of their teaching of Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the uMhlathuze Circuit?

1.9 Research Design and Methodology

1.9.1 Research paradigm

The research paradigm chosen for this study is the critical paradigm. Cohen, Manion and Morrison (2007) describe the critical paradigm as a paradigm that is based on equality and democracy of the society, not merely giving an account of behaviour of the society. It aims is to emancipate and to

redress inequality and promote freedom in society by focusing on legitimacy, equality, voice, power, ideology, participation and interest. Cohen et al. (2011) argue that the main focus of the critical paradigm is to transform society, meaning changing society to a democratic one. The aim of choosing this critical paradigm was to explore teachers' reflections of teaching Geographical Information System (GIS) to grade 11 within CAPS in order to assist geography teachers to reflect on what they are lacking. This paradigm was utilised because none of the studies were conducted on GIS as an action research using the critical paradigm. Using the critical paradigm, I examine the ways in which geography teachers are teaching GIS and provide recommendations of what can be done to improve teaching of GIS in grade 11.

1.9.2 Research approach

This study adopted a qualitative approach. In a qualitative approach, the emphasis is on the quality and depth of information (Nieuwenhuis, 2007). The qualitative approach is an approach concerned with understanding the meanings which people attach to actions, decisions, beliefs, values and the like within their social world, and understanding the mental mapping process that respondents use to make sense of and interpret the world around them (Ritchie & Lewis 2003). I used qualitative approach, because, as a researcher, I wanted to understand teachers' reflection of teaching Geographical Information System for grade 11 CAPS. Qualitative research is concerned with developing explanations of social phenomena that inform understanding about the world in which people inhabit and why things exist the way they are (Hancock, 2002). As a researcher I wanted to understand the major reasons for teachers reflecting in particular ways in order to explain their practice. As a researcher I also identified lessons that can be learnt from the Grade 11 teachers' reflections on teaching GIS. With these abovementioned reasons, the qualitative approach is highly applicable for this study.

In conjunction with qualitative approach, this study also utilised an action research approach. According to Cohen et al. (2007) action research involves the small scale intervention. This action research involved a group of four geography teachers, three of which are teaching in the same school. Cohen et al. (2007) argue that action research is a process in which practitioners study problems so that they can evaluate, improve and make decisions. They further state that action research is about planning, acting, observing and reflecting rigorously. As the researcher in an action research study, I am there to provide a solution to a problem, or to make teachers improve their teaching practice. Phase one of the teachers' reflection is to get an understanding of what are the geography teachers are teaching, whether they understand three levels of reflection when teaching GIS and whether they are able to

incorporate, with understanding, the concepts of curricular spider web. The expectations from phase two are that teachers should reflect, with understanding, of what they are teaching. Action research was also utilised to explain what informs our reflections as geography teachers on teaching Geographical Information System (GIS) for grade 11 CAPS. Christiansen et al. (2010) state that action research assumes that teachers are the best in explaining what is taking place in their classrooms. Hence, in this action research I used four geography teachers who are teaching grade 11 because they know best what is taking place in their classrooms.

1.9.3 Sampling

Cohen and Holliday (1996) identify the two major sampling. The first is probability sampling, which also known as random sampling, whereby the focus on the wider population with equal chance given for selection. The second sampling method is non-probability sampling, also known as purposive sampling, whereby the focus is on a few select members. For this study I used purposive sampling and convenience sampling. Convenience sampling falls under non- probability sampling. Purposive sampling was used to include teachers that I am familiar with in terms of working in the same circuit and doing cluster moderations together. I also utilised convenience sampling whereby I selected teachers because they were easily accessible since some of them I stay with and also teach in nearby high school.

1.10. Data generation methods

In this study I utilised three techniques in data generation, namely a reflective activity, a focus group discussion and one-on-one semi-structured interviews

1.10.1 Reflective activity

The first qualitative method of data generation used in this study is reflective activity. Blarke (2007) describes reflective activity as an open question which allows the respondent to use their own words to answer; I prepared open-ended questionnaires for participants to complete. These questionnaires were guided by the ten concepts of curricular spider web. Hall (1996) states that reflective activity is emancipatory because it is based on the construction of knowledge, using authentic data to reflect on the experiences of the participants, and it upholds principles of democracy between the participants. As a researcher in this study, I do not hold priority over the participants' views. The most important aspect

of reflectivity activity is self-conscious awareness of the results of how the participants and the researcher value opinions and attitudes, and influence on the research.

1.10.2 Focus group discussion

From reflective activity, I moved further to group discussion. Since the intention was to get primary data from the participants we then moved to focus group discussion. According to Cohen et al. (2011), group discussion encourages group members to become active, with the researcher facilitating group discussion. Questions for the focus group discussion were based on the curricular spider web concepts, similar to the questionnaires from the reflective activity. As a researcher teacher, I facilitated the discussion, giving all participants a chance to think about the questions and then respond to each question asked. The questions were also phrased according to the participants' understanding, and I was alert to not losing the meaning and the demands of the questions. Watts and Ebbutt (1987) state that one of the advantages of focus group interviews are that they are time saving; one of the reasons to use focus group interview was to save time. For this study I conducted two sessions of focus group interviews that lasted about one hour each phase that gave us two hours in total.

1.10.3 One-on-one, semi-structured interviews

From, focus group discussion, I moved to one-on-one semi-structured interviews. Morse and Richards (2002) state that one-on-one semi-structure interviews are similar to the interview; it is characterised of open-ended questions that are prepared in advance together organised probes. According to Haralambos (1985), semi-structured interviews are seen as more appropriate for drawing out attitudes and opinions of the participants. In this research I wanted to understand teachers' reflections of teaching Geographical Information System (GIS) in grade 11 CAPS. Kumar (2005) states that open-ended questions can extract in-depth information from participants. For the benefit of this study it was necessary to use open-ended questions in order to explore teachers' reflection of teaching GIS.

1.11 Data analysis

Cohen et al. (2011) state that qualitative data analysis comprises of organising, accounting for and explaining, in other words making sense of data from the participants' definitions, stating patterns, themes and categories. Cohen et al. (2011), further state that qualitative data is heavy to interpret, many frequently interpretations to be made and qualitative data is further distinguished by merging data. Qualitative data derived from interview, observations, audio and video and film. Cohen (2011)

argues that transcriptions of interviews are accurate verbatim records, on the other, transcription interviews omit non-verbal aspects, and are time consuming. In order for the data to be fit for the purpose, the researcher should be able to describe, portray, summarise, interpret, discover patterns, generate themes, understanding of individuals and the groups and how to raise issues.

1.12 Ethical clearance

According to Leedy and Ormrod (2005), whenever human beings are investigated, ethical implications are essential to be considered. Leedy and Ormrod (2005) point out four categories of ethical considerations that are important in a research project; these include: protection from harm; informed consent; right to privacy; and honesty. Sarantakos (2005) identified three levels of harm that a participant may experience during the research. These levels are: physical harm; legal harm; and mental harm. The four participants of this research project were not exposed to harm; during the research project it was my obligation to protect all participants throughout the research equally. No risky tasks were undertaken throughout the research project. The identity of each participant was confidential at all the times. Participants were given letters of consent to sign. The consent letters stated the topic of the research project: teachers' reflection of teaching GIS in grade 11 CAPS. The aim of this research, which was to transform geography teachers, to enable them to practice reflection on their daily practices and to inform Department of Education about the findings. Participants were knowledgeable that their contribution is voluntary and they were free to withdraw at any time of the research. I also wrote a letter to the school principal requesting to do the research in the selected school and permission was granted.

Further on ethical issues, I send a letter for permission to conduct a research study in the selected high school to the Provincial Chief Director of the KwaZulu-Natal Department of Basic Education. Once more, in the letter, I stated the topic, the aim and the purpose of the research project. A letter of access into the school was received after several attempts, at first I sent a letter via email, which was ignored, and no response was given to me. The second attempt, I went personally to the Provincial office of the KwaZulu-Natal Department of Basic Education (DOBE) with a hard copy of my letter. Thereafter, I waited for one week to receive the access letter. From DOBE I went further on obtaining the letter from the University of KwaZulu-Natal; again there were challenges of not receiving ethical clearance on time. At first, my supervisor sent my proposal to the ethical clearance department, which is at the Howard College campus. After that, I waited for several weeks, I then personally went to the ethics offices to enquire about the letter. It was then that I found out that I had to clarify some of the issues in my

proposal; I made some clarifications and then sent it back. I then waited about one week to get my ethical clearance.

1.13 Trustworthiness

Bassey (1999) used the concept of 'trustworthiness' which originated from the work of Lincoln and Guba (1985). This concept comprises of many questions that need to be asked in each stage of the research. Bassey (1999) identified, prolonged engagement with data, observation of imaging issues, checking of raw data, triangulation of data, and systematically matching the emerging issues with statements that have been analysed. A critical challenge of the findings is to provide sufficient detail for research. Trustworthiness in a qualitative inquiry is used to support the argument that the findings are 'worth paying attention to'. According to Lincoln and Guba (1985), in a qualitative research project there are four issues of trustworthiness that need the attention of the researcher: credibility; transferability; dependability; and conformability. The above four issues are discussed in detailed in the following paragraphs.

1.13.1 Credibility

According to Flick (2006), credibility refers to the accurateness of the documentation, the reliability of the producer of the document, and the freedom of errors. Similarly, Shenton (2004) states that credibility is about ensuring that the instruments used to measure results are trustworthy and credible. To ensure credibility in this action research I used three methods of collecting data, which are reflective activities, group discussions and semi-structured interviews. Four participants were used in this study for the purpose of increasing credibility. During the group discussion and semi-structured interviews, the same questions were used to ensure that participants understood the questions and that I was able to compare their responses. Further, to ensure credibility of this study I had to undergo several stages, including confirming being a registered student at UKZN, and the writing of the proposal that was approved by my supervisor; I then defended my proposal in the presentation of aspects in the field of curriculum and research, the proposal was submitted for ethical clearance, and each chapter was submitted to my supervisor for review several times. I finally produced a complete document. The document was submitted through Turnitin to check the level of plagiarism, and from there the document was submitted to the editor for spelling check-up. Finally, the document was submitted to two external examiners for final examination.

1.13.2 Transferability

According to Cohen et al. (2002), transferability is the degree to which results of the search can be generalised to a wide-ranging population. This study is embedded in the critical paradigm. According to Cohen, Manion and Morrison (2007) the critical paradigm is a paradigm that is based on equality and democracy of society, and does not merely give an account of the behaviour of the society; it aims to emancipate and to redress inequality and promote freedom in society. Generalisation of the results from this study could not be transferred to other contexts. Data presented in this study is not stagnant and it may change as the context changes; it also changes from teacher to teacher.

1.13.3 Dependability

According to Shelton (2004), dependability is the extent to which a piece of work can obtain similar results if the work was repeated in the same context with same methods. Shelton (2004, p. 71) suggests that the researcher should use an “overlapping method” in order to ensure dependability. To ensure dependability in this study I described the stages that gave these results of this study for the next researchers to find similar results. I used three methods of data collection, namely reflective activity, group discussion and semi-structured interviews. These three methods measured the same results, which suggests that the findings are reliable. Data generated was organised into common themes to further ensure reliability of the findings.

1.13.4 Conformability

According to Shenton (2004), conformability is the concern of the researcher in a qualitative study about the objectivity of the study. Further on conformability, Shenton (2004) argues that the results of the study must be based on experiences and ideas of the participants, instead of the predilection of the researcher. I tried to eradicate any act of bias in the study, I went through the generated data, reflecting several times just to insure that I am not biased in any form.

1.14 Limitation of data

Data was limited by time frame; data was collected over a period of a month and covered two cycle of action research. If there was more time to do teachers' reflection of teaching GIS, there would have been more observable outcomes. In the first cycle, teacher B was not part of the research project and those teachers that were present had no understanding of action research. In the second phase I replaced teacher B, then the new teacher B had to be taught first before he became part of this action research project. In the second cycle, teachers had an understanding of what we were doing and where we were lacking and where we needed to improve. I felt that we needed more time since we were not

used to reflecting on our own teaching, particularly with GIS where teachers face many challenges. Further, the study was conducted on a small scale (one school with four geography teachers) therefore findings of the study can be used in this context and they cannot be generalised

1.15 Summary of each chapter

1.15.1 Chapter one: Background of the study

In this chapter I provided background of the study, I defined the following subtopics; purpose of the study, location of the study, rationale of the study, literature review, objectives of the study together with critical research questions, research design and methodology, research approach or style, sampling, data generation methods, data analysis, ethical clearance, trustworthiness and the limitations of the study. These subtopics were presented in the form of a chart flow for the aim of showing the collaboration of concepts and to enable it to be simply understood by the readers.

1.15.2 Chapter two: literature review

Chapter two involves an engagement with the literature surrounding my topic. The literature review is focused on two portions of this study. The first part discussed literature related to three levels of teacher reflections (technical, practical and critical reflection); the second part discusses literature using the ten concepts of curricular spider web to frame the literature. This chapter relates literature to the objectives of the study, aiming to answer three research questions that were defined in chapter one.

1.15.3 Chapter three: Research design and methodology

Chapter three focuses on explaining the research strategy that is used in this study and how the strategies are used to achieve the research objectives and answer critical research questions. This chapter discusses that the research paradigm used is the critical paradigm. The research style includes action research, the sampling used was purposive sampling, and the data generation methods include reflection activity, group discussion and semi-structured interviews. The issues of trustworthiness are considered, including credibility, dependability, transferability, conformability are considered, including the limitations of the study.

1.15.4 Chapter four: Findings

Chapter four focuses on providing the results of the study. This action research study focuses on teachers' reflections of teaching Geographical Information System (GIS) at grade 11 CAPS. The findings were presented using the ten concepts of the curricular spider web. These concepts were discussed as themes. To ensure that the voice of the participants is not lost, I included direct quotes in the presentation of the data.

1.15.5 Chapter Five: Discussions

Chapter five focuses on summarising the whole study by checking whether the objectives and findings of the study match in order to address the research questions. In this chapter I summarised the research findings; these findings stated teachers' reflections of teaching Geographical Information System (GIS) at grade 11 CAPS. The chapter also includes the conclusions of findings on each theme presented, and recommendations are provided.

1.16 Chapter conclusion

Chapter one has provided background and context of this study and the purpose of this action research study is defined. This chapter also explains the rationale of the study, describing objectives of this study together with its critical research questions. This chapter aimed at providing the readers with an understanding of this action research study that was conducted. The following chapter is based on providing literature-related reflection and also the teaching of GIS.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Introduction

In the previous chapter, I discussed the introduction to the study by clarifying the rationale, objectives and critical questions for the study. The aim of this chapter is to engage with literature related to teachers' reflections of teaching Geographical Information System (GIS). According to Mertens (1998), the literature review is a very important tool of a research project, particularly in study that consists of a small sample. Mertens (1998) suggests two main aims of conducting literature review. Firstly, during the planning of research, the aim of the literature is to provide information within a framework to determine whether the research undertaken fits in with the 'big picture' of what is already known about the research topic from prior research. The literature review is important to formulate a rationale for the topic being researched. Secondly, the literature review can be used as an end in itself, whereby the literature is used to inform practice or to guide and provide understanding of what is known or what exists out there, in relation to the research topic.

The literature review did not only contribute to the study, but it also assisted me to identify the gaps from previous studies. This chapter discusses three concepts, namely reflection as the phenomenon of the study, curricula (including a summary back ground of curriculum changes in South Africa since 1997), and GIS. I utilised the curricular spider web by Van de Akker (2009) as the framework to shape my literature. In order to have an effective curriculum, there is a need to embrace the ten concepts of the curricular spider web namely: rationale; aims and objectives; content; teaching activities; teacher's role; materials and resources; learning environment; time; assessment; and accessibility. The following figure 2.1 introduces the flow of this literature review, stating the project title (which helps to identify the relevant literature) and the focus. The literature review is structured according to concepts relevant to the title, propositions and the gaps from previous studies which are engaged with in this study.

Literature review table

Project title: teachers' reflections of teaching Geographical Information System (GIS) in grade 11 within CAPS in a township school in the uMhlathuze Circuit		
Phenomenon: Teachers' reflections		
Focus: Teaching of GIS in grade 11 CAPS		
Concepts	Propositions	Gaps
Teacher Reflections	Process of reflection Rationale for teacher reflections	
Teacher Reflections	Rationale for teacher reflections	
Teacher Reflections	Three Levels of reflection: Technical, Practical & Critical reflection	Critical paradigm & reflective activity
Teacher Reflections	Challenges of reflection	
Teacher Reflections	Promoting methods	
Teacher Reflections	Teachers as Agents of change	
Curriculum	Plan for learning Plan of learning	
Curriculum Presentations	SUPRA, MICRO, MESO, MICRO & NANO	
Change	Curriculum change	
Curriculum Change	Curriculum Assessment Policy Statement (CAPS)	
Teacher Change	Curriculum Change	
Reasons for curriculum change	Political reasons, Economic reasons & Social reasons	
Quality curriculum	Relevance, Consistency Practicality, Effectiveness & Sustainability	
Curricular spider web	Rationale, Aims, objectives, Content & teaching activities	
Curricular spider web	Teacher role, resources & learning environment	
Curricular spider web	Time, assessment & accessibility	

Table 2.1

2.2. Phenomenon (Teachers' reflection)

Unpacking reflection

Dewey (1933) defines reflection as “assessing the grounds (justification) of one’s beliefs”, stating that by so doing we are examining the assumptions whereby we justify our convictions. Dewey (1922), states that reflection aims to support teachers’ understanding of subject knowledge, allowing them to have the capability to think openly and learn from their teaching actions. Boud, Keogh and Walker (1985) describe reflection as affective activities whereby the individuals participate in exploring their experiences in order to develop and lead to new understanding. According to Khoza (2015), the concepts of reflection may help teachers with a direction to reflect on their experiences before, during and after their practices. Simplifying the reflection language may help teachers to achieve critical reflection. The study conducted by Khoza (2015) on student teachers’ reflections on their practice of the Curriculum and Assessment Policy Statement (CAPS) concluded that teachers should be aware of the teaching curriculum profession, understand the reasons for teaching the curriculum and be willing to teach and learn in order to always reflect before their actions, during their teaching, as well as after their actions.

In addition to the conclusion drawn by Khoza (2015), the study conducted by Aldridge (2012) argues on using a new learning environment questionnaires for reflection in teacher action research. The findings were that teachers who use student feedback for improving the learning environment are more likely to be successful when working collaboratively than working alone. Also, teachers who reflect are able to implement changes through the eyes of their learners by questioning their teaching. Ward and McCotter (2004) suggest that teachers have a role to play in developing the habit of reflection so that their teaching will be easier to evaluate, summarise and report on. They further state that reflection is part of professional development that increases student understanding. Given the importance of reflection, it is therefore vital for the teachers to reflect on their teaching for their own professional development and so as to easily understand and accept the changes of curriculum. The curriculum of South Africa has moved from a competence curriculum to a performance curriculum of CAPS. This shift in the curriculum suggests that teachers should change or transform their teaching style.

2.2.1 Process of teacher reflection

Valli (2009) states that there are many processes that can be used by teachers to become reflective teachers. Amongst these processes are action research, case studies and class or group discussion; these processes are selected depending on what teachers are trying to improve at that time. Action research is used by teachers when teachers reflect on their daily practice, or on what they do in classrooms. Case studies are employed when teachers are searching for teaching methods that are likely to be working, and they also bring theories into practice. Class discussion or group discussion gives teachers an idea of what learners are capable of, and by so doing, learners are able to learn morals and values depending on the subject matter.

Hatton and Smith (1995) conclude that the most important part when a teacher is thinking about reflection is to think about practice. While Dewey (1933) cautions teachers to be aware of the consequences before embarking on action, Schon (1983) states that teachers' reflection must not be confined under certain education theories. The study conducted by Sutherland, Haward and Markauskaite (2006) on professional identity creation, shows that during week ten, students were now able to translate theory into practices when reflecting on social issues. Adding on what the process of reflection should include, Gordon and Dehler (2012) state that teachers should be able to select, organise, and interpret, meaning teachers should be able to identify the problem there are faced with, or particular areas of improvement in the teaching and learning process. When Gordon and Dehler (2012) mention 'organise', this means that the reflective teacher is arranging ideas resources, or anything required to achieve the intended outcome. As a result, the teacher is able to interpret the results and implement changes. According to Reynolds (2015), the process of reflection includes the ability of the teacher as the curriculum implementer to provide the opportunity for learners to express themselves in the form of dialogue; learners also become a part of decision-making when necessary. The process of reflection is leading this discussion into the rationale for teachers' reflection; this is aiming at answering the question of why teachers are reflecting.

2.2.2 Rationale for teacher reflection

According to Mclyntre (1993), the aim of reflection is to develop and improve the understanding of the subject matter. Similarly, Larrivee (2008) states that reflections help teachers to find strategies and methods to achieve their goals. Larrivee (2008) also notes that teachers should not only reflect on issues that are taking place in their classrooms but they should be able to reflect on social and political

issues. Teachers are perceived as the agents of change, when attempting to achieve change, one needs to reflect on previous incidents or events in order to improve on them. Also, reflection is seen as the method of professional development; through reflection teachers able to acquire knowledge, skills and make informed decisions.

According to Smyth (1991), teachers should be able to: describe, inform, confront and reconstruct. When describing the teacher must ask the question: what do I do? This will inform the answer of knowing what is being done. Inform, this lead to question of what does the description means to me as a teacher? The answer should encapsulate understanding of the subject matter. Confronting, leads to the question of how I deal with the described phenomenon. Reconstructing, leads to the question of how can I do this differently? This asks teachers to apply more than one way of finding solutions or improving the situation. According to Van Manen (1977) teachers may do these through three stages because reflections have three stages similar to those discussed by Zeichner and Liston (1987) namely technical reflection, practical reflection and critical reflection.

2.3 Three levels of reflections: technical level, practical level and critical level

2.3.1 Technical reflection

According to Van Manen (1977), technical reflection focuses on efficiency and effectiveness as a means to accomplish certain goals. These goals are not open for criticism or adjustment. At this level, technical reflection is a source of knowledge whereby the teacher's decisions are grounded on different kinds of sources which includes research, the experiences of other educators, values and attitudes. Technical reflective teachers focus also on their behaviour, the subject, their relationship with learners and the culture of the school. Similarly, Roynolds (2015) describes technical reflection as surface reflection whereby the focus is on strategies and methods employed to achieve stipulated goals. Teachers at this level are worried with what works for them instead of considering the value of goals.

This suggests that the teacher is concerned about which techniques or strategies he or she should implement in the classroom in order to achieve the desired goals or outcomes. At this point, the teacher is working towards achieving the goals, and if a particular teaching strategy is not working or not giving the preferred outcomes, the teacher applies other strategies until the outcomes are achieved. For example, the goal for teaching GIS is to promote the use of new technology; the teacher may ask learners to use the internet to differentiate between spatial and spectral resolution. At the end of the lesson, learners will be able to use technology to meet the expected goals. Other examples of technical

reflection may be new teachers who know how to use the state's assessment instruments to evaluate whether the lessons taught were successful or not. These technical reflective teachers should have technical skills, have an ability to maintain order, provide clear instructions, and provide students with constructive feedback. Teachers at this point are able to implement and manage new programs they have received from the workshops or training (Valli, 2009). The next section will include the second level of reflection: practical reflection and GIS

2.3.2 Practical reflection

According to Van Manen (1977) practical reflection is open for investigation not only of means, but also for goals to be achieved, furthermore it examines the assumptions upon which these goals are based, and the defined outcomes. Practical reflection is different from technical reflection in that the identified meanings are not static, but are included in through language. The study conducted by Lyons (2015) on reflection in teaching shows that teachers are failing to distinguish between analysis, description and reflection. This suggests that practical reflection focuses on goals rather than teaching methods used by teacher to achieve desired outcomes. The teacher at this level considers the possibility and feasibility of achieving results. For example, the goal for teaching GIS is to promote the use of new technology, although outcomes are to promote the use of technology, the teacher will have ask him or herself these questions: are the teaching and learning materials available? Are my learners able to use computers? What can I do to have a successful lesson? With these few questions in mind, the teachers may start to challenge the classroom environment she or he is teaching in, and change teaching methods if the need arises in order to achieve the desired goals. Moving further to the third level of reflections, critical reflection; this level of reflection is seen as the most important and most helpful to teacher development.

2.3.3 Critical reflection

According to Roynolds (2015), critical reflection is a commitment to seek clarity, and raise questions that are moral and technical in nature. For example, grounding the idea of power dynamics and ideology that exist within the social fabric; these include measures, implications, and way that inequality in power connects with issues of race, age, class and gender. Critical reflection is concerned with the perspectives that people are socially connected instead of existing in isolation from an individual perspective. The primary aim is to understand where society is, based on fairness and democracy, and these must imitate education and social life as a whole. Similarly, Larrivee (2008) states that at this level, a critical reflective teacher includes the investigation of both personal and professional belief

systems. Again, from a critical reflective position, emphasis is based on their own practice and also social conditions. The aim is not only focused on understanding, but also on improving the quality of life of those who are least powerful. Critical reflection entails the distribution of power in the classroom, allowing learners to question and learn to solve problems inside and outside the classroom environment. At this level, learners are actively involved in the creation or production of knowledge instead of being passive recipients of information (Dehler, Welsh & Lewis, 2001).

Moving further, teacher reflection focuses on how positive teachers can reason. It encourages teachers to contextualise their understanding of teaching where teachers learn to make decisions and choices about learning goals (Kennedy, 1989). Reflective teaching, or the reflective teacher involves the teacher having abilities to think about teaching, his/her actions and the context in which teaching is taking place. Teachers can reflect, make judgment about the situation or themselves, and from there, action is taken to rectify the mistake or to improve on their teaching.

The third category of reflection is critical reflection and it has three levels. The first level of critical reflection is based on the methods used to achieve results. According to Rosenberg (2004), an example of this level is whereby a teacher makes surface reflections based on particular activities within the lesson. The comments made are usually unsupported judgments and do not attempt to question aspects of the curriculum or the context in which the learners live and learn. The second level of critical reflection is centred on specific experiences, views, understandings and influences they have on practice activities or action. The third level of critical reflection is the critical investigation of the methods used to achieve results.

The fourth category of reflection as described by Boody (2008) are the concepts of 'reflection-on-action and reflection-in-action'. These categories focus on decisions made during the teaching and learning process. Schon (1983) concurs with this statement by stating that teachers make decisions during the process of teaching and learning, and that these decisions are grounded on practical knowledge in most cases, and practical knowledge is a result of their experiences. Knowledge is also informed by context, classroom situation or environment, values and beliefs systems and these will allow the teachers to reflect on their actions.

On top of the above discussed types of reflection and their levels or categories, Vall (2009) presents deliberative reflection and personalistic reflection. Deliberative reflection is when decision-making is based on different sources such as experiences, research, beliefs and values and advice from other

teachers. A reflective teacher must make decisions and should be able to give reasons for the decision that was made. Deliberative teachers consider teaching behaviour, relationship with students, subject matter and the school's organisation, including the culture and climate of the school. Personalistic reflection, according to Vall (2009), is when a teacher reflects in a personal way, and combine professional and personal lives. Teachers think about their lives and/or their own students. They are not only concerned with the academic performance of their students but also about life in general. The personalistic reflective teacher wants to understand their students and be prepared to act on giving the best for their students' personal interests, concerns, and hopes for the future. This kind of reflection has less emphasis about students' success on tests.

According to Sparks-Langer, Pasch, Starko, Colton and Simmons (2010), teachers are failing to integrate ideas across the three levels of reflection namely, critical, practical and technical reflection. Teachers focus more on two forms of reflection when there are teaching technical and practical aspects. This suggests that teachers are concerned about reaching an unexamined goal. Also teachers want to know how they can plan their lessons and manage learners. The critical level of reflection is limited if teachers are not considering moral and ethical issues of the lesson. Sparks-Langer et al. (2010) suggest that in order to improve teachers in all three levels of reflection; teachers should create field activities whereby they are able to discuss social issues and issues of power. These issues will allow development of values and morals and automatically they embrace the third level of reflection which is critical reflection.

2.4 Challenges associated with critical reflection

Neville and Smith (1995) state that there are many problems associated with reflection and these include presumptions about the teaching profession, and that teachers are not capacitated to reflect on their daily activities. Reflection is not connected to the work of teachers, it is perceived as an academic pursuit while teaching is perceived as a matter of being present and action in the classroom, with little or no reflection on the actions taking place in the classroom environment. According to McNamara (1990), time and opportunity are needed for development so that teachers can acquire necessary skills. Suitable knowledge is required by student teachers to understand the concept of reflection so that they will apply it in their daily teaching. Structure and ideological of total programs, in order to implement and improve reflection, a critical reflective approach stresses an ideology of teachers' dissimilar to that of traditional used by Valli (1992). The study conducted by Ward and McCotter (2004) on reflection has a visible outcome for preservice teachers, and finds out that teachers have a challenge when it comes to

reflection because standards, in particular the tests, move away the focus of reflection towards meeting specific targets and do not improve the practice. Reflection is not seen as a tool for helping teachers to improve on their daily practices. According to Howard (2010), teaching becomes difficult without critical reflection; critical reflection is also difficult because it forces teachers to ask themselves many questions that are challenging, and answers of those questions turn out to present bigger challenges.

2.5 Methods of promoting critical reflection to teachers

There are several methods or approaches to promote teachers' reflection, however I will discuss four in this literature review. Neville et al. (1995) identify the following approaches, which are similar to those discussed by McAninch, (1993); the first approach includes action research projects, whereby teachers reflect on their own professional practices, and their own teaching as a whole. The second approach includes case studies and ethnographic studies of students, classroom, teachers and schools. The third approach is microteaching and supervised teaching. The last approach is structured curriculum tasks. Action research is the most important method of promoting reflective teachers.

While Zeichner and Liston (1987) provide us with three stages of reflection, Boody (2008) give us more knowledge about teachers' reflection and he identifies four categories of reflection. First, 'teacher reflection as retrospection' is where a teacher reflects back on his or her past experiences, with the aim of pinpointing challenges, and successes in order to learn from them. By so doing teachers learn to improve on particular situations. According to Bentham (2009), the concept of 'teacher reflection as retrospection' is similar to the one describes by Dewey (1933) as 'reflection on action'.

The second category of reflection is problem-solving. According to Boody (2008), the first step of problem-solving is a pre-reflection step. The second step under problem-solving is reflection. The reflection step has five phases. The first step is the no action phase, in which a teacher is working by his or her suggested action plan. The second phase is recognised by feelings of unease, where the teacher identifies a problem and the need to solve it. The third phase is about applying a method of dealing with the problem. The fourth phase is to provide solutions. The fifth phase is to verify the method used to solve the problem. Dewey (1933) describes this level as 'post-reflection'. The following table is the summary of the rubric of reflection adopted from the work of Ward and McCotter (2004).

Rubric for teacher reflection

	Level			
	Routine	Technical	Dialogic	Transformation
	Disengaged from change process.	No change of the perspective.	Cycle of questions.	Important questions and change.
Focus	Self-centred or personal concern: gaining recognition. Avoid blame.	Focus on teaching, planning and tasks. Does not include teaching issues.	Dialogue is with students, concerned with those who are struggling.	Personal transformation regarding pedagogy, culture, morals and history.
Inquiry	Questions based on personal change. Focus is not on acknowledging or blaming the problem rather is on critical questions.	Questions are based on a specific situation.	Questions lead to new ideas of addressing the challenge, students and others are involved in the process.	Long term planning, involve others including mentor and students. Critical questions are asked.
Change	Analysing the situation without getting involved in the process.	Responds to a situation, but not using situation to change develop new perspective.	Develop new insight of teaching. Identifying strength and weakness and providing solution to improve situation.	Transformation that lead to change of practices.

Table 2.2: (Ward & McCotter, 2004).

The above rubric for reflection suggests that teachers at the beginning are using what I can describe as 'normal behaviour' or a daily routine; the questions need to be asked how teachers are moving away from a daily routine to reach a level of transformation or change. Although this question is significant in providing the solution to the problem, the following questions are important too. What is it that makes it so difficult for teachers to transform? What are the contributing factors? Is education system flexible enough to allow teachers to go beyond the scope of the curriculum? According Ward and McCotter (2004), in order to achieve change we must go through technicalities of our behaviour, technicalities that will include planning in response to the problem. The next stage of a reflective teacher is to be involved in dialogue with students whereby we allow room for the expressing of ideas to teachers so that teachers can be the agents of change. When teachers are given that platform, automatically they will be applying change in their daily practice. Transformation will only be achieved once teachers are engaged in the process of change.

2.6 Critical reflection and teachers as agents of change

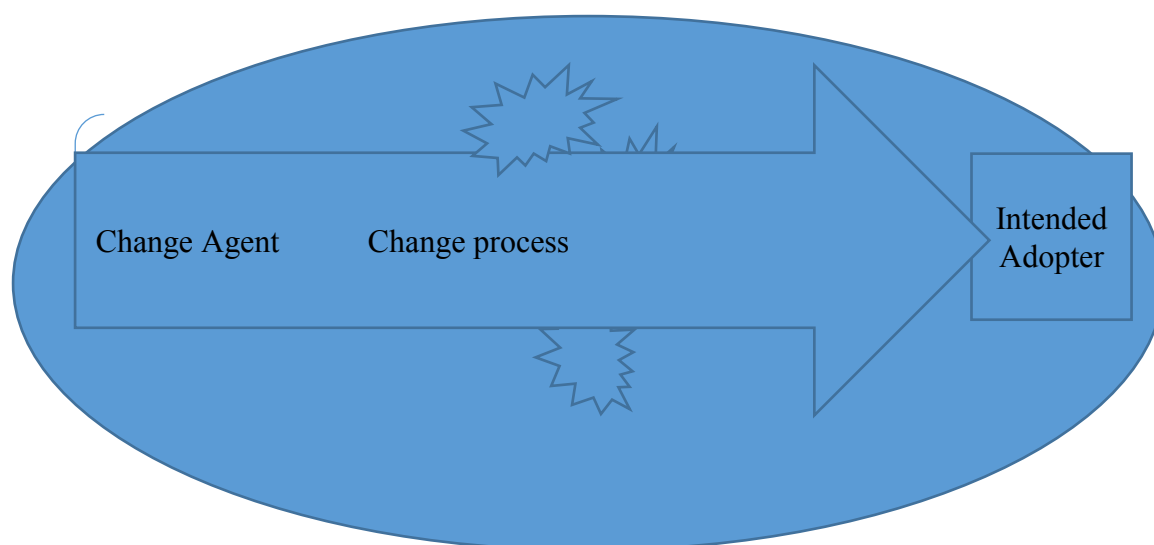


Figure 2.1 Ellsworth (2000 p. 20) Model of Change

Gallagher (1991) describes change as a long process if it includes rooted beliefs that have been a major part of teachers' personalities. Similarly Pillay (2006) states that people become more comfortable and secure in their familiar routine, so change means that people are taken out of their routine and comfort. Pillay (2006) further states that when there is change, people become resistant. When talking about change, researchers always talk about people's resistance too (Fullan, 1993; Osterman & Kottkamp, 1993). This is because change comes with uncertainty, unpredictability and probably more importantly, change requires extra effort on the part of the implementers. So, incorporating reflection into teacher education programmes will not be easy. Following is a discussion of some issues to be considered.

This model of change by Ellsworth (2000) is two-way process whereby the intended adopter becomes a change agent after the process has been completed. For change to take place it must show the following a change agent, change process, innovation and an intended adopter. Along the process of change there are individuals or factors that contribute to the failure of implementing change successfully. Ellsworth (2000) identifies barriers that may negatively influence the change process. One key barrier is that of culture barriers. Culture includes beliefs, values, attitudes and morals of an individual which hampers change. Msibi and Mchunu (2013) suggest that to have change in the teaching profession, teachers should be experts in their subject they teach. Currently teachers lack content knowledge, skills, innovation and experience to implement the curriculum effectively. Teachers, however, were not trained to be innovative; rather they were trained to be technicians. Olsen (2002)

states that normally, dissemination of new is not happening in South African schools, communities and societies but it follows a certain process. According to Dooley (1999), in the first stage, society learns about the new technology's presence, and its purposes or functions. In the next stage, negative or positive attitudes towards the new technology develop. In the third stage, a decision is made whether to adopt or reject the technology. In the fourth stage, the new technology is implemented. Finally, reinforcement of new technology is made. To disseminate technology without problems, teachers need to act professionally.

2.7 Definitions of the term Curriculum

There are several definitions of the term curriculum however; in this study, I discussed two meanings. Firstly, the definition by Jan Van Den Akker (2009) who defines curriculum as a plan for learning (intended stage). It is a framework that outlines what a teacher should do in order for learners to learn. This implies that the curriculum proposes some teaching strategies that will enable the teacher to efficiently facilitate learning and achieve his or her goals. Secondly, it is the definition by Pinar (2004) who defines curriculum as a plan of learning (implemented and attained). This implies that curriculum arranges the content that teachers should deliver to learners. In this instance, the performance of teachers in delivering the content should be in line with the demands of the curriculum, consequently to achieve that, teachers should be able to reflect on their teaching experiences. The performance curriculum emphasises the intended (formal document) curriculum (plan for teaching/ learning), whereas Pinar (2004) is talking about implemented (teachers' experiences) curriculum (plan of teaching). Van De Akker (2009) moves further on dividing curriculum into five levels, these levels are discussed below as curriculum presentations.

2.7.1 Curriculum Presentations

The curriculum is separated into five levels namely, the international curriculum (SUPRA), the national curriculum (MACRO), the school or institution curriculum (MESO), the teacher curriculum (MICRO) and the learner curriculum (NANO) (Van De Akker, 2003). Under these five levels, there are three forms in which the curriculum can be characterised. Firstly, is the intended curriculum which encompasses the ideal vision or basic philosophy underlying the curriculum. It also includes formal/written intentions as specified in the curriculum documents and material. Secondly is the implemented curriculum which depends on how the curriculum is perceived or interpreted by its users (especially the teachers). It also includes the operational process of teaching and learning which are commonly known as 'curriculum-in-action'. Lastly, is the attained curriculum which encompasses experiential or learning experiences as

perceived by learners; it also includes learned knowledge which results in learning outcomes of learners.

2.7.2 Change and Curriculum change

At this juncture it is important to define change for the benefit of this study. Change is an alteration or a substitution of one for the other. Change is a process whereby old ideas, patterns, actions are replaced by a new set of ideas. Change can take place internationally, continentally, nationally, locally, in communities, and in schools. Germs (2000) states that change does not take place in a vacuum, meaning that change takes place because of a response to something that happened before. Change in education systems can be influenced by the changes that are taking place globally; those changes automatically forces continents, countries, local communities and schools to move with the change. The change in the global education system results in a new curriculum being introduced in schools. A new curriculum means new methods of teaching, the adoption of new skills, attitudes, values, knowledge and assessment methods. South Africa is a good example of these curriculum changes.

One of the characteristics of apartheid in South Africa was with the education system which was about segregation in terms of race and gender. After apartheid, South Africa introduced a new education system which aimed at mitigating the challenges that South Africa faced before democracy, in order to use education to produce responsible citizens. Broadly named, this type of education approach was known as Outcome Based Education (Curriculum 2005), and it was taken from United States. This educational system was aimed at assessing learners' performances, based on the clearly defined outcomes. However, the goals of OBE were not achieved and as a result a review in 2000 was required. The study conducted by Ward et al (2004), indicated that the main cause of OBE's failure was that from its inception, it was designed to describe the process instead of identifying and recognising the quality and the levels of reflection. Linking reflection to teaching is a tool that gives shape general principle.

The review of the curriculum produced the Revised National Curriculum Statement (RNCS) in grade R to 9 and National Curriculum Statement (NCS) in grade 10-12 (2002). For a second time the implementation process faced other challenges in 2002 and resulted in another review whereby the Department of Education revised the RNCS and NCS to produce the National Curriculum Statement (NCS) in 2012. NCS is a combination of RNCS and NCS to form a one document across the grade from grade R to 12. NCS is a new curriculum that is built from earlier curricula with updated aims in

order to be clearer in terms of what is to be taught and what should be learnt in each term. The NCS represent a policy statement for teaching and learning in South Africa and consists of the Curriculum and Assessment Policy Statement (CAPS) for all subjects, programmes and promotion requirements, and protocol for assessment (Department of Basic Education, 2011).

2.8 What is the Curriculum and Assessment Policy Statement (CAPS)?

After the Department of Basic Education (DOE) in South Africa realised that they faced many challenges when implementing RNCS, the DOE made amendments for the curriculum to be comprehensive and provide clear guidance to teachers. This amendment brings about the introduction of CAPS that was implemented from 2012 to 2014 (Bjorklund, 2014). According to Pinnock (2011), CAPS is an amendment to the National Curriculum Statement (NCS), and is not a new curriculum. Most people believe CAPS is new curriculum altogether yet CAPS follows the same requirements, processes or procedures as the NCS from grade R to grade 12. What is remarkable about CAPS is that it is based on the content that needs to be covered by teachers, unlike NCS which was based on the outcomes (what is expected of learners at the end of the lesson), so teachers were working towards achieving those outcomes. According to Du Plessis (2013), the CAPS document is based too much on subject-specific information and is fixed; CAPS and NCS have similar rationale in terms of linking the curriculum with the Constitution of South Africa. CAPS and NCS have similar skills, knowledge and values. The introduction of CAPS in South African schools forces teachers to change their daily practices, this lead us to teacher change with the change of the curriculum.

Before identifying changes that were brought by CAPS over NCS it is important to discuss the meaning of the following concepts as they are the major changes: critical outcome, development outcome, purpose, principles, inclusivity, assessment, planning and integration. According to the Education Departments (1997) critical and developmental outcomes are the major outcomes that are initiated in the Constitution of South Africa and they are also stated in the South African Qualifications Act of 1995. They explain clearly what kind of citizen should be created by the education system. For instance, learners should develop an ability to be entrepreneurs. Moving to principle, according to Fish (2003), the principle of the curriculum means planning on what is intended, and delivering what is planned and experienced from learners. The next concept is inclusivity, and Blanco (2009) defines inclusivity in the curriculum as the provision of education based on understanding diversity, not individuals. This suggests that learners should gain the same learning experiences as there are common teaching and learning processes. The next concept is assessment, and according to Lambert and Lines (2000),

assessment is defined as the process of gathering, interpreting, recording and using information of learners' responses for educational purposes. The last concepts are planning and integration, which speaks to the ability of teachers to define the purpose of teaching, assessment, and collecting the necessary resources to provide instructions to learners. The following table indicates the basic changes between NCS and CAPS

Basic changes between NCS and CAPS

Concepts	NCS	CAPS
Qualification	Grade R to Grade 9	Grade R to grade 12 GETC is not mentioned CAPS only exit level is at Grade 12
Critical Outcome	Clearly stated	Combined: aims and curriculum content.
Development Outcome	Variety strategies to learn effectively. Responsible citizens. Education and career opportunities.	Not clearly stated
Purpose	Equipping learners economic, race, gender, knowledge, skills and values	Equipping learners with knowledge, skills and values. Knowledge in local context, while being sensitive global imperatives.
Principles	"participatory, learner-centred" approach	active and critical learning
Inclusivity	Not clearly stated	Detailed: amongst general aims
Inclusivity	Learning outcomes	Content
Assessment	Assessment Standards	Assessment
Planning	Phase plan, lesson plan Learning programme	Lesson plans year plan
Integration	Coherence between learning areas	Not stated
Teacher role	competent, interpreting what and how to teach	No stated
Learner role	Work as a group	Individual work
Approach	Discovery-based learning	Content based

Knowledge	Everyday	School
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Table 2.3 (Plessis & Mbunyuz, 2014)

The above table suggests that NCS focused on the foundation phase, intermediate phase and senior phase. The General Education and Training (GET) and Further Education and Training (FET) was not included in the NCS whereas CAPS started from the foundation phase to FET. Moving to OBE, NCS has clearly stated OBE learners were learning for the aim of achieving the desired outcomes. This suggests that teaching methods are not important when teaching NCS, but rather what is important is to achieve the outcomes, whereas CAPS is focused on the content that has to be delivered by the teacher to the learners in a specified period of time. OBE is embraced by the content in CAPS. The purpose for NCS is based on equipping learners economically, to be aware and respect other races and genders, have knowledge, have the necessary skills to cope with the real life situations and also have values. The purpose of CAPS is to equip learners with knowledge, skills and values. In CAPS, knowledge relates to the local context, while being sensitive to global imperatives; in other words CAPS aims at giving knowledge that will allow learners of South Africa to match the rest of the world. Since NCS was based on OBE, it then focused on a learner-centred approach, whereby learners are the key role players; this lead to learners working as groups whereas CAPS is based on content therefore the role for the teacher remains crucial, hence CAPS focused more on teacher-centred approach and learners are working individually. These changes are forcing teachers to change since the curriculum has changed; teachers have to move from their normal practices to a new practice which is has been brought by the change of curriculum.

2.8.1 Teacher change as the curriculum changes

According to Seavage (1998), teachers have a vital role to play in making accurate curriculum decisions and they must be involved in the change process. Similarly, Govender (1998) argues that for change to take place in the curriculum, two vital roles must be occupied. Firstly, people who will benefit from change must be involved in creating change and directing change. Teachers are the implementers of the curriculum, and they know and understand what is happening in their classrooms, therefore they should be part of curriculum change, hence the process of change should start with them in order to implement the curriculum properly. For instance, they should change their beliefs, cultures, and perceptions about teaching practice and assessment methods. This, in short terms, is saying teachers should practice critical reflection in order for them to implement the curriculum correctly; if teachers are not reflecting, they are unlikely to change their culture and believes. According to Fabiano (1998),

effective learning can be achieved when all schools are provided with properly trained teachers. When teachers are well trained they are able to make correct decisions regarding teaching and learning, ways of, and tools of, assessing learners and be able to reflect on their daily practice for their personal development.

2.8.2 Reasons for curriculum change

There are numerous reasons that bring about change in the curriculum, however almost all of these reasons are rooted in the political and economic, both globally and locally. Jansen (1998) identified **political, economic** and **social** as the causes of curriculum change. Currently, countries are not independent in terms of education due to globalisation, which changes the curriculum in schools for both developing and developed countries. The political reasons for change in curriculum is seen in the following quote by Department of Education (1997, p. 78): “The change of the curriculum to react on apartheid education, creating education that is open, non-prescriptive and reliant on teachers creating their own learning programmes and learning support materials”. Jansen (1999) expands on this saying “The major aim for curriculum change ‘involved the cleansing of the curriculum of its racist and sexist elements in the immediate aftermath of the election” (Jansen, 1999; Cross, 2002; Chisholm, 2003).

According to report by Linda (2003) on the Politics of Curriculum Review and Revision in South Africa, the issues of curriculum revolved around roles of political and particular players. Those players are the African National Congress, the teacher unions and the university intellectuals. Jansen (2006) argues that change of the curriculum is based on the assumption about what is happening in classrooms. From the first quote by the DOE the changes that are taking place in the education of South Africa are allowing the teachers to become part of the curriculum in a way that they design the curriculum and also implement the curriculum. One worrying factor is whether or not the teachers are well equipped to undergo these changes. Another question is whether school environments are capable enough to support the teachers and curriculum. These two quotes above give an impression that curriculum change is driven by political reasons. The economic reason for change in the curriculum is seen in the following quote by Department of Education (2011): “The purpose of National Curriculum Statement is to provide employers with a sufficient profile of learner’s competences”. Mahomed and Tyers (1996) further add to this saying: “The present education and training system is designed to meet the needs of an outdated and renders the economy incapable of competing with workforces”

One of the reasons that called for the introduction of Outcome Based Education in South Africa was the inability to create sustainable economic growth (Jansen, 1999). The proposal made by the Congress of South African Trade Unions (COSATU) to the government was that of addressing education and training in order to develop a curriculum that will respond to the needs of economy and produce a skilled workforce. Nowadays, the world is worried about globalisation which means that almost all countries must be aligned in terms of curriculum in order to meet the need of the changing world. However, Jansen (1996) argues that there is no evidence from the literature that changing the curriculum will lead to economic growth. The social reason for change in curriculum is seen in the following definition of social transformation by the Department of Education (2011): "Social transformation: ensuring that the educational imbalances of the past are redressed, and that equal educational opportunities are provided for all sections of the population" (Department of Education, 2011)

Social transformation first requires teachers to be well trained in order for them to transform the society. Teacher professionalism remains the core of transformation, meaning that teachers need to be qualified to reflect on their daily activities, competence and managing their classrooms. Secondly, teaching resources must be available in schools to make teachers roles more comfortable. Lastly, school management must implement policies and provide all forms of support to teachers, learners and school governing bodies.

Nieveen (1999) identifies four criteria for the quality of a curriculum. The first is relevance which includes the need for the intervention and its aim is centred on state-of-the art knowledge. Second is consistency that focuses on the arrangement of the curriculum and whether it is logical and cohesive. The CAPS arrangement of the curriculum is presented properly as it contains logic and coherence and each chapter is given a time allocation, content is given to teachers, and assessment methods including mark allocations are provided. Thirdly, is practicality, which includes expected practicality. With CAPS' actual practicality, I argue that it is lacking in subjects such as geography due to the fact that certain chapters require specific and expensive resources in order to achieve the desired outcomes. Lastly, is effectiveness, which includes expected effectiveness (where the intervention is expected to result in a specific outcome) and actual effectiveness (where the implemented intervention actually results in the expected outcomes). Van de Akker et al. (2009) argue that in order for the curriculum to be effective, it must be sustainable in a way that learning, teaching activities and learning or teaching materials are utilised, and text books and posters are be used. Modern resources should be maintained and be affordable to meet the demands of the curriculum.

Even though CAPS explicitly describes content to be taught to learners, assessment strategies and time allocation for each chapter, teachers still find it difficult understand it. For instance, Khoza's (2015) study indicates that teachers (participants) did not cover the three domains, namely cognitive, (thinking/knowledge), psychomotor (skills) and effective (values/attitudes) in their responses because their understanding is minimal with regard to CAPS. Bloom's taxonomy in CAPS is presented as part of summative assessment; for this reason, Khoza (2015) recommends that teachers should be aware of the teaching profession for them to understand the fundamental reasons for teaching the curriculum and be willing to teach and learn in order for them to continually reflect on their teaching. Kennedy, Hyland and Ryan (2006) argue that the challenge facing teachers is to make sure that there is a connection between teaching methods, assessment techniques, assessment criteria and learning outcomes. This suggest that the teachers must have clear understanding of the curriculum, including Boom's taxonomy, and be aware that in order to deal with the curriculum one needs to deal and understand the concepts of curricular spider web by Van den Akker (2009)

curricular spider web

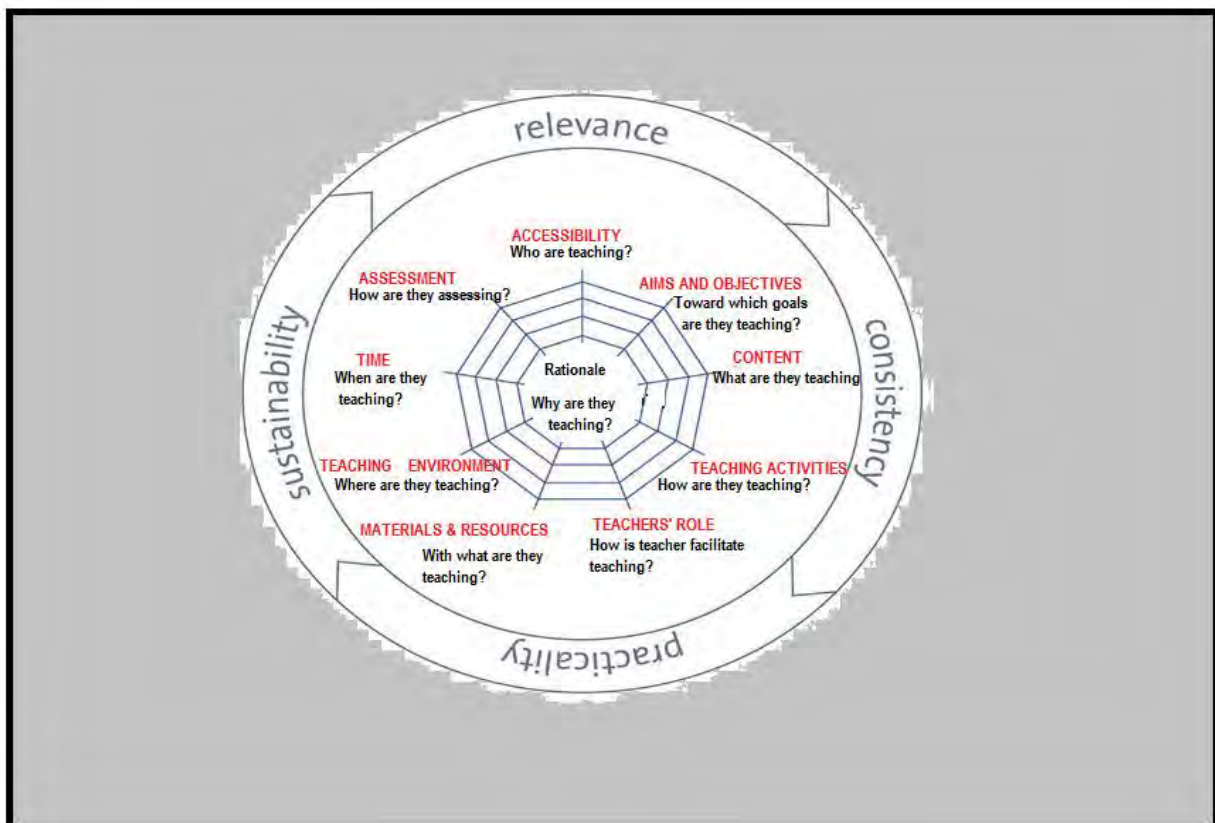


Figure 2.2 Redrawn curricula spider web from Berkvens et al., 2014, p. 8.

Khoza (2014) explained these concepts of a curricular spider web as e-learning signals whereby rationale is the core of the curriculum. The curricular spider web consists of ten concepts, driven by questions for each concept in order for it to be understood. The questions are as follow:

- Why were they teaching GIS? (Rationale: personal, content & societal),
- Towards which goals are they teaching GIS? (Aims and objectives),
- What are they teaching? (Content),
- How are they teaching GIS? (Learning activities),
- How are teachers teaching GIS? (Teacher role: teacher centred, learner centred & content centred),
- With what are they teaching GIS? (Materials and resources: ward-ware, soft-ware & ideological-ware),
- Where are they teaching GIS? (Learning environment),
- When are they teaching GIS? (Time),
- How are their assess teaching of GIS? (Assessment: formative & summative),
- Who are teaching GIS? (Accessibility: physical, financial & cultural access)

2.9.1 Rationale of teaching GIS (content, personal & societal rationale)

According to Van den Akker et al. (2009) the rationale of teaching is the response to the question of why teachers are teaching GIS. Rationale is divided into three levels namely: content (pedagogical) rationale, personal rationale and societal rationale. The rationale is at the core of the curricular spider web because it is important for the teacher to understand the rationale for teaching a particular subject.

Teachers can teach GIS because of content rationale, for the benefit of this study it is important to define the term GIS as it described by grade 11 CAPS book. According to Bornman, Cohen Ranby, Sookdeo and Saunders (2011), GIS is an interrelated system of computer hardware, software and geographic data that one can to capture, store, update, manipulate, analyse and display geographic information. Macchan (2003) defines GIS as capturing, storing, analysing, and managing data and associated attributes that are spatially referenced to the Earth. For example, when using GIS the same map could include sites that produce pollution, such as gas station and sites that are sensitive to pollution, such as wetlands. Such map would help people to determine which wetlands are most at risk.

The rationale of teaching GIS in grade 11 CAPS, firstly, is for the learners to be able to work with a complex set of geographic data. Secondly, is to move away from the use of traditional maps since print maps are static and they cannot change with changing times. Thirdly, computers allow sophisticated ways of storing complex geographic data, including capturing, storing and manipulation. Lastly, satellite images provide digital maps and they are recorded digitally, automatically they need computers and software for GIS to be analysed (Bornman, 2011). This suggests that the rationale of teaching GIS is to expose learners to technology and make use of it. However, the study conducted by Khoza (2015) found out that teachers' rationale for teaching their subjects seem to a rationale for the intended curriculum (CAPS), and their reasons for teaching their subjects do not indicate that they contributed towards the design of their subjects' intended curriculum.

According to Green (2007), most of teachers in secondary schools face the challenge of understanding content in GIS and new terminology in teaching it, as a result, some teachers avoid the GIS chapter, and as result learners' right to education is compromised. Similarly, McNamara (2003) suggests that in order to deal with the problem facing teachers in secondary schools, the department of education needs to conduct extra workshops for teachers in order for them to have a better understanding of technology and be prepared teach and also use GIS without any discomfort. If teachers are well equipped with GIS, they will be inspired to teach and become creative, however, if teachers are not equipped with skills to use GIS, learners will not get assistance in problem solving. This suggest that some teachers do not know why they are teaching GIS, which is why it is easy for them to skip GIS chapter. Msibi and Mchunu (2013) state that the current curriculum (CAPS) requires high level of professionalism to cope with it, and they describe a willingness to change as one of the attributes of professionalism. This suggests that teachers need to transform in order to deal with CAPS.

In addition to content rationale there is also a personal rationale for teaching, according to Kehdinga (2014a); personal rationale is important to teachers because it assists learners to gain the achieved curriculum and further assist teachers to theorise on the curriculum. Personal rationale of teaching GIS plays an important role in the implementation of the curriculum. Teachers must align themselves with technology and be passionate to learn new thing regarding technology for them to implement in their classrooms. When teaching GIS, most teachers are not teaching for personal rationale; the study conducted by Granmore (2004) on GIS in secondary schools indicated that teachers' beliefs and attitudes towards technology are the main cause of technology integration in classroom. Similarly, Clough (2004) identifies a lack of confidence among teachers as an obstacle of proper teaching of GIS.

Haimes (2015) also found out that the background of the teacher includes level as a student, pedagogical practice is amongst the contributing factors of such practice.

Teachers can teach because of societal rationale; Haimes (2015) findings were based on content reasons and personal reasons, the participant did not include societal reasons. Khoza (2015), states that society should encourage professional behaviour that will promote professional effectiveness in the implementations of the curriculum. Similarly, Zaltman and Duncan (1977), state that one of the barriers that hinders proper implementation of the curriculum is the societal problem and also the relationship between the teacher and the school with the culture of the community. It is important for teachers to understand the community in terms of culture, beliefs and values in order to address the need of the community in the implementation process of the curriculum.

2.9.2 Who are teaching GIS grade 11? (Accessibility: physical, financial and cultural access)

According to Lorraine (2011), most black teachers are still considered unqualified to teach geography; previously black teachers in South Africa were trained for two years and received a teaching certificate after grade 12, while white teachers were trained for three years. These segregations in terms of teachers' training in education leads to many geography teachers are lacking skills of teach map work skills. Lorraine (2011) points out that the challenge that is facing South Africa at the present moment is the lack of geography teachers. As a result, social science which combines history and geography, is mostly taught by history teachers who are likely to lack map skills. Also geography teachers are mostly above 35 years and they have not been taught GIS during their schooling days. According to Kerski (2007), in most public high schools, GIS is taught by science teachers. Kerski (2007) further states that the fact that science teachers are teaching GIS over geography teachers signifies that geography teachers are failing to implement GIS. These suggest that most teachers who are teaching GIS in geography are not well equipped in terms of subject knowledge. The above discussion is in line with the following quote: "The majority of teachers lack the required subject knowledge, are not teaching what they are trained to teach and too often lack the commitment to teach for six-and-a-half hours every day" (Motshekga, 2010).

Accessibility embraces these three issues of the curricular spider web by Van den Akker (2009), namely, physical access (is the school reachable to learners?) financial access (is education affordable to learners?) responsible and cultural access (is education the curriculum acceptable to the society?).

Looking firstly at physical access, Kerski (2007) argues that in order for GIS to be implemented effectively in secondary schools, schools must build a suitable environment whereby students will be able to investigate the real world. Downs (1994) states that geography should be linked in terms of theory, and should be practical and relevant based on subject knowledge. According to human right commission, everyone has the right to education. The South African Schools Act (SASA) of 1996 is drawn from the constitution of South African. SASA states that the infrastructure of the school must constitute of a classroom, electricity, water, sanitation, a library, laboratories for science, technology, mathematics and life science, sport and facilities and perimeter security.

In terms of financial access, Johansson (2003), says that lack of funds in secondary schools and computer classrooms are the challenges that hinder proper implementation of GIS. Similarly, Ertmer (1999) identified numerous barriers to technology integration in classrooms and classifies these barriers into two parts: external and internal. The external barriers are the lack of funding and support from the Department of Education and the internal barriers are the lack of support within the school, particularly the school management and school governing bodies. Moreover, Brush (2007) concurs with this argument and identifies 123 challenges to technology integration in secondary schools. These challenges are classified into six major categories as: knowledge and skills, resources, beliefs, attitudes, subject culture and assessment.

According to South African Schools Act of 1996 chapter two 'Learner Compulsory attendance', every parent must ensure that every learner attends school from the first day of the year. Subject to this act: any parent who fails to comply with the laws is guilty of an offence and liable to a fine or imprisonment for a period of not less than six months. Again, chapter one, section 5 of South African Schools Act 84 of 1996 states clearly that no learner shall be refused to public schools on the basis that his or her parents are unable to pay school fees or do not subscribe to the mission statement of the school. Several studies have indicated that technology use in the classroom plays a positive role to influence teaching and learning, but then again there are several challenges with regard to technology in our schools, mainly in developing countries, of which South Africa is a good example (Bartsch, 2003).

Moving on to cultural access (is the curriculum taught acceptable to the society?), according to South African Schools Act, 84 of 1996, South Africa aimed at redressing the past injustice of apartheid in education, and combating racism and sexism in order to protect and advance our diverse culture and language and sustain the rights of all learners, parents and educators. Section 2, sub-section 7, of SASA 84 of 1996 is based on freedom of conscience and religion at public schools; religious

observation may be conducted at a public school, under the rules of governing body that are informed by constitution of South Africa which upholds this freedom for learners and members of staff.

Similarly, Debbie (2009) identifies five challenges of teaching GIS. These including the lack of sufficient training of geography teachers for effective implementation of GIS, insufficient computer laboratories and most school subjects compete for computer access, transformation in the teaching approach and method and time factors limiting other instruction in teaching GIS. Normally, workshops for geography teachers are scheduled once a year and the rest are moderations that are scheduled four times a year; workshops are not enough for the teachers to get sufficient knowledge to understand GIS.

Watson (2001) pointed out that to integrate technology in schools is very complex, and it requires an understanding of teachers as they deliver information, their perceptions and beliefs, and teachers' motivations about learning and technology. Scheffler and Broda (1999) state that teachers lack the necessary confidence to integrate technology into their lessons and tend to ignore it. The above arguments are supported by a study that was conducted by Brush (2007) which found that teachers that lack competence, knowledge, and prior experience are resistant to apply new technologies in their lessons and this has been found to be major a challenge.

Due to lack of subject knowledge, geography teachers ignore the teaching of map skills, meaning they also ignore teaching of GIS since it forms part of map work skills. GIS can be easily understood when it is taught using the necessary teaching resources which are computers with internet. Most teachers in our schools lack computer skills and this makes it difficult for them to understand GIS, even when using paper-based GIS as the solution to the schools that lack resources. With the belief that GIS involves a lot of science, some schools are using science teachers to teach GIS; this suggests that geography teachers are not capable of teaching GIS. The underlying question then, is why GIS was incorporated into the geography curriculum? Teachers are the implementers of the curriculum and if their teaching environment does not support teachers and learners then the curriculum faces challenges. Also, if teachers are not trained to implement the curriculum correctly, we face many more challenges.

The above discussion, specifically on who are teaching GIS, is not embracing all four criteria of quality curriculum raised by Nieveen (1999). The first criterion is relevance; CAPS is not fully relevant in the subject of geography, perhaps this is so in other countries, but not in South Africa when geography teachers are still lacking in term of numbers, let alone lacking in subject knowledge. Teachers as the curriculum implementers must be well equipped with regard to subject that they are teaching; if this is

not the case, the curriculum will not be effective. According to Lorraine (2009), in some schools, IT facilities are available but are used by mathematics and science teachers. This also denotes that CAPS is not sustainable; at the present moment, the right to education in most South African schools means to be able to attend primary and secondary school and be able to read and write, with nothing beyond this. As the world changes with technology, our teachers are still struggling to cope with technology.

2.9.3 Goal: towards which goals are you teaching GIS? (Aims, objectives & learning outcomes)

According to Kennedy, Hyland and Ryan (2006), aims refers to broad general statements of teaching purpose, whereby a teacher indicates what to cover in the process of learning. Aims focus the teacher to show the content of the module or programme. With regard to GIS, the most important aim of teaching GIS is to promote the use of technologies, such as Information Communication Technology (Department of Basic Education 2011). Holmere (2006) states that GIS is a technical and practical theme of geography whose aims and objectives will be achieved in a laboratory setting. This implies that aims and objectives of teaching GIS would not be achieved in a classroom environment, but rather in a laboratory environment where there are resources available for learners. This also further suggests that the aims and objectives of CAPS, with regards to GIS, are not connected through the content to the learners. Generally, most schools in rural areas and in townships lack basic resource and these resources form the basic demands of the curriculum. This suggests that that the aims and objectives of CAPS towards the teaching of GIS are amongst the reasons why teachers are skipping the content of GIS, as Green (2007) alluded.

Kennedy et al. (2006) describe objectives as specific statements of teaching intention whereby specific areas that need to be covered are identified in the process of learning. CAPS objectives are discussed as specific aims. Magliaro (2005) states that teachers are accountable for selecting the learning objectives that are appropriate for learners to master and also should select relevant programs that will present learning levels from low to high. Learning outcomes are statements of expectation on what learners should know, understand and be able to do at the end of the lesson (Gosling & Moon, 2001). In the CAPS document, outcomes are described as specific skills; the skills that learners should acquire with regard to GIS are to gather and organise information and process it as well as interpreting and evaluating information (Department of basic education, 2011). Diana (2008) states that GIS outcomes are that learners progress in visualisation of the landscape by using aerial over-layering on the map. Similarly, Islon (2003) pointed out that GIS allows learners to explore cartography by choosing relevant colours, graphical abilities and correct methods of choosing and present data on the map. Mackain

(2000) also points out that GIS opens room for high levels of thinking by learners by replacing static maps with digital maps.

In the above two paragraphs I theorised on the issue of goals in teaching GIS; in this paragraph I interpret the above by using five criteria of quality curriculum: relevance, consistency, practicality, effectiveness and sustainability by Nieveen (1999) as the tool of analysing whether CAPS is a quality curriculum or not, and whether CAPS addresses these five propositions. In terms of relevance, the aims are relevant because they do speak to the real world which concentrates on globalisation whereby technology is used as a tool to transform societies. Moving to consistency, CAPS is consistent since the CAPS document is arranged in such a way that it give direction to teachers such as content, time allocation, teaching methods and assessment methods. In terms of practicality, GIS is practical to a certain extent since teachers in our schools are teaching paper-based GIS which require maps yet aims are speaking about the use of technology and even maps are lacking in some schools. In terms of sustainability, CAPS is not sustainable in terms of GIS in most schools in South Africa, since most of schools lack resources including maps which have become a replacement of computer based GIS. This discussion leads us to the content as one of the components of the curricular spider web by Van De Akker (2009).

2.9.4 GIS CAPS content: what are teachers teaching?

Content defines what teachers are teaching. Shulman (2000) argues that to be an effective teacher one must hold and display proficiency in the content knowledge of a subject. According to Shulman (2000), content refers to the understanding of concepts' underlying structure of the subject being taught. Defining teacher quality is a prickly endeavour, with any single definition bound to disappoint at least one group of people. Spaul (2013) argues that a good teacher must exhibit, professionalism (values), be willing to teach (attitudes and desires), have ability to teach (knowledge, skills and pedagogy), and must be competent to teach (instilling knowledge, skills and values the learner should acquire at school). These suggest that the teachers must know and understand content in order to implement the curriculum correctly. Khoza's (2015) research determined that all the participants were able to interpret the content and time allocations with regard to CAPS, however, the interpretive study conducted by Halemesa (2007) on the use of GIS in South Africa schools, concluded that more than half of the geography teachers lack understanding of GIS and teachers were not aware of using GIS in geography lessons. Only five per cent of teachers specified that they are using GIS software in their geography lessons. The following table (2.4) was taken from the geography CAPS document for the FET band.

The following also provides an example of the content covered in a week's time. CAPS provides one week plans for grades 10 to 12. The content is arranged in a way that learners are able to embrace geographical skills including identifying, collecting information, making decisions, suggesting solution, and being able to work independently. The way CAPS content is organised in terms of GIS is that it is supported by the necessary skills needed to be acquired by the learners. However, Ozturk, (2011) argued that the autonomy of teacher does not allow them to think and act freely as they implement the macro curriculum. This suggests that teachers must not be autonomous as Msibi and Mchunu (2013) pointed out that CAPS undermines the teaching profession. Since teachers are the implementers of the curriculum it means they understand the micro curriculum whereby they consider needs of learners, and decisions are made on that basis.

CAPS arrangement of GIS for FET

Grade 10	Grade 11	Grade 12
<p>Geographical Information System (GIS)</p> <ul style="list-style-type: none"> • Concept of GIS • Reasons for the development of GIS • Concept of remote sensing • How remote sensing work • GIS concept: spatial objects, lines, points, nodes and scales 	<p>Geographical Information System (GIS)</p> <ul style="list-style-type: none"> • Spatially referenced data • Spatial and spectral resolution • Different types of data: line, point, area and attribute • Raster and vector data • Application of GIS to all relevant topics in the grade • Capturing different types of data from existing maps, photographs, fieldwork or other records, on tracing paper. 	<p>Geographical Information System (GIS)</p> <ul style="list-style-type: none"> • GIS concepts: remote sensing, resolution • Spatial and attribute data sharing and data security • Data standardisation, data integration, buffering, querying and statistical analysis • Data manipulation: data integration, buffering, querying and statistical analysis • Application of GIS by government and the private sector • Relate to all topics in grade 12 • Develop a “paper GIS” from existing maps, photographs or other records on layers of tracing paper.

Table 2.4 (Geography CAPS, 2011)

With reference to the table above, GIS is taught from grade 10 to 12; in grade 10 learners are introduced to the GIS concepts and the reasons for the development of GIS. In grade 11 learners are expected to understand the work from grade 10, with more detailed information added and learners are expected to distinguish different types of data and apply GIS. GIS requires teacher understanding and also the use of necessary resources. In our case, as we are focusing on paper-based GIS we apply GIS using maps and text books. In grade 12, learners are also expected to understand forms of data and be able to apply GIS in relevant government departments or private sectors.

According to Jones (2012), the training of teachers shows that CAPS has made work for teachers simpler and understandable. Msibi and Mchunu (2013) noted that CAPS indicate what is needed to be covered by teachers, for instance the number of weeks for each topic. Over and above this, topics are prescribed for teachers and teaching approaches are stipulated. While the CAPS document notes that teachers do not have to stick to the teaching plan provided, they further stated that deviating from this plan or topics is impossible since learners are expected to cover the same work in the same term across the country. The CAPS document notes that it promotes principles of active and critical learning: encouraging an active critical approach to learning rather than rote and uncritical learning of given truths' (Department of Basic Education, 2011). In the above statement, Msibi and Mchunu (2013) argued that it is unclear as to how this will be achieved as accompanying text and workbooks are prescribed, thus limiting the agency of the teacher in the classroom. The CAPS document is content-driven, meaning the content is set for teachers and learning is based on school knowledge. They also argue that this document undermined the teachers' pedagogical content knowledge. This suggests that teachers need expert guidance in order to perform their jobs correctly.

Clough (2004) revealed that geography teachers in secondary schools are faced with the challenges of pedagogy and new terminology in teaching GIS, hence teachers skip the GIS chapter, and as a result, learners suffer. The terminology used in GIS is complex for teachers, considering that the majority of teachers in South Africa are not qualified and the access to technology is very limited in most schools (Karter, 2009). Geography teachers lack confidence and they are struggling with GIS (Clough, 2004). This suggests that teachers experience problems when teaching GIS, particularly with the strange terminology used. Green (2007) stated that professional development in teaching of GIS continues to be a difficult issue for numbers of teachers in South Africa. Language used in GIS, opportunities in the curriculum and the expensive training remains are the major reasons that contribute to non-attendance of GIS training available to teachers. From my experience, the training is not enough for teachers, as

the Department of Education presents two hour workshops, four times a year and it does not work. Manlod (2006) states that most of our schools in semi-urban and in rural areas employ teachers who know little about GIS and some don't even know the concept of GIS

To have a good content knowledge means the teacher must be well vested with knowledge and understanding of the subject matter. Understanding the content also gives confidence to teachers, who are able to go beyond what the books present, and want further knowledge. Content is what distinguishes the teacher from the learner, meaning that once the teacher lacks content knowledge of the subject, there is no distinction between the two figures. Once the teacher lacks understanding it then leads to a failure of implementing the curriculum. In South Africa we apply paper-based GIS as the solution to the challenges of resources that are lacking in our schools, however the content of GIS still needs technology for proper implementation of the curriculum. Content of GIS in CAPS is directly speaking to the fundamental needs of globalisation which concentrates on the use of technology across the world. In this way, CAPS is relevant, however, geography teachers are far behind technology and also behind in understanding concepts of GIS. This diminishes their level of professionalism because teacher professionalism means be prepared, be on time in class, have knowledge of the subject and be able to reflect on daily bases. Content plays a major role in shaping teachers as professionals.

Nieveen (1999) describes four criteria of a quality curriculum which can be used as a tool to analyse the quality of CAPS as the curriculum, namely: relevance, consistency, practicality, effectiveness and sustainability. CAPS content, with regard to GIS is relevant, since content is centred on the needs of society which is to embrace technology and allow society to fit to the need of the world and globalisation. Although there is a gap in the content of GIS, since the content is not structured in a similar way to learner activities. The content for GIS is the same for schools with learning support material and with the schools that are lacking learning support material. This is in contrast with the learner activities, which provides some form of alternative for the schools and teachers to choose, on the basis of their context. In terms of consistency of content of GIS in CAPS, in grade 10 learners are introduced to the variety of GIS concepts (Figure 2.6) then in grade 11, they move further with the foundation that was built in grade 11, extending GIS where they have applied the GIS content on their real life situation. In this way, content of GIS in CAPS portrays logic and cohesiveness. With regard to practicality, content of GIS in CAPS is practical when applying paper-based GIS as the solution to the challenges of resource scarcity in many schools in South Africa. However, from several studies it appears that many teachers in South Africa lack understanding of GIS, therefore practicality becomes questionable as other schools lack even maps. With regard to effectiveness CAPS content in GIS,

teachers are abandoned, no intervention is made by Department of Basic Education to support teachers in terms of training teachers, nor is there the support of teachers with the necessary teaching and learning materials. Instead the Department of Education is putting pressure on teachers to produce good results through media, social network and so on. Moving to sustainability by Van de Akker (2009), content of GIS needs modern teaching resources, and in most rural and townships schools, resources are scarce, therefore the curriculum is not sustainable. This discussion leads to teaching activity as the next component of the curriculum spider web by Van de Akker (2009).

2.9.5 Teaching activities: How are teachers teaching GIS?

According to Louise, Smith and Van Doren (2015), teaching activities should ensure the following: firstly, is to understand the main purpose for each activity that is taught to learners. Secondly, activity should be constructed in a way that each learner is responsible for their own learning. Thirdly, is to ensure that teaching activity brings or draws knowledge and skills that are beyond the classroom situation. Lastly, teaching activities should be transferable out of the classroom. Formal activities are used for recording purposes with an aim of producing results at the end of the year. Informal activities are done to monitor the daily progress of the learner (Hoadley & Jansen, 2013). Further Khoza (2013a) believes that informal activities are important to learners since they have different role to play of connecting learners to the real world situation. This suggests that both formal and informal activities are important in the learning process.

According to Platinum grade 11 CAPS book, activity five focuses on the use of computers and the internet, and learners will not be able to write activity five without these resources. The rest of the activities are based on theory in contrast with the aims and objectives of teaching GIS which is to promote the use of technology. However, in the very same book there is an alternative activity that refers learners to a case study, which suggest that those schools with limited resources should engage with the case study activity, therefore paper-based GIS will still be a solution to many schools. This does not bring justice to those learners because they are no longer learning the common curriculum across the country. Also teachers have no choice of giving learners any activity except the ones that are based on theory.

However, when using Nieveen's (1999) four criteria for a quality curriculum as the tool of analysing CAPS, CAPS is relevant. Since some activities in the CAPS books cater for those under-resourced schools, context is catered for. Considering that South Africa is still a developing country, not all

schools have all the resources required to suit the needs of curriculum. In terms of consistency, CAPS policies are aligned with materials and logical; however, along the way curriculum consistency is lost when they are no material available in majority of the schools. There is not only a lack in teaching materials, but there is also a lack in equipping teachers who are the implementers of the curriculum, because in some schools, teaching support materials are available, but the challenge is with the teachers who are not trained to incorporate technology in their lessons. In terms of practicality, CAPS teaching activities are practical since teachers have an alternative in some books, and their decision when choosing activities is informed by the teaching support material and their knowledge of incorporating technology in their lessons. In terms of effectiveness of the curriculum, GIS becomes effective when learners are able to engage practically in activities and not theorise them. In terms of sustainability, learner activities that focus on theory are not sustainable since they ignore the practical application that others are engaged in; this raises the question of which society these learners are going to fit in if they are not fully accommodated by the curriculum.

2.9.6 Teachers' role: How are teachers facilitating teaching of GIS?

According to the study conducted by Khoza (2015) on student teachers' reflection on their practice of CAPS, almost all participants use the teacher-centred approach in order to finish the syllabus presented to them. This indicates that there are gaps between teachers and the curriculum itself because practical subjects automatically need a learner-centred approach since learners are to practise what is taught to them. The study further suggests that understanding whether the curriculum is driven by learner-centred, teacher-centred or content-centred approach can result in achieving the curriculum goals. The teacher's role with regard to teaching of GIS, is not clearly specified as to which approaches are relevant to the teaching of GIS, However, Watson (2001) posits that technology integration is a compound phenomenon that includes teachers' understandings, motivations, perceptions, and beliefs about learning and using technology. The study further recommends that teachers should use learner-centred approach in order for learners to grasp complicated GIS terms.

Scheffler and Broda (1999) state that most teachers in secondary schools lack confidence to incorporate technology as part of their lessons and tend to overlook it. According to the study by Granmore (2004), geography teachers' attitudes and beliefs towards GIS are amongst the reasons for judging whether technology will be incorporated successfully in the classrooms. Similarly, the study conducted by Hew (2007) concludes that some teachers easily accept and integrate new concepts with technology, as the outcomes change is practiced and possible in their lesson. But, correctly most

teachers are not concerned with technology because they believe that technology is for young people. Hence the implementation process of GIS in geography is less effective.

Davis (1989) identifies the technology acceptance model, whereby user acceptance of new technology relies on two key elements: firstly, the extent to which a person believes that the technology can benefit his or her job performance; and secondly, the extent to which the user believes that the technology is “free of effort” (Davis, 1989). Nevertheless, research studies show that technologies allow learners to develop higher-order thinking but only if they are coupled with appropriate pedagogical strategies. Lim (2007) assert that if teachers accept technology and believe that it is beneficial for their lessons, technology integration can be achieved more easily. In some schools geography resources such as computer laboratories are available but are not utilised due to several reasons and therefore, complicates the implementation of GIS.

Addressing performance curriculum challenge through teacher professionalism

According to Msibi and Mchunu (2013), professional teachers are innovative, dedicated and are always concerned about improving their occupations and developing their profession. They further state that the behaviour or the actions of teachers in township and rural schools are signs of a lack of teacher professionalism. This lack of teachers’ professionalism affects the results of learners, particularly in township and rural schools. Msibi and Mchunu (2013) state that resource scarcity in schools must not be used as an excuse of low performance, rather the lack of teacher professionalism contributes greatly to the failure of learners in rural and township schools. Researchers identified a number of challenges when it comes to curriculum implementations, amongst them is the poor dissemination of the curriculum by the Department of Basic Education. Teacher professional also contributes in the improper implementation of the curriculum. Moletsane (2004) states that in order to address teacher professionalism, teachers need to be at the centre of change. To have successful programmes that deal with teacher development, it is important to focus on professional development. Moletsane (2004) further states that teachers should be responsible for managing their own professional development. Luneta (2012) recognised five characteristics of effective professional development:

- Professional development must be linked with the goals of the Department of Education, CAPS in South Africa and the needs of teachers
- Knowledge, instructional approaches and learning outcomes must be appropriate.
- Allow learning opportunities to apply new strategies
- Allow opportunities for reflection

- Provide continuous feedback to students

Influencing factors of teacher professionalism

Beijaard, Verloop and Vermunt (2000) identify three influencing factors of teacher professionalism. The first factor is the teacher being a subject-matter expert. Subject knowledge shapes teacher professionalism, including a teacher being a classroom manager and facilitator of learning. The second factor is that the teacher is a pedagogical expert, and this includes the teacher being able to engage with learners, and embracing the private and personal life of students in a professional manner. Thirdly, the teacher as a didactical expert, which includes teachers being able to plan for lessons and evaluate lessons after implementation. Teachers are able to identify the areas of improvement through critical reflection. These factors embrace the abilities of a 'good teacher'; if teachers are able to act on these three factors, they can reflect on improving on their daily practice. In order for teachers to gain necessary skills and abilities of teaching, they need to reflect on their daily practices; action research should be utilised for both experienced teachers and new teachers.

Utilising action research to address teacher professionalism

According to Creswell (2012), action research is used when one has a specific educational problem to address. Action research is used in order for teachers to reflect on their own daily practice. It is only used within the scope of the school; action research offers an opportunity for staff and teacher development, not only in their teaching exercise but also as professionals. From there action research is used to address school problems. Ferrel and Weitman (2007) acknowledge that action research empowers teachers through opening the opportunity for teachers to express themselves as decision-makers. Furthermore, action research provides knowledge to teachers, therefore teachers become aware that they are professionals. Action research focuses on what is happening in the classroom, therefore for the benefit of this study it is important to define the concept 'curriculum'. This discussion of the teachers' roles leads to the discussion of material resources as one of the components of curriculum spider web (Van den Akker, 2009)

2.9.7 Material and resources for teaching GIS CAPS: with what are teachers teaching GIS?

Khoza (2012, p. 75) defines a resource as anything that facilitates or initiates learning or "any person or thing that communicates learning". According to Krishna (2013), teachers believe that successful teaching and learning depend on the teaching and learning resources. Khoza (2012) categorises educational resources into three categories namely: hardware resources, meaning the use of physical equipment that learning process, for instance computers, overhead projectors, and chalkboard and so

on; software; and ideological-ware. According to Chi-Chung, Lai and Wong (2009), some geography teachers have limited access to the hardware that is suitable to teach GIS. Chi-Chung et al. (2009) further state that in some schools, the hardware is available to other subjects, but not in the geography classroom. Hence it is of paramount importance to create a classroom environment whereby hardware resources are available in order to have active teaching and learning of GIS. The study conducted by Wilmot and Dubea (2015) found that learners were sharing books in groups of two to three and when the teacher was asked why learners were sharing books, the teacher responded that the school was not aware of how many learners were doing geography. This suggests that the geography is not taken seriously like other subjects and also suggests that if textbooks are not adequately provided, then additional resources such as maps and computers are more unlikely to be provided.

Also software resources, are important in the teaching of GIS; software resources are the computer programs that store information. Access to appropriate GIS software is very important for geography teachers since they need to be able to use basic GIS software. Over and above software and hardware is the ideological-ware resource. Ideological-ware is identified as a main educational resource amongst the three because learning falls within this category. Chi-Chung et al. (2009) argue that to implement GIS successfully, geography teachers must have subject knowledge and necessary skills required to use GIS, and also teachers should understand the curriculum. According to Amory (2010), teaching and learning is not about technology but is about ideology. Johansson (2006) concurs with this statement by pointing out that providing schools with enough computers and other required resources does not automatically mean that the educational aims of incorporating technology into the curriculum are achieved.

Coupled with the above stated paragraph on resources, the study conducted by Watson (2001) on GIS, also indicates that, even though some teachers are using computers and other resources for administrative purposes, the majority of teachers are not using computers as part of the resources in their classrooms. Watson (2001) further states that computers may be accessible in schools but most of the teachers are not equipped with the necessary skills to use them. This suggests that accessibility to resources does not mean effective implementation of the curriculum but rather this is a collaborative exercise that includes the government, the Department of Education, school management, teachers and communities. Resources affect the way in which teachers teach. According to the Department of Basic Education (2011), the following is an additional list of resources for teaching geographical skills and techniques which embraces GIS: atlases, orthophoto maps, aerial photographs, GIS images, topographic maps and previous examination papers.

Baker (2005) states that the challenge lies in the attempted establishment of a suitable environment in which technology can be taught effectively in South Africa. Kidman (2006) points to three main challenges that are obstructing the integration of GIS in schools of South Africa. First is the lack of financial resources, which is seen as the major obstacle to integrate GIS effectively. With the introduction of GIS in geography, there are strong needs for financial support for purchasing the required hardware, software and other educational resources, along with the money required for the training of geography teachers. Most of schools in South Africa do not have enough resources such as computers, yet GIS needs computers; furthermore, GIS software is expensive, therefore effective teaching of the GIS is hindered (Watson, 2006).

The second challenge is the lack of support which hinders effective teaching of GIS. Kidman and Palmer (2006) identify three levels of support that are vital in the full functioning of a school. The first of which is the support from school leadership, including community members, next, is support from tertiary institutions and lastly is the support from the Department of Education. According to the researcher's experience, the three levels of supports in South Africa are not balanced. Communities are ignored by the school management with the beliefs that they are illiterate, therefore including community members is less important to them. Universities offering teaching courses do not adequately equip geography teachers with the necessary skills of teaching GIS, hence the support for GIS teaching is lacking. The Department of Education is not fully supporting the schools such that geography teachers, in terms of providing resources for teaching GIS, and most important is to train them from time to time.

The third challenge is the lack of time to teach GIS; this issue is fully covered under the section below this. Resources are part of the teaching environment. The teaching environment is a part of the ten components of the curricular spider web as discussed by Van De Akker (2009). The teaching environment is relevant for the question: where are the teachers teaching? In teaching of GIS, the teaching environment is very important because most of the problems faced by teachers emanate from space they are using. It also determines whether the curriculum will be implemented successfully or not. The learning environment is linked to assessment used by teachers in assessing learners. The teaching environment leads us to the issue of time.

2.9.8 Time and location of teaching GIS grade 11 CAPS: When are teachers teaching GIS?

According to section 4 of the Employment of Educator Act of 1998 teachers should be at school for a minimum of 7 hours per day. According to the CAPS policy document (2011), the time allocation for the teaching of geography in grade 11 is four hours per week. Kerski (2003) identified the lack of time as one of the major challenges in teaching GIS effectively. This speaks to the sufficient time for geography teachers to attend workshops, improve their teaching methods and learn the basic GIS skills. The time that is reflected in the work schedule is not sufficient for geography teachers to implement GIS. This suggests that the implementation of GIS in geography faces challenges, and as a result the process of teaching and learning is affected. Harvey (2007) states that when teachers teach GIS in school, they should be aware that it is essential for learners to learn the complex application of GIS quickly, but the use of it demands high-tech resources, and GIS use needs more investment of time. According to Clifford (2005), the resources available to teach GIS in South Africa lean towards Auditory-Sequential thinking. This means that the teacher gives a verbal lesson and the learners will then make notes. If teachers have enough time to teach GIS they will also have enough time for assessment.

2.9.9 Assessing in GIS grade 11 CAPS: How do teachers assess learning?

Assessment is defined as the process of gathering, interpreting, recording and using information and learners' responses for educational purposes (Lambert & Lines, 2000). According to Broadfoot and Murphy (1990), assessment is an important scope of interest and an area debate in education. Black and William (2004) state that the information acquired through assessment is employed to give learners knowledge to be used for transformation, based on learning actions or activities. According to the study conducted by Khoza (2015), all participants indicated that they follow the CAPS documents which specify the use of both formal and informal assessments. According to the study conducted by Bjorklund (2014) on perceptions of the implementation of CAPS, some teachers had challenges when trying to understand the assessment guidelines for CAPS. Coetzee (2012) concurs that one of the areas in CAPS where teachers experience challenges is assessment.

According to Looney (2005), formative assessment refers to frequent, interactive assessment of students' progress and understanding to identify learning needs and adjust teaching appropriately. For William (2011), formative assessment is used in different ways, such that it was no longer helpful; instead they preferred the term assessment for learning. This suggests that formative assessment and assessment for learning is the same. Formal assessments are those tasks that make up the formal programme of assessment for the year. Teachers should mark and record formal assessment; all

formal assessments must be moderated to ensure quality and maintain standards, while informal assessments are a daily monitoring of learners' progress (Department of Basic Education, 2011). Summative assessment is in contrast to formative assessment in the way that it focuses on summarising the results of a student, and the results are produced at the end of term or year for certification purpose.

Assessment is discussed in three types namely, assessment for learning, assessment of learning and assessment as learning. According to Gtiggans (2002), assessment for learning is a process whereby the educator delivers information, involves learners in the assessment and the teacher keep the records for future usage. The advantages of assessment for learning are very wide, firstly, learners gain confident because they are responsible for themselves progressing, and as a result, they want to carry on and better their achievements. Learners get to understand that they are in charge of their learning. Assessment for learning benefits the teachers because their learners become inspired to learn and the parents benefit when they see high achievement. Gtiggans (2002) suggest that the department should develop a professional program that will focus on teachers' development in terms of the expertise needed to assess for learning. The following table indicate formal assessment for geography grade 11

Summary of formal assessment expected in grade 11 geography CAPS

Grade	Formal Assessment	CASS (25%)	Final Exam (75%)	Total
11	<ul style="list-style-type: none"> 3 assessment tasks 2 tests Mid-year examination 	3 x 20=60 2 x 10=20 1 x 20=20 100		400
	<ul style="list-style-type: none"> End-of-year examination 		Paper 1 = 225 (3 x75) Paper 2= 75 300	

Table 2.5

Weighting of cognitive levels in grade 11

Grade	Lower order (Knowledge/ Remembering)	Middle order Understanding, Applying	High order analysing, Evaluating, Creating
11	30%	50%	20%

Table 2.6 (Geography CAPS, 2011)

Programme of assessment for grade 11 CAPS

Term	assessment	Description of assessment	Marks
1	1	Data-handing task	20

	2	Test	10
2	3	Mapwork task	20
	4	Mid-year examination (Paper 1 & Paper 2)	20
3	5	Research/Essay writing task	20
	6	Test	10
		Year Mark	100
4	7	End-year examination (Paper and Paper 2)	300
		Total assessment	400
		Percentage	100%

Table 2.7 (Geography CAPS, 2011)

The promotion requirements in the FET according to CAPS:

- Seven subjects
- Learner must pass home language: 40%
- Learner must pass 2 other subjects: 40%
- Learner must pass 3 other subjects: 30%
- No aggregate mark is used.

On top of what is presented by CAPS documents as the formal assessment, the Provincial Department of Education, on the 14 August 2015, issued circular no. 3 of 2015 which states the guidelines for promotion and progression for grade 10-12:

- Use policy prescripts
- Learner must be retained once in a phase not more than four years
- If the learner does not meet the requirements for promotion, learner must be progressed to the next grade.
- The purpose of circular no 3 is to align CAPS learner promotion with the requirements of NCS.

While the Department of Education provided school principals with the above stated guidelines for promoting and progressing learners, teachers who know and understand better what is happening in classroom are not consulted, because with or without learning in classrooms, learners will progress to the next grade. Reiterating that with the statement of the Department of Education that says “learner must be retained once in a phase not more than four years”; in the FET, a learner should spent three years not less than that; when they spend four year it suggest that learner should only fail once. In

other words, teachers must understand the issues of the curricular spider web. Teachers must also be able to reflect on their day-to-day practice.

According to Stephen, Stiggins, Arter and Chappuis (2004), assessment of learning is where a teacher administers the test correctly to ensure accuracy of the results. The results are used to help students to meet the required standards. The teacher, as the assessor, sets the tests, and builds the assessment for grading and reports, along with interpreting the learner results for the parents. However, the possible problem around the assessment of learning is that the test set by the teacher may not cover the curriculum and it may cover only what was taught to learners. The role of students in this regard is to meet standards set by teacher and they strive to get better marks. The timing of this assessment is done at the end of the lesson to generate evidence of learning. With CAPS, assessment for learning becomes inappropriate since teachers are teaching based on the timeframe given to them. This means all schools, subject by subject, are teaching something at the same pace. According to the study conducted by Wiliam (2011), "What is assessment for learning", assessment practices sometimes limit student learning.

Stephen, et al. (2004) define assessment as learning as where the teacher changes standards to fit the classroom; the target is set and learners will be informed in order for them to work toward achieving that target. With assessment as learning, the teacher is responsible to provide feedback to learners and also learners are part of the assessment process. As learners are involved in the assessment process they are able to improve their results. This kind of assessment is conducted throughout the lesson to influence the learning process. However, there are possible problems around assessment as learning; teachers sometimes depend on learners when they lack skills, time, or aspiration to assess. Assessment therefore leads to the issue of the content taught to learners. According to Phoenix (2000), there are different ways to assess GIS in the geography classroom. Conducting projects, implementing applications, using internet-based mapping and instructional modules are among the methods which are being used in classrooms today. Although geography teachers can teach GIS using one computer, almost all of the aspects stated their methods of teaching required individual students having access to their own computers. Also, classrooms cannot be regarded as a good and proper environment to teach GIS, instead geography laboratories at schools are suitable environment to conduct an effective geography lesson where GIS would be easily incorporated.

2.10 Conclusion

This literature has explored levels of reflection as the phenomenon of this study. I focused more on critical reflection, and also explored the important role played by teacher professionalism as amongst the leading elements that transform teachers in order to become agents of change. From the literature, it clear that teachers should reflect on their daily practice in order to address the challenges they faced in their classrooms. This literature explored understanding of GIS. The literature review also explored the conceptual framework by Van den Akker (2009). The curricular spider web enabled the shaping of the literature regarding the issues of curriculum and also gives us a clear picture of what is happening in South African schools in relation to the teaching of GIS. The concepts framing this study are: rationale, accessibility, aims and objectives, content, learning activities, teacher role, materials and resources, and the learning environment.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

In the previous chapter, I discussed the literature related to teachers' reflections of teaching Geographical Information System (GIS). The aim of this chapter was to achieve the following research objectives:

1. To identify Grade 11 teachers' reflections of teaching Geographical Information Systems (GIS) at grade 11 CAPS in township school in the uMhlathuze Circuit
2. To explain the reasons why Grade 11 teachers reflect in particular ways on the Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the uMhlathuze Circuit?
3. To understand the lessons learnt from the Grade 11 teachers' reflections of teaching Geographical Information System (GIS) at grade 11 CAPS in a township school in the uMhlathuze Circuit

The above stated research objectives will be achieved through addressing the following critical research questions:

1. What are the Grade 11 teachers' reflections of their teaching of Geography Information System Curriculum and Assessment Policy Statement (CAPS) in a township school?
2. Why do the Grade 11 teachers reflect in particular ways on the Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school?
3. What lesson can be learnt from the Grade 11 teachers' reflections of their teaching of Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school?

For the aim of achieving the three objectives and answering the three critical research questions of teachers' reflections of teaching Geographical Information System (GIS) at grade 11 CAPS, in this chapter it necessary to discuss the research paradigm: critical paradigm; research style: action research; sampling: purposive and convenience; and data generation methods: reflective activity, focus group discussion and semi-structure interviews. Further, this chapter discusses data analysis: inductive

and deductive reasoning, ethical issues, and trustworthiness: transferability, dependability, confirmability and credibility. Lastly are the limitations of this study.

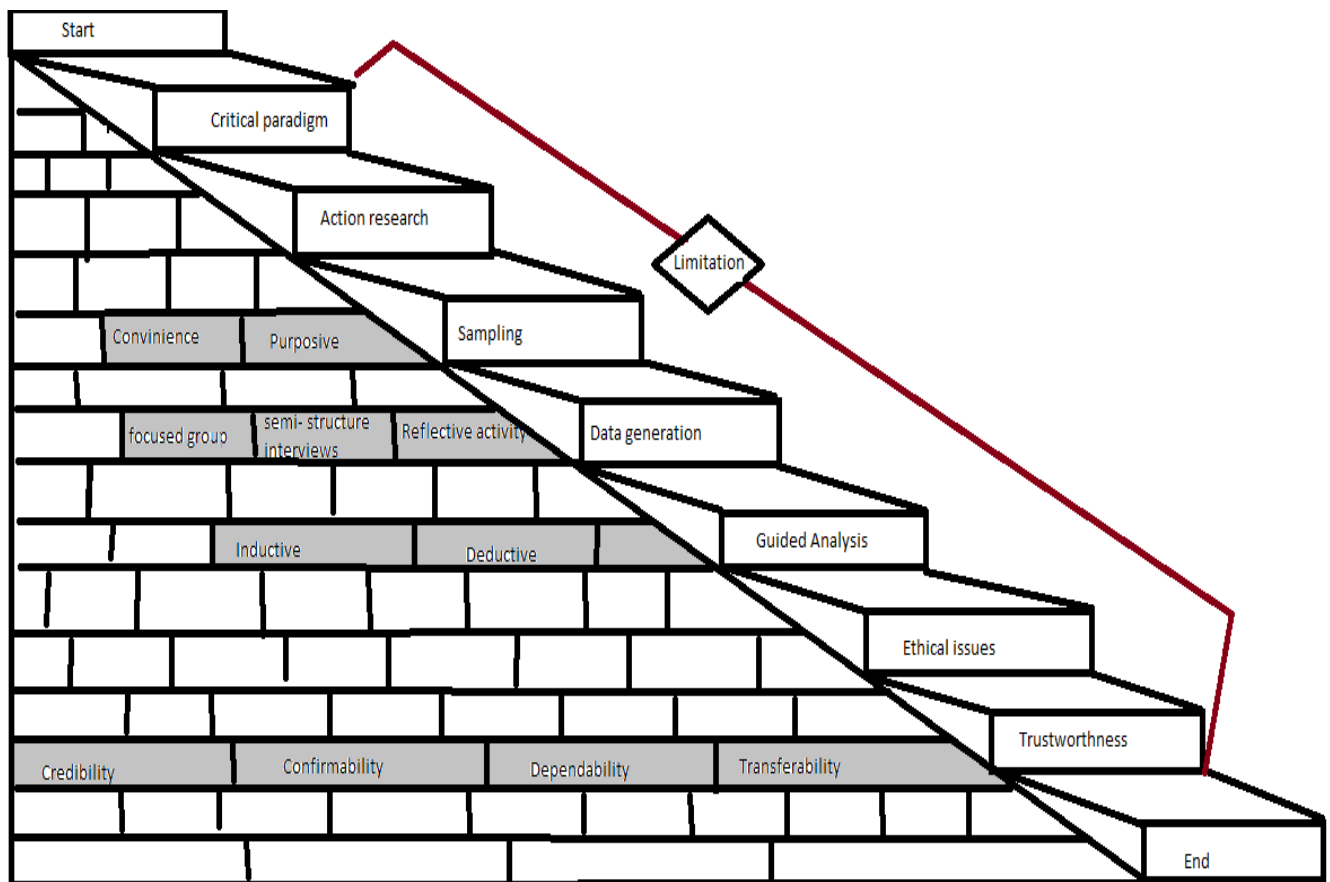


Figure 3.1 flow chart

3.2 Research paradigm

Durrhein (2002) describes the research paradigm as the perspectives that direct the rationale for the research; further, the paradigm shapes the researcher toward a particular direction of data collection methods. Similarly, Guba (1990), and Denzin and Lincoln (2005) describe paradigm as the sets of belief that guide action. They further state that a research paradigm is concerned with taking a particular position on a particular issue, considering ethics and values. Mertens (1998) concurs with the above description of a paradigm by stating that a paradigm is way of looking the world. A paradigm is made up of certain philosophical assumptions that shape and direct our thinking and actions. A paradigm involves educational and psychological research which helps the researcher to direct his or

her thinking. Guba and Lincoln (1994) state three major questions that define a research paradigm. Firstly, what is the nature of reality? Secondly, what is the nature of knowledge and the connection between the person who is the knower and the person who would be known? Thirdly, how can the person who knows go about getting the required knowledge and understanding? Creswell (2009), and Cohen, Manion and Morrison (2011) stated that it is important for research study to outline the research paradigm. Lather (1991) states four research paradigms in educational research, namely: interpretive; positivist; critical; and post-structural. On the other hand, Cohen et al. (2011) identified three paradigms in education research, namely; positivist, interpretive and the critical paradigm. According to Cohen et al. (2011) each research paradigm is categorised according to the level of thinking starting from ontology, epistemology, methodology and axiology. The following diagram (figure 3.2) illustrates the three research paradigms described by Cohen et al. (2011).

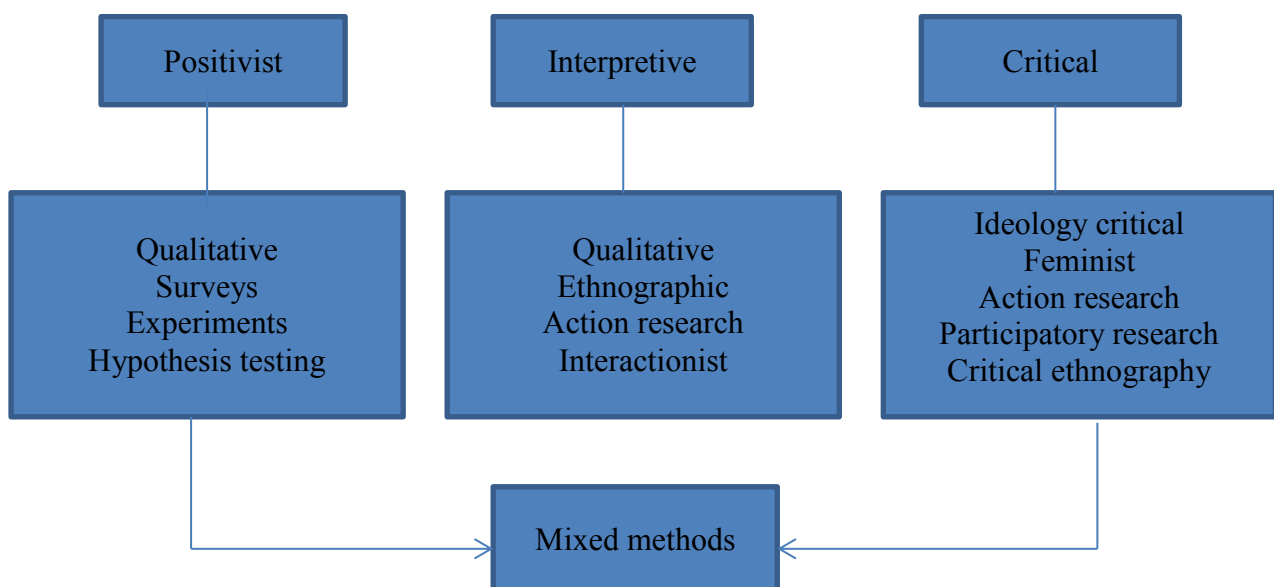


Figure 3.2: Educational research paradigms

Out of the three research paradigms, this study falls under the critical paradigm. According to Reeves and Hedberg (2003, p. 29), like all paradigms, the critical paradigm has “explicit and tacit assumptions that guide inquiry”. Cohen et al. (2011) state that the main focus of the critical paradigm is to transform society, meaning changing society to a democratic society. This suggests that the researcher is doing research with the aim of transforming society, hence this study is focused not only on finding out about teachers reflection, but also to further change the ways in which teachers are teaching GIS. According to Connole (1993), the critical paradigm shares same similar features with other research paradigms, particularly the interpretive paradigm, however the critical paradigm focuses on the dimensions of

emancipation based on the nature of knowledge and the social process as a result of the research. Popkewitz (1984) states the function of the critical paradigm, is to understand the relationship between the value interest and action that change the world. Mertens (1998) states that the critical paradigm is influenced by factors such as politics, the economy, social systems, gender, ethics and values; what is taken to be 'real' may need to be critically examined. The following diagram (figure 3.3) illustrates the critical paradigm by defining ontology, epistemology, methodology and axiology.

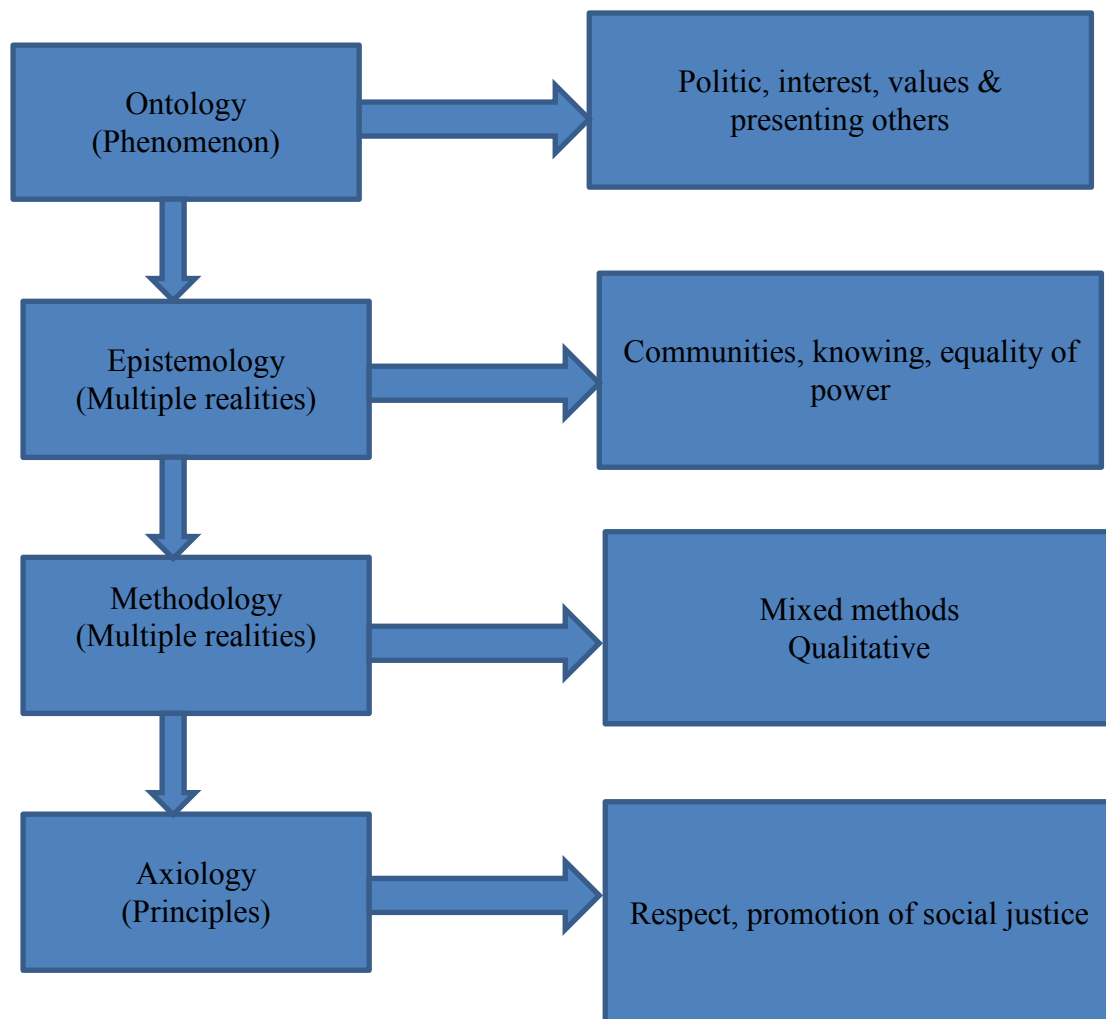


Figure 3.3: Critical paradigm

Since this study focuses on the teachers' reflections of teaching Geographical Information System (GIS) in grade 11 CAPS, and the aim of this study is to transform education, particularly geography teachers as curriculum implementers, therefore positive change is required to be practiced by teacher. Teachers will be able to integrate technology in our subjects as the curriculum requirements. This also suggests that the study is aimed at addressing problems, discussing implications and engaging geography teachers in the process of teaching and learning GIS. It is therefore important for this study

to be framed by the critical paradigm and meaning will be projected at transforming education and teachers.

This study may therefore assist us, as geography teachers, with how we can improve our teaching strategies; it may happen that we, as teachers, apply correct methods of teaching GIS, however there is always room for improvement. This study provides recommendations based on the findings of the study with the aim of transforming geography teachers. There are several critics of the critical paradigm, for instance Cohen et al. (2011), who state that the critical paradigm is viewed as a paradigm that carries out the political agenda of the researcher, which runs counter to the purposes of research. The researcher is seen as the only voice that changes the community, yet there are many ways of understanding the real world (Cohen, 2007). There is also a confusion of understanding the action research and how it differs from other qualitative research. There is sometimes a lack of training of those who undertake action research which suggests that they may have weaknesses around the methodology they are using. Action research is time-consuming, and lack of time is amongst the challenges of practicing action research. Finally, criticism arises around the lack of objectivity for the researchers of action research.

To overcome the weakness of the critical paradigm, I acted neutrally, meaning I was not taking side of a particular participant or being biased. Moreover, in this case, I am not a researcher only but also a geography teacher who needed to be transformed as part of the geography teachers (participants). With regard to time issues, I attempted to do proper planning and organisation and used a systematic approach to all aspects in order to overcome time constraints. On the issue of objectivity, it is vital to recognise the values and beliefs that inform this study, and question assumptions and particular behaviour at each level of the research process, in order to achieve a sense of reflexivity in the study (Wellington, 2000).

The previous paragraphs presented an argument which defined clearly that this study is based on social science research, hence it was framed by action research. At this juncture the study further adopted a qualitative approach in which emphasis is placed on the quality and depth of information (Nieuwenhuis, 2007). I used a qualitative approach, because the purpose is to reflect on teaching Geographical Information System in grade 11 CAPS. Hancock (2002) described qualitative research as research concerned with developing explanations of social phenomena that inform understanding about the world in which people inhabit and why things exist the way they are. According to Cohen et al. (2011), the qualitative research paradigm is characterised by people actively creating their own

meanings of the situations; the researcher needs to understand social context, behaviour, context-related, context-dependent and context-rich. The researcher needs also to understand that realities are multiple and there is a relationship between the knower and what is known, and that these two are inseparable.

For the benefit of this study, these characteristics were important to me as a researcher to consider, since data generation was based on human behaviour which entails the social context and the social situation. In this study, social context means the reflection of geography teachers teaching GIS. Furthermore, the rationale for employing the qualitative approach as the method of data generation was because of the values that it upholds; Cohen et al. (2011) state that the qualitative method provides in-depth information and detailed understanding of phenomena. The in-depth information originates from actions, behaviour, non-observable behaviour, attitudes, and observable phenomena. This approach, not only focuses on the researcher, but ensures that the participants are also given a voice. By employing the qualitative approach with its character of providing in-depth information, I suggest that data provided in this study was not reduced, but rather it uncovered all the necessary issues regarding teachers' reflections of teaching GIS. It is the utilisation of qualitative approach that supported this study to be able to respond clearly to the three research question identified in the introduction of this chapter.

For this study, the qualitative approach was important to be used since it focuses on describing human behaviour (the teaching of GIS); the qualitative approach provides an in-depth understanding of the phenomenon (that is teachers' reflection). Cohen et al. (2011) state that qualitative research provides us with 'how' and 'why'; this involves the process of understanding how things are the way they are. Within the context of the qualitative approach, as define by Cohen et al. (2011), the 'how' and 'why' in this study denote teachers' reflections on teaching GIS, as the critical research questions allude. Furthermore, the methods of data generation are reflective activities, semi-structured interviews and group discussions. On data generation in qualitative study, Paley (2007) cautioned the researchers about the data generation, saying that participants may respond in a way that the researcher wants to hear. Again, Paley (2007) provides the counter statement that, in some situations it is useful to know the way in which people interpret what happened to them, regardless of other reasons. However, the qualitative approach has the potential to generate data that is credible, regardless of others views about data.

3.3 Research approach/style

In addition to the qualitative approach, I used action research. Different authors defined action research in different ways. Cohen and Manion (1994: 186) define action research as a “small-scale intervention in the functioning of the real world and a close examination of the effects of such intervention”. According to Kemmis and McTaggart (1992), action research is based on changing individuals and also culture of people, institutions, communities and societies. According to McNiff (2002), action research is based on practical matters that have been observed by the participants which are normally problematic to a small group and yet there is the potential to make change. Similarly, Check and Schutt (2012) describe action research as the whole research in which the researcher engages in collecting data with an aim of solving a problem. Lastly, Ebbutt (1985) describes action research as a systematic study that puts together action and reflection with the aim of improving daily practice.

According to Atkins and Wallace (2012), the values underpinning action research is based on moral and ethical issues. These moral and ethical issues are shaped by practical learning, context of the research and values and beliefs. Action research upholds values such as respect, integrity and honesty. The values in action research lie not on what we do, rather on what and how we practice our educational professions. These values become part of our practice and they inform research whereby we examine and question our practice. Reflective teachers conduct action research time and again in order to improve their own teaching practices. Through action research, reflective teachers identify problems and use different ideas and information to find solutions to problems. According to Valli (2009), engaging in action research allows teachers to take an active role in improving their teaching. Elliot (1991) describes the main aim for action research saying that it is improve in one’s practices in order to develop new thinking and knowledge. The above definitions (Cohen & Manion, 1994, Valli, 2009 & Elliot, 1991) all place significance on the part that is common: action. In this study, participants’ knowledge and understandings are improved upon through the use of action research. The action and practice displayed by participants will develop new understanding and practice of teaching Geographical Information Systems.

According to Creswell (2012), action research has three stages. The first stage is to identify the process to address the problems facing society. The second stage is to engage the practitioners, for instance teachers to find solutions for their own problems. The third stage is participatory, whereby teachers transform the problem, and they approach this through using group to address the problem. According to Creswell (2012), the third stage is the most important stage of action research. Kemmis (1994) states

that these group processes have its own four stages where they do planning, action, observing and reflecting. These group processes involve active participation and democracy to all members. According to Mill (2011), action research means different thing to different people. However, two major types of educational research are discussed. These include practical action research and participatory action research. Practical action research is where teachers research in their classroom, with the aim of improving their learners' performance and also for their own professional development. The aim of practical research is to research only a specific school situation with a vision of improving that situation and practices. Participatory action research focuses on change in society, the community, the organisation and the family, rather than immediate classroom problems. According to these two types of action research provided by Mill (2011), this study focuses on practical action research since the researched area is based on transforming the teaching profession.

The following figure is redrawn from the work of Kemmis (1994). Firstly, I believe that before we engage in a process of planning, we need to identify the area of concern. It is not always the case that there is a problem, but rather a change or improvement is needed in teaching practice, since we as teachers deal with the changing of the curriculum and also continuously deal with different learners. After identifying the problem, the question arises on how to address the problem or challenge or improve the situation. Planning will then involve all the stakeholders in order to address the problem. Moving on, the next stage is to implement the planning task and observe planning. The next stage is to reflect on the planned, implemented, observe task; the process is done repeatedly until expected results are achieved. The following diagram (figure 3.4) illustrates the action research cycle

Action research cycle

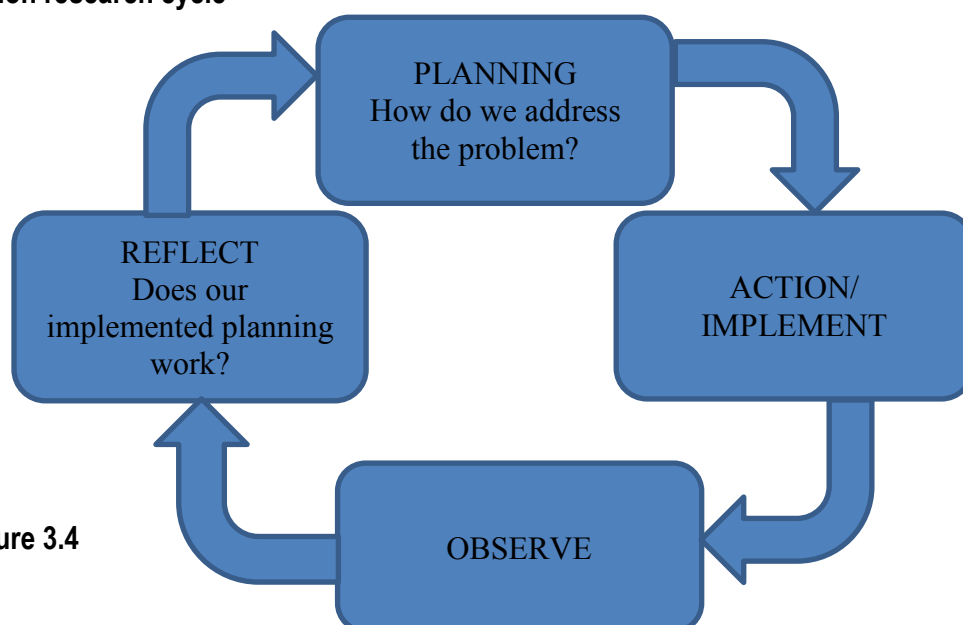
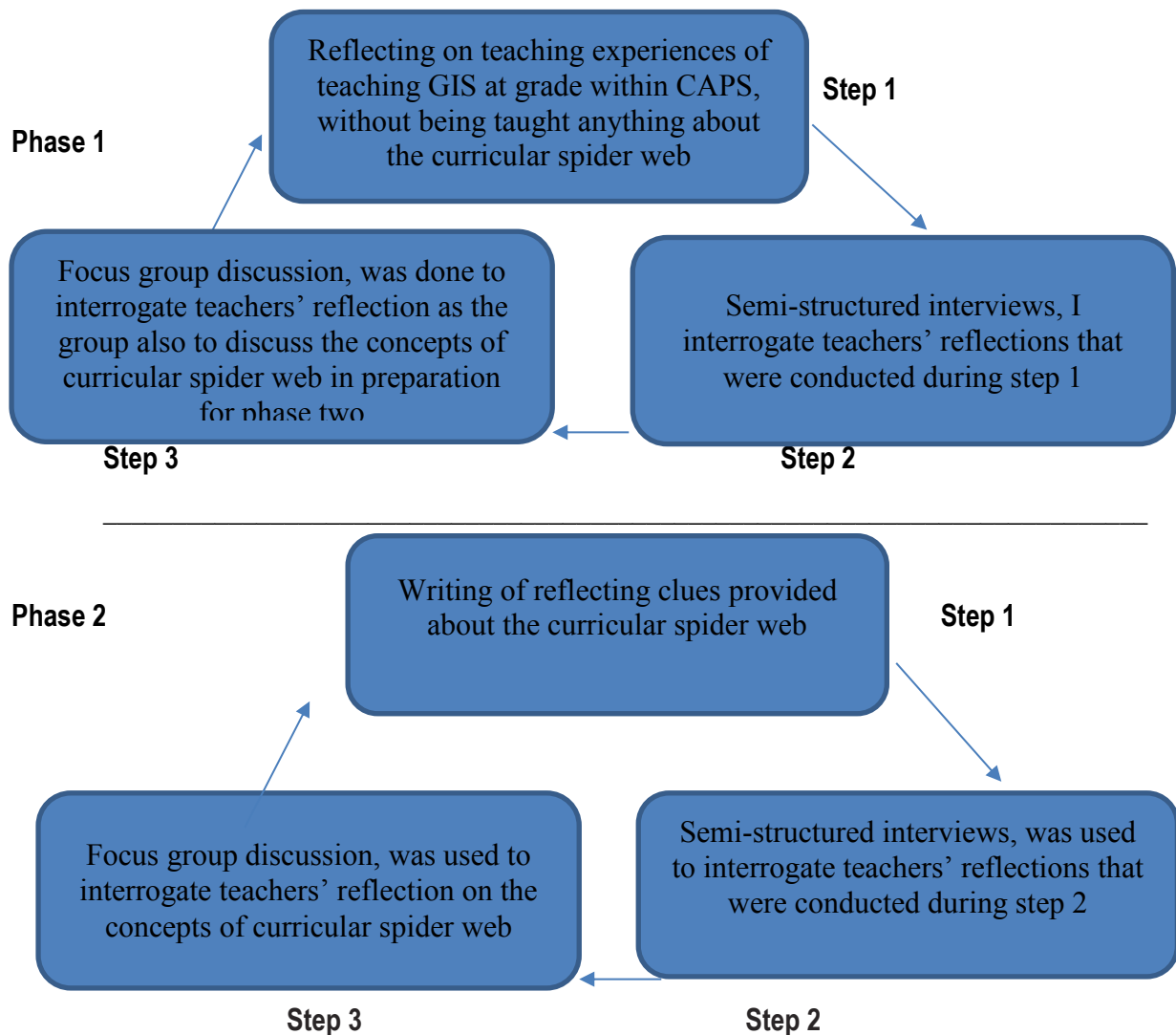


Figure 3.4

Putting this action research cycle into action, the following diagram (figure: 3.5) illustrates the process of action research implemented with geography teachers when teaching GIS in grade 11.



The above diagram indicates action research encapsulating the three methods of generating data used in this study (a reflective activity, one-on-one semi-structure interviews and a focus group discussion). These two phases were conducted with the aim to transform geography teachers when teaching GIS in grade 11 CAPS. In phase one, the researcher needed to get a clear understanding of the four geography teachers.

In particular, it was important to find out what teachers knew about the curricular spider web without being told. I started by, giving the four teachers questionnaires to assess their understanding of the curricular spider web concepts without giving them any clues about what these were. The questionnaires were kept by the teachers for three days, to allow them to have more time to complete. After three days I collected the questionnaires; I analysed them on the fourth and fifth day, and I noticed that teachers were not aware of the curricular spider web concepts. I then organised a meeting with the teachers where I questioned them about their responses during reflective activity (step one). Step two was based on one-on-one semi-structured interviews, where I wanted to understand more on the teachers' reflections by interrogating deeper. I then realised that teachers had little understanding of the curricular spider web concepts. When teachers teach GIS they do not seem to consider these concepts, for example all four teachers were not able to distinguish between the goals, aims and objectives. Hence, I decided to move on to step three which was based on focus group discussion, at this step I equipped teachers with an understanding of the curricular spider web.

- **Group meeting**

Although the teachers knew each other, they still needed a chance to truly understand one another in order to facilitate easy communication with the aim of working together. Teachers were to introduce themselves and describe a little of their background, likes and dislikes, strengths and weakness etc. This was done to create a free environment with the participants in order to allow them to be transparent and open to one another. More than that, teachers were encouraged to talk to one another, so the group was necessary to create that atmosphere. As a teacher researcher it was important to understand the participants in order to achieve the goals of this study which were to answer the three research questions.

In the group conversation, Mr Hlophe reflected on his experiences as a geography teacher who is teaching GIS for the first time this year. When he started teaching he taught social science in grade 8 and 9 and therefore had little experience of teaching GIS. For this short period, he did pick up that GIS is challenging in term of understanding it and he did note that it lacks the necessary teaching materials. Mr Phungula reflected on his experiences with regard to GIS; Mr Phungula has been teaching for four years. During that period, his method of teaching GIS did not change due to the scarcity of resources. Mr Zondi reflected on his experiences as a geography teacher who enjoyed teaching geography, in particular paper one, however when it came to the teaching of GIS he experiences frustration because he does not have a clear understanding of certain concepts although he had been teaching for seven years. Mr Sokhulu has been teaching geography for ten years; he is a responsible teacher who loves

his work and works hard to get better results in geography. His teaching of GIS has challenges, starting from resource scarcity, along with the content being difficult to understand, and lack of communication between the Department and teachers

- **Creating group understanding of GIS**

The aim of this study is to transform teachers' daily practices. Teachers should have an ability to reflect on three levels: practical reflection; technical reflection; and critical reflection. For the benefit of this study it was therefore important for the teachers to have a clear understanding of GIS. Teachers may understand content of GIS, however, when teachers do not reflect on their own teaching, they will not be able to apply appropriate teaching strategies in their classrooms. Group understanding was based on understanding the following table that was drawn using the ten concepts of the curricular spider web by Van den Akker (2009). I started by giving the teachers an understanding of performance curriculum, with its expectations which are based on delivering the content, with time becoming the key factor for teaching and learning. At this level, I also issued handout to the four geography teachers and explained to them each of the ten concepts. Then in preparation for phase two, teachers worked as a group to prepare a lesson plan that was to be taught by them in grade 11, in order to observe their transformation.

After teachers were aware of the curricular spider web concepts, teachers were to be given a reflective activity to answer. Teachers again were given three days to finish the questionnaires; after three days I collected the questionnaires, I analysed them, and on my analysis I noticed that teachers improved from the previous reflective activity. Almost all teachers embraced the ten concepts of curricular spider web in their responses. This suggests that geography teachers were transformed and social change did take place in this study. For example, teachers were enabled to show an understanding of defining their rationale for teaching GIS in grade 11 and also defining their goals for teaching GIS. After the reflective activity we then moved to step two, one-on-one semi-structured interviews and at this level, all four teachers showed a clear understanding of the curricular spider web concepts and further, teachers understood the demands of CAPS. For example, some teachers asked why it important to consider accessibility, particularly culture. This suggests that teachers were considering factors that they were not aware of, and beginning to question the new information. Teachers further showed an understanding of CAPS, and not only on the concepts of curricular spider web. For example, teachers were aware that CAPS is a performance curriculum, hence it is content-driven and time is an important factor that drives the curriculum. After step two, we then moved to step three which was based on focus

group discussion; at this step, teachers reflected as a group on what transpired during step two. Teachers displayed a clear understanding of the curricular spider web by embracing all the concepts of curricular spider web in their lesson planning. This was due to the teachers' development that was done in step two in both phase one and two. The results of these two phases showed improvement in the teachers' practices in order to develop new thinking and knowledge, as Elliot (1991) described as the main aim for action research. Teachers were able to teach GIS using the new knowledge they received during the action research.

3.4. Sampling

According to Cohen et al. (2011), sampling is an important element of the research. Sampling should take place during the planning stage of the research project. The researcher should be aware of the following factors when sampling: time, expenses and accessibility. Often these factors prevent the researcher from generating sufficient information from the intended population. It is therefore vital to use a small group of the population and information or knowledge gained could possibly represent the larger population; however, this depends on the framing of the study. Cohen and Holliday (1996) identify the two major sampling. The first is probability sampling or random sampling, whereby the focus is on the wider population with equal chance given; the second is non-probability sampling, also known as purposive sampling, whereby the focus is on a few members of the wider population, and some are excluded. For this study I used purposive sampling and convenience sampling. Convenience sampling falls under non-probability sampling.

3.4.1 Purposive sampling

In this study I used purposive and convenience sampling. According to Cohen et al. (2007), purposive sampling is a characteristic of qualitative research, whereby the researcher decides on the cases to be incorporated on the sample based on the judgement of typicality for the study. By so doing, the researcher is able to build a satisfactory sample that will produce specific results. A purposive sample is chosen for specific purpose, as the name suggests. Cohen, et al. (2011) state that, in purposive sampling, the researcher makes specific choices about participants and that it is usually convenient to the researcher. Cohen, et al. (2011) further states that purposive sampling is used to get access to the 'knowledgeable people' meaning those people who have more, or in-depth, knowledge about the research topic. According to Maree (2007), purposive sampling is the manner in which the participants are selected because of the same defining characteristics that make them holders of the data for the study and also involves smaller sample size. Fraenkel and Wallen (2003) state that in purposive sampling, it is the choice of the researcher to judge whether the sample groups of participants are

sufficient to provide the required information. For this study, I purposefully chose four geography teachers who are teaching in two different schools. The following table illustrates the population used as the sample in this study.

Participant details

Participants	Age	Teaching experience (years)	Subject taught	Phase/Grade	Gender	Qualification	Race
Mr Hlophe	26	4	Geography	10-12	M	M+5	African
Mr Phungula	28	5	Geography	10-12	M	M+5	African
Mr Zondi	46	20	Geography	10-12	M	M+3	African
Mr Sokhulu	33	8	Geography	10-12	M	M+4	African

Table 3.1

3.4.2 Convenience sampling

According to Cohen et al. (2007), convenience sampling is sometimes called accidental or opportunity sampling. Convenience sampling refers to choosing of the participants on the basis that they are near and are available for the task. I chose the four participants because it was convenient for me as a researcher, as the school I used is close by my place of work. The aim of convenience sampling is to focus on the identified group, and not to generalise the result to the wider population. Although this sample is convenient to the researcher, it also can be biased. For me as a researcher, I used direct quotes when analysing the data to attempt to avoid bias, along with the use of literature to guide my results. For this study I chose grade 11 because they were the most relevant learners, since I taught them during weekends when assisting my colleague; in this way I had easy access to them. According to Janson (2002), at times we use convenience sampling as a derogatory term when conducting a study to describe those people that are easily available. Jansen (2002) further states that convenience sampling can be used to generate validity and reliability when it is well documented.

3.4.3 Finding participants

This study is an action research, meaning the aim is to emancipate or assist teachers to improve on their daily practice; this is important to me as a researcher and also to my role as a geography teacher. It was therefore important that participants were selected according to their willingness to participate,

because, at the end of the research, the teachers will be empowered. I identified these four teachers as my participants directly from their schools. The first teacher is a male who was interested in understanding what the action research is all about, since he is currently doing a master's degree in education (leadership); when I introduced myself to him and my research project it was easy to understand one another. With the second, third and fourth participants, we knew each other, as we had met geography moderations, workshops and sometimes in union activities.

The challenge that I experienced is that Mr Xulu did not avail himself to be the part of the discussion yet he agreed and signed the consent letter. When I went to his school for the first time with the aim of collecting data, he disappeared from school. I arrived just before break time so that we would have been able to get time for discussion but he was nowhere to be found. I tried to call him his phone was off. Immediately after we were done teaching, he was back at school. When I asked him to provide the best date suitable for him to be the part of the study, he cited two tests that were going to be written by his learners, and he even went back to asking what is this research about. I then had to explain to him again and ensure him confidentiality. The reluctance of Mr Xulu meant that phase one of the data collection lacked one participant. In preparation for phase two, I phoned all the participants to remind them about our meeting, however Mr Xulu, again, was not available. I then concluded that he was not willing to be the part of this research project. This suggests that he was afraid to know how to teach GIS or he was not willing to change at all. I decided to replace this participant with another teacher from another school who was available to be the part of this study.

The newly appointed participant was to fill the role of Mr Xulu. Mr Phungula geography teacher at Celumusa High School. Mr Phungula and I are friends and we went to University together; we both majored in geography and we both teach geography at schools. He is also doing master's degree in education (gender studies). We used to invite one another for team teaching during holidays. In our teaching we shared some similar concerns about GIS. Mr Zondi, Mr Sokhulu and I normal meet in cluster moderations, and I did not know them as well as Mr Hlophe, and our discussions took about three weeks

3.5 Data generation methods

As the researcher, I used a triangulation method to generate data because I aimed at generating a high level of trustworthiness in the study. Cohen (2000) describes triangulation as the use of various methods, sources, and people when collecting data. I applied triangulation using a reflective activity, semi-structured interviews and a focused group discussion. Data were generated in two phases. Phase

one was about finding teachers' understanding of GIS, whereby I used open-ended questionnaires for teachers to respond. This was done during the third week of the third term. Phase two of generating data was based on individual semi-structured interviews, which were done to promote a probing of the teachers' reflection of teaching GIS that had developed during open-ended questions. This was done in the fourth week of the third term, to avoid the fourth term which is stressful, hectic and very short to conduct a research project of this nature. The following are three methods of data generation discussed in detailed.

3.5.1 Reflective activity (Open-ended questionnaire)

Blarkie (2007) describes a reflective activity as involving open-ended questions that allow the respondents to use their own words to answer. Hall (1996) states that reflective activities are emancipatory because they are based on construction knowledge, using authentic data to reflect on the experiences of the participants, and it upholds principles of democracy between the participants. Questionnaires were constructed using the objectives of the study and the curricular spider web as a framework of the study. The advantages of open-ended questionnaires are that the participants are able to respond as much as they wish and they are suitable to investigate complex issues in which simple answers cannot be provided (Cohen et al. 2007). However, the disadvantages of questionnaires are that the respondent may overlook instruction as they are occupied with the demand to write. Furthermore, to complete a questionnaire takes more time than to place a tick in a rating scale box (Cohen et al 2007). At this stage, I started by giving each participant an opportunity of telling a story about their experiences of teaching GIS. This was done to explore teachers' understanding of teaching GIS. Thereafter I used questionnaires, and I made sure that the questionnaires were short and were written in plain or simple English to avoid a misinterpretation of the questions. Questions were framed by the following concepts from the table adopted from the work of Van de Akker's (2009) concepts of curricular spider web.

Reflective activity questions based on curricular spider web and mapping of answers

Concepts	Questions	Answers should embrace the following Propositions:
Rationale	Why are we teaching GIS?	Personal reasons (pedagogical) Content reasons (studies) Societal reasons (beneficial)
Goals	Towards which goals are we	Aims

	teaching GIS?	Objectives Outcomes
Content	What are we teaching?	Subject knowledge
Teaching activities	Which activities are we using to teach GIS?	Formal activities Informal activities
Teacher role	How are we facilitating teaching?	Instructor Facilitator Assessor
Material and resources	With what are we teaching?	Hard-ware resources Soft-ware resources Ideological-ware resources
Learning environment	Where are we teaching?	Teaching space
Time	When are we teaching GIS?	Teaching hours
Assessment	How are we assessing GIS?	Assessment for learning Assessment of learning Assessment as learning
Accessibility	Who are teaching GIS?	Physical access Financial access Cultural access

Table 3.2

Below are the questions that the teacher's engaged with, along with ideas of expected answers that they might have given.

Why are you teaching GIS?

The above question aimed at teachers giving answers or responses that would engage with the three questions mentioned above. Teachers are also expected to use CAPS as a frame of reference, as it is the current performance curriculum taught in South Africa. For instance, for personal reasons, teachers are teaching GIS because they are passionate about GIS; for content reasons, teachers are teaching GIS because GIS is in the Department of Education policy, and as a result it became part of their job to teach GIS; for societal reasons, teachers are teaching GIS because of the need from the community,

and teachers are expected to respond based on a relationship between the community and their teaching of GIS. The data collected should speak to these three propositions.

To what which goals are you teaching GIS?

From the above question, teachers should show an understanding of each and every lesson they teach, and plan to teach, is determined by the aims, objectives and learning outcomes. The aims are broad general statements that are based on the content to be taught (Kenned et al. 2006). For instance, the aim for teaching GIS is to promote the use of technologies. The objectives are a specific statement of teaching intention. Teachers should display an understanding of CAPS objectives as they are discussed as specific aims. Outcomes need to be known by learners, and are able to demonstrate or to show an understanding of the content. Teachers should display an understanding that with CAPS, outcomes are described as specific skills, particularly the skills that learners should acquire with regard to GIS, whereby learners are expected to gather, organise and evaluate information.

What are you teaching?

Teachers should display an understanding of the micro-level of the curriculum. Subject knowledge can be measured through the use of the relevant prescribed books, covering of the relevant topics, and explained with logic in which learners can easily understand. With CAPS, grade 11, GIS is structured according to these sub-topics: spatially referenced data; spatial and spectral resolution; and different types of data: line, point, area and attribute, raster and vector data. The application of GIS to all relevant topics in the grade also involves the capturing of different types of data from existing maps, photographs, fieldwork or other records, on tracing paper.

Which activities are you using to teach GIS?

Teachers should be able to distinguish between formal and informal activities. Informal activities focus on the teacher and learners, and is done during the teaching and learning process to measure learners' progress. An example of informal tasks are classwork, homework, class discussion and demonstration. Formal activities are done at the end of the teaching and learning programme to measure whether the desired outcomes have been met. These include controlled tests, examinations, projects and continuous assessment

How are you facilitating teaching?

Teacher should display an understanding of the teacher's role as an instructor, facilitator, and as the assessor. When the teacher uses a teacher centred-approach, he or she gives instructions to learners,

and learners become passively involved in their learning. In CAPS, teachers are expected to play the role of the instructor, rather than a facilitator, since CAPS is content driven approach. When the teacher uses a learner-centred approach, he or she facilitates in class, and learners become actively involved in their learning, while the teacher becomes more passively involve. With NCS, the learner-centred approach was relevant because it was based on outcomes; learners were expected to know something at the end of each lesson. With the teacher as assessor, teacher needs to show understanding of the content and use relevant tasks, activities, and classwork to assess the learners.

With what are you teaching?

Teachers should display understanding of three forms of resources they use when teaching GIS. These include hard-ware resources, which are the tools used to teach GIS, for example computers, projectors, and printers. Soft-ware resources include material used with the hard-ware to display information. Ideological-ware resources, Khoza (2013a), defines as anything that we cannot see or touch in our teaching, for example teaching methods and strategies used by teachers to teach GIS

Where are you teaching?

Teachers are expected to describe the teaching space they are using to teach GIS. The teaching space includes the classroom and the laboratory.

When are you teaching GIS?

Teachers should explain the times at which they are teaching GIS, including their timetable in relation to time provided by the CAPS document for GIS.

How are you assessing GIS?

Teachers need to display an understanding of formative and summative assessment. Formative assessment, which also refers to assessment for learning, is a method of assessment that focuses on frequent, interactive assessments of students' progress and understanding to identify learning needs and adjust teaching appropriately (Looney, 2005). An examples of this is the use of classwork, homework and tasks to monitor the progress of the learner. Summative assessment, which is also refers to assessment of learning, focuses on summarising the results of a student, and the results are produced at the end of term or year for certification purpose, for example controlled tests and examinations, including continuous assessment.

Who is teaching GIS?

Teachers should include the issues of physical access, for example, whether or not the teaching of GIS is accessible to learners. Financial access, financial constraints that may negatively affect the teaching of GIS, should be considered. An example of this is the shortage of funds from the government or the Department of Education or from the school to train teachers, and to purchase necessary teaching resources. Cultural access means any cultural factors that have an impact on the teaching of GIS.

After designing the reflective activity questions, I gave the questions to the four participants. These questions were administered twice for the purpose of ensuring honesty. Teachers were asked to respond professionally and with honesty. Teachers were given enough time to complete the questions – two weeks. At the beginning of the second week, I called all the four geography teachers reminding them to complete the questionnaires that were to be collected at the end of the week. This method of data collection was relevant to the study because teachers had enough time to respond on their own without any pressure or supervision. From the reflective activity I moved further to semi-structured interviews, as discussed below.

3.5.2 One-on-one semi-structured interviews

From the reflective activity I progressed to semi-structured interviews. Morse and Richards (2002) describe semi-structure interviews as similar to the interview, as it is characterised by open-ended questions that are prepared in advance together organised probes to elicit further information. According to Haralambos (1985), semi-structured interviews are seen as more appropriate for drawing out the attitudes and opinions of the participants. In this research, I wanted to understand the teachers' reflections of teaching Geographical Information System (GIS) at grade 11 CAPS. Kumar (2005) identified the strengths of using semi-structured interviews as a method of data generation. Kumar argues that the open-ended nature of the questions draw out in-depth information from the participants. For the benefit of this study it was necessary to use open-ended questions in order to explore teachers' reflection of teaching GIS. The advantage of this method means gives rich and appropriate data. Another point Kumar makes is that open-ended questions permit participants to answer freely. This means participants are not restricted in any form; questions are open for discussion with no specific information being required. Lastly, open-ended questions permit the researcher to be free when asking questions. This suggests that as the researcher, I was able to ask any question that is linked to the subject matter and also re-phrase the questions when necessary.

Kumar (2005) also identifies the weaknesses of using semi-structured interviews as the method of data generation. Firstly, the analysing of data from open-ended questions becomes difficult. This suggests that I must have a clear understanding of the content in order to arrange the data properly. Open-ended questions take more time because of the large amount of data produced; therefore I must have enough time to deal with the analysing of the data. Secondly, this method suffers from interpretational constraints; this means that at a particular point, the researcher might be bias when interpreting data due to the power relationship with the participants. In this study, I interviewed the participants, and requested that we were perceived to be on the same level, as we were all teachers based in high schools. I requested again that they respond objectively to the questions.

The semi-structured interviews questions were informed by guidelines from Hatch (2002, p.160). These guidelines shaped the interview questions. Firstly, interview questions should be open-ended. This allows free response from the participants, avoiding imposing direction. Secondly, the questions should be clear. This allows free communication with no barrier to the participants. Thirdly, questions should be in phrased in familiar language to participants. This is to avoid the misinterpretation of the question. Lastly, the phrasing of questions should respect the subject knowledge of the participant.

Interviews with participants were conducted using interview schedule. According to Bell (1993), a major advantage of the interview is its 'adaptability', where the interviewer could follow-up on ideas and probe responses which are beyond the limitation of a questionnaire. The probing of the responses enables the participants to clarify and develop their responses, whereas in a questionnaire the responses have been taken at 'face value'. Prompting and clues are used to encourage participants to elaborate further. These interviews took 30-45 minutes with each participant. The first interview of the action research cycle was done on the 20th of July, 2015 with the four geography teachers. The interview focused on teachers' reflection of teaching GIS. Similar to the reflective activity, questions were also used in the semi-structured interviews. I audio-taped the first interview process and transcribed them, then I moved further to the second interview. I conducted the second interview of the action research cycle on the 27th of July, 2015. I also audio-taped the second interview and thereafter I transcribed it. These interviews took place at Zikhalizakho High School after school hours, with the aim of not disturbing the activities of the school. From the semi-structured interviews, I moved further to focus on group discussion as described below.

3.5.3 Focus group discussion

According to Cohen et al. (2011) focus group discussion encourages group members to become more active, with the researcher facilitating group discussion. In a qualitative research, group discussion is one of the useful methods of generating data. Watts and Ebbutt (1987) identify the strengths of group discussion. Firstly, they state that the researcher is able to identify participants that have the potential for discussion. By using focus group discussion, I also intended to minimise participants that may withdraw from this study because I was able to identify those that are more interested in, and committed to, the study. Secondly, I was able to facilitate discussion; when a group of people works together, it is likely that they share the same experiences. A concern of an individual becomes known by the rest of the group, and subject is then discussed by the group which generates more data than individual interviews. Generating more data enabled me as a researcher to gain insight into the individual interviews. Lastly, focus group interviews are time saving and for this study I made two sessions of group interviews that lasted about two hours in each session that give us four hours in total.

Watts and Ebbutt (1987) identify the weaknesses of group discussion that I considered in this study. Firstly, focus group interviews may result in 'group thinking', whereby participants' opinions are altered to match those of the group. To overcome this challenge, I gave each participant in the group a chance to respond to the questions (Arksey & Knight, 1999). Secondly, sometimes group interviews take a long time. I had to monitor the time closely to make sure that we remain on track. The estimated time of these group discussions was two hours in each phase, and participants were audio-taped and then transcribed. The group discussion was planned to be conducted in the same school but due to time and the tight schedule of participants, we ended up changing the venue. The challenge was that the school was busy preparing for trial examination, therefore we had to make changes in order to avoid disturbance. Lastly, in group discussions, sometimes only one person dominates the discussion. The aim of this group discussion was to generate data from the whole group, and not the individual responses from the group. To curb that challenge, I allowed all four participants to respond to each question. In each method of data generation, I generated data twice, for the purpose of meeting the needs of action research and also to ensure the reliability of the study. During the focus group discussions, teachers sat together in order to reflect on GIS lessons, sharing their experiences, and as the researcher I set questions for the group based on curricula spider web concepts in order to drive discussion. Questions were similar to the questions used in the reflective activity and semi-structured interviews. In figure 3.2, I also stated the mapping of the expected answers. The following table describes the data generation plan.

Data generation plan

	Question one	Question two	Question three
Why I generate data?	What are the Grade 11 teachers' reflections of their teaching of Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the uMhlathuze Circuit?	Why do the Grade 11 teachers reflect in particular ways on the Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the uMhlathuze Circuit?	What lesson can be learnt from the Grade 11 teachers' reflections of their teaching of Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the uMhlathuze Circuit?
What are the research strategies?	Reflective activity.	One to one, semi-structured interviews.	Focus group discussion.
Who are the sources of data?	Four Grade 11 Geography teachers.	Four Grade 11 Geography teachers.	Four Grade 11 Geography teachers.
How many sources of data will be accessed?	Four Geography teachers during phase one (Reflective activity, semi-structured interview and focus group discussion). Four Geography teachers during phase two.	Four Geography teachers during phase one (Reflective activity, semi-structured interview and focus group discussion). Four Geography teachers during phase two.	Four Geography teachers during phase one (Reflective activity, semi-structured interview and focus group discussion). Four Geography teachers during phase two.
Where is the data generated?	Four Geography teachers are used to generate data, from two one grade 11 class: <ul style="list-style-type: none"> • Reflective activity • Semi-structured interview • Focus group discussion 	Four Geography teachers are used to generate data, from two one grade 11 class <ul style="list-style-type: none"> • Reflective activity • Semi-structured interview • Focus group discussion 	Four Geography teachers are used to generate data, from two one grade 11 class <ul style="list-style-type: none"> • Reflective activity • Semi-structured interview • Focus group discussion
How many times will be	Four Geography teachers during phase one (Reflective activity,	Four Geography teachers during phase one (Reflective activity,	Four Geography teachers during phase one (Reflective activity,

data be generated?	semi-structured interview and focus group discussion). Four Geography teachers during phase two	semi-structured interview and focus group discussion). Four Geography teachers during phase two	semi-structured interview and focus group discussion). Four Geography teachers during phase two
How is data being generated?	<ul style="list-style-type: none"> •Reflective activity •Semi-structured interview- using tape-record •Focus group discussion- using tape-record 	<ul style="list-style-type: none"> •Reflective activity •Semi-structured interview- using tape-record •Focus group discussion- using tape-record 	<ul style="list-style-type: none"> •Reflective activity •Semi-structured interview- using tape-record •Focus group discussion- using tape-record
Sound reasons of this plan fit for data collection:	<p>Open-ended questionnaires are used for the participants to respond as much as they wish. Semi-structured interviews are used draw out attitudes and opinions of the participants. Group discussion encourages group members to become active. Applying these three methods will enable me to understand teachers' reflections of teaching Geographical Information System (GIS) at grade 11 CAPS. A tape-recorder was used to then transcribe the participants' responses to ensure validity of the study.</p>	<p>Open-ended questionnaires are used for the participants to respond as much as they wish. Semi-structured interviews are used draw out attitudes and opinions of the participants. Group discussion encourages group members to become active. Applying these three methods will enable me to understand teachers' reflections of teaching Geographical Information System (GIS) at grade 11 CAPS. A tape-recorder was used to then transcribe the participants' responses to ensure validity of the study.</p>	<p>Open-ended questionnaires are used for the participants to respond as much as they wish. Semi-structured interviews are used draw out attitudes and opinions of the participants. Group discussion encourages group members to become activity. Applying these three methods will enable me to understand teachers' reflections of teaching Geographical Information System (GIS) at grade 11 CAPS. A tape-recorder was used to then transcribe the participants' responses to ensure validity of the study.</p>

Table 3.3

3.6 Data Analysis

Cohen et al. (2011) state that qualitative data analysis comprises of organising, accounting for and explaining, in other words making sense of data from the participants' definitions, and stating patterns, themes and categories. Cohen et al. (2011), further state that qualitative data is heavy to interpret, with many interpretations to be made, and qualitative data is further distinguished by merging data. Qualitative data is derived from interview, observations, audio and video and film. Cohen (2011) cautioned the researchers about the use of interviews, when considering the use of transcribes interview for data analysis. On the one hand they are accurate verbatim records, but on the other, transcription interviews omit non-verbal aspect and they are time consuming. In order for the data to be fit for the purpose, the researcher should able to describe, portray, summarise, interpret, discover patterns, generate themes, understand individuals and the group and particularly know how to raise issues.

This study adopted a guided analysis, which includes inductive and deductive reasoning. The inductive method help to categorise data into themes; the generated data was analysed according to De Vos's (2010) model which states that analysing data is a process of bringing up emergent themes and findings out of the generated data. In this study, themes were derived from the curricular spider web concepts, and were supported by the literature review conducted in this study. De Vos (2010) suggests that certain stages must be followed when analysing data. These include stating the procedure of keeping data; generating data and initial analyses; handling acquired information; documents review; creating classes; forms and subjects; recoding the information; trying the found understandings; coming up with other understandings and representations and putting together the data in a form of a report. The data was described, and compared with current literature and combined to determine the teachers' reflections of teaching GIS. The conceptual framework that was utilised is from the curricular spider web (Van den Akker, 2009); it was used to guide the research through all aspects of teaching and learning that were incorporated in order to formulate a conclusion about the topic.

Firstly, the reflective activity that was used as the first method of data collection to explore teachers understanding of reflections was analysed in order to identify themes; participants met twice at this level. Pictures of resources used by teachers in teaching GIS were taken and pictures of the geography classroom were taken to display the environment that teachers are working in; more importantly, to explore teachers understanding of GIS, different reasons for teachers' reflections were explored and lessons were drawn from teachers' reflection. Secondly, during the semi-structured interviews, data

was transcribed, analysed and categorised into themes using the concept of curricular spider web. Themes were compared to the literature and conclusions were drawn from there. Lastly, data from the group interview was mostly collected at a reflection level of the action research cycle. Data from the group interview was transcribed, analysed and categorised into themes. Participants met twice at this stage and when they were interviewed, I used audiotape for record keeping.

3.7 Ethical issues

According to Leedy and Ormrod (2005), whenever human beings are being investigated, the ethical implications need to be considered. Leedy and Ormrod (2005) pointed out four categories of ethical considerations that are important in a research project, and these include: protection from harm; informed consent; right to privacy; and honesty.

Protection from harm

Sarantakos (2005) identified three levels of harm that a participant may experience during the research. These levels are; physical harm, legal harm and mental harm. The four participants of this research project were not exposed to harm during the research project, as it was my obligation to protect all participants throughout the research equally. No risky events were taken throughout the research project.

Informed consent

To ensure this, participants were given letters of consent to sign. The consent letters stated the topic of the research project: teachers' reflection of teaching GIS in grade 11 CAPS. It also included the aim of the research which was to transform geography teachers, to enable them to practice reflection on their daily practices and to inform Department of Education about the findings. Participants were knowledgeable that their contribution was voluntary and they were free to withdraw at any time of the research. I also wrote a letter to the school principal requesting to do research in the selected school and permission was granted.

Further on ethical issues, I sent a letter for permission to conduct a research study in the selected high school to the Provincial Chief Director of the KwaZulu-Natal Department of Basic Education. Once more, in the letter, I stated the topic, the aim and the purpose of the research project. The letter of access into the school was received after several attempts; at first I sent a letter via email, and it was

ignored with no response being given to me. The second attempt, I went personally to the provincial office of the KwaZulu-Natal Department of Basic Education (DOBE) with a hard copy of my letter. Thereafter I waited for one week to receive the access letter. From the DOBE I went further by obtaining the letter from the University of KwaZulu-Natal; again there were challenges of not receiving ethical clearance on time. At first, my supervisor sent my proposal to the ethical clearance department which is at the Howard campus. After that I waited for several weeks, I then personally went to the ethics offices to query the letter. It was when that I found out that I had to clarify some of the issues in my proposal. I made the clarifications and sent it back. I then I waited about one week to get my ethical clearance.

Right to privacy

Participants were made aware of their right to privacy regarding their responses. I used pseudonyms; this was used to ensure the safety and identity of the participants. The outcomes of this study are used only for research purposes. The data collected during this study will be destroyed after minimum period of five years, as per the university rules on ethics.

Honesty with professional colleagues

The findings of this study were presented with honesty and professionalism. I used direct quotes where necessary to acknowledge the participants' words. For professional purposes, interviews and group discussions were done during suitable times that did not disturb the participants and their other school activities.

Access into the school

In preparation to conduct the research, I phoned all the four geography teachers in the school. I then phoned the school principal to explain my visit. When I got into the school, I first described the study to the school principal and then I asked the permission to have a conversation with the geography teachers. He then referred me to the Head of Department (HOD) and I went to the HOD's office and stated the study and the purpose of the study. From there I was given permission to have a conversation with the geography teachers. I described the topic, the purpose and data methods of this study to the teachers. All the teachers showed an interest in the study. I then wrote letters to the principal requesting written permission to conduct a study in his school; I also wrote consent letters for the geography teaches

3.8 Trustworthiness

Bassey (1999) used the concept of 'trustworthiness' which originated from the work of Lincoln and Guba (1985). This concept comprises of many questions that need to be asked in each stage of the research. Bassey (1999) identified, prolonged engagement with data, observation of imaging issues, checking of raw data, triangulation of data, and systematically matching the emerging issues with statements that have been analysed. A critical challenge is that the findings provide sufficient detail for research. Trustworthiness in a qualitative inquiry is used to support the argument that the findings are 'worth paying attention to'. According to Lincoln and Guba (1985), in a qualitative research project there are four issues of trustworthiness that need the attention of the researcher: credibility, transferability, dependability and conformability. The above four issues are discussed in detailed in the following paragraphs

1.8.1 Credibility

According to Flick (2006), credibility refers to the accurateness of the documentation, the reliability of the producer of the document, and the freedom of errors. Similarly, Shenton (2004) states that credibility is about ensuring that the instruments used to measure results are trustworthy and credible. To ensure credibility in this action research, I used more than one method of collecting data, which were reflective activity, group discussion and semi-structured interviews. Four participants were used in this study for the purpose of increasing credibility. During the group discussion and semi-structured interviews, the same questions were used to ensure that the participants understood the questions and I was therefore able to compare responses. Furthermore, to ensure credibility of this study, I underwent several stages, including confirming that I am the registered student at UKZN, and writing the proposal that was approved by my supervisor; I then defended my proposal, the proposal was submitted for ethical clearance, and each chapter was submitted to my supervisor for his input several times. I finally produced a complete document. The document was submitted through Turnitin to check the level of plagiarism, and from there the document was submitted to an editor for spelling and grammar checks. Finally, the document was submitted to two external examiners for final examination.

3.8.2. Transferability

According to Cohen et al. (2002), transferability is the degree to which results of the search can be generalised to a wide-ranging population. This study is embedded in the critical paradigm. According to Cohen, Manion and Morrison (2007), the critical paradigm is a paradigm that is based on the equality

and democracy of society, and does not merely give an account of the behaviour of society. Its aims are to emancipate and to redress inequality and promote freedom in society. The data presented in this study is not stagnant, and it may change as the context changes and also from teacher to teacher. Therefore the findings from the teachers' reflections of teaching GIS can be transferable to other contexts and from teacher to teacher. However, for the study to be able to be transferred, teachers must apply the concepts of the curricular spider-web when teaching GIS, and furthermore, teachers must use the CAPS document when teaching GIS.

3.8.3 Dependability

According to Shenton, dependability (2004, p. 71) is the extent to which a piece of work can obtain similar results if the work was repeated in the same context with the same methods. Shelton suggests that the researcher should use an 'overlapping method' in order to ensure dependability. To ensure dependability in this study, I described the stages that gave the results of this study for the next researchers to find similar results. I used three methods of data collection, namely reflective activity, group discussion and semi-structured interviews. These three methods measured same results, and this suggest that findings are reliable. Data generated was organised into common themes to further ensure reliability of the findings.

This study was conducted into two phases. In the first phase teachers reflected without being told anything about the curricular spider-web; this was done to check what the teachers understood about the concepts of curricular spider web. At this stage I used a reflexive activity and one-on-one semi-structured interviews. I then went on to the second phase, using the very same concepts of the curricular spider-web. This stage focused on identifying the gaps in order to close those gaps through a focus group discussion. I used a tape recorder as the instrument of collecting data; I transcribed data then I take took the transcribed data to the participants (4 geography teachers) to confirm that the data and what I transcribed was true and reflected what was said during phase one and two. Participants were further consulted to confirm findings to ensure the dependability of the results through the use of the reflective activity, one-on-one semi-structured interview and the focus group discussion. I then use direct quotations to present my findings in order to avoid being biased and to provide solid evidence of the findings. With these processes I believe dependability was achieved.

3.8.4 Conformability

According to Shenton (2004), conformability is the concern of the researcher in a qualitative study, particularly around the objectivity of the study. Shenton (2004) says that the results of the study must be based on the experiences and ideas of the participants, instead of the predilection of the researcher. I tried to eradicate any act of biasness in the study; I went through the generated data, reflecting several times just to insure that I was not biased in any form. This was achieved through the use of the same questions to all four participants and to all three methods of data generation (reflective activity, one-on-one semi-structured interview and focus group discussion). I used a tape recorder to confirm the data generated; I confirmed the data with the four participants.

3.9 Limitation of data

Data was limited by time frame; data was collected during a period of a month and covered two cycles of action research cycle. If there was more time to do research, there would have been more observable outcomes. In the first action research, teacher B was not present, and the present teachers had little idea of what was happening with the research. In the second phase, I replaced teacher B, and then the new teacher B had to be taught first before he became part of this action research project. However in the second cycle, the teachers had an understanding of what did, where we were lacking and where we needed to improve. I felt that we needed more time since we were not used to reflection of our own teaching, particularly with GIS where teachers face many challenges.

3.10 Conclusion

This chapter discussed the research design and methodology of the study, which includes: the context in which this study was conducted; accessing the participants, and their role in this study; and the action research cycle adopted from the work of Kemmis (1994). There were three methods of data collection (reflective activity, group interviews and semi-structured interviews), and these were discussed along with the instruments used, and their purpose. The following chapter focuses on data analysis generated using the action research cycle.

CHAPTER FOUR

RESEACH FINDINGS AND DISCUSSION

4.1 INTRODUCTION

This chapter presents and discusses the generated data. Data was generated through the reflective activity, semi-structured interviews and group discussion. The data was obtained in order to answer the following critical questions:

1. What are the Grade 11 teachers' reflections on their teaching of the Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school of uMhlathuze Circuit?
2. Why do the Grade 11 teachers reflect in particular ways on the Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school of uMhlathuze Circuit?
3. What lessons can be learnt from the Grade 11 teachers' reflections on their teaching of the Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school of uMhlathuze Circuit?

4.2 Data presentation and discussion

The data that I discuss first is data generated from the reflective activity; this was administered through open questions. The aim of reflective activity was allowing geography teachers to use their own words to answer open-ended questionnaires. Secondly, data from semi-structured interviews aimed at drawing lessons for teachers from their reflections. Lastly, group interviews, aimed at identifying various reasons for teachers to reflect in particular ways through group discussion; teachers were also enabled to share their ideas and experiences. Themes are originated from the table below (figure 4.1) which constitutes the ten concepts of the curricular spider web. Before presenting data, I firstly state the experiences of each geography teacher.

4.2.1 Experiences of Mr Hlophe (fictitious name) of teaching GIS

"I have been teaching for about four years now, I started teaching GIS this year. In previous years I was teaching Social science in grade 8 and 9. It is my first time teaching GIS in the FET. However I am a dedicated teacher, hardworking teacher, I am a teacher who is always in class at all the time. When I

am expected to be in class I go to class no matter how big my working is, for example sitting in the staffroom doing marking or other things at the expense of learners, I don't do that. Regarding GIS is not easy to teach it in our schools, since we are focusing on the theory part of GIS neglecting the practical part of GIS, due to circumstances such as the shortage of resources like computers. However I try to explain to learners using practical examples, although in some cases I failed to improvise because GIS requires practicality, what I am teaching the learner must be able to apply it using necessary resource”

4.2.2 Experiences of Mr Phungula (fictitious name) of teaching GIS

“For me teaching GIS is very difficult, reason being is that we don't have resources for teaching GIS. As we understand that to teach GIS we need to use computers that not permit us to teach GIS effectively, because we are lacking in terms of computers, that make it difficult to teach GIS in our schools. However I engage my learners with the use of maps in relation to GIS, so I noticed that this make them to easily understand the concepts of GIS, because when they are relating maps and GIS, GIS has to do with things that are found in the map, so when collaborating maps with GIS that make it automatically simple for learners to understand the concepts. Further I am equipped with knowledge of the subject, that make me to be different from other teachers, because I know all the concepts that are found in GIS, that make it easy for me to even explain to learners. That is the only thing I am doing, because we do not have computers, if they were computers I was going to engage learners to the laboratory”

4.2.3 Experiences of Mr Zondi (fictitious name) of teaching GIS

“I am a geography teacher who enjoy teaching geography particular paper one. However when coming to the teaching of GIS I experiences frustration because I do not have fully understanding of certain concepts although I had been teaching for many years. In 2006 we attended several workshops about GIS but those workshops were not helpful to me because it was the last I attended GIS workshop. I think the department was work shopping us because they were introducing this chapter after that you are alone. None than that I think I am hard working teacher, who always seek for assistance when facing challenge. Ever since I started teaching I always get 100%, not even a single year I got less”

4.2.4 Experiences of Mr Sokhulu (fictitious name) of teaching GIS

Mr Sokhulu has been teaching geography for eight years, he is a responsible teacher, loving his work and working hard to get better results in geography. His teaching of GIS has challenges, starting from resource scarcity; it is also difficult content to understand and there is a lack of communication between the Department and teachers.

“If we can get regular workshops not only for GIS for geography as a whole we can produce far better results, since I started teaching in 2007 I don’t remember myself attending any workshop regarding GIS. Other than that I think geography is enjoyable to teach and far better if you move with your learners as from grade eight to twelve” (Participant D, 2015)

4.3 Themes, question per theme, categories of responses and levels of reflection

Concepts	Questions	Categories of response	Levels of reflection
Rationale	Why are you teaching GIS?	Personal reason (pedagogical) Societal reason (beneficial) Content reason (studies)	Technical level Practical level Critical level
Goals	To wards which goals are you teaching GIS	Aims Objectives Outcomes	Technical level Practical level Critical level
Content	What are you teaching?	Subject knowledge	Technical level Practical level Critical level
Teaching activities	How are you teaching GIS?	Formal activities Informal activities	Technical level Practical level Critical level
Teacher role	How do you facilitate learning of GIS?	Instructor Facilitator Manager Assessor	Technical level Practical level Critical level
Material and resources	With what are you teaching?	Hard-ware resources Soft-ware resources Ideological-ware resources	Technical level Practical level Critical level
Learning environment	Where are you teaching GIS?	Teaching space	Technical level Practical level Critical level
Time	When are you teaching GIS	Teaching hours	Technical level Practical level Critical level
Assessment	How do you assess learning of GIS?	Assessment for learning Assessment of learning Assessment as learning	Technical level Practical level Critical level
Accessibility	With whom are you teaching GIS?	Physical access Financial access Cultural access	Technical level Practical level Critical level

Figure 4.1

4.3.1 Why are you teaching GIS?

○ Theme one: Rationale

During phase one of reflective activity using the concepts of curricular spider web, the first concept participants had to respond on was rationale which consists of personal, societal and content. The finding from the participants indicates that teachers are teaching GIS because it is stipulated in the geography curriculum. The four participants reflected only on content rationale. The following are direct quotes from the four participants with regard to the rationale of teaching GIS. Mr Hlophe says: "I teach GIS because is stipulated on the department of education policy document as part of geography, if is not in the content of geography I wouldn't be teaching GIS but for now I feel obligated to teach GIS". Mr Phungula states that: "we are teaching GIS in order to engage learners to technology (computers) in relation to geographic information". Mr Zondi says that: "It is within the curriculum of grade 11 therefore I must teach it as a teacher". Mr Sokhulu described his view by saying: "if I am not teaching GIS I will be violation the policy of the department".

The above four quotes from the four geography teachers suggests that they are teaching GIS for content rationale, as it mandatory to teach GIS, due to the department policy, not because there is a personal or societal rationale behind the teaching of GIS. This suggest that during phase one of the reflective activity, the four participants were not aware of the rationale for teaching GIS, since the three propositions of the rationale under the curricular spider web were not all embraced by participants.

During phase two of the reflective activity, the participants were able to embrace the rationale of teaching GIS using three propositions (personal, content and societal rationale). Mr Hlophe states that "I have done a four-year degree in Education, where I specialised in geography and further I have Honours degree when I was doing curriculum studies" (content rationale). Similarly, Mr Phungula says: "I have acquired bachelor degree in education specialising in geography then I have done honours degree in leadership" (content rationale). Mr Zondi says: "I teach GIS because is one of the geography chapters that I love and enjoy, GIS save time, although we do not have enough resource[s]" (Personal rationale). Mr Phungula states that "I teach the Information that is stored in a computer that helps learners to better understand places without actually being there, learners should knowledge of different places... on top of that communities and society is changing to technology maybe due to globalisation that is taking place around the world therefore GIS fit correctly to the needs of the world" (Societal rationale). During the phase two participants showed improvement by responding to three

categories of the rationale (personal/ pedagogical, societal/ beneficial and content/studies rationale); this suggests that teachers changed from phase one to phase two, and social change took place.

The above discussion indicates that during phase one, the participants taught GIS on the basis of the performance curriculum (CAPS), together with competence curriculum (NCS). In the performance curriculum, teachers focus on prescribed documents and no other means of teaching they can explore, beyond what is stipulated. This is in relation to the direct quotes from Mr Hlophe, Mr Phungula, Mr Zondi and Mr Sokhulu, during phase one of the teachers' response. This suggests that teachers were reflecting at a technical level during phase one. Competence was shown by teachers during phase two of action research whereby teachers included what the benefits of teaching GIS to learners was. The world is changing due to technology, therefore teachers must teach what is relevant to learners and that will help them to meet the needs of the world. During phase two, participants reflected on a critical and practical level of reflection, and all three categories of the rationale in reflective activity were covered by teachers at the end of research.

4.3.2 Towards what goals are you teaching GIS?

Theme two: Goals

During phase one of the reflective activity using concepts of curricular spider web, the second concept participants had to respond to was on the goals for teaching GIS; goals have three proposition aims, objectives and learning outcomes. The findings indicate that the participants responded only on the objectives of GIS. All four participants did not reflect on the aims and learning outcomes for teaching GIS. The following are direct quotes from the four geography teachers, with regard to the goals of teaching GIS. Mr Hlophe: "before I respond to the question, allow me to ask this one first, what is the different between aims, objectives and learning outcomes?" Mr Phungula says "the main goal of teaching GIS is to make learners understand geographic concepts with the use of modern technology (computers)" Mr Zondi and Mr Sokhulu were in line with Mr Phungula, whereby they define goals for teaching GIS as the way of exposing learners to technology.

However, during phase two of reflective activity, the four participants responded showing improvement on their reflection, even though the participants were not able to distinguish aim from objectives and learning outcomes. This can be evidenced from the these direct quotes regarding the objectives, aims and learning outcomes of teaching GIS during phase two of the reflection cycle. Mr Hlophe: "I teach

them so that they will be able to organise geographical information and be able to use it in real context” (learning outcomes). Mr Zondi states that:

“In my teaching I make a point that I use something learners are familiar with, for instance when I want them to define GIS concepts with understanding such as ‘computer system’, [aims] I use radio system as an example as to no speaker or amplifier can work on its own they need one another so that the goal of producing sound will be achieved” [objectives].

During phase one of teachers’ reflections on the reflective activity, teachers were to respond on the goal of teaching GIS which has three categories: aims, objectives and learning outcomes. The participants at this phase responded on a technical reflection, technical level is speaking to reflection base on aims and objectives. Kennedy, Hyland and Ryan (2006) define aims as broad general statements of teaching purpose, whereby a teacher indicates what to cover in the process of learning; objectives are defined as a specific statement of teaching intention about specific areas that need to be covered and are identified in the process of learning (Kennedy, Hyland and Ryan 2006). CAPS objectives are discussed as specific aims (Kennedy, Hyland and Ryan 2006). Further added to the learning outcomes, Gosling and Moon (2001) describe learning outcomes as statements of expectation on what a learner should know, understand and able to do at the end of the lesson.

The findings from phase one indicate that teachers are using aims and objectives that are defined in the intended curriculum (CAPS) and these aims and objective do not speak to the content and context of teaching GIS, hence teachers find themselves struggling to cope with the demands of the intended curriculum (CAPS). This suggests that teachers lack an understanding of the concepts of the curricular spider web; these concepts assist teachers to better implement the intended curriculum. Jansen (2006) states that in order for the curriculum to be effective, teachers should ask them first the purpose of the knowledge they are teaching, and not just transmit knowledge to learners; teachers should define the skills they are developing in learners.

4.2.3 What content are you teaching in?

Theme three: Content

During phase one of the reflective activity, the third concept of curricular spider web, participants had to respond to subject knowledge. Mr Hlophe responded that “I teach the theory of GIS where I explain the development of GIS”. Mr Phungula and Mr Zondi have the same understanding: “I teach GIS concepts of GIS, the use of GIS and so on” (Mr Zondi). Mr Sokhulu says that “we are teaching paper-based GIS, not the actual GIS that require computers”.

During phase two, Mr Hlophe responded that: “in GIS I teach GIS concepts, such as spatially referenced data, spatial and spectral resolution, raster and vector data”. Mr Phungula said “I am teaching geographical information system that has to apply having in mind that we have computers; maps are used to explain concepts of GIS. Mr Zondi says “lot of concepts involved in GIS these includes raster data, vector data and types of data: line point and polygon types of resolution. Mr Sokhulu had a similar understanding of teaching GIS concepts.

During phase one reflections, the three teachers reflected on paper-based GIS, rather than the actual content that they teach in GIS grade 11. Mr Hlophe reflected on the content of GIS that is covered by CAPS in grade 10, yet our focus was specifically on grade 11. During this first phase, teachers did not respond on certain concepts that are taught in grade 11 GIS. This is similarly to the study conducted by Halemesa (2007) on the use of GIS in South Africa schools, which concluded that more than half of the geography teachers lack an understanding of GIS and teachers are not aware of using GIS in geography lessons. This suggests that teachers had no clear understanding of the content for teaching GIS in grade 11. It was then necessary to teach teachers about the concepts of the curricular spider web.

During phase two, the four participants showed a clear understanding of the content for teaching GIS. Teachers reflected on the subtopics that compose GIS in grade 11 CAPS such as different types of data. Also teachers showed an understanding of the link between the GIS for grade 10 and 11. According to CAPS policy document (2011), teachers are expected to understand and teach the following concepts for geography GIS in grade 11: spatially referenced data, spatial and spectral resolution, different types of data: line, point, area and attribute, raster and vector data, application of GIS to all relevant topics in the grade and capturing different types of data from existing maps, photographs, fieldwork or other records, on tracing paper. In the second phase of this data generation,

findings corroborate with Khoza (2015), which confirmed that all the participants were able to interpret the content and time with regard to CAPS.

Msibi and Mchunu (2013) pointed out that CAPS is content-driven, meaning that detailed content provided for teachers. Regarding the content in phase one, teachers displayed that they did not consider the content that is stipulated in the CAPS books. In the same breath, Msibi et al. (2003) state that the content set for teachers undermines teachers' content knowledge, while they are many African teachers who do not understand their content. This suggests that most teachers in our schools have little understanding of the content they are transmitting to learners. This further suggests that CAPS is not implemented accordingly, because teachers lack the content knowledge that must be mastered to achieve the performance curriculum which is content driven. Hoadley and Jansen (2013) describe the teacher as a scholar who must understand his or her subject. While Giroux (1988), describes teachers as intellectuals, who can make decisions in their work. These views suggest that teachers must be sources of knowledge and understand the content they are teaching in GIS CAPS. When teachers have an understanding of content, they will be able to undergo these three levels of the curriculum: the planned curriculum, the implemented curriculum and the curriculum as achieved.

During the second phase, the four teachers reflected on the all subtopics that are taught in GIS grade 11 CAPS. The results of teachers' reflection at this phase suggests that teachers were transformed, moving from knowing GIS generally to the specific GIS content that is prescribe for grade 11. Msibi et al. (2013) pointed out that teachers fail to implement the curriculum because they lack the content knowledge, saying that teachers in rural and township schools were trained to be technicians instead of being trained to be innovative. This suggests that the majority of learners do not receive the necessary information as they should. This results in the failure of the curriculum, regardless of it structuring and time allocation as prescribed by CAPS. Msibi et al. (2013) view teachers as experts in their subjects, suggesting that teacher should demonstrate subject knowledge in order to have a successful implementation of the curriculum. This suggests that if teachers lack subject knowledge there is no chance of implementing the curriculum, which results in high levels of failure rates.

4.3.4 Which activities are you using to teach GIS?

Theme four: Teaching activities

During phase one of reflective activity using concepts of curricular spider web, the fourth concept participants have to respond on the teaching activities. Three out of the four participants responded on

the informal activities, one teacher included formal activities none reflected on the continuous activities. Mr Hlophe: "I use relevant tasks in the books, I used them, just to give learners more work so that they are able to practice". Mr Phungula: "I use classwork, class test and activities". Mr Zondi: "I give learners activities that are found in the CAPS books and tests to measure how much they have understand the content, tests that I set are mostly derived from class activities and home works". Mr Sokhulu: "I give them home works almost every day, teach for 45 minutes then 15 minutes is for the activity or task"

However, during the second phase all teachers reflected also on the formal activities and continuous assessment. Mr Hlophe: "I use classwork, projects which are used for grading at the end of the year". Mr Phungula "on top of home works and classwork I use controlled tests, these small piece of work assist learners at the end of the year because they form CASS, which comprises of 25%." Mr Zondi, "for the formal activities I am guided by the CASS grid that we received at the work shop at the beginning of the year, projects and tests are clearly stated by the grid". Mr Sokhulu: has the same idea as Mr Hlophe. This suggests that teachers were transformed in terms of understanding teaching activities. In the first phase, three teachers reflected only on the informal activities. The teachers initially understood that teaching activities were only about informal activities however, it also includes formal and continuous activities that are used for the grading of learners (CASS). Teachers seemed to know these categories (formal, informal and continuous activities) of teaching activities but they were not aware of them when they had to respond during phase one. This is so because teachers are using these teaching categories every day in their teaching.

During phase two, teachers used their geography grid that they received during geography workshop to identify formal activities and continuous activities; the grid assisted the teachers in identifying times for doing particular activities and using the appropriate marks to grade learners. This grid was a copy of the CAPS policy document for geography which means that for formal activities and continuous activities learners are using the prescribed CAPS document. This is in contrast to phase one on the informal activities, when the teachers used any activities that suited his lesson. Phase two suggests that the teachers have transformed or they have acquired more information on teaching activities. Phase one the reflection suggested that teachers reflected on the practical level of reflection, and did not reflect on the critical reflection, which was aimed at teachers reflecting on the continuous activities (CASS). Continuous activities are important too, because they are used to grade learners, and they contribute 25% at the end of the year, so when teachers have little clear understanding of continuous activity, this means learners have a high chance of failing, and vice versa.

Another point is that teachers dwell too much on the informal activities when teaching GIS during phase one, as informal activities are to be used by the teacher to check the level of understanding of the lesson taught. A reflective teacher may use this activity to judge his or her lesson. According to Donna (2005), an informal activity is the method of distributing information to learners which ensures greater responsibility of the learners. This suggests that teachers must give learners informal activities which form part of teaching strategies, distributing of content knowledge that will be assessed at the end of the year. Teaching activities suggest that teachers are implementing the curriculum properly (CAPS), however teachers should be aware of all categories of teaching activities. In the same breath, Louise et al (2015), state that teachers should make sure that teaching activity carries knowledge and skills that are outside the classroom situation and also teaching activities should be moveable out of the classroom. This suggests that geography teachers should use teaching activities that are linked to the real world; knowledge and skills of activities should not be confined in the classroom environment, rather they should speak to the demands of the world, and these may include technology, economics and so on.

4.3.5 How do you facilitating teaching of GIS?

Theme five: Teacher's role

During phase one of the reflective activity using the concepts of the curricular spider web, the fifth concept participants had to respond to was the teacher's role, which has three categories (teacher centred, learner centred and content approach). Mr Hlophe: "to facilitate teaching of GIS I personally make examples that explain terms of the topic (GIS) doing this help learner to understand better in the absence of resources". Mr Phungula: "It is hard to facilitate GIS, so I only use teacher-centred method whereby I am the only one talking and learners listen". Mr Zondi: "I don't have other alternatives of teaching GIS rather than standing in front of the learners talk and talk then give activities... I think that the only approach I have". Mr Sokhulu: "I use teacher-centred approach and learner-centred approach, but more dominating is teacher-centred because there is a lot that must be explained by the teacher when teaching GIS. Learners have little role to play on their learning because we do not have resources" At this level, three teachers reflected on the teacher-centred and learner-centred approach, and one teacher (Mr Hlophe) reflected on the content-centred approach.

However, during the phase two of reflection, teachers reflected on three categories with understanding. Mr Hlophe: "my role differs from time to time for instance all my lessons start from what learners know,

with GIS I use basic knowledge of maps skills, learners identifying geographical features then I take it from there” Mr Phungula: “my role is very huge in the classroom; I give learners instructions, assess learners and make sure that learners work is marked and moderated when necessary. Mr Zondi had the same understanding as Mr Hlophe and Mr Phungula. Mr Sokhulu: “I monitor, Facilitates, Manages, instruct, lead and be a parent figure to my learners.

The findings during phase one indicated that three teachers reflected on the practical level of reflection and one teacher reflected on the critical level of reflection. During phase one, teachers seemed to be confined into two categories, the teacher-centred and learner-centred approach, due to the lack of necessary teaching resources. The use of these categories suggests that teachers give instructions to learners without considering the curriculum needs; also teachers assess learners at any given time. This leaves a gap of the content taught to learners as these two approaches seem to demand the content approach. Content has been dealt with in the third theme, and this suggests that concepts of the curricular spider web are connected to each other and teachers must have clear understanding of them in order to implement the curriculum correctly.

During the phase two teachers reflected on the three categories of the teacher’s role including the content-centred approach. This suggests that teachers were transformed, since the three teachers moved from reflecting only on two categories which were technical and practical level to including a third category which was critical level. This means teachers were not aware of the third category as it was not included in the reflection. Kennedy, Hyland and Ryan (2006) say that the focus of the teacher is to show the content of the module or programme. This implies that teachers should have a clear understanding of the content-centred approach for them to execute the curriculum. Before teachers understand the aims of teaching, the content-centred approach should guide teachers, particularly when teachers are teaching performance curriculum (CAPS), where the curriculum is content-driven.

Further teachers use their logical reasoning to identify the teaching method they must use to teach the intended curriculum (CAPS). CAPS does not specify the approach teachers must use to teach GIS, hence teachers have no clear understanding of the teaching methods that are relevant to the teaching of GIS. The CAPS policy does not provides clear guidance to indicate the approach teachers should use when teaching GIS. The approach of teaching GIS is determined by the availability of necessary resources, and when teachers lack these resources, the curriculum will not be implemented accordingly.

4.3.6 With what are you teaching GIS?

Theme six: Resources for teaching GIS

During phase one of the reflective activity using the concepts of the curricular spider web, the sixth concept participants had to respond to were the resources for teaching GIS. Mr Hlophe: "I use textbooks and chalk, study guide and maps are available". Mr Phungula: "books, chalks and chalkboard are the only resources I am using in my school because there is only one computer in my school which is normally used by the school secretary... soft-ware such as Google, GPS and so on, I cannot explain to learners because they do not understand, they need it to be explained practically where they will be able to practice". Mr Zondi: "I use the available basic resources such as text books, sometimes even those text books are limited and learners are three in one book", chalkboard chalks and the very limited maps". Mr Sokhulu: "previous years I was also using school TV to teach with DVD but it was most for grade 12 because normally they are few in classroom". At this phase teachers reflected only on hard-ware and soft-ware.

However, during phase two, teachers also include ideological-ware in their reflection. Mr Hlophe: "when I teach GIS, I consider many things, resources I will be using, the classroom situation, outcome and objectives of my lesson assessment method I will be using". Mr Phungula "lesson start from me as the teachers, so I am the first resources that must be available to build understanding to learners, by delivering content that will be assessed at the end of the period. This automatically calls for me to be able to identify my aims and objectives" Mr Zondi "I use anything that will help me to convey the message or lesson to learners early, although it different when comes to GIS because I must be a resources first, and be able to interpret the complex concepts to learners. Other resources may be available but if I don't understand the concepts as a teacher it means they are no resources for teaching" Mr Sokhulu "Teaching of GIS involves creativity, like when am teaching about resolution, I use my cell phones; take different pictures with different cell phones. With resources in GIS it means I have to be a resources on my own thereafter I think of hard-ware and soft-ware"

Resources are categorised into three levels: hard-ware, soft-ware and ideological-ware (Khoza, 2012). The findings from phase one indicate that teachers reflected on the two categories of teaching resource; hard-ware and soft-ware. None of the teachers reflected on ideological-ware. This suggests that teachers were not aware of the ideological-ware during phase one. Teachers used hard-ware and soft-ware resources, since they responded that they used textbooks, maps, chalkboards etc. According to Chi-Chung, Lai and Wong (2009), some geography teachers have limited access to the hardware

that is suitable to teach GIS. Msibi et al. (2013) state that teachers in rural areas and township schools faced challenges of a shortage of resources. This suggests that even though teachers are reflecting on hard-ware resources, they still lack computers. Teachers also reflected on the use of DVDs (software), and indicated that there is an understanding of soft-ware such as Google and GPS however they do not have access to that soft-ware. Although teachers responded on the hard-ware resources, they further indicated that resources such as computers are lacking in their schools. Chi-Chung et al. (2009) state that in other schools it is likely that the hardware is available, but it is available for others subjects, and is not in the geography classroom. This suggests that teachers are not implementing the curriculum correctly because they do not have hard-ware resources, particularly for geography. Teachers' responses included the use of DVDs for teaching GIS, which suggests that teachers can use anything to teach their subjects as long as the aims, objectives and learning outcomes are achieved. Khoza (2012, p. 75) defines a resource as anything that facilitates or initiates learning or "any person or thing that communicates learning".

During phase two teachers embraced the concept of ideological-ware, whereby teachers reflected on learning outcomes and assessment levels as part of their teaching resources. This suggests that geography teachers were transformed; they have gained new understanding since they were not aware that they were not utilising resources that can be used to facilitate the learning process. According to Amory (2010), teaching and learning is not about technology only but is also about ideology. Johansson (2006) concurs with this statement by pointing out that providing schools with enough computers and other required resources does not automatically mean that the educational aims to incorporate technology into the curriculum are achieved. This suggests that teachers are important resources that must be equipped with sufficient subject knowledge in order to be successful in implementing curriculum.

4.3.7 Where and when are you teaching GIS?

Theme seven: Teaching environment and time

During phase one of the reflective activity using the concepts of curricular spider web, the seventh concept participants had to respond to was on the teaching environment and time of teaching GIS. Mr Hlophe "we are basically using learners' classroom to teach GIS. No other spaces we are using expect classrooms, teaching GIS can be anytime of the year however the department policy dictate when we are supposed to teach GIS". Mr Phungula "I am using classroom because is the only available teaching environment we teach GIS at any time, in most cases the school timetable determines the times, but what I have noticed is that I normally teach GIS after break" Mr Zondi and Mr Sokhulu have the same

understanding with Mr Hlophe and Mr Phungula. The findings indicates that teachers were not clear about the concepts of time, as in phase one they reflected on their personal timetable, and the times that were reflected in the policy document were not discuss in details. This suggests that teachers reflected on the policy document as something they did not understand.

During phase two, teachers reflected on times for teaching GIS that are stipulated in CAPS. Mr Hlophe: "I was not teaching FET previous years so at some point I experience challenges. Coming to the issue of time I don't think these times are enough, sometimes I even teach in weekend just to catch time" Mr Phungula: "first, I need to ensure that I teach GIS at the beginning of the year as per the policy document. Mr Zondi: "I follow the CAPS policy document and work schedule, hours are provided, and I feel time allocation is very limited when compared to the work that is being done by teachers" Mr Sokhulu: "I learned new things since we are sharing information to be honest I was using text books, other documents like policy its self no. If I teach according to CAPS policy document I will not experience any problem because everything is given"

Regarding the teaching environment, teachers teach in a classroom when teaching GIS, and there was no laboratory or computer rooms. In the classrooms, learners are overcrowded; sometimes learners sit in threes in one desk. The current ratio in the geography class is one teacher to sixty learners, which is against the normal ratio in formal model C schools, which is one teacher to thirty-five learners. The classrooms have broken windows that make it difficult for learners to learn under these conditions, particularly in winter. Msibi (2013) states that the history of apartheid has imprisoned our schools, particularly schools in rural areas and the township context.

Moving to time, according to CAPS policy document, GIS should be taught at the beginning of the year, in the first term. During the phase one of action research teachers showed little understand of time when teaching GIS. During phase two it appeared that teachers were aware that the time that is allocated for GIS is limited since learners should be using maps in most of their activities. Teachers also reflected on the fact that the CAPS policy document does not reflect the time for teachers to attend workshops, and the time reflected is only for teaching and learning. Kerski (2003) identified the lack of time as one of the major challenges in teaching GIS effectively. This speaks to the insufficient time available for geography teachers to attend workshops, improve their teaching methods and learn the basic GIS skills. The time that is reflecting in work schedule is not sufficient for the geography teachers to implement GIS, hence teachers are teaching on the weekends.

The above discussion regarding time of teaching GIS, indicates that all teachers during phase one did not teach according to the performance curriculum. The performance curriculum, content is structured accordingly, including time allocation for each chapter, tasks and activities and so on. When teachers neglect time for teaching GIS and others teaching GIS during the third term, it suggests that teachers are not teaching to the CAPS policy document. This also suggests that teachers did not reflect on the technical level of reflection during phase one, rather teachers were focusing on learning outcomes. This suggests that teachers reflected on the practical level during phase one. During phase two, teachers expressed an awareness that time is important in the current curriculum (CAPS) and that teaching and learning in the performance curriculum is measured by time not by learning outcomes. When teachers have a clear understanding on using time, they will also have clear understanding of using the correct teaching approach and assessment methods.

4.3.8 How do you assess learning in GIS?

Theme nine: assessments of GIS

During phase one of the reflective activity using the concepts of the curricular spider web, the eighth concept participants had to respond to was assessment. Mr Hlophe: "I use homework, class test, controlled tests, tasks at some points I used my own task that are not in the text book". Mr Phungula: "I normally use informal assessment such as class activities together with homework to measure the rate of learners understanding in my formal assessment I use controlled tests and examinations and all teachers have the same understanding of assessment"

During phase two, Mr Hlophe: "we assess learners' knowledge of GIS through continuous assessment, formal assessment, using question papers, answer sheet, activities on their books" Mr Sokhulu: "we assess in class during our teaching and out of the classroom situation, we assess through homework, we use projects and investigations we also write tests and exams". The two teachers had the same understanding of assessment.

The findings from phase one, showed that teachers focused on the formative assessment, reflecting a little on summative assessment and no time was spent reflecting on continuous assessment. Teachers were not aware of the teaching grid for grade 11, and they assessed as they wished. An example of this is that in term one, grade 11 must do a data handling task which must contain 75 marks; contrary to this teachers are using a class test to assess learners. This is in line with the conclusion drawn by Bjorklund (2014) that states that some teachers had a challenge when trying to understand the

assessment guidelines for CAPS. Coetzee (2012) concurs that one of the areas in CAPS where teachers experience challenges is assessment. Giggins (2002) suggests that the department should develop a professional program that will focus on teachers' development in terms of the expertise needed to assess learning.

During phase, two findings indicate that teachers are using formative assessment, summative assessment and continuous assessment to assess learners' understanding of GIS. These include tests, exams, homework, and tasks, where learners are using questions, answer sheets and their text books. In formal assessment, teachers reflect on exams and controlled test; in continuous assessment, teachers reflect on the use of projects and investigations. Teachers also became aware of the grid that must be used in grade 11 to assess learners. This suggests that teachers were transformed, and could understand assessment level and assess according to the CAPS policy document. Similarly to the study conducted by Khoza (2015) that shows transformation of teachers when dealing with assessment, the study shows that all participants indicated that they follow their CAPS documents which specifies the use of both formal and informal assessments.

The findings indicate that teachers are also using formal assessment in the form of controlled test; these tests are used by teachers to grade learners at the end of the year. This suggests that formal assessment is important and teachers must use it for record purposes, contrary to informal assessment whereby teachers give homework and class tests to learners without any intention of grading the learner. Informal assessment is used in different ways such that it was no longer helpful (William, 2011). This suggests that for a teacher focusing on the informal assessment is immaterial; teachers should have a clear understanding of formal assessment. This further suggests that geography teachers should focus on understanding and implementing formal assessment where learners will be graded at the end of the year.

4.3.9 Is the teaching of GIS accessible?

Theme ten: accessibility

During phase one of the reflective activity using the concepts of the curricular spider web, the ninth concept participants had to respond to was accessibility. Mr Hlophe: "I am teaching alone, no support from my HOD... learners have access to GIS although is lacking somewhere" Mr Phungula: "my HOD was challenged by GIS as a result he complained that he does not understand the concepts of GIS so he cannot help me" Mr Zondi: "the teaching of GIS has no limitation in my school, although we are struggling with resources and support from Department of Education. Mr Sokhulu: "Nothing prohibits us

to teach GIS despite the shortage of resources” Accessibility comprises of three categories: physical financial and cultural access. None of teachers reflected on the cultural access.

In the second phase, teachers’ outlined the complex language used in GIS that makes it difficult for learners and teachers to understand. Mr Hlophe: GIS is not easy to understand, learners are struggling and also teachers sometimes, and for instance it took me also two years to follow what is taught in GIS Mr Zondi: “although we come from far place but we get into the school on time, the challenge is that same of our learners are staying very far from school and they arrive late at all the time, in my school first period is very problematic. Mr Sokhulu: “we do not have much in term of access but I think religion affect us particularly in on the third term, people of this area are most from Shembe church they took learners for almost a month and we as teachers we have to understand their culture within the church” Mr Phungula have same understanding with Mr Hlophe.

The finding from teachers reflecting on accessibility, showed that the teaching of GIS is accessible to all learners, however, teachers lack support from the school management. Some of the school management appear not to understand GIS, and as a result they do not give the necessary support that is due to geography teachers. Another level of support that is lacking is financial support from the Department of Education, whereby teachers do not have enough teaching resources such hard-ware and soft-ware and enough training in geography. In terms of physical access to the school, learners have an access to the teaching of GIS since the school is located in their own community, however some learners stay far away, and as a result arrive late at school, hence teachers do not take the first period seriously. This further suggests that all teachers that should be in class teaching during the first period, however they normally do not teach because learners are not in their respective classrooms where teaching and learning is taking place. From my own observation since I teach at a nearby high school, some learners had to travel about eight kilometres to and from the school. This suggests that some learners reach school and home exhausted which may affect the learners’ performance.

Teachers also reflected on the impact of culture (religion) in their teaching, stating that most of learners were absent from the school due to church activities. This suggests that most learners in this area are not attending school for a period in the third term; however this does not stop teachers from teaching, although it has a negative impact on the learner performance at the end of the year. According to the South African Schools Act, 84 of 1996, South Africa aimed at redressing the past injustices of apartheid in education, to combat racism and sexism, and protect and advance our diverse culture and language to sustain the right of all learners, parents and educators. Section 2, sub-section 7, of the SASA of 1996

is based on freedom of conscience and religion at public schools; religious observation may be conducted at a public school, under the rules of governing body that are informed by the constitution of South Africa which upholds the rights of learners and members of staff. There is a gap between the demands of religion and the demands of the SASSA as they both uphold the right of the learner, and the teachers and the curriculum is caught in between, as the example of religion shows.

The findings indicate that the teaching of GIS is affected by the issues of culture, and physical and financial access is a challenge that teachers are facing with. Financial access means having enough money to purchase enough resources, as well as having money to help teachers to attend workshops regarding GIS. Teachers did not reflect on the financial access in terms of allowance from the Department of Education. The findings also indicate that teachers do not have access to GIS in terms of understanding; the teachers mentioned it taking about two years to understand GIS. This raises the question of what the learners were learning during this period. This gave me an assumption that learners were deprived of the right to have basic education. Watson (2001) pointed out that to integrate technology in schools is very complex, and it requires understanding of teacher as they deliver information, perceptions and beliefs, as well as teachers' motivations about learning and technology. This suggests that teachers should have access first to technology, and be able to use this technology before they engage with implementing technology in their classroom because if teachers are not proficient with technology learners' access to education is deprived.

4.4 Chapter conclusion

In this chapter I have presented the data, analysed it and discussed it. The data was firstly, presented in the form of a table that shapes the themes and categories. These themes were constructed using the concepts of the curricular spider web. The curricular spider web concepts showed that a lack of one concept affects the whole process of teaching and learning, for instance rationale for teaching GIS; if teachers lack an understanding of the rationale as to why are they teaching, teachers unable to identify the objectives of teaching GIS that will also result in them not understanding the necessary resources that are applicable to teaching of GIS. This suggests that geography teachers should be more capacitated in understanding the concepts of the curricular spider web and also practice critical reflection before, during, and after teaching. In this chapter it also appears that the school management and the Department of Education do not support geography teachers with enough time and enough teaching resources. The following chapter focuses on the conclusions and recommendations of each chapter.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECCOMENDATIONS

5.1 Introduction

The study was constructed around exploring teachers' reflection of teaching GIS grade 11 CAPS in the uMhlathuze circuit. In the previous chapter, I discussed the research findings, and in this chapter I focus on bringing together the main findings from the previous chapter, as well as the conclusions and recommendations that were drawn from the data analysis and discussions. These findings are utilised for the purpose of answering the three critical research questions. I identify findings that emerged from data, themes were made under the concepts of curricular spider web and recommendations are made.

5.2 Summary of chapters

This study focused on teachers' reflections of teaching Geographical Information System (GIS) at grade 11 CAPS in township school in the uMhlathuze Circuit. This study has three objectives and also three research questions that are identified in the paragraph below. The following is the table showing the number of words in chapter one, two, three and four.

Chapters	Number of words	Chapter in %
Chapter one	4865	11
Chapter two	15950	36
Chapter three	10703	24
Chapter four	7885	17
Chapter five	5232	12
Total	44635	100

Figure 5.1: chapters, number of words and the percentage

5.2.1 Chapter one

This chapter focuses on the background of the study. I stated by introducing the study whereby I describe briefly the introduction of CAPS, and a flow chart was used to indicate the mapping of this chapter in figure 1.1. I describe the purpose and location of the study (To explore teachers' reflections of teaching Geographical Information System (GIS) at grade 11 within CAPS in a township school at uMhlathuze Circuit, located in the Pinetown district school. The rationale of the study was discussed, where I outlined my personal, content and content reasons for undertaking this study. A brief literature

review was discussed. For this study it was important to state the research objectives and research questions:

Objectives of the study

1. To identify Grade 11 teachers' reflections of teaching Geographical Information System (GIS) at grade 11 CAPS in a township school in the uMhlathuze Circuit
2. To explain the reasons why Grade 11 teachers reflect in particular ways on the Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the uMhlathuze Circuit?
3. To understand the lessons learnt from the Grade 11 teachers' reflections on teaching Geographical Information System (GIS) at grade 11 CAPS in a township school in the uMhlathuze Circuit.

Critical Research Questions

1. What are the Grade 11 teachers' reflections of their teaching of Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the uMhlathuze Circuit?
2. Why do the Grade 11 teachers reflect in particular ways on the Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the uMhlathuze Circuit?
3. What lesson can be learnt from the Grade 11 teachers' reflections of their teaching of Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the uMhlathuze Circuit?

In this chapter I further discussed the research paradigm (critical paradigm) and research approach (qualitative approach and action research). Sampling (purposive and convenience) was also discussed. I indicated the three methods of data generation (reflective activity, one on one semi-structure interviews and focus group discussion). I further discussed the data analysis, including ethical issues and trustworthiness of the study. Lastly in this chapter I discuss the limitation of the study, together with the summary of each chapter.

5.2.2 Chapter two

This chapter focuses on literature related to GIS. This chapter firstly discussed the rationale for teacher reflection and the three levels of reflection: practical, technical and critical. I discussed the challenges of teacher reflection and the methods of promoting teacher reflection. Secondly, I defined curriculum, and

discussed curriculum as a plan for learning and curriculum as a plan of learning. Further on curriculum I discussed the curriculum presentation, this includes five levels namely: SUPRA, MACRO, MESO, MICRO and NANO. Thirdly, I discussed the concepts of a quality curriculum namely: relevancy, practicality, effectiveness, consistence and sustainability. Finally, I discussed the concepts of the curricular spider web, namely: rationale, goals, learning activities, teacher role, materials and resources learning environment, time, assessment and accessibility. The literature review indicated the importance of teachers understanding the levels of reflection and also being able to understand the concepts of the curricular spider web. When geography teachers understand and practice reflection and show an understanding of the curricular spider web, they will be able to overcome the challenges of teaching Geographical Information System.

5.2.3 Chapter three

This chapter focuses on detailed research design and methodology utilised in this study. Firstly, I discussed the research paradigm: critical paradigm together with action research. Secondly, I discussed the sampling technique used in the study: purposive and convenience sampling. Thirdly, data generation methods were included: reflective activity, one-on-one semi structured interviews and focus group discussion. Fourthly, data analysis: guided analysis. Fifthly, I discussed ethical issues. Sixth, trustworthiness: Credibility, transferability, dependability and conformability. Lastly, I discussed the limitations of the study.

5.2.4 Chapter four

This chapter focused on presenting findings from the generated data. Data was analysed using guided analysis, the concepts of the curricular spider web and the literature review. The curricular spider web concepts were used to frame themes for this study; the themes were structured as follow: reasons for teaching GIS; goals for teaching GIS; teaching activities; facilitating teaching of GIS; resources for teaching GIS; teaching environment and time; assessments of GIS; and lastly accessibility. These concepts that formulated the themes are very important for teachers to properly implement the curriculum.

5.3 Major findings

Conclusions are drawn from the findings and also the literature review of this study. Conclusions are based on the concepts of the curricular spider web that framed the themes, namely: reasons for teaching GIS; goals for teaching GIS; teaching activities; facilitating teaching of GIS; resources for teaching GIS; teaching environment for GIS; time for teaching GIS; assessments of GIS; and

accessibility. These themes shaped the understanding of teachers' reflections of teaching Geographical Information System (GIS) at grade 11 CAPS.

5.3.1 Rationale for teaching GIS

According to the literature, the rationale for teaching has three levels: personal, content and societal rationale (Berkevans et al., 2014). According to Kehdinga (2014a), personal rationale is important to teachers because it assists learners in gaining the achieved curriculum and further assists teachers to theorise on curriculum. Granmore (2004), on GIS in secondary schools indicated that teachers' beliefs and attitudes towards technology are the main cause of technology integration in classroom. With content rationale regarding GIS, most of teachers in secondary schools face the challenge of not understanding the content of GIS and the new terminology (Green, 2007), and this suggest that most teachers do not have subject knowledge of GIS. With societal rationale, Khoza (2015) believes that society should encourage professional behaviour that will promote professional effectiveness in the implementations of the curriculum. This suggests that society is important in the implementation of the curriculum. These three levels of rationale are important for teachers teaching GIS at grade 11 CAPS, however CAPS is not specific in describing the rationale for teaching GIS in grade 11. This suggests that teachers should construct their own the rationale for teaching GIS, but this may result in an improper implementation of the curriculum because teachers would be working from a uniform rationale.

The findings indicate that the rationale for teaching GIS is important for the teachers to understand, as it at the core of the curricular spider web concepts. This means teachers must understand and practice it before understanding other concepts. When geography teachers understand the rationale for teaching GIS they will improve on their daily practices. At the first phase teachers reflected on the personal and societal rationale, and this suggests that teachers reflected on a practical and technical level of reflection. However during phase two, teachers reflected on all three levels which suggests that teachers reflected further to include the critical level, whereby teachers indicated the content rationale. Grade 11 teachers' reflections of their teaching included practical reflection and technical reflection. I further respond to the second critical question of why the teachers reflect in such ways and the answer is that teachers are reflecting commonly at these two levels (practical and technical) because they are based on everyday knowledge, not based on the content. This suggests that teachers are using general knowledge instead of content knowledge to reflect.

5.3.2 Goals for teaching GIS (aims and objectives)

The findings indicated that the participants were not clear on understanding the goals for teaching GIS. For proper implementation of the curriculum it is important for teachers to understand the teaching goals. In the literature I found out that numerous challenges are faced by geography teachers when teaching GIS; from these findings, one of the challenges is that teachers lack an understanding of goals of teaching GIS. In the first phase of my action research cycle, some teachers were not aware of the difference between aims and objectives. During this phase, some only reflected on the practical and technical levels, whereby they were referring to aims and objectives of teaching GIS.

The literature review indicates that it is important to define aims, objectives and learning outcomes for the proper implementation of the curriculum. Aims refers to a broad general statement of teaching purpose, whereby a teacher indicates what to cover in the process of learning (Kennedy, Hyland and Ryan 2006). This suggests that that aims are focused on the whole chapter that needs to be taught to learners while objectives are described as specific statements of teaching intention whereby specific areas that need to be covered are identified in the process of learning (Kennedy, Hyland and Ryan 2006). Magliaro (2005) believes that teachers are accountable for selecting the learning objectives that are appropriate for learners to master and they should also select the relevant programs that will present levels from low to high. However with CAPS, the specific aims and objectives are not stated per subject, and aims are general to all subjects from grade R to 12. This suggests that subjects are not independently defined as having a clear definition of the expectations. Teachers appeared confused as the findings indicate that teachers are using aims and objectives that are defined in the intended curriculum (CAPS) and these aims and objective do not speak to the content and context of teaching GIS, hence teachers find themselves struggling to cope with the demands of the intended curriculum (CAPS).

5.3.3 Content teachers are teaching

The findings indicated that teachers are teaching GIS concepts; these concepts include: spatially referenced data, spectral resolution, raster and vector data, line point and polygon feature. These concepts are taught through theory. Teachers are unable to teach GIS practically because they lack computers and other necessary teaching resources. This suggests that there is no balance between the general aims of teaching GIS which is to engage learners with the use of technology. Content demands enough teaching resources, yet teachers only have access to books, maps chalk and chalkboard. During phase one of action research cycle, teachers were reflecting on the paper-based GIS whereby they are using maps and textbooks to teach GIS rather than explaining their

understanding of the GIS content. This suggest that teachers focused on the competence curriculum when teaching GIS; their concern is more about what learners can and cannot do due to resources scarcity. While CAPS is a performance-based curriculum where the concern is based on delivering the content.

CAPS content, with regard to GIS, is school-based knowledge, hence content is centred on the needs of the society which is to embrace technology and allow the society to fit to the needs of the real world and globalisation. This suggest that the content for GIS is relevant to learners, however CAPS content regarding GIS is not becoming practical because teachers are reflecting on the paper-based GIS because they lack resources to implement the curriculum practically. Most of schools in South Africa do not have enough resources such as computers, yet GIS needs computers; furthermore, GIS software is expensive therefore effective teaching of the GIS is hindered (Watson, 2006) which suggests that teaching of GIS CAPS is not effective.

The findings from the first phase of action research cycle indicated that teachers are using CAPS as a guide to teach GIS. Teachers were not specific about when they taught GIS, yet the CAPS document is specific in structuring the content per term. CAPS is a performance-based curriculum, meaning it is content driven; teachers should work according to CAPS policy document, however teachers are not planning according to CAPS document. This suggests that teachers are not trained enough and they lack properly workshops that will assist them to teach according to the prescribed document. This further suggests that there are gaps between teachers and the curriculum. Phase two of this action research cycle transformed geography teachers, since they able to use CAPS policy document as a guide to implement the curriculum.

5.3.4 Teaching activities

The findings indicated that teachers used homework, class activities and tests to measure whether learners understood. This suggests that teachers use both formal and informal activities when teaching GIS. According to the literature, formal activities are used for recording purposes with an aim of producing result at the end of the year, whereas informal activities are done to monitor the daily progress of the learner (Hoadley & Jansen, 2013). This suggests that both formal and informal activities are important for the proper implementation of the curriculum. According to the CAPS policy document (2011) there are three formal assessment tasks that must be done by learners before the mid-year exams.

The findings from data analysis during phase one, show that out of the three categories of teaching activities, teachers reflected on the practical and technical categories only where by teachers were explaining formal and informal activities. Teachers did not reflect on the continuous activities (CASS) which fall under the third category (critical reflection) however during phase two, teachers reflected on the third category. This suggests that teachers were transformed, since they reflected on something new or something they did not consider during the first phase.

5.3.5 Facilitating teaching of GIS

Teachers were to reflect on the three approaches: teacher-centred, learner-centred and the content-centred approach. The findings indicated that teachers are using a teacher-centred approach to facilitate the teaching of GIS. This is similar to the findings of the study conducted by Khoza (2015) on student teachers' reflection on their practice of CAPS, which found that participants are using a teacher-centred approach in order to finish the syllabus presented to them. Geography teachers commonly use this approach because they believe that there are no other alternative methods they can use to facilitate the teaching of GIS. This belief is rooted in the shortage of resources to teach GIS, and this is contrary to the goals of introducing GIS in secondary schools. Teachers believe that they are responsible for teaching of theory of GIS which is paper-based.

According to the CAPS policy document (2011), it does not specify the teaching approach teachers should use when teaching GIS. This suggests that teachers can use any teaching approach (teacher-centred, learner-centred and content-centred approach) that they are comfortable with, and not what the curriculum is providing. This further suggest that CAPS is not consistent when referring to the teaching approach because it does not provide a uniform approach that should be used by teachers.

The findings from phase one indicate that teachers are using a teacher-centred (instructor) approach, meaning that teachers reflected at a practical and technical level. In the second phase, teachers indicated that they use a content-centred approach (assessor) which suggests that teachers further reflected on a critical level. This indicates a transformation of the teachers.

5.3.6 Resources for teaching GIS

There are three categories of resources: hard-ware, soft-ware and ideological-ware (Khoza, 2012). The successful teaching and learning depends on the teaching and learning resources (Krishna, 2013) which suggests that in order to implement curriculum effectively, teachers must be supported with teaching resources. The findings indicated that teachers are using hard-ware resources (books, chalkboard and maps) which suggests that teachers were reflecting on the practical and technical

levels during phase one. However in phase two, teachers reflected also on the ideological-ware, which suggests that teachers started to reflect at a critical level.

Although teachers are familiar with hard-ware, teachers still lack those basic resources in their geography classrooms, for instance maps. The lacks of these three categories of resources suggest that the curriculum is not implemented properly, and the concepts of curricular spider web do not work as a single unit to have a positive outcome to the curriculum. Proper hard-ware resources for teaching GIS are the computers together with necessary soft-ware resources. This suggest that CAPS is not consistent because the aim for teaching GIS is to equip learners with technology so that they will meet the demands of the real world (globalisation), based on the clear aims of CAPS; the bold question is how teachers are expected to do this if technology is not in the classrooms where learners are learning.

5.3.7 Teaching environment and time for GIS

The findings from the literature indicated that the time allocation for the teaching of geography in grade 11 is four hours per week (CAPS, 2011). Kerski (2003) believes that the lack of time is one of the major challenges in teaching GIS effectively. This refers to the insufficient time for geography teachers to attend workshops, improve their teaching methods and learn the basic GIS skills. Holmere (2006) states that GIS is a technical and practical part of geography whose aims and objectives will be achieved in a laboratory setting. The findings indicated that teachers use the learners' classrooms to teach GIS. There are no special classroom for GIS, for instance a computer laboratory where they are enough computers with internet and necessary GIS software. This suggests that CAPS is not consistent in terms of the teaching space the teachers are using. Furthermore, regarding the time for teaching GIS, the findings indicated that time for teaching GIS is limited, as teachers believed that to teach practical subject like GIS they need more time, hence they organised extra hours on weekends. Another challenge teachers face is that of resources for teaching GIS beyond the classroom as the classroom is not conducive for GIS. This suggests that teachers are frustrated when they have to teach GIS, lot of issues that they must consider before teaching.

5.3.8 Assessments of GIS

Findings from the literature indicate that assessment is an important scope of interest in the debate on education (Broadfoot & Murphy, 1990). Black and William (2004) believe that information acquired through assessment is employed to give learners knowledge to be used for transformation based on learning actions or activities. The literature identified formal (summative assessment) and informal assessment. Formal assessments are those tasks that make up the formal programme of assessment

for the year (controlled tests and final examination) that are used for grading the learner. Informal assessments (formative assessment) are a daily monitoring of learners' progress (Department of Basic Education, 2011) and informal tasks, homework and activities are used. Continuous assessment is part of formal assessment where learners are expected to do projects and do experiments.

The literature identifies formal assessment for geography CAPS. In CAPS, each controlled test and examination is described according to the topic it must cover. However, with the informal assessment, CAPS does not specify this, which suggests that teachers are using any informal assessments that they wish to use, and not according to the curriculum. This further suggests that informal assessment is not taken as seriously as formal assessment, however they are important in building learners' understanding of the subject matter. From the finding in the phase one of reflection, teachers reflected on the formal (controlled tests and examinations). According to CAPS, formal assessment is uniform, meaning all learners across the country are assessed in the same way; the teachers also reflected on the informal (homework, activities and tasks) assessment. This suggests that teachers reflected on the practical and technical levels during phase one. Informal assessment is not specific; teachers use any activities, homework, class tests and tasks to assess learners. This does not have any foundation in preparing learners for formal assessment. During phase two, teachers also reflected on the continuous assessment (CASS), this suggests that teachers started to reflect on the critical level.

5.3.9 Accessibility

Findings from the literature indicate that accessibility has three facets: physical, financial and cultural access. The findings from the phase of action research cycle indicate that teachers are not supported by the school management and the Department of Education. The Department of Education does not provide enough teaching resources, and sometimes the school management does not have a clear understanding of GIS and as a result they do not support geography teachers. During phase one, teachers reflected at a practical level of reflection. The findings from the phase two on physical access indicate that most of the learners have physical access to the school, however others struggle to be in school on time due to the long distance they have to travel to school. This results in most teachers not teaching the first period, and this implies that learners are not learning in the first period. With financial access, teachers reflected on the issues of resource shortages; due to the financial status of the department, the school is not able to purchase teaching resources which limits the teaching of GIS.

Moving further on the cultural access, teachers reflected on the issue of culture (religion), as they pointed out that the Shembe church is dominant in the community, and during the third term

most of learners are absent from school due to the church activities. This suggests that many learners in this area do not attend school in the third term; this does not stop teachers from teaching, although it has a negative impact on the learner performance at the end of the year. This suggests that teachers reflected at a critical level of reflection. This finding indicates that religion impact negatively on the school curriculum as some learners are absent due to church activities, teachers and the present group of learners continue with teaching and learning. This suggests that learners who went for church activities (Shembe) have high chances of failing end of the year. This further suggests that CAPS is not consistent, since the curriculum is designed for learners, but when learners are not at school, CAPS does not define the value of education and it is seen as less important than religion.

5.4 Suggestions for further action research studies

This study tries to close the gap of geography teachers with regard to their understanding of GIS, although there are still significant gaps. Suggestions for further action includes:

1. More action research studies that will focus on geography teachers' reflection (understanding of levels of reflection).
2. More studies on geography teachers' understanding of the curricular spider web concepts.
3. More studies on the challenges of teaching GIS in rural and township schools.

5.5 Recommendations

After the reflective activity, group discussion and one-on-one, semi-structured interviews with regard to teachers' reflections of teaching Geographical Information System (GIS) at grade 11 CAPS in township school, I recommend that the following should be considered in helping geography teachers and the Department of Education.

5.5.1 First recommendation

For the proper implementation of the GIS curriculum in secondary schools (intended curriculum), CAPS should define the rationale for teaching GIS. The three levels (personal, content and societal rationale) of rationale should be inserted in the CAPS Policy document. When teachers understand the rationale of teaching GIS, there will be fewer problems in the geography classrooms. The Department of Education in KwaZulu-Natal should consider taking a leading role in developing teachers.

5.5.2 Second recommendation

CAPS should define specific goals per subject, because subjects are independent. A clear definition of goals will lead to teachers' understanding of content knowledge, and CAPS currently are confusing to teachers. The Department of Education should intervene in ensuring that they first stipulate goals per subject and also workshop with teachers about those goals.

5.5.3 Third recommendation

The Department of Education should ensure that content of GIS is balanced or is linked clearly with the goals of teaching GIS. Currently goals are not clearly connected to context of South African schools with the content taught. For instance goals are referring teachers to the laboratory space while content is based on paper-based GIS. This creates a system whereby teachers are teaching in any manner without being guided by the Department of Education's policies. Currently, geography teachers are not well-trained when approaching GIS; teachers are not trained enough and they lack the workshops that will assist them to teach according to prescribed document. Subject advisors and other stakeholders in schools should be more supportive of geography teachers.

5.5.4 Fourth recommendation

The training of teachers by the Department of Education is most important to ensure that teachers are using appropriate activities to assess learners. Furthermore, the training of teachers will not be sufficient if there are no clear policy documents that guide teachers. The department should extend the geography policy to accommodate GIS such that it clear to teachers and what they practice in schools.

5.5.5 Fifth recommendation

Teachers should be trained by the Department of education to ensure that teachers are equipped with necessary information and skills regarding facilitating of GIS. Also teachers should be able to get support from school management, including school governing bodies and Department of education.

5.5.6 Sixth recommendation

The Department of Education, together with the school management, should provide schools with sufficient resources for teaching GIS, for instance computers and overhead projectors. Computers must have the necessary software because it is meaningless to have a computer for geography without the software needed.

5.5.7 Seventh recommendation

The Department of Education, together with the school management and the school governing bodies should provide schools with a computer laboratory with proper functioning computers so that learners and teachers will be motivated to learn GIS. The lack of a computer room means that curriculum implementation is lacking. Regarding times for teaching GIS, time or periods for teaching GIS should be extended; this may be done only during the first term. Also the department should train the school management staff about the use of GIS in geography and the importance of technology in general, to ensure that geography teachers and the school management have the same view as far as GIS is concerned.

5.5.8 Eighth recommendation

Findings indicate that learners are staying far from the school as the result they arrive late from school and miss the first period. Therefore learners must be provided with transport such free buses in the morning and in the afternoon. Further findings indicated that some learners are not coming to school during the third term due to religion. Therefore the Department of Education should involve all the relevant stakeholders to address the problem, for instance communities should be educated about the value of education to their children, and also the School Governing Bodies must properly govern the schools.

5.5.9 Ninth recommendation

The Department of Education should train teachers in order to apply the correct methods of assessment, and teachers should be aware of formal, informal and continuous assessments. The three

levels of moderations will assist geography teachers, and moderation should take place at a school level that is done by the Head of Department. Moderation should take place at cluster level that is done in groups of schools, as well as along with department moderation which involves the schools in the district. Normal moderations are taken seriously only in grade 12 subjects, and other grades are neglected.

5.6 Chapter conclusion

Although geography teachers showed transformation, particularly when doing the second phase of action research cycle, geography teachers still need more time to practice critical reflection, because it appears that during the first phase of action research cycle, teachers were not aware of the concepts of the curricular spider web and as a result when they taught GIS they did not define the rationale of their teaching and goals to which they were teaching. This affects all the concepts not being understood which led to poor lessons. Resources such as hard-ware soft-ware and ideological-ware are key in teaching GIS, since GIS is a practical section of geography. The lacking of these resources suggests that the curriculum is not implemented according to the CAPS policy document. Also the Department of Education and school managements do not support geography teachers, for instance in providing resources, enough time for teaching and the training of teachers as curriculum implementers.

5.7 Conclusion

The purpose of this study was to explore teachers' reflections of teaching Geographical Information System (GIS) at grade 11 CAPS in a township school in the uMhlathuze Circuit. To achieve the purpose of this study three objectives were set; objective one was to identify teachers' reflections on teaching GIS. The second objective was to explain the reasons why teachers reflect in particular ways. The third objective was to discover the lessons that can be learnt from the Grade 11 teachers' reflections of their teaching of Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the uMhlathuze Circuit. Critical research questions were also set; these questions are stated below together with their answers:

1. What are the Grade 11 teachers' reflections of their teaching of Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school of uMhlathuze Circuit?

The teachers reflected on the three levels of reflection on GIS namely, practical reflection, technical reflection and critical reflection.

2. Why do the Grade 11 teachers reflect in particular ways on the Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school in the uMhlathuze Circuit?

The teachers' reflections are influenced by everyday knowledge or school knowledge. This suggests that the teachers' backgrounds regarding the subject (GIS) and also their teaching experiences shape teachers' reasons as to why teachers reflect on everyday knowledge or school knowledge.

3. What lesson can be learnt from the Grade 11 teachers' reflections of their teaching of Geography Information System Curriculum and Assessment Policy Statement (CAPS) at a township school of uMhlathuze Circuit?

The lessons that can be learnt are that practising reflection is important because teachers are able to find time to question their own work and improve through new understanding and ideas. This was especially the case with critical reflection which was achieved mostly during the second phase of the action research cycle. The second phase of each theme indicated that teachers were transformed. We can further learn that concepts of the curricular spider web are very important to understand in order to implement curriculum that is relevant, consistent, sustainable and practical.

This chapter focused on the conclusions and recommendations; I first started with the introduction, followed by the chapters' summary. Chapter one focused on background and the orientation of the study. Chapter two, focused on literature review. Chapter three focussed on research design and methodology and chapter four focussed on findings and discussions.

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Annexures

Annexure A: Letter to the school principal

PO BOX 8710
Merrivale
3291

Dear Sir/Madam

Request to conduct a research

I would like to request for permission to conduct a research at your institution. I would like to apologize in advance for any inconvenience I might cause on my side. Hopefully the research will not disturb the smooth running of the school.

The research intends to: Teachers' reflections of teaching Geographical Information System (GIS) at grade 11 within CAPS in a township school in a Umhlathuze Circuit. My plan is to interview the teachers in your school who are teaching grade 11 geography. This piece of research is part of my Master's Degree studies.

I would like to assure you that information gathered will be treated with utmost confidentiality. I am bound by ethical standard of conducting research not to reveal any information gathered, furthermore the dignity, privacy and interest of the participants will be respected. The following items will be given to the teachers to read:

Please note that:

- Your confidentiality is guaranteed as your inputs will not be attributed to you in person, but reported only as a population member opinion.
- The interview may last for about 1 hour and may be split depending on your preference.
- Any information given by you cannot be used against you, and the collected data will be used for purposes of this research only.
- There will be no limit on any benefit that the participants may receive as part of their participation in this research project;
- Data will be stored in secure storage and destroyed after 5 years.
- You have a choice to participate, not participate or stop participating in the research. You will not be penalized for taking such an action.
- The participants are free to withdraw from the research at any time without any negative or undesirable consequences to themselves;
- Real names of the participants will not be used, but symbols such as A, B, C, D, E and F will be used to represent participants' names;

- The research aims at knowing the challenges of your community relating to resource scarcity, peoples' movement, and effects on peace.
- Your involvement is purely for academic purposes only, and there are no financial benefits involved.
- If you are willing to be interviewed, please indicate (by ticking as applicable) whether or not you are willing to allow the interview to be recorded by the following equipment:

	willing	Not willing
Audio equipment		
Photographic equipment		
Video equipment		

I can be contacted at:

Email: 209506824@stu.ukzn.ac.za

Cell: 0744641583

My supervisor is Dr. SB Khoza who is located at the School of Education, Edgewood campus of the University of KwaZulu-Natal.

Contact details: email: khozas@ukzn.ac.za Phone number: +27312607595.

Discipline Co-ordinator is Dr. LR Maharajh,
Curriculum Studies, School of Education,
Edgewood College, University of KwaZulu-Natal

(Tel) 0312602470 (Cell) 0822022524, Email: marahajlr@ukzn.ac.za

You may also contact the Research Office through:

P. Ximba

HSSREC Research Office,

Tel: 031 260 3587 E-mail: ximbap@ukzn.ac.za

Thank you for your contribution to this research.

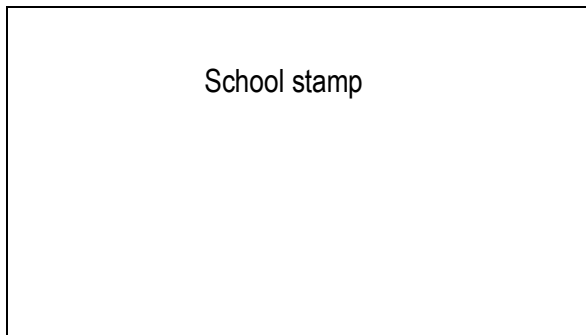
Please sign the following declaration and include your full names as indicated:

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

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

.....
SIGNATURE OF PRINCIPAL

.....
DATE



Annexure B: Consent form for participants

Box 8710
Merrivale
3291

Dear Participant

INFORMED CONSENT LETTER

I am undertaking a research project on “Teachers’ reflections of teaching Geographical Information System (GIS) at grade 11 within CAPS in a township school in Umhlathuze Circuit”. Therefore, it will be highly appreciated if you could read this document, sign the declaration below and email it as an attachment to my email address 209506824@stu.ukzn.ac.za

The research is influencing the ways in which people are being educated and trained. South Africa, like any other developing countries, is forced to conduct studies of this nature in order to view educator’s perception. Therefore, this study aims at providing valuable information the teachers’ perception in teaching Geographical Information System (GIS) in Secondary schools.

Please take note of the following issues:

1. There will be no limit on any benefit that the participants may receive as part of their participation in this research project;
2. Answer all the questions;
3. Respond to each question in a manner that will reflect your own personal opinion;
4. Your identity will not be divulged under any circumstance;
5. There are no right or wrong answer;
6. All your responses will be treated with strict confidentiality;
7. Real names of the participants will not be used, but symbols such as A, B, C will be used to represent participants’ names;
8. The participants are free to withdraw from the research at any time without any negative or undesirable consequences to themselves;
9. The participants will not be under any circumstance forced to reveal what they don’t want to reveal; and
10. Audio or video recording will be made.

This research project is supervised by Dr Khoza. His telephone number is (031) 260 7595 at the University of KwaZulu-Natal and his email address is khozas@ukzn.ac.za

Thank you for your support, co-operation and valuable time: Best wishes from

S. Zuma
University of KwaZulu-Natal
Cell: 0744641583
Email: 209506824@stu.ukzn.ac.za

Please sign the following declaration and include your full names as indicated:

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

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

.....
SIGNATURE OF PARTICIPANT

.....
DATE

Annexure C: Letter to the Department of Education

Box 8710
Merrivale
3291

To: District Director

Application for Permission to Conduct Research in schools at UMhlatuze circuit in Pinetown district

My name is Sphesihle Zuma. I am a Curriculum MEd. candidate studying at the University of KwaZulu-Natal, Edgewood campus, South Africa. My interest is on the teachers' reflections of teaching Geographical Information System (GIS) at grade 11 within CAPS in a township school at Umhlatuze Circuit".

I have identified Zikhalizakho High School as the sample of this research project. Therefore, I would like to request to use this school and their grade 11 Geography CAPS teachers to conduct this research project. Please note the following:

- The school and teachers' confidentiality is guaranteed.
- The interview, reflective activity and focus group discussion may last for about 1 hour.
- Any information given by your teachers cannot be used against the school, and the collected data will be used for purposes of this research only.
- There will be no limit on any benefit that the school and teachers may receive as part of participation in this research project;
- Data will be stored in secure storage and destroyed after 5 years.
- Teachers have a choice to participate, not participate or stop participating in the research. The school and teachers will not be penalized for taking such an action.
- The school and teachers are free to withdraw from the research at any time without any negative or undesirable consequences;
- Real names of the school and teachers will not be used, but symbols such as A, B, C and D will be used to represent teachers' names;
- School and teachers involvement is purely for academic purposes only, and there are no financial benefits involved.

Time frame

	Time Frame	Guidelines
1	01February – 15 February 2015	Topic development
2	15 February – 26 February 2015	Research proposal (Draft)
3	26 February – 06 March 2015	Research proposal (2 nd draft)
4	10 March- 20 March 2015	Submission of final research proposal and defense
5	11 March-27March 2015	Defending of research topic
6	27 March – 30 April 2015	Literature review and theoretical framework
7	30April- 29 MAY 2015	Data production
8	29 May- 30 June 2015	Analysis of data generation
9	30 June-31 July 2015	Write up and submission of chapters of the research
10	31July – 31 August 2015	Submission of all chapters after correction
11	30 September – 31 October 2015	Submission of 1 st draft
12	30 November 2015	Submission of final research report

This research project is supervised by Dr Khoza.
Telephone number is (031) 260 7595
University of KwaZulu-Natal
email address is khozas@ukzn.ac.za

For any questions you can contact me on the following:

Cell: 0744641583
Email: 209506824@stu.ukzn.ac.za

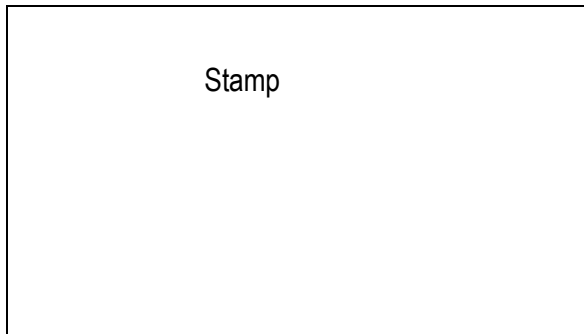
Please sign the following declaration and include your full names as indicated:

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

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

.....
SIGNATURE OF THE DIRECTOR

.....
DATE



Annexure D: Permission from the department



education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Enquiries: Nomangisi Ngubane

Tel: 033 392 1004

Ref.:2/4/8/447

Mr S Zuma
PO Box 8710
MERRIVALE
3291

Dear Mr Zuma

PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **“TEACHERS’ REFLECTIONS OF TEACHING GEOGRAPHICAL INFORMATION SYSTEMS (GIS) AT GRADE 11 CAPS IN TOWNSHIP SCHOOL AT UMHLATHUZE 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.

UMhlatuze Circuit

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

KWAZULU-NATAL DEPARTMENT OF EDUCATION

POSTAL: Private Bag X 9137, Pietermaritzburg, 3200, KwaZulu-Natal, Republic of South Africa ...dedicated to service and performance
PHYSICAL: 247 Burger Street, Anton Lembede House, Pietermaritzburg, 3201. Tel. 033 392 1004 **beyond the call of duty**
EMAIL ADDRESS: kehologile.connie@kzndoe.gov.za / Nomangisi.Ngubane@kzndoe.gov.za
CALL CENTRE: 0860 596 363; Fax: 033 392 1203 WEBSITE: WWW.kzndoe.gov.za

Annexures E: Permission from the University of KwaZulu-Natal



26 August 2015

Mr Sphehile Zuma 209506825
School of Education
Edgewood Campus

Dear Mr Zuma

Protocol reference number: HSS/0792/015M

Project title: Teachers' reflections of teaching Geographical Information System (GIS) at grade 11 CAPS in township school at Umhlathuze Circuit.

Full Approval – Expedited

This letter serves to notify you that your application in connection with the above has now been granted full approval.

Any alterations to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach/Methods must be reviewed and approved through an amendment /modification prior to its implementation. Please quote the above reference number for all queries relating to this study. 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.

Best wishes for the successful completion of your research protocol.

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

Dr Shenuka Singh (Chair)

Westville Campus, Govan Mbeki Building

Postal Address: Private Bag X54001, Durban 4000

Telephone: +27 (0) 31 260 3587/8350/4557 Facsimile: +27 (0) 31 260 4809 Email: zimban@ukzn.ac.za / snvmanm@ukzn.ac.za / mohuno@ukzn.ac.za

Website: www.ukzn.ac.za

1910 - 2010
100 YEARS OF ACADEMIC EXCELLENCE

Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

Annexure F: Reflective Activity

Teacher's name: _____

1. Why are you teaching (rationale) GIS CAPS?

2. Towards which goals (aims & objectives) are you teaching GIS CAPS?

3. What content are you teaching (content) in GIS CAPS?

4. Which activities you using to teach (teaching activities) GIS CAPS?

5. What resources are you using to teach (resources) GIS CAPS?

6. How do you facilitate learning of (teacher's role) GISCAPS?

7. Where and when are you teaching (location &time) GIS CAPS?

8. How do you access the teaching of (Assessment) GIS CAPS?

9. How do you assess learning of (Accessibility) GIS CAPS?

Annexure G: One-on-one semi-structured interview

With one-on-one interview participant is expected to tell a story on the teaching GIS CAPS experiences using concepts of curricular spider-web

1. Why are you teaching (rationale) GIS CAPS?
2. Towards which goals (aims & objectives) are you teaching GIS CAPS?
3. What content are you teaching (content) in GIS CAPS?
4. Which activities you using to teach (teaching activities) GIS CAPS?
5. What resources are you using to teach (resources) GIS CAPS?
6. How do you facilitate learning of (teacher's role) GISCAPS?
7. Where and when are you teaching (location &time) GIS CAPS?
8. How do you access the teaching of (Assessment) GIS CAPS?
9. How do you assess learning of (Accessibility) GIS CAPS?

Annexure H: Focus group discussion

With the focus group discussion participants are expected to discuss based their experiences of teaching GIS CAPS using the concepts of curricular spider-web

1. Why are you teaching (rationale) GIS CAPS?
2. Towards which goals (aims & objectives) are you teaching GIS CAPS?
3. What content are you teaching (content) in GIS CAPS?
4. Which activities you using to teach (teaching activities) GIS CAPS?
5. What resources are you using to teach (resources) GIS CAPS?
6. How do you facilitate learning of (teacher's role) GISCAPS?
7. Where and when are you teaching (location &time) GIS CAPS?
8. How do you access the teaching of (Assessment) GIS CAPS?
9. How do you assess learning of (Accessibility) GIS CAPS?