RHODES UNIVERSITY

DEPARTMENT OF EDUCATION

GRADE 10 LIFE SCIENCE TEACHERS' UNDERSTANDING AND DEVELOPMENT OF CRITICAL THINKING SKILLS IN SELECTED SHOOLS IN NAMIBIA

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ABSTRACT

The educational reform policy in Namibia adopted the principles and practice of learner-centred education, a policy based on constructivist epistemology. This approach emphasises that learners are constructors of knowledge and that they must discover information and construct their own learning. Constructivist techniques require the use of critical thinking through learners' active involvement in the learning process. The aim is for learners to use critical thinking to identify problems, ask questions, reason, examine and solve problems in real situations and make sound decisions. This approach provides learners with activities and experiences that stimulate them to learn to think for themselves and to ask questions. Therefore, teachers need to design activities that require learners to think critically and act independently through mastering these various modes of inquiry.

The purpose of this study was to explore how the selected Grade 10 Life Science teachers understand and implement critical thinking in their teaching practice. I conducted the study in two secondary schools from the Omusati region in Namibia using a case study to gain insight into the implementation of critical thinking. Three data collection instruments: interviews, document analysis and class observations were used. The reason for conducting this study was to gain a better understanding of how teachers use various strategies to foster critical thinking skills in Life Science and the challenges they experience in teaching in secondary schools.

The results of the study revealed that teachers have a theoretical understanding of what critical thinking implies and the role it plays in learning. They are also aware of the strategies used to develop critical thinking skills. However, these theoretical perspectives do not reflect in their teaching in that some of the strategies that the teachers used did not bring about meaningful learning. Learners are still required to recall factual knowledge, thus active involvement of the learners is limited. The study also revealed that there are specific issues that hamper the implementation of critical thinking, which include superficial understanding of learner-centered education, teacher-tell approach, overcrowded curriculum, inexplicit syllabus, lack of good examples from the textbooks

and examinations, too short lesson periods, lack of language proficiency and lack of professional development.

The findings indicate that despite the theoretical understanding of the teachers in this study, their actual practice of developing critical thinking skills is problematic. The study concludes that teachers should be encouraged to design better-structured activities in order to involve learners beyond just being listeners. In light of these findings, the study recognizes a need for ongoing in-service professional development to support teachers in modelling critical thinking to their learners and to teach them to think critically.

The findings of the study will serve to inform both my and my colleague's professional practice as advisory teachers with regard to what to focus on when advising and supporting the teachers in schools.

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My deepest appreciation and sincere thanks goes to my beloved husband, Joseph, and my children, Mandume, Nahambo, Munghwetele, Kaunalenga, Koneka, Pandulo and Ndinoshiho for their understanding, physical and moral support and patience throughout this study.

Above all, I give thanks to God the Almighty who gave me courage and wisdom to complete this research project.

I dedicate this to my beloved father, Tobias Amupala, whose hope always was for me to succeed.

DECLARATION

I, Ndiyakupi Avia, hereby declare that the work contained in this thesis is my own work, and that it has not been submitted for any degree or examination at any other university.

Signed:_____ Date: _____

ACRONYMS USED IN THIS STUDY

BETD	Basic Education Teachers Diploma
IOL	Institution of Open Learning
LCE	Learner Centred Education
MBE	Ministry of Basic Education
MBEC	Ministry of Basic Education and Culture
MBESC	Ministry of Basic Education, Sports and Culture
MoE	Ministry of Education
MEC	Ministry of Education and Culture
NAMCOL	Namibia College of Open Learning
NIED	National Institution for Educational Development
SCASS	States Collaborative on Assessment and Students Standards
UNAM	University of Namibia
WCED	Western Cape Education Department

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

> The ability to think clearly and rationally is important whatever we choose to do. If we work in education, research, finance, management or the legal profession, then critical thinking skills are not restricted to a particular subject area. Being able to think well and solve problems systematically is an asset for any career. The new economy places increasing demands on flexible intellectual skills, and the ability to analyse information and integrate diverse sources of knowledge in solving problems. Good critical thinking promotes such thinking skills, and is very important in a fast-changing workplace.
>
> (Joe Lau and Jonathan Chan)

This study investigates how Life Science teachers understand the concept of critical thinking and its role in learning and how they implement it in their daily classroom practice. Chapter one provides an overview of the research site, followed by the research context. The chapter also identifies the aim and the goals of the study. I conclude with an outline of the structure of the thesis.

1.2 RESEARCH SITES

This study was conducted in two selected schools in the Omusati region one of the 13 political regions in Namibia.

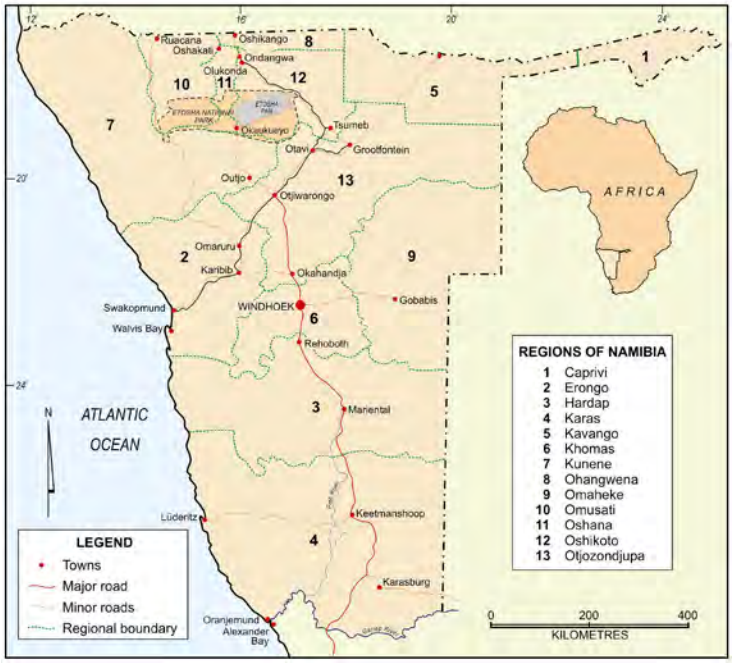

Figure 1. Map of the regions of Namibia. (Sue Abrahams, 2006). Graphics Unit, Rhodes University, Grahamstown.)

The following description of Omusati Region including its location, population and geographical background provides a brief contextual analysis of the study site (Omusati Regional Poverty Profile – Summary Report, 2007). Omusati Region is located in the north-central part of Namibia and shares a common border with neighbouring Angola. Divided into 12 constituencies, Omusati covers a total area of 26, 573 km and accounts for 3,23% of the total land area of Namibia. It has a population of around 228 842 people. The administrative centre of the region is Outapi, which is also the seat of the Regional Council and government ministries.

Two distinct geographical areas define the region. North Omusati comprises part of the Cuvelai system while the remaining part of the region can be characterised as Kalahari Sandveld with a small part in the Southeast can be classified as Mopane Shrublands. The area is characterised by thousands of shallow drainage channels or Oshanas that funnel towards the Etosha Pan. The name Omusati, lends itself well to this region as it describes the most prominent vegetation in the area, namely Mopane

trees and shrubs, which is called ‘Omusati’ in Oshiwambo, one of the local languages. The direct translation of the word ‘omusati’ is ‘what a deceased said’.

According to the statistics of Omusati Education Regional Office, in 2008 there were 269 schools of which 8 are junior secondary (accommodating Grades 8-10). The Omusati region has one Agricultural College; 12 secondary schools (accommodating senior secondary phase, Grades 11-12); 86 combined schools (accommodating Grades1-10); and 163 primary schools (accommodating Grades 1-4).

The study was conducted in two secondary schools; one is situated in a rural area and the other one in a semi-urban area. The rural school is Kombanda Secondary School (a pseudonym), which is 20 km outside Oshakati town. It has an enrolment of 513 learners, which makes it one of the larger schools in the region. I observed one of the two Grade 10 classes consisting of 38 learners

The semi-urban school is Kumbaya Secondary School (a pseudonym). This school was established after independence in Omusati Region. It is a school 80km outside Oshakati town. It has an enrolment of 645 learners, which makes it one of the largest schools in the region. The Grade 10 class I observed has 38 learners.

1.3 **CONTEXT OF THE STUDY**

The national education policy, *Toward education for all* states that basic education aims at promoting the intellectual development of all learners which includes ‘developing a lively, questioning appreciative and creative intellect, enabling learners to discuss issues rationally, solve problems and apply themselves to tasks’ (Namibia. Ministry of Education and Culture [MEC], 1993: 56). The learner centred education (LCE) approach as stipulated in *Toward education for all*, has as its focus the development of each learner’s ability to construct his/her own understanding which is only possible through the ability to think and act independently and consistently from an informed position (Namibia. MEC, 1993).

Splitter (1991) claims that it might be better if schools were to spend their valuable time in helping students develop techniques for examining the reasonableness of what they say and for making meaning of hidden assumptions. This would facilitate a constructive dimension of critical thinking, which is ultimately of great significance in developing conceptual understanding. He emphasised that educators have an obligation to help learners develop their capacity to think in order to understand the point of logical thinking (Splitter, 1991). Namibian education policy as laid out in a document produced by the National Institution for Educational Development (NIED), perceives learning as an interactive, shared and productive process, where teaching creates learning opportunities which enable learners to explore different ways of knowing and develops the whole range of their thinking abilities both within and across subject areas of the curriculum (Namibia. MBE, 2003).

The Life Science syllabus, in which this study is located, indicates the skills that learners have to develop. These include learning outcomes such as problem solving, and critical and creative skills that enable learners to take a critical approach to evidence and generate new ideas. A critical thinking approach is seen as important as it 'makes learning meaningful, relevant and challenging for learners' (Namibia. MBE, 2003: 32) while also enhancing the development of personal and social skills. Thus it is seen as important to develop creative and critical thinkers through Life Science to prepare learners to make informed and responsible decisions in and for their society and environment (Van Harmelen & Wilmot, 2001: vii).

Splitter (1991: 89) views critical thinking as a 'cornerstone of education' and claimed that 'there is in many parts of the world a growing awareness that thinking in general and critical thinking in particular, are areas of concern that can no longer be ignored.' This requires that the teaching and learning process in general should involve active engagement in critical thinking, which includes thinking, reasoning and questioning. Gibson (2003) also states that the critical thinking movement is currently at the forefront of educational reform in the world seeking to transform education in all disciplines and at all levels. He further claims that this movement has gathered strength as a result of increasing concern among employers, educators and public officials that students are not learning the thinking and reasoning skills needed to manage the complexity of contemporary life (Gibson, 2003).

Gibson (2003) goes on to say that critical thinking is often identified with allied concepts such as problem solving, decision making, reasoning, informal logic or simply thinking. Elder and Paul (1994) explain that critical thinking is best understood as the ability of thinkers to 'take charge of their own thinking'. This requires that they develop sound criteria and standards for analysing and assessing their own thinking (Elder & Paul, 1994). Thus to think critically is to distinguish between fact and opinion; ask questions; make detailed observations; uncover assumptions and define their terms; and make assertions based on sound logic and evidence (Ellis, 1997). According to Page and Mukherjee (2007) critical thinking is necessary for learners to be able to deal with the 'increasing complexities of real-life problems'. Elder (2004) adds that critical thinking is necessary for making reasoned judgment.

In addition, (Namibia. MBE, 2003: 34) claims that if 'the quality of learning' is to be improved there is a need for teachers to understand why and how to develop learners thinking ability through teaching and assessing. This implies that it is important for teachers to have a good grounding of their disciplines but also to understand why and how to assess for learning with understanding through promoting critical thinking (NIED, 2003). The strategies that are advocated are consciously designed and developed to enhance and to develop the learners' critical cognitive faculties. These include a range of activities such as questions, small group discussions, homework tasks, debates, role-play as well as fieldwork and issue-based activities. Therefore multiple classroom experiences that require learners to apply cognitive skills to enhance critical thinking are viewed as an essential part of the daily school programme.

However, *Learner Centred Education in the Namibian context* (Namibia. MBE, 2003) indicates that learning support materials still overemphasize factual recall at the expense of including opportunities for exploration and problem solving.. It continues that existing learning support materials seldom use a scaffolding approach to develop learners thinking ability where questions stimulate reflection, comparison and exploration, continually building on the knowledge acquired. On the other hand, because of the continued focus on normative assessment and examinations teachers

also tend to focus on memory recall at the expense of providing opportunities for learners to demonstrate their understanding and thinking ability.

As a teacher and a mother I am interested in the issue of developing young learners' ability to think. When interacting with children I have always tried to challenge them and to make them believe that they are able to think critically and to understand the value of such thinking. Based on my experiences as an advisory teacher I have been concerned by what appears to be a general lack in systematically and purposefully developing critical thinking among learners (Doyle & Mallet, 1994; Splitter, 1991). Thus as an advisory teacher, my interest in this study was first prompted by my classroom observations during school visits and by monitoring regional examinations. Having been involved in marking the National examinations I am expected to comment and give feedback on and contribute to the Examiners' report. My experience was that teachers often ask closed questions that required learners to give short answers and factual recall that showed a lack of enhancing conceptual understanding through thinking critically. As my responsibility as an advisory teacher is to assist and support teachers teaching Life Science, my initial concern was to ask whether I have a proper understanding of and insight into the issues that contribute to this state of affairs. This study was therefore prompted by my desire to investigate issues with regard to my research question and to improve my role as an advisory teacher as well as to shed some light on the possible problems that might be contributing to this state of affairs**.**

In the light of the above, I want to find out how Grade 10 Life Science teachers understand critical thinking as well as how they implement it in their daily practice. I have elected to focus on Grade 10 hoping that teacher-learner interaction at this level will provide me with better information in terms of the learners' language proficiency at this phase. I hope that the study will inform advisory teachers, examiners and curriculum developers on how to help teachers to make teaching and learning meaningful through promoting critical thinking. Further to this I hope that this study will have meaning to my colleagues both in pre- and in-service education.

1.4 RESEARCH GOAL

The goal of this study was to investigate how selected Life Science teachers understand and implement critical thinking skills in their daily practice.
Therefore my research question is:

- How do Life Science teachers understand and implement critical thinking skills in their daily classroom practice?

1.5 THE STRUCTURE OF THE THESIS

The thesis consists of six chapters and they are structured as follows:
Chapter 1 introduces the study by giving the reader an insight into the location of my research site. It also describes the context of the research, the aim and research goal as well as the research questions.

Chapter 2 provides an analysis of how a constructivist epistemology informs the learner centred approach, on which Namibian educational reform policy is based, with regard to the implementation of critical thinking. In particular, it critically analyses and reviews literature that shaped and informed this research and that provided an important foundation and framework for the study.

In Chapter 3 I present the research design and the methodology as well as the techniques I used to collect data. I describe how I used different data collection instruments such as semi- structured interviews, observation and document analysis to investigate how teachers understand and develop critical thinking skills in Life Science.

Chapter 4 presents the findings derived from the different data collection instruments I used. These are presented in the form of the categories that emerged from data analysis, which include the profile of the teachers and the schools; teachers' perception and understanding of the concept 'critical thinking' and its role in teaching and learning; the description of the teachers' lessons; strategies that teachers use to develop critical thinking skills; evidence of critical thinking skills to be developed from the documents; challenges in teaching critical thinking skills and suggestions for possible support to teachers in implementing critical thinking skills.

In Chapter 5 I discuss the research findings reported in chapter four. This provides an in-depth analysis and interpretation of the findings.

In Chapter 6 I conclude the study by providing a critical overview and reflection of what prompted the research and why it was considered worthwhile. I also give an overview of the key findings and what I learnt about the topic researched. Furthermore, I outline tentative suggestions about how the issues that arose need to be addressed in the light of the research. Finally, I provide suggestions for further research in the area.

CHAPTER 2

LITERATURE REVIEW

2. 1 INTRODUCTION

This chapter analyses and reviews the literature that shaped and informed this research and provides an important framework for my study on critical thinking practices in the Namibian context and how it is perceived and implemented by selected Grade 10 Life Science teachers in practice.

My argument in this research is that if teachers are to develop learners' intellectual abilities they themselves should have a sound understanding of the concept of 'critical thinking' and the pedagogy surrounding it. This argument is supported by Costello (2000), who suggested that teachers should get proper training in how to improve their own critical thinking skills, demonstrate eagerness to think critically and be open to exploring new ways to enhance and broaden learners' thinking skills. Hinchey (1998: 41) suggested that teachers need help to 'be better' with their learners in order to give them an opportunity to develop their own understanding. From the literature explored it became evident that if critical thinking is to be well understood, there are theories and principles to bear in mind as well as strategies that should be used. It appears from the literature and the policy documents that the teaching of critical thinking and the development of critical thinking is a pragmatic problem in developing learners conceptual understanding and learning with understanding. As it is so important, then I argue that teachers should themselves have the necessary skills and should have a sound understanding of the strategies and theories of solving problems. My focus in this study is to test, firstly, how well teachers know the theory underpinning critical thinking. Secondly, how well teachers understand these principles and strategies and how they apply them.

This chapter begins with a description of the Namibian education reform policy. It includes looking at the broad curriculum and the Life Science syllabus in the context

of critical thinking. I proceed to an overview of critical thinking, which consists of two subsections in which I explore theories and principles of critical thinking. I indicate the key ideas from various theories that relate to my topic thus providing the framework that informs my research question. I then move on to an examination of critical thinking and learning. I review the role that critical thinking plays in formal education and strategies that teachers can use to develop learners' critical thinking as well as assessment of critical thinking. I also explore challenges that teachers may experience in teaching critical thinking. The findings from this area of research will help me to develop support mechanisms for teachers in schools. I then discuss different perspectives on teachers' knowledge. Under this section, I include the importance of teachers' understanding of the concept of critical thinking, followed by views on teacher development and support concentrating on what teachers need to know. An analysis of what it means to understand critical thinking concludes this section. The last section of the chapter explores research on critical thinking, including relevant research that has been previously conducted in Namibia. I conclude this chapter by giving a brief overview of why critical thinking is seen as important in the Namibian context.

2. 2 AN OVERVIEW OF CRITICAL THINKING IN THE NAMIBIAN EDUCATION CURRICULUM

The Namibian education reform process opted for a learner centred approach to teaching and learning. This study is based on these principles; therefore I explain how critical thinking fits within this policy based on constructivist epistemology. Namibian education policy (Namibia. MEC, 1993) is based on a learner centred approach and aims at helping learners to think independently and critically through mastering strategies for identifying, analysing and solving problems in line with the aims of the reform policy. Thus, teaching and learning ought to provide learners with activities and experiences that stimulate them to learn to think for themselves and ask questions (Namibia. MEC, 1993).

The approach of learner centred education is to develop each learner's 'ability to construct his/her own understanding' and focuses on the 'autonomy of the learner', which implies the learners' ability to think and act independently on an informed basis (Namibia. MBE,,

2003: 30). In addition it advocates that teachers should make learning meaningful, relevant and challenging for learners so that learners develop personal and social skills. This is regarded as an improved approach to teaching and learning as it contrasts with the former education system that was characterized by a teacher centred approach. The problem with this approach was that it focused on rote learning at the expense of cognitive skills and creative learning (Namibia. MBE, 2003). The following section analyses two of the key policy documents in more detail to locate critical thinking in the Namibian context.

2.2.1 The Broad Curriculum and the Life Science Syllabus in the context of critical thinking

I argue that critical thinking is a significant reform ideal within the learner centred philosophy of education in Namibia. Thus the learner centred focus adopted by Namibia emphasised developing 'a reflective attitude and creative, analytical and critical thinking and the ability to participate actively in collaborative decision making' (Namibia. MEC, 1993: 81). Furthermore, it is claimed that critical thinking by teachers develops the ability to create learning opportunities, which enable learners to explore different ways of knowing, and develop the whole range of their thinking abilities (Namibia. MEC, 1993: 81). The pilot curriculum guide for formal basic education also aims at,

> Promoting intellectual development which places emphasis on developing a lively questioning, appreciative and creative intellect enabling learners to discuss issues rationally, solve problems and apply themselves to tasks.
>
> (Namibia, MBESC, 1996).

The Life Science curriculum also stipulates the cross-curricular issues that serve as a direct link from the natural science syllabi to other subjects that deal with particular risks and challenges in our Namibian society (Namibia. MoE, (2007). The syllabus identifies the main challenges and risks we face:

> if we do not care for and manage our natural resources; ignore the risks caused by HIV and AIDS; risks to health caused by pollution, poor sanitation and waste; challenges to democracy and social stability caused by inequity and governance that ignore rights and responsibilities and which we face from globalisation.
>
> (Namibia. MoE, 2007: 4).

Thus critical thinking in the Life Science curriculum is contextualised in the various topics covered by the three syllabuses (Grade 8, 9 and 10) that focus on issues and problem solving. The key issues and problems embedded in the topics are as follows:

Table 1: Key issues and topics in the syllabus

Issues	**Topics Grade 8**	**Topics Grade 9**	**Topics Grade 10**
Environmental Education	- Plants and their abiotic environment - School garden - Ecosystem	- Living organisms - Plants - Ecosystem	- Diversity of organisms - Ecology
HIV and AIDS	-Health Education	- Health Education	- The body's immune system
Population Education		- People, food and the environment	- Reproduction - Family planning and contraception
Human Rights and Democracy	-Ecosystem	- Ecosystem	- Ecology
Information and Communication Technology	-Process skills: microscope	-Process skills: microscope	-Process skills: microscope

Thus in applying critical thinking in the context of Life Science the inference is that learners, through focusing on these problems and issues, will develop the skills and competences that are proposed by the syllabus. These areas will provide the context and situation in which learners will apply critical thinking and where they will be expected to solve problems.

Critical thinking as emphasised in this primary policy document guiding teaching and learning in Namibia is given importance in teaching Life Science. Therefore the Life Science syllabus also indicates a learning outcome, which is designated as 'critical and creative skills', which implies the ability to foster a critical approach to evidence and to generate new ideas (Namibia. MoE, 2007: 3). The emphasis here is that learners should get actively involved in the learning process by allowing them to be creative and give them opportunities to ask questions and explain concepts, so allowing them to gain deeper insight into what they are learning. The active

participation of learners implies that learners also listen to the questions, opinions and concerns of others through which they gain greater clarity and understanding of the concept under discussion. This is done to enhance the development of learners to become critical and creative thinkers who are able to reason well, solve problems and make fair judgments in the context of this subject.

In this way teaching and learning is seen to become exciting and meaningful to the learner, helping them to make sense of the information, resulting in conceptual understanding (Chaffee, 2005); Namibia. MEC, 1993). The Life Science syllabus requires 'learners to be given increasing responsibility to participate in planning and evaluating their own work, under the teacher's guide' (Namibia. MoE, 2007: 5), which enable them to reflect on their learning and results in learning with understanding. However, there is little guidance in the Life Science curriculum documents to help teachers to gain a deeper understanding of critical thinking or how to achieve it.

2.3 OVERVIEW OF CRITICAL THINKING

The literature on critical thinking identifies particular skills, characteristics, processes and products related to critical thinking. In this section I will analyse these aspects in the light of the literature on theories and principles of critical thinking. The analysis below provides the sort of theoretical framework teachers need to develop a deep understanding of critical thinking.

2.3.1 Theories of critical thinking

Under this section I try to highlight the particular characteristics of what researchers identify as crucial to the term 'critical thinking'. The literature studied indicates particular actions that the authors' claims identify critical thinking as a particular and unique form of thinking. These are what Beyer (1995) cited in Grayson (1998: 2) explains as essential aspects of critical thinking:

- **Dispositions:** Critical thinkers are sceptical, open-minded, value fair-mindedness, respect evidence and reasoning, respect clarity and

precision, look at different points of view, and will change positions when reason leads them to do so.

- **Criteria:** To think critically we must apply criteria. We need to have conditions that must be met for something to be judged as believable. Although the argument can be made that each subject area has different criteria, some standards apply to all subjects.
- **Argument:** Is a statement or proposition supplied with supporting evidence. Critical thinking involves identifying, evaluating, and constructing arguments.
- **Reasoning:** The ability to infer a conclusion from one or multiple premises. To do so requires examining logical relationships among statements or data.
- **Point of view:** The way one views the world, which shapes one's construction of meaning. In a search for understanding, critical thinkers view phenomena from many different points of view.
- **Procedures for applying criteria**: Other types of thinking use a general procedure. Critical thinking makes use of many procedures. These procedures include asking questions, making judgments, and identifying assumptions.

In this context, Wade (1995) cited in Grayson (1998) emphasises actions such as making sense, self regulation, reflection, asking questions, defining a problem, examining evidence, analyzing assumptions and biases, avoiding emotional reasoning, avoiding oversimplification, considering other interpretations, tolerating ambiguity and metacognition (Grayson, 1998). In the same light Elder and Paul (2004) citing Facione (1990) share this view as they regard critical thinking to be purposeful, self regulatory judgment which results in interpretation, analysis, evaluation, and inference as well as an explanation of the evidential, conceptual or contextual considerations upon which that judgment is based.

According to Splitter (1991: 90) citing Ennis and Howe and Warren (1989) critical thinking refers to the 'processes and skills involved in rationally deciding what to do or what to believe'. O'Rourke (2005) describes thinking as what we do when we deliberate, reflect, ponder, explore, interpret, create, consider and engage in a host of traditional cognitive processes. These include skills such as the ability to clarify questions, gather relevant data, reason to logical or valid conclusions identify key assumptions and/or trace significant implications (Paul, Elder & Bartell, 2008). Chaffee (1998: 51) also explained the term 'critical' that comes from the Greek word for 'critic', (kritikos), which means 'to question, to make sense of, to be able to

analyse'. He further related it to the word 'criticize' which means to 'question and evaluate'.

In addition, Chaffee (1998: 85) claimed that critical thinking is 'not just one way of thinking', but should be viewed as 'a total approach' to the way we make sense of the world, which 'involves an integrated set of thinking abilities and attitudes'. Moreover, Gibson (2003) believed that whenever we think through any subject it could only be done through our own capacity to reason and make sense of things. Splitter (1990: 92) also maintained that critical thinking is making sense out of experience, thus to 'construct meaning and understanding'. This implies that it is through critical thinking that conceptual understanding is enhanced. This idea supports the fact that critical thinking is a search for meaning; a way of making sense out of any information in order to find the validity of data being presented. Moreover, Morgensen (1997: 18) suggested that understanding is gained by the individual him/herself when 'actively examining and questioning' the world around her/him. Thus, Diestler cited (1998) in O'Rourke (2005) suggested that a critical thinker is someone who uses specific principles to evaluate reasoning and make decisions.

Another aspect of learning to think critically that I found worth considering is what Fisher (1990: 66) sees as 'learning how and when to question and what question to ask and also how to reason, when to use reasoning and what reasoning methods to use'. As van Harmelen & Wilmot (2001: 10) put it, 'all learning and knowledge originates from questions' thus the most important tool to use is questions that surely involve reasoning. Therefore a learner, to become a critical thinker, should develop attitudes such as a 'desire to reason, willingness to challenge and a passion for truth' (Fisher, 1990: 66). In this respect, Fisher claims that if teachers want to teach learners to become critical thinkers then they should help them discover that the process of evaluating, approving and disapproving of one's own ideas is 'natural and healthy'. This implies that they should develop an understanding that it is important to become "independent thinkers" who can reason and think fairly so as "not to be easily manipulated and controlled by others" (Fisher, 1990: 72). Thus getting learners to ask questions should be integral to day-to-day teaching (van Harmelen & Wilmot, 2001). In this sense, Fisher regards developing critical thinking through strategies as vital in encouraging learners to be reasonable, fair minded and skilled thinkers.

Critical thinking according to De Klerk (2000) citing Wimbey & Lockhead (1979) includes problem solving. This entails reasoning, inferring, creating and assessing arguments, explanations and problem solving skills (De Klerk, 2000). Critical thinking therefore is defined as the ability to analyse facts, generate and organize ideas, defend opinions, make comparisons, draw inferences, evaluate arguments and solve problems.

One of the aspects that Elder and Paul (1994) detail in their description of critical thinking is that of self-regulation. This is best understood as the ability of thinkers to be responsible for their own thinking. This requires that thinkers develop sound criteria for analysing and assessing their own thinking and regularly use those measures to improve its quality (Elder & Paul, 1994). This suggests that thinking about what to believe or do must meet appropriate standards if it is to be regarded as critical thinking (Elder & Paul, 1994). Splitter (1991) citing Siegel also highlights that a critical thinker is one who looks for and requires reasons, thus has the ability appropriately to assess the force of reasons in the context in which reasons are to play a role. Siegel (1988) in Bailin, Case, Coobs & Daniels (1999) has defined critical thinking as involving the ability to assess reasons and the eagerness, desire and disposition to base one's actions and beliefs on reasons. Bailin et al. (1999) explore this view further by suggesting that in addition to assessing intellectual products appropriately, critical thinking will include responding constructively to reasons and arguments given by others in the context of discussion.

Hoaglund (1995) cited in De Klerk (2000: 14) also points out that critical thinking is reflective thinking in that 'it observes its own progress, evaluates each step to decide whether it is justified, and corrects its own errors'. This view has been supported by Mertes (1991) cited in Huitt (1998) who postulates that critical thinking is a conscious and deliberate process, which is used to interpret or evaluate information and experiences with a set of reflective attitudes and abilities that guide thoughtful beliefs and actions. O' Rourke (2005) added to the view that critical thinking is purposeful thinking, thus, it requires an exercise of goal pursuit skills. This implies that a critical thinker consciously reflects on her/his thinking processes. Fisher (1990) explains that one who can think critically is able to carefully 'examine experience, assess knowledge and ideas weigh arguments before reaching a balanced judgment'. Hughes

(1996) cited in O' Rourke (2005) also suggested that the primary focus of critical thinking skills is on determining whether arguments are sound; meaning, if they have true premises and logical strength.

Another characteristic of critical thinking identified by many sources is metacongition. According to Grayson (1998) citing Jones & Ratcliff (1993) metacognition is thinking about one's own thinking. More specifically, 'metacognition is being aware of one's thinking as one performs specific tasks and then using this awareness to control what one is doing'. Morgensen (1997: 18) shares this sentiment as he argues that critical thinking is reflecting as metacognition, which he refers to as 'thinking about thinking itself', that 'develops human understanding'. Moreover, Lau & Chan, (2008: 2) claim that critical thinking is a meta-cognitive skill, as it requires 'careful reflection' on the good principles of reasoning and 'analysing a conscious effort to internalise them and apply them in daily life'. On the other hand, Bailin et al. (1999) believe that critical thinking is in some sense good thinking. They noted that it is the quality of the thinking, not the process of this thinking, which distinguishes critical from uncritical thinking. Quality of thinking according to Beyer (1997: 2) is the 'degree to which the characteristics of thinking considered essential to its smooth and effective functioning are present in any act of thinking'. He acknowledged researcher Nickerson's viewpoint who sees high-quality thinking as 'intentional, efficiently carried out, consistent, deep and productive' (Beyer, 1997: 2).

Fisher (1990: 69) citing Bloom concurs that the term critical thinking is synonymous with 'evaluation', which he regards as 'the highest of six thinking skills' or 'cognitive goals' of education which are, knowledge, comprehension, application, analysis, synthesis and evaluation. However, Ennis cited in De Klerk (2000: 14) indicates a slight element of disagreement with this viewpoint because he sees critical thinking as 'not identical with Bloom's taxonomy (1956) of higher order thinking skills'. He argued that although critical thinking includes many of the practical higher order thinking skills, it also 'comprises dispositions'. Thus a person needs also to show natural qualities of mind and character to be regarded a critical thinker. Moreover, Epstein (2000) as cited in O'Rourke (2005) says that critical thinking is evaluating whether we should be convinced that some claim is true or some argument is good, as well as formulating good arguments.

Thus if we consider the various characteristics, skills, processes and products related to critical thinking in the Namibian context then it would seem that we need to focus particularly on developing learners' ability to be self regulatory, reflective and to evaluate their own thinking and that of others, while at the same time ensuring that learners acquire an understanding of and respect for the need to become critical thinkers through the practice of critical thinking.

2.3.2 Principles of critical thinking

The previous section revealed that many authors emphasised the issue of principles and standards. In this section I attempt to clarify what is meant by these principles and why they are important. Gibson (2003) claims that critical thinking is now at the forefront of educational reform as it seeks to transform education in all disciplines and at all levels. Morgensen (1997: 21) offers the same argument that critical thinking is a 'central education concept through which a healthy, just and sustainable future is created'. He further pointed out that critical thinking aims at identifying and challenging what is in existence. As Lau and Chan (2008) point out, this implies the need to enhance the ability to deal with changes and contemporary issues quickly and effectively and the ability to analyse information and integrate diverse sources of knowledge in solving problems.

According to Larson (1994 (no page) one of the 'most violated principles of critical thinking is thoroughness' – that is gathering together all available facts on the subject under scrutiny. In Bailin et al. (1999: 297) critical thinking is viewed as largely 'a matter of teaching students to make appropriate use of the concepts, standards and strategies and procedures our culture has developed for disciplining thinking and increasing its fruitfulness'. Splitter (1991) also holds the view that it is important to note that in a community of enquiry learners become aware of themselves as thinkers and not merely as learners of other people's thought. However, Lau & Chan (2008) revealed that although most people would agree that critical thinking is an important thinking skill they lack the knowledge of how to improve their own thinking. Therefore Rawling (n. d.: 62) describes the main characteristics of an enquiry-based approach as one that:

- involves learners as active participants in a sequence of meaningful learning through enquiry
- provides opportunities for the development of a wide range of skills and abilities
- provides possibilities for open-ended enquiries in which attitudes and values may be clarified and an interchange of ideas and opinions can take place
- provides scope for an effective balance of both teacher directed work and more independent student enquiry

For this reason Harlen and Jelly (1989) cited in Chombe (2007) suggested that we should provide learners with opportunities to tell what they really think about things, analyse what they are likely to mean by those things and help them to develop a better understanding where there is a lack of understanding. This view suggests that critical thinking should develop the ability to imagine alternatives and propose possible modes of action. Chaffee (1998) pointed out that 'a more powerful critical thinker is acquiring the abilities needed to achieve goals and solve problems and make intelligent decisions' (Chaffee, 1998: 588). Therefore it is vital for learners to be educated to be able to think in an open-minded and flexible way thus becoming more powerful critical thinkers.

From the literature explored it became evident that the movement to the information age has focused attention on good thinking as an important element of life success. Therefore *Critical Thinking* (2008) argues that critical thinking in a strong sense does not include simply the acquisition or retention of information or the possession of a skill-set, which one does not use regularly; nor does it merely exercise skills without acceptance of the results. Thus, Elder (2004: 2) states that 'an effective thinker must be willing to think well as well as able to think'. Looking at its limitation, she cites Facione's view (1990) that a person can be good at critical thinking, meaning that a person can have appropriate dispositions and be skilful at the cognitive process, while still not being a good, in the moral sense, critical thinker. This implies that a person can be good at developing arguments and then unethically use these skills to mislead or exploit a person or deliberately confuse and confound, or frustrate a project (Elder, 2004). She further claimed that experts find it hard to imagine a person good at critical thinking who is not also good in the broader personal and social sense. The

following are attitudes and dispositions identified by Carroll (2007: 5) as belonging to a critical thinker are listed below:

- *Intellectual humility:* a willingness to admit error, change beliefs when warranted, or suspend judgment
- *Confidence in reason:* a willingness to go wherever the evidence leads
- *Intellectual curiosity:* a love of exploring new topics, learning new things, gaining knowledge
- *Intellectual independence:* a willingness to examine honestly and fairly the positions of those you disagree with, and a willingness to question authority, tradition, and majority opinion

Therefore as Elder (2004) puts it, if a person is really a good critical thinker, in the procedural sense and if the person has all the appropriate dispositions, then that person would not do exploitative things. Thus, educating good critical thinkers means working towards this ideal (Elder, 2004). Our classrooms/teaching environment ought therefore to be focusing on applying the above principles, standards, procedures and strategies if we are to develop the desired critical thinking of the policy frameworks.

2.4 CRITICAL THINKING AND LEARNING

In the context of the education reform policy, learner centred education aims at 'developing learning with understanding, which include the skills and attitudes required to contribute to the development of society' (Namibia. MoE, 2007). This implies the development of each learner's ability to construct her/his own understanding. The emphasis is that understanding is gained by the individuals themselves when actively examining and questioning the world around them (Morgensen, 1997). This implies that learning is both an individual and collaborative experience (Namibia. MBE, 2003) that takes place through reflecting and making meaning out of experience. Therefore in this section I try to shed light on how critical thinking contributes to learning.

From the literature explored, it became evident that the critical thinking movement is currently seen to be at the forefront of educational reform in various part of the world. Paul et al. in *Critical Thinking Community* (2007), claim that critical thinking is the

heart of well-conceived educational reform and restructuring, because it is at the heart of the 21st century. Bailin et al. (1999) support this viewpoint as they claim that developing critical thinking is an important goal of education. In the same vein Gibson (2003) describes critical thinking as foundational to the effective teaching of any subject. She further elaborated that whenever we think through any subject we can do so only through our own capacity to reason and make sense of things. However, Leat cited in Lambert and Balderstone (2000) reveal that there is a particularly serious problem in some teaching as teachers put too much emphasis on teaching and not enough on learning which leads to an emphasis on factual information and not enough on the intellectual development of learners.

In my experience learning is not age-specific. This is borne out and supported by Costello (2000), and the same applies to critical thinking. Splitter (1991) also argues that even quite young children can do abstract thinking and they make connections between the concrete and the abstract which facilitate their understanding. Therefore Leat and McAleavy cited in Splitter (1991: 97) suggest that 'even teachers in early childhood education should incorporate abstract thinking into teaching and learning activities'. It is in those early years that children begin the process of seeking meaning and making sense of their experience (Splitter, 1991: 98). Chaffee (1998) supports this claim indicating that when children enter school, they are natural questioners, but this questioning attitude is often discouraged, as it is the teacher who asks the questions and the learners' job is to learn the answers.

In the literature reviewed, critical thinking is also regarded as visionary thinking. Essentially, Namibia. MEC, 1993: 60 offers the same view that

> learners should be taught how to reflect critically on their place in the world, to practice envisioned alternative ways of development and living, evaluating alternative visions, learning how to negotiate and justify choices between visions, and participating in community life to bring such visions into effect.

In this way learners are prepared for the responsibilities and challenges of adult life and to be citizens in a democratic society from their childhood. According to Bostwick (2008: 1) learning is expressed as the ability of students 'to analyse carefully and logically information and ideas from multiple perspectives'. The social

constructivist view also sees learning as an interactive, shared and productive process, where teaching is creating learning opportunities which enable learners to explore different ways of knowing, and develop the whole range of their thinking abilities (Namibia. MBE, 2003). Further, the natural curiosity and eagerness of all young people to learn to investigate and make sense of a widening world must be 'nourished and encouraged by challenging and meaningful tasks' ((Namibia. MEC, 1993: 60).

Looking at critical thinking in terms of moral issues De Klerk (2000: 10) citing Nickerson suggests that learners need to become good thinkers because 'thinking is at the heart of what it means to be human'. She further adds that 'to fail to develop one's potential in this regard is to preclude the full expression of one's humanity.' Therefore (Namibia, MEC, 1993: 60) maintains that 'learners should be empowered to think and take responsibility not only for their own, but also for one another's learning and total development'. Chaffee (1998) argued that active thinking is one of the keys to effective learning. This implies that thinking critically requires active thinking, to deal effectively with life situations. In other words, critical thinkers actively use their intelligence, knowledge and abilities to make sense of the world (Chaffee, 2002). He further proposed that to think critically or actively is to engage in the process of achieving goals, making decisions and solving problems. Namibia, (MBE, 2003) in this respect argues that if we really want learners to develop critical thinking skills and become critical thinkers then we should avoid rote learning or memorization as this in itself simply indicates learning without understanding, Thus, for learning with understanding to take place, children should be encouraged to think critically through reasoning and arguing well (Costello, 2000).

Splitter (1991: 91) argues that 'educators have an obligation to help learners develop their logical capacities and inclinations so that they will at least understand the point of thinking logically'. Yet Wright (2002) claims that teaching critical thinking is problematic because there are competing definitions and practices and many barriers to its implementation. However, although these problems still exist, it can gradually be resolved if educators who are agents of change gain sound understanding and become actively involved in helping learners to develop an understanding of their own thinking and reasoning through using appropriate strategies, informed by relevant principles and theories of critical thinking.

2.4.1 The role of critical thinking in formal education

Given that critical thinking is an important aspect of learning it must of necessity play an important role in teaching. According to Splitter (1999: 89), it is a 'corner-stone of education'. He further stresses that critical thinking is an area of educational concern that 'can no longer be ignored' as it has a direct impact on children's cognitive development This view is supported by Bailin et al. (1999) who claim that developing critical thinking is an important goal of education. Paul in *Critical Thinking Community* (2007) also argues that critical thinking is essential to effective learning and productive living. Thus Hoaglund (1995) in de Klerk (2000) believes that critical thinking benefits every person, be they students, workers, consumers or citizens. Summer (n. d.) cited in *Critical Thinking* (2008) explains that

> ….the critical habit of thought if usual in society, will pervade all its mores, because it is a way of taking up the problems of life. Men educated in it cannot be stampeded by stump orators. They are slow to believe. They can hold things as possible or probable in all degrees, without certainty, and without pain. They can wait for evidence and weigh evidence, uninfluenced by the emphasis or confidence with which assertions are made on one side or the other. They can resist to their dearest prejudices and all kinds of cajolery. Education in the critical faculty is the only education of which it can be truly said that it makes good citizens.

This statement implies that enhanced critical thinking skills are also essential to meet employment challenges (Bostwick, 2008).

Lau & Chan**,** (2008: 1) give the following reasons why critical thinking ought to be integral to all formal education systems, suggesting it:

- *is a domain-general thinking skill* – that the ability to think clearly and rationally is important in whatever we choose to do, be in education, finance, management, research or the legal profession
- *is very important in the new knowledge economy* – that the global contemporary economy places increasing demands on flexible intellectual skills and the ability to analyse information and integrate diverse sources of knowledge and solving problems

- *enhances language and presentation skills* – that thinking clearly and systematically and learning how to analyse logical structure of texts, improves the way we express our ideas and comprehension abilities
- *promotes creativity* – that it plays a crucial role in evaluating new ideas, selecting the best ones and modifying them if necessary
- *is crucial for self-reflectivity* - that in order to live a meaningful life and to structure our lives accordingly, we need to justify and reflect on our values and decisions.

According to Lambert & Balderstone (2000) critical thinking develops learner's ability to cope with intellectually challenging tasks, leading to improved self-esteem through genuine achievement. Moreover, Chaffee (1998) argues that critical thinking enables learners to become experts, to view the world clearly and to make productive choices. Splitter (1991) also suggested that it is through critical thinking that learners are prepared to be responsible for their own lives as adults and to be intellectually self-sufficient. This implies that critical thinkers are enabled to make sound and independent judgments on whatever information they may be given in their daily life. In addition, Leat and McAleavy cited in Lambert and Balderstone (2000) argue that promoting critical thinking enables pupils to become more reflective and develops their reasoning abilities. Thus learners develop qualities and attitudes that make them eager to reason well within the disciplines and to know that they have the right to be treated with respect (Splitter, 1991). As we live in a democratic society, reasoning enables learners to solve problems and make informed decisions. Thus, it is through critical thinking that learners are enabled to reason and to argue well and fairly (Costello, 2000).

Learning to argue according to Costello (2000) is also one of the central objectives of education. Paul cited in *Critical Thinking Commu*nity (2007: 1) argued that critical thinking 'is not just thinking, but thinking that entails self-improvement'. He contends that the first benefit one can accrue from instruction in critical thinking is the discipline and improvement of one's minds. Lau and Chan (2008) also claim that critical thinking can help us acquire knowledge, improve our theories and strengthen arguments. According to de Klerk (2000), critical thinking helps us ask important questions and to seek answers to them. In addition, Potts (1994) points out that asking open-ended questions that do not expect 'one right answer' also encourages learners

to think and respond creatively without fear of giving the 'wrong' answer. Thus teaching that develops critical thinking skills provides opportunities for learners to see how a newly acquired skill can apply to other situations and to their own experience (Potts, 1994).

2.4.2 Strategies of developing critical thinking

In the previous section the discussion reveals how critical thinking is viewed as an essential dimension of formal education. This section will focus on the strategies that can be used to develop critical thinking skills at classroom level. The strategies for developing critical thinking skills that a teacher can use are to a large extent influenced by the theories and principles that I reviewed earlier. Critical thinking is described as a total approach to understanding how to make sense of the world (Chaffee, 1998; Gibson, 2003; Splitter, 1991). This approach can be applied by allowing learners to think and reflect critically via meaningful activities in order to gain sound understanding of the world in which they live ((Namibia. MEC, 1993). The policy document goes on to claim that for learners to be prepared for the responsibilities and challenges of adult life and citizenship, teachers have to guide them to become informed citizens capable of making intelligent decisions. Rusbult (2006) also argues that in order to teach thinking, we need instruction that encourages thinking. Thus for teachers to bring about meaningful learning they should be able to encourage learners to develop their own understanding by involving them in intellectual activities at all levels.

Namibian policy stresses that in a learner centred approach learners are expected to develop intellectual thinking through questions that stimulate reflection, comparison and exploration, continually building on the knowledge acquired (Namibia. MBE, 2003). Bostwick (2008) argues that learning is expressed as the ability of students to analyse carefully and logically information and ideas from multiple perspectives. Students are also expected to assimilate content, but this is often interpreted to mean that they are required to recall information and to have some comprehension of knowledge but need not be fully engaged in the 'range of thoughtful thinking activities that they are expected to demonstrate as graduates' (Bostwick, 2008: 1). It is therefore necessary for learners to learn to think logically through asking and

answering questions at the beginning of an enquiry that will lead them to new understanding.

Lambright cited in Bostwick (2008) argues that students must go beyond acquiring facts and learning theories. This implies that they must be capable of applying knowledge. Therefore Bostwick (2008) identifies learning objectives associated with critical thinking as the ability to analyse complex issues and make informed decisions; to synthesise information in order to arrive at reasoned conclusions; evaluate the logic, validity and relevance of data; solve challenging problems and use knowledge and understanding in order to generate and explore new questions. For learners to acquire these skills, teachers need to adopt what Leat cited in Lambert & Balderstone (2000: 306) call 'changing pupil's approach'. This requires teachers to change their own view of teaching and learning from one that assumes that intelligence is fixed to the one that assumes that it is fluid and can therefore be developed (Lambert & Balderstone, 2000). This can only be developed through involving learners in doing things and thinking about the things they are doing (Brightman, 2008).

Bostwick (2008: 5), cited Lambright who highlighted Cross's idea that if one wants to teach critical thinking, 'one devises exercises that require students to practice critical thinking' and at the same time 'demonstrate their progress in achieving the complex skills' inherent in this type of thinking. The article *Teaching Critical thinking* (2008: 6), also shared this viewpoint that the ability to think critically develops through 'practice and exercise'. It is through homework, assignments and tests that this exercise is provided. The article further elaborated that to provide effective exercise teachers must try to break the work down into small, written assignments in order not only to allow learners to gain more practice in thinking critically, but to be in a better position to learn by trial and error. It is important that assignments involve the tasks of critical thinking and must offer meaningful feedback and model critical thinking in the way they are presented (*Teaching Critical Thinking*, 2008).

In order for learners to acquire critical thinking skills, teachers must encourage them to go beyond their present thinking through an activity, which Lambert & Balderstone (2000: 308) call the 'construction zone'. They suggest that there is a need for teachers

to adopt a more 'hands off' approach during the phase they refer to as construction zone activity. What is meant by 'construction zone' action is that

> the teacher becomes more of a classroom observer, carefully studying the actions of the learners, listening to conversations about the tasks and trying to make sense of their reasoning and strategies being used to resolve the cognitive conflict (Lambert & Balderstone, 2000: 308).

Lambert & Balderstone (2000: 308) further suggest that the teacher then 'takes on more direct control' using direct questions to explore learners' thinking, clarify, understanding and establish patterns in the reasoning used. This is where learners' thinking is challenged by new experience or evidence. Simpson (1996) however, argues that teachers' questions are not the only way to work toward critical understanding. She recommends that if teachers decide to work with questions, they must value and respect children's own agenda and not control the children's talk and thinking with their own adult questions. She further points out that teachers' questions can limit and prevent them from recognizing what children are talking about. She advises teachers to allow time in discussions for learners to think and build their own meanings and not rush to fill up pauses with a new questions and the teacher's own ideas.

As indicated earlier, the use of questions is a strategy recommended for developing critical thinking. Fisher (1990) argues that a key to critical thinking is self-questioning and there is no better way to encourage children to monitor their own thinking than for a significant adult in a child's life to model openness to self criticism. Therefore teachers need to teach learners to examine, probe, question and reflect on what they have learned (Brightman, 2008). In South Africa the Western Cape Education Department (WCED), (2000) shares this opinion as they propose that learners must be encouraged to ask questions, to argue and to speak their minds on all issues under study. In the same vein, Fisher (1990: 92) also suggests that children should be encouraged to 'qualify their statements if they have insufficient evidence'. He explains that they should be asked for 'evidence on which their statements of belief are based and be encouraged to recognize the possibility that alternative claims could be true'. Teachers then need to use probing questions and problem solving questions using the cue words that demands more than factual recall such as: Do you think..?

Why do you think..? What do you think and why? What reason? etc., thus requiring learners to not only comprehend a situation but to analyse, sort out and make relationships, look for patterns and anomalies and then evaluate before making the decision (van Harmelen, 2005). These questions are related to critical thinking and include action verbs such as explain, discuss, account, evaluate, compare and contrast. Probing questions and problem solving questions therefore test a variety of cognitive skills but also are able to reveal learners' attitudes and values. Teachers also need to understand that each type of question has a different function in the teaching/learning situation

Lambert and Balderstone (2000: 309) share the same sentiment as they regard 'designing appropriate activities and strategies to facilitate cognitive conflict as an important part of a teacher's planning and preparation in enhancing developing cognitive skills'. South African education policy (WCED, 2000: 28) shares this viewpoint suggesting that a teacher should 'design and set up appropriate contexts in which learners will become engaged in interesting activities that encourage and facilitate learning'. As WCED (2000: 28) puts it:

> The teacher may guide learners as they approach problems, may encourage them to work in groups to think about issues, questions and usually support them with encouragement and criticism as they tackle real issues and subjects.

Therefore, working in groups can be a valuable strategy if used well (Brightman, 2008). The teacher should organize the learning situation in a way that enhances the development of cognitive skills that lead to meaningful learning.

What I also find worth considering regarding the development of critical thinking is teaching learners to make sense of pictures. Pictures are valuable tools that can be used in various ways to develop thinking skills. For example learners can formulate their own questions about a picture, tell or write a story about it by using their imaginations (van Harmelen, 2005). Van Harmelen claims that in this way they employ a variety of different thinking skills, be it practicing logical sequences and developing a variety of social skills. In addition, she points out that these include sharing ideas, learning tolerance and understanding, learning to accept views of others, having to make and take decisions. The analysis of the questions which

learners formulate provides the teacher with the necessary insight into the levels at which learners are thinking and the interest learners have about the given situation (van Harmelen, 2005).

It is important to understand that critical thinking is a complex activity and we should not expect that one method of instruction would prove sufficient for developing each of its component parts (Huitt, 1998). Therefore it is necessary for teachers to apply inquiry methods, such as role play, debates, projects, problem solving activities, experimenting, reporting, interviews, etc. that provide learners with activities and experiences that will stimulate them to think and ask questions.

2.4.3 Assessment of critical thinking

This section briefly explores what assessment entails, policy perspectives on assessment and the role of assessment in the teaching and learning process with regard to the development of critical thinking skills. Literature has defined assessment in different ways. Firstly, Gipps (1994) cited in van Harmelen (2000) and Wilmot (2003) defines assessment as the range of methods used for evaluating learners' performance and attainment. Secondly, Le Grange & Reddy (1998) describe assessment as the word to use when judgments are made about learners' performance, which involves gathering and organising information about learners in order to make judgments and decisions about their learning. Thirdly, Moll (2002: 7) describes assessment of learning as 'interwoven with teaching, which occurs through teacher's observation of learners, teacher observation of learners at work, and through learners' exhibitions and portfolios'. Lastly, Black, Harrison, Lee, Marshall & William (2003) describe assessment for learning as any assessment for which its first priority is to serve the purpose of promoting learners' learning.

The Namibian Education Reform policies regard assessment as an integral part of the teaching and learning process. According to the States Collaborative on Assessment and Students Standards (SCASS), (2006) assessment is used to accomplish a number of different objectives: to learn more about the individual being tested; to rank the performance and achievement of individuals; to make decisions regarding learners placement; to identify specific problems and needs; and to improve learning or instruction. Therefore, Namibian policy documents (Namibia. MEC, 1993; Namibia.

MBESC, 1999) stipulate that teachers must link their assessment to the objectives and competencies laid down in the syllabus of the subject. The policy provides examples of assessment activities to be carried out that include tests, examinations, projects, quizzes and portfolios but also questioning and observing a learner at work and homework. Literature emphasizes assessment of learners thinking through getting them to ask questions themselves as these effectively reveal their thinking abilities (van Harmelen & Wilmot, 2001; van Harmelen, 2005). Policy document (Namibia. MBE, 2003) argues that if learning is to be assessed in depth, formalised assessment should be thorough in terms of assessing skills, knowledge and competences. This implies that assessment should encourage and promote the development of higher analysis thinking skills that enable learners to think critically and creatively, to solve problems, to make decisions and communicate effectively (Gibbs & Stobart, 1997; Pahad, 1997).

Learning in Namibian education is assessed through two different strands: assessment of learning which serves a summative purpose and assessment for learning that serves a formative purpose (Wilmot, 2003). Summative assessment refers to an end-of-year test or examination (Namibia. MBE, 2007), while formative assessment involves a range of strategies designed to monitor and support progress and provide feedback on the learners' performance (Reid, Clyde, Smith, Ross & Harrison, 2006). Namibian policy (Namibia. MEC, 1993: 129) considers the latter assessment as having a formative role for learners because it 'helps learners to use intelligently what they have learned to solve problems'. SCASS (2006) also describes formative assessment as a process used by teachers and learners during instruction that provides feedback to adjust ongoing teaching and learning to improve learners' achievement of intended instructional outcomes. Wilmot (2003: 11) claims that formative assessment enables teachers to find out where learners are 'at', at different stages of the teaching and learning process, thus informing the next step to be taken for the learners to make progress. Angelo (1995) cited in Grayson (1998) stresses that the use of ongoing classroom assessment is a way to monitor and facilitate learners' critical thinking. He suggested an example of asking learners to write what he calls a 'Minute Paper' where learners respond to questions such as 'What was the most important thing you learned in the class today?' This provides opportunities for learners to learn and practice critical thinking skills in meaningful contexts.

The Namibian policy document (Namibia. MEC, 1993: 128) further stipulates that 'to serve learning well, whatever tests or examination we use need to be concerned with thinking and understanding and not simply recall'. Van Harmelen & Wilmot (2001) suggest that assessment needs to be more varied and should assess in more depth the structure and quality of both learners' knowledge and understanding. This implies that examinations and tests as a form of assessment should require learners to respond to open ended and higher order questions. This is not only essential for assessment reasons but also to enhance understanding and critical thinking in learners in their daily life (Osborne & Wellington, 2001). The Namibian policy document confirms that the current problem in Namibia is that far too often examinations and tests are designed to measure the recall of disconnected bits of information. This document also suggests that although we say we want learners to develop their ability to think critically, to compare, to analyse, to synthesize, to imagine, and to innovate, in practice none of these are measured; instead all examinations do is to assess their recall of factual information (Namibia. MEC, 1993). Collins and Lacey (1996: 65) share the view that 'many teachers overuse lower order questions which merely demand recall.'

Therefore Wilmot (2003) encourages teachers to develop and ask questions that will assess understanding and thinking in the classrooms to make learners critical thinkers. It is important for teachers to build critical practice into their teaching by developing appropriate testing and evaluation of learners. Providing regular opportunities for pair or small group discussions allow learners to practice asking questions that promote further critical thinking. Writing assignments are an excellent vehicle for promoting critical thinking.

2.4.4 Challenges in teaching critical thinking

The intention of the learner centred approach adopted by Namibia is that teachers would empower learners to think by using teaching techniques that encourage active learner participation. However literature indicates that there are challenges with regard to its implementation. Mimbs (2005: 12) reveals some of the challenges of using critical thinking in the classroom as described by teachers in a workshop. He lists them as follows:

> Students don't buy into it; takes time and effort; lack of adequate resources.

The article on *Critical Thinking Skills* (1988) claims that some of the challenges in teaching critical thinking include an inadequate knowledge base on teaching critical thinking and conditions that require classroom management at the expense of academic instruction. Elder & Paul (1996) concur that most teachers do not seem to realise how unaware most students are of their thinking. They express their concern that little is being done at present to help students 'discover' their thinking, thus a shift is needed.

Muirhead (2002) points to the dilemma that educators face of how to foster critical thinking with students who vary in their need for academic guidance. Collins and Lacey (1996) confirm that many students with learning difficulties find it difficult to answer questions, which encourage them to think. They noted that students are used to responding to recall and naming questions but need considerable practice with the higher order questions. Therefore teachers need to give students plenty of practice and to demonstrate how to answer thinking questions.

Schafersman (1991) raises concerns that in most cases even students entering colleges lack critical thinking skills, which they should have learned during their primary and secondary education. This is an indication that there is a need to promote critical thinking at all levels in formal education. One of the aspects I have also experienced is that the existing school curriculum is often viewed as overloaded and lesson periods are considered too short and do not provide enough time for using appropriate approaches for teaching critical thinking. On the other hand, the demand of examination syllabuses and the difficulties of classroom management and resource provision, inhibit teachers from selecting the classroom approaches most appropriate to the teaching of critical thinking skills (Rawling, n.d.). Collins and Lacey (1996) add that it is difficult to find help with assessing learners 'thinking processes, which implies making judgments. Thus more in-service training is also needed to expose all teachers to a variety of these approaches for them to practice them in a variety of contexts (Wright, 2002).

Language is also another challenge in teaching and learning critical thinking. Namibia. MBE (2003) argues that language is the most important key to learning; our cognitive, emotional and social development is dependent on language. This means that it is through language that learners get the opportunity to think, ask questions and discuss in groups thus constructing their own understanding and making sense of their experience. In Namibia one of the greatest challenges we still face nearly twenty years after independence is that most learners and teachers experience difficulties in expressing themselves explicitly because of a lack of language proficiency in the language of instruction. Muirhead (2002) suggests that in education, teachers need to focus on the use of language as the entire communication process is closely linked to thinking.

2.5 TEACHERS' PERSPECTIVES ON CRITICAL THINKING

2.5.1 The importance of teachers' understanding of the critical thinking concept

Literature claims that unless teachers understand and believe in teaching critical thinking across the curriculum, and are able to incorporate it in their lessons, critical thinking will be problematic in the education arena. Wright (2002) argues that by focusing specifically on learners' thinking abilities teachers can foster a critical attitude and more sustained learning of critical thinking skills, criteria, concepts, and procedures might also occur. Wright further claims that unless one has a certain attitude towards and disposition for thinking, whatever strategies and procedures to teaching critical thinking are introduced may be powerless. Therefore teachers need to acquire the vocabulary and a sound understanding of critical thinking. For example, Buchanan (n. d.: no page), a teacher, states that:

> Critical thinking has become an integral part of my teaching. I infuse it on three levels: to plan daily lessons and course-wide objectives; by modelling good critical practices in front of my students and by creating activities that foster critical thinking in the students themselves. I make it becomes second nature.

Therefore, in the light of this discussion, teachers need to have a sound understanding of what it means to teach critical thinking skills. They need to provide evidence that

they understand critical thinking or that their students have learned how to do it in order to claim that they are able to implement it effectively (Bissell & Lemons, 2006). As Bissell and Lemons, (2006) explain good teachers should be able to cultivate critical thinking at every stage of learning so as to stimulate thinking essential to conceptual understanding. I argue that teachers who do this see and understand the significance of critical thinking in learning.

2.5.2 Teacher development and support

How teachers might be helped to integrate critical thinking into their teaching both within subject areas and across the curriculum formed part of a commission that recognised the need to support teachers in this area (McGuinness, 1999). The article on *Critical Thinking Skills* (1988) claims that to improve learners' performance on critical thinking tests, schools of education must improve teacher training. It was further stressed that this can only be accomplished through the intervention of explicit models of teacher development and teacher support. Thus as McGuinness (1999) suggests, good practice points to the need for in-service education to include networks of teachers, peer coaching and a thorough exploration of evidence in relation to children's learning.

In addition, Ashton (1980) cited in *Critical Thinking Skills* (1988) suggested that schools of education must teach cognitive skills to pre-service teachers before training them to teach these skills in the classroom. Making this point more forcefully, Walsh and Paul (1988) cited in *Critical Thinking Skills* (1988) asserted that critical thinking skills must be integrated into all aspects of teacher preparation and future teachers should be trained to be models of effective thinking strategies. This implies that educational institutions considering a critical thinking skills emphasis must make a long-term commitment to programs fostering the critical thinking process; provide in-service training; assign mentors to new teachers; allot time for teachers to share effective strategies for instruction; and involve experienced teachers in the selection of instructional materials and testing programs.

2.5.3 What teachers need to know

McGuinness (1999) argues that if learners are to become better thinkers, to learn meaningfully, to think flexibly and to make reasoned judgments, then they must be taught explicitly how to do it. Teachers need to understand that critical thinking is not an add-on to the curriculum but it is an integral part of teaching and learning (Wright, 2002). According to Mimbs (2005) teaching critical thinking skills requires teachers themselves to be competent in using higher order thinking skills. Therefore O' Rourke (2005) argues that as a teacher of critical thinking one should be in a position to explain oneself from time to time which will be a guide to the practice of critical thinking. Mimbs (2005) agrees that teachers need to model critical thinking skills to their learners and explicitly teach them to think critically. As Bissell & Lemons (2006) put it, there is a need to focus on questions, readings and activities that stimulate the mind of the learners that will lead to learning with understanding. This implies that a teacher must be able to describe, practice, model and assess critical thinking in an explicit way. For example, teachers need to use questions effectively. They therefore need to understand that effective questioning, according to the Natal College of Education (1997) is a skill, which needs practice. This essentially involves planning broadly, learning, trying out and practicing different ways of using questions.

It is also important to teach student teachers how to ask good questions, to think critically, in order to continue the advancement of the very fields we are teaching (Grayson, 1998). In addition, van Harmelen & Wilmot (2001) suggest that as teachers we have to teach our learners how to ask questions, how to debate, how to organize their time as a day-to-day practice. Learners need to share each others' questions and answers in a mutually supportive way; formulating their own questions as well as classifying and discussing which helps them to understand which leads to learning with understanding (Doyle & Mallet, 1994). Teacher preparation therefore needs not only to focus on how to use various strategies but how to design and develop them in such a way that they facilitate critical thinking. McGuinness (1999) also emphasises that it is important to give learners the time and opportunity to talk about thinking processes, to make their own thought processes more explicit, to reflect on their strategies and thus gain more self-control. She further points out that children bring their own conceptions (and misconceptions) into the classroom. Thus new knowledge and alternative strategies for thinking should be socially constructed in the classroom

not only through informed teacher instruction but also through practical activities, dialogue, reflection and discussion with peers and adults (McGuinness, 1999).

Teachers also need to know that, with the proper encouragement and cultivation, learners can develop the ability to think for themselves, to form reasonable points of view, draw conclusions, think clearly and logically, persuade each other by reason and, at the same time, become reasonable persons (*Critical Thinking Community*, 2007). Another essential aspect teachers need to understand is that critical thinking in the classroom is facilitated by a physical and intellectual environment that encourage a spirit of discovery (Potts, 1994). This includes seating arrangements that allow interaction between the teacher and the learners to minimize a passive, receptive mode among the learners and visual aids to encourage ongoing attention to critical thought processes. Therefore De Klerk (2000) proposes that a change of attitudes in teachers is necessary in order to achieve the goal.

2.6 RESEARCH ON CRITICAL THINKING AND PEDAGOGY

2.6.1 Namibian researchers' views

As Namibian education is based on a learner-centred policy, which is informed by a constructivist view in which critical thinking is one of the significant ideals within this approach, there is a need to find out how teachers perceive this ideal and implement it. I realise that very few studies carried out in Namibia have focused specifically on how critical thinking skills are understood and developed at classroom level. One of these studies is that of De Klerk in 2000, which was an investigation to determine the effects of different socio-economic factors, language environments and attitudes of first year Natural Resources students, on their performance in a critical thinking appraisal at the Polytechnic of Namibia. The focus was mostly on determining the factors that may have influenced students' critical thinking abilities.

The study reveals that many lecturers still expect the 'right' answers to their questions from students, which are often the right answers they want, instead of exploring alternatives. She also indicates that some lectures think that all they have to do is to

ask questions of a critical thinking type in the examination without prior training of the students and they expect a high pass rate. The investigation has also pointed out other possible background barriers to the development of critical thinking in learners such as parents /guardians who are uneducated/undereducated in terms of schooling, a low standard of English proficiency (official language), and a lack of the right attitude to enable learners to practice critical thinking. Thus if we are looking at critical thinking in the Namibian context, we look at: principles, strategies, assessments, challenges and teachers' understanding of critical thinking.

2.7 CONCLUSION

A very important aspect to bear in mind is that teaching critical thinking skills on their own is not enough, but it is essential to also teach learners why it is worthwhile. Literature emphasizes that critical thinking skills should be incorporated in all teacher-training courses. This will ensure that meaningful instructional activities that promote internalisation of critical thinking skills and knowledge are integrated into classes and applied in all contexts. The traditional way of teaching in schools should be changed, as they are not conducive to teaching critical thinking. Teachers need to understand that they should allow learners to make sense out of given information and do their own thinking.

Having explored the literature in this chapter, I have discovered indicators regarding theories, principles and practices that will enable me to be more alert to what teachers are doing in the classroom. These indicators will enable me to analyse their practice during my observation. My argument in this study is that if teachers are to develop learners' critical thinking skills then they themselves should have a thorough understanding of the concept and the pedagogy involved. Hence, my focus in this research is to investigate how Life Science teachers understand and teach critical thinking in Grade 10. In the next chapter I will discuss the methodology and methods that I use to investigate the teachers' understanding of critical thinking and how they implement it.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter presents the research methodology used to conduct the case study. In the research design I describe the approaches, methods and tools that I used to collect data, as well as procedures that I followed in order to analyse the data. My research question is, 'How Life science teachers understand and implement critical thinking skills in their daily practice?' In explaining how I answered this question, I have used the following structure: research orientation, research approach, selection of the sample, data collecting instruments, data analysis, validity, ethics, research issues, problems and limitations and conclusion.

3.2 RESEARCH ORIENTATION

Considering the purpose and the nature of my study, I decided to locate my research within a qualitative, interpretive case study with the focus being to explore the Grade 10 Life Science teachers' perceptions and implementation of critical thinking skills in two secondary schools in Omusati Region. According to Connole (1998:14) in an interpretive orientation, the task of a researcher becomes that of 'understanding what is going on'. In this approach the emphasis is on reaching a deep understanding that emphasises not only the what and how dimensions of actions, but especially why they occur as they do. This means that the researcher can 'identify patterns of meaning which emerge' (Connole 1998:14) and then interpret them. Patton (1990) cautions that such patterns, themes and categories must come from data; they cannot be imposed. The key dimension of this form of research is on meaning making and understanding.

I selected this approach, as it was pertinent to my study. Cohen, Manion and Morrison (2000) described the interpretive approach as a way to get into the research participants' worlds and to understand their situation from within. Furthermore, the

focus is on actions, which only make sense to us through our interactions with the 'actors' and by sharing their experiences (Cohen, Manion & Morrison, 2000). By meeting both teachers in their schools and by attending their classes I hope to achieve the sort of results suggested by the interpretative orientation and to use these results to inform and to guide my professional practice.

3.3 RESEARCH APPROACH

I used a qualitative case study approach for this research. Connole (1998) emphasises the close relationship between the interpretive orientation to research and the adoption of a qualitative case study as both focus on the making of meaning in the context of the situation under review. Anderson and Arsenault (1998: 95) highlighted this relationship as they regard qualitative research 'as a form of inquiry that explores phenomena in their natural settings and uses multi-methods to interpret, understand, explain and bring meaning to them'. Janse van Rensburg (2001:16) states that this method reflects an interest in contextual meaning making rather than generalised rules. Instead of surveying a large group, this approach takes a close look at individuals or small groups in naturalistic settings. For Maykut and Morehouse (1994: 45) 'a natural setting is a place where the researcher is most likely to discover, or uncover what is to be known about the phenomenon of interest'. In a natural setting, human behaviour can be reflected on and its meaning interpreted.

Apart from the advantage of this approach, as Patton argues, it also has limitations. In a qualitative approach there is an element of conducting an in-depth study of the phenomenon (Patton, 1990) and because of this, it makes sense that one cannot have a large sample. Cohen, Manion and Morrison (2000) have also criticised qualitative research for two reasons. In the first place they claimed that qualitative research is limited by the subjective nature of the research. Secondly, the size of the sample is small which means that the results cannot be generalised in the same way as large-scale surveys. Thus as one works with a much smaller sample, it is obvious that such a sample is not fully representative. However, despite these perceived limitations the real advantage of in-depth studies such as these is the provision of rich data, which are able to illuminate the situation being studied in a way not possible with the traditional survey approach.

As I indicated in the previous paragraph, as part of my research design, I opted to use a case study approach. According to Bassey (1998: 77) a case study is a 'method of inquiry', which involves taking extensive data from the participants being questioned or observed, with the purpose to extract meaning to better understand the situation in a real sense. Denzin and Lincoln (2000: 445) also describe a qualitative case study as 'characterised by researchers spending extended time on site, personally in contact with activities and operations of the case, reflecting revised meanings of what is going on'. This provided me with the opportunity to explore what was going on in each teacher's class in terms of the strategies and techniques they use to promote learners' critical thinking ability in their daily practices.

However, it is important to note that a case study also has limitations. Merriam (2001: 41) contends that a case study 'can oversimplify or exaggerate a situation leading a researcher to erroneous conclusions about the actual state of affairs'. I was aware of this potential problem and attempted to avoid it by using a cross-referencing multiple data collection method. I also included raw data or direct quotes for the reader to make her/his own interpretations of the situation under study.

3.4 SAMPLING

Researchers define sampling as the procedure a researcher uses to select people, places or things to study. Maxwell (2005) defines sampling as decisions about where to conduct the research and whom to involve, an essential part of the research process. Maxwell (2005) adds that sampling usually involves people, and settings, events and processes. Cohen, Manion and Morrison (2000) also refer to sampling as the way or method used to determine the number of people who will participate in the study as well as the time and accessibility to the participants needed to conduct the research.

My sample consisted of two Grade 10 Life Science teachers from two different secondary schools in Omusati region. Merriam (2001) claims that purposeful sampling is based on the assumption that the researcher wants to discover, understand and gain insight; therefore sampling must be selective in order to provide as much as valuable information as possible. Therefore I have purposively chosen Life Science

teachers, as Life Science is not only the specific subject area for which I am responsible, but because this particular subject lays special emphasis on the development of critical thinking through problem solving and decision making activities. My choice was mainly influenced by the following criteria: First, was the easy accessibility of the school; meaning close to my workplace, which made daily travelling possible. The second factor was easy accessibility in terms of accommodation; as one of the selected schools required that I spend the whole week close to the school. Thirdly, I selected the teachers because they have a good reputation in terms of the teaching of Life Science and the learners' level of English proficiency was good.

In addition to this, these are experienced teachers therefore they are more likely to provide me with rich information. According to Patton's argument (1990: 169), 'the logic and power of purposeful sampling lie in selecting information-rich cases for study in depth. He further indicates that 'information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the research, thus the term purposeful sampling'. Although one of my selected teachers withdrew because of the pressure of her further studies, the one who replaced her was at a neighbouring school, so it did not affect my plan. Apart from him being a male, which I happen to appreciate because of gender balance, he was just as qualified and experienced as the previous teacher.

As part of ethical procedures, I gave each school and teacher a pseudonym. Teacher one is Penda from Kombanda Secondary School a rural school outside of the Oshakati town. Penda is a qualified Basic Education Teacher Diploma (BETD) male teacher with six years teaching experience in the subject and he did some courses in Biology. Teacher two is Pawa from Kumbaya Secondary School, a semi-urban school in the outskirts of the town. Pawa is also a qualified BETD female teacher with eleven years of teaching experience in the subject and she also did a Further Diploma in Biology. Although there is a gender difference, it was not intentionally planned, and did not have any influence on the outcome of the study.

3.5 RESEARCH PREPARATION PROCESS

To ensure that I obtained relevant information to answer my research question, I planned the kind of data I needed to gather through each method. Firstly, I set out a data list (Appendix A) to guide the interview schedule and observation guide that I used to observe and record all lesson activities and document analysis. Secondly, I set out the interview schedule (Appendix B) containing several specific questions that I found relevant to ask all my participants. Lastly, I worked out a stimulated recall interview schedule (Appendix C) to guide me in following up what was happening during lesson observation. To test the interview questions, I piloted them. Denzin and Lincoln (1994: 213) advise that: 'Before devoting oneself to the arduous and significant time of the qualitative study, it is a good idea to do a pilot study'. Welman, Kruger and Mitchell (2005) claim that one of the benefits of the pilot study is to provide additional information with regard to improving the final questions Further to this, the rationale behind the pilot study is to determine the length of the interview, suitability of questions, ethical issues and practical issues related to the use of a tape recorder and videotape.

The pilot study was conducted with participants who were not part of the sample. My main purpose was to discover which areas would need attention and to make some adjustments if necessary. After the piloting process it was evident that some of the questions were not clear and needed to be rephrased, left out or added. As a result of the pilot interview I changed my questions and made the necessary adjustments needed for the actual interviews. During the piloting process, I learned how to transcribe the interview, observe ethical issues and practised how I should probe to get in-depth information.

After piloting I went through all the necessary steps of obtaining permission from both the principals and teachers. I had already written a letter to my Director requesting permission to conduct my research in schools (Appendix A). I then identified the research site. This was followed by my visits to schools, where I negotiated with the teachers teaching Life Science Grade 10. After the Director granted me permission, I made appointments with the principals telephonically and discussed my purpose and intentions for my visit and promised to send them my permission letter from the Director (Appendix B). Once that step was over, I sent the permission letters to the principals. I then finalized my negotiations with the teachers

mainly telephonically. They faxed their teaching timetable to me for planning. I also sent them my data list to familiarise themselves with what I needed to know from them to show their understanding of teaching critical thinking skills. I then made arrangements with the person who videotaped the lesson observations.

The actual study began on 19 May and was finalized on 05 June. The teachers signed a consent form and set up the interview dates. I spent a whole week with each teacher. Interviews were conducted at different times. Penda was the first one to be interviewed and observed then Pawa followed during the first week of June. I had interviewed each teacher on the first day, which was Monday then I observed each teacher's four lessons during the week. The stimulated recall interviews took place on the last day of the week after the observations. I did this because the teachers' schedules were so tight that I could not fit everything in so I only took notes of all the aspects observed and followed them up later. I transcribed the interviews and collected all necessary documents such as teachers' lesson plan files as well as learners' summary/work books. I made copies from these documents to work on later.

3.6 DATA COLLECTION METHODS

My data collection methods consisted of interviews, observation and document analysis, which provided me with the opportunity to create greater validity, through a process of triangulation. Cohen, Manion and Morrison (2000) view triangulation as a powerful way of demonstrating concurrent validity in qualitative study through the use of two or more methods. Denzin and Lincoln (2000: 443) also claim that this method 'serves to clarify meanings by identifying different ways the phenomenon is been seen'. Thus I used these multiple method approaches in order to add credibility to my study in terms of validity. To analyse the data I clustered together similar aspects using a matrix in order to bring meaning to the collected information. It is how I made sense of the participants' definitions of the situation, 'noting patterns, themes, categories and regularities' (Cohen, Manion & Morrison, 2000). This allowed me to get a picture of the emerging situation through sifting, sorting, reviewing and reflecting.

3.6.1 Interviews

Merriam (2001) describes interviews as a person-to-person encounter in which one person gets information from another. According to Cantrell (1993) interviews allow for the collection of data in the subjects' own words, thereby affording the researcher an opportunity to discover the subjects' perceptions, interpretations and the meaning that they give to their actions. I selected semi-structured interviews. For Kane and O' Reilly-de Brun (2001: 115) semi-structured interviews 'offer pre-determined focus', but also 'flexibility' in how the questions are put and allow for open-ended discussion of the answers. My semi-structured interviews were linked to open-ended questions to allow for the emergence of new ideas on the topic (Merriam, 2001). I applied the semi-structured questions in my research at three different stages; the initial pilot study, during the actual interviews and for the stimulated recall interviews. My main reason for using this method was to allow my participants the freedom to express themselves fully, while at the same time enabling me to maintain the sort of structure and focus I require to make meaning of the key aspects inherent to the understanding of critical thinking and its development. According to Gillham (2000: 65) it is 'flexibility' that makes semi-structured interview such a 'productive research tool' as it is simple and almost 'natural'.

As I indicated earlier, I had a list of questions to explore and to guide me. One of the advantages of this type of interview according to Merriam (2001: 74) is that 'it allows the researcher to respond to the situation at hand, to the emerging worldview of the respondent, and to new ideas on the topic'. Therefore, although such questions were not predetermined (Merriam, 2000) I used open-ended questions in my interview that allowed in-depth probing (Cohen & Manion, 1996). From the interviews, I collected information on the teacher's profiles; their knowledge about the subject; strategies they use to develop critical thinking; their perceptions of critical thinking and its role; challenges and other issues arising such as motivating and support learners to gain self-esteem. The interviews were tape-recorded and transcribed.

In spite of the fact that this method seems to work perfectly and provides rich information, I had some limitations. Firstly, the time and site selected by Teacher one was not conducive as the site was very noisy and the teacher was rushed because of

the afternoon sessions with NAMCOL learners. Secondly Teacher two was not as responsive as I hoped she would be.

3.6.2 Class observation

After the interviews, I observed a selection of lessons. Gillham (2000: 46) describes observation in a research case study as the 'most direct way of obtaining data'. Kane and O' Reilly-de Brun (2000: 116) further explain that observation allows the participants to 'understand the whole context of a complex situation'. I used this method, as I wanted to support the interviews by observing what participants actually do in a real situation. For Patton (1990) it is a powerful tool for gaining insight into a situation under study and thus provides a check on what is reported in interviews. As Cohen, Manion and Morrison (2000: 305) have noted, it allowed me an opportunity 'to gather live data from live situations'. This technique enabled me to look with a critical eye at how teachers help learners to develop critical thinking skills. All the lessons observed were video recorded and transcribed to add validity to the notes I took in the classes.

Like any other research methods, observation is also characterised by some weaknesses. The problem with observation according to Welman, Kruger and Mitchell (2005) is that the presence of the observer in class could influence the participants' behaviour. This did not appear to affect my study. My participants' behaving appeared to be unaffected, except at the beginning of the lesson on the first day, because of the video recording. In addition, teachers are used to being observed by heads of department, principals and advisory teachers.

3.6.3 Document analysis

The last method I used was document analysis. For Merriam (2001), 'a document' is a term referring to written, visual and physical materials that are relevant to the study. The documents I used included the Grade 10 Life Science syllabus, the teachers' daily lesson plans, learners' written work, examiners' reports, tests and examinations. Together with the data from the interviews and observation, these documents provided evidence of teaching and learning in terms of the extent to which teachers

promote learners' thinking abilities. I focused on strategies and activities used to develop critical thinking skills that include types of questions, role-plays, games, quizzes, etc. The syllabus was used to look at the basic competences set for developing high order thinking skills and the examiners' reports were analysed to find the extend to which learners are able to answer questions of high order thinking in the external examinations.

3.7 DATA ANALYSIS

After the data were collected from various sources, it was then scrutinised to make meaning out of the findings. Merriam (2001: 178) views data analysis as a process of meaning making out of data through 'consolidating, reducing and interpreting what people have said and what the researcher has seen and read'. This process enabled me to reflect on the information I obtained from interviews and observation transcripts and documents analysis, which helped me to identify themes, categories and patterns.

My data analysis followed a number of stages. I used what Patton (2001) terms 'source questions' to guide my analysis of each source. These questions allowed me to remain focused on what kind of things to look for in each source. The second stage was to do as Merriam (2001) suggested, read my interview and class observations transcripts and my documents analysis data. As I read through each source, I employed two strategies of colour coding, noting key areas such as teacher's understanding, and strategies teachers claim to use in their teaching. This stage was followed by identifying patterns and categories in my data. I used the same coding for both sets of interviews, and finally I was able to come up with recurring patterns, regularities and anomalies between the two teachers. The fourth stage was to do what Patton (2001) refers to as a case analysis of each teacher. This means that one first writes the case history of each participant. I started this process by grouping the responses under the guiding questions, and was able to summarize what each teacher said under each theme. The fifth stage was to make a table presenting the strategies that the teachers used to develop critical thinking skills (Table 2). This was now at a stage of making what Patton (2001) refers to as 'cross case analysis'. I was now in a position to present findings from the interviews.

The analysis of class observation was done a bit differently from the interviews. After reading through my class observation transcripts, I set up a table that enabled me to pick out strategies used by the teacher to encourage learners to think critically; the questions asked during the lessons; the evidence of the teacher's understanding; and finally evidence of learners' questions and their ability to answer higher order thinking questions. It also helped me to pick up what was going on in each lesson regarding my research questions. Using the source questions, I found the process for the document analysis not that difficult. I was able to easily identify what I was looking for. Finally, I analysed each source separately. I used such analysis to identify categories, patterns and themes for my study and I was ready to write my data presentation and analysis chapter.

3.8 VALIDITY

In doing research it is important to ensure that it is valid and worthy (Cohen, Manion & Morrison, 2000) and that findings match reality (Merriam, 2000). Therefore in this study I have enhanced validity by employing the following strategies.

3.8.1 Triangulation

As described in this chapter, I used multiple data sources. These included interviews, observations and documents. This process is referred to as triangulation. According to Denzin and Lincoln (2000: 443) triangulation is 'a process of using multiple perceptions to clarify meanings in order to enhance the credibility of an observation or interpretation'. I did this by using multiple analyses whereby I conducted interviews, visited classes and reviewed the teachers' lesson plans, syllabus, tests, examinations examiners' reports and learners' work/summary books (Cohen, Manion & Morrison, 2000). In addition, Anderson (1998: 131) stated that, 'triangulation also helps eliminate bias and can help detect errors or anomalies in your discoveries'. Thus I used this approach to eliminate bias and to ensure validity and add credibility to my study in order to strengthen my findings.

3.8.2 Member checking

To ensure validity I took the interview transcripts back to the participants for verification and validation. I did this to give the respondents the opportunity to verify and to add further information should they so desire (Cohen, Manion & Morrison, 2000; Merriam, 2001).

3.8.3 Stimulated recall interviews

This method was used to clarify issues that arose during observations (Murray & Nhlapo, 2001 cited in Chombe, 2007).

3.8.4 Primary data

In my report, I included what Chombe (2007) refers to as 'primary data' through direct quotes and snapshots from classes.

3.8.5 Accurate recording

Throughout the data collection process, I made sure that I took detailed notes and used tape and video recordings to ensure accurate recording of my data.

3.9 RESEARCH ETHICS

Maxwell (2005: 7) believes that ethical concerns should be an integral part of every aspect of the research design. Given this guidance, I considered ethical issues to be an important dimension in my research. Anderson and Arsenault (1998) claim that it is compulsory for the qualitative researcher to first obtain permission from a person with authority in the organisation when conducting research, hence my letters requesting permission to do the research to the Regional Director of Omusati Educational Region, the principals of the selected schools and the participants. I provided the principals with the letter from the Director that granted me permission to conduct my research. I clearly explained the purpose of the selected research to the principals and the participants.

I made my participants aware that it was their right to withdraw at any stage of the research and requested them to sign the consent forms as a proof of agreement to be involved in the research (Appendix C). I informed them that they would have the opportunity to read and verify the data and reassured them about confidentiality and anonymity.

3.10 LIMITATIONS

One of the limitations is that both schools selected were boarding schools. Teachers' schedules were very tight and both had other commitments after hours therefore the stimulated recall interviews were only done on the last day. This hindered the opportunity for teachers to reflect immediately after each lesson. Due to the fact that the Grade 10 examination is external, both teachers were trying to cover up to two new topics in one lesson period (40 minutes), which affected the use of some strategies such as ample time for questioning or carrying out activities that allow the use of high order thinking. One of the participants was reluctant to answer some of the questions during the stimulated recall interview.

3.11 CONCLUSION

In this chapter, I presented my research design that comprised the methods and tools that I used to collect data, as well as the different stages that I followed in order to analyse data. I also discussed strategies that enhanced my findings as well as ethical issues and validity. I ended this chapter by identifying limitations with regard to the process.

In the next chapter, I report on my findings from the semi-structured interviews, observations and document analysis. I do this by cross-referencing the information collected from all my data sources and breaking them into themes.

CHAPTER 4

DATA PRESENTATION AND ANALYSIS

4.1 INTRODUCTION

In this chapter, I report on the findings obtained from the participants in this study based on an analysis of the semi-structured interviews, observations and documents. I have also included information from the pilot study that I found useful. I present my data in categories that emerged from the data collection process that were influenced by my research question. My data are presented by using the following structure:

- The profile of the teachers and the schools
- Teachers' perception and understanding of the concept 'critical thinking' and its role in teaching and learning
- The description of the teachers' lessons
- Strategies that teachers use to develop critical thinking skills
- Evidence of critical thinking skills to be developed from the documents
- Challenges in teaching critical thinking skills
- Suggestions for possible support to teachers in implementing critical thinking skills

4.2 THE PROFILE OF THE TEACHERS AND THE SCHOOLS

This section presents a contextual analysis of the two schools and the two teachers I worked with in my study. For the sake of confidentiality, anonymity and privacy, as I indicated in the previous chapter, each school and each teacher is given a pseudonym. The first teacher is Penda, a male teacher at Kombanda Secondary School. This is a rural school 20 km outside Oshakati town in Omusati Region. The school has a library and a laboratory. Penda has been teaching Life Science for six years now. Penda is a qualified BETD teacher who did some courses in Biology with the Institution of Open Learning (IOL). He has also attended in-service workshops.

Kombanda Secondary School has an enrolment of 513 learners, which makes it one of the larger schools in the region. As a secondary school it offers the Grade 8 to Grade 12 programme. There are two Grade 10 classes of 38 learners each. Life Science is taught four times a week and each period is 40 minutes long.

The second teacher I interviewed is Pawa, a female teacher at Kumbaya Secondary School. This school was established after independence in Omusati Region. It is a semi-urban school 80km outside the town of Oshakati. Kumbaya Secondary School is a big school with an enrolment of 645 learners, which makes it one of the largest schools in the region. It goes from Grade 8 to Grade 12. There is only one Grade 10 class of 38 learners. Life Science is taught four times a week and each period is 40 minutes long. The school has a library and a laboratory. Pawa has been teaching Life Science since 1997. She has 11 years experience in the subject. Pawa is also a qualified BETD teacher, who specialised in Agricultural Science. She also obtained a further Diploma in Biology with the University of Namibia (UNAM).

The teacher I interviewed for my pilot study is Wetu, a teacher at Komeya Combined School in Oshana region. It is a semi-urban school 10 km south of Ongwediva town. Wetu has been teaching Life Science for five years in Grades 8, 9, and 10. She completed the BETD where she focused on Grade 8 – 10, which is the Junior Secondary Phase. When I ask Wetu whether she is currently studying, she responded saying: *I have just completed my Advanced Certificate in Environmental Education with University of Johannesburg.* Komeya Combined School goes from grade 5 to grade 10 with an enrolment of 342 learners. There is one Grade 10 class of 29 learners. Life Science is taught four times a week and each period is 40 minutes long. The school has a small library and there is no a laboratory.

4.3 TEACHERS' PERCEPTIONS AND UNDERSTANDING OF THE CONCEPT CRITICAL THINKING AND ITS ROLE IN TEACHING AND LEARNING

Establishing the teachers' perception of the concept critical thinking and the role it plays in teaching and learning is pertinent to this study. The inference is that if

teachers consider critical thinking to be important in learning it is more likely that they will ensure that such skills are developed and applied by the learners. Therefore, under this section, I provide findings of how the teachers in this study understand what critical thinking means and the role that it plays in learning. The data from this section was taken from both the pilot study interview and the initial interviews

4.3.1 Teachers' views about the meaning of critical thinking

Both Penda and Pawa have a similar view of what critical thinking is. According to Penda critical thinking means '*that the learners have to think deeper in order to find the solution about something'*, but also '*looking at how learners are actually thinking; cognitive development'*. He described levels of thinking as follows:

> *Higher levels of thinking includes maybe when you give learners a topic, for example which is more difficult, then you are encouraging learners to think very higher. But then there are this, simple questions that are just asking things that are very simple.*

Pawa describes critical thinking as thinking that *'requires a mental trip as someone has to think more deeply'*. She also refers to critical thinking as *'agree and disagree about certain things'*. She further describes it as *'sort of criticizing whatever comes across his or her way'*. In the stimulated recall interview she pointed out strategies she uses to promote critical thinking as follows:

> *Learner-centred can be a strategy that I have been using, ..where I have posed questions to the learners, to think more about what they have come up with or to think more about certain concept just look for clarity or how they understand it.*

To Pawa, higher levels of thinking are *'cognitive that can be linked to critical thinking'*. Wetu, the teacher from the pilot study, understands that critical thinking *'has to do with the ability to give reasons and make judgment about things'*. Analysis of the descriptors of critical thinking given by the teachers Penda and Pawa suggests that they have a partial understanding of what critical thinking is, for example they associate it with thinking more deeply, with solving problems, and a situation where people can express agreement or disagreement, and criticism and both associate it with the word 'cognitive'. On the other hand Wetu, the teacher in the pilot

study, described it differently when she said critical thinking *'has to do with the ability to give reasons and make judgment about things'*.

Pawa could also differentiate between closed questions and open-ended questions as she explained saying:

> *It's like you can ask a learner to list or to mention and the 'what' questions they may just have one answer. But for open-ended question the learner can approach a certain concept or a certain topic from different angles. Where they can give different reasons, but maybe they are all correct. Or maybe a learner can give a list of reasons or explanations. Yaa, they are open-ended, because a learner can give as many facts as possible.*

Looking at the response it seemed that to Pawa critical thinking means an accumulation of facts rather than explanation or application. This again indicates that teachers cannot explicitly articulate the theory underpinning critical thinking but that they do have an understanding of it even if it reveals certain misconceptions.

4.3.2 The role of critical thinking in teaching and learning

One of the questions put to the participants related to their perception of the importance of critical thinking in teaching and learning. Both teachers in the actual study as well as Wetu in the pilot study consider critical thinking to be important. This is what they said about the importance and role of critical thinking in teaching and learning:

Penda: *I think it is more important to encourage learners to think critically. This helps learners to solve problems on their own. You see, we are not teaching learners just because of teaching them, but we are, you know teaching learners to be able to solve problems in the future.*

Pawa: First of all learners are learning from one another. Like if they are debating, if one learner mentions one point what another learner does not know, from there the child is learning. The central point is just that they learn and they are at liberty because they are free to talk and express themselves. This is important for their academic development, because it is only when they think critically is when they can also be able to make decisions in life, later life.

Only a learner who can think critically like in science subjects, not only in Life Science, can succeed in the examinations, because if they want to follow that line for science, critical thinking is playing a role. So it is important for their future,

Wetu: *Well, this strategy (role play) will enable, I mean, it makes learners proud of themselves in the sense that it makes them see that they can make important decisions. Not only the teacher can make decisions, but they themselves can also come up with valuable decisions, in planning their activities and organizing themselves, I mean, within their groups. Well, It makes them confident. At least they know the ideas they come up with are valid so, they do not feel inferior*

From the responses, it is clear that both Penda and Pawa have similar perceptions of the importance of critical thinking in learning. They both consider critical thinking to be important for academic development as it helps learners to learn from one another and learn better so they become successful in their examinations. In addition, Penda also indicated that critical thinking helps learners to solve problems in their daily life. Wetu and Pawa felt that it is through critical thinking that learners will be able to make valuable decisions in life. Wetu also sees critical thinking as developing learners' self esteem and confidence.

It was noted that some of the roles that they indicated were general rather than specific, for example they stated that '*critical thinking is important for academic development'* and that '*it helps learners to learn better so they become successful in their examinations'*. The following section analyses the lesson observed and examines how these views about critical thinking translate into practice.

4.4 THE DESCRIPTION OF THE TEACHERS' LESSONS

I observed four Life Science lessons taught by the participating teachers in Grade 10 classes of 38 learners each. Each lesson covered 40 minutes and no double period could be observed throughout the week.

Learning is expressed as the ability of learners to carefully and logically analyse information and ideas from multiple perspectives ideally using multiple teaching strategies. Thus it is necessary for teachers to apply inquiry methods, including role-

play, debates, projects and problem solving activities that provide learners with experiences that will stimulate them to think and ask questions. The lessons that are presented below examine the approaches to learning that were observed in this study.

Penda's classroom, which is a standard sized classroom, had the desks arranged in single rows. There is a chalkboard that he used for writing notes on while presenting his lesson. Each learner had a summary book in front of them from which they read answers when he asked questions on the topic. The arrangement in Pawa's class was different. The learners were sitting in groups of five and this seemed to be a permanent arrangement of the desks. There is also a chalkboard, which she uses to write notes on during the lesson. There was nothing on the walls in either classrooms neither posters nor learners' work. Textbooks were seldom used in either of the classes and the learners primarily used their summary books to take notes during the lesson presentation.

Penda taught different topics from the syllabus that include cell, cell processes and nutrition. During these four lessons the learning objectives/basic competences were that learners should be able to describe the structural and functional relationship among cells, tissues, organs and systems; discuss the significance of cell processes for an organism including osmosis, diffusion and selective permeability; know and list the main characteristics and categories of nutrients; outline the differences between organic and inorganic nutrients.

Pawa was also teaching different topics from the human biology part of the syllabus. She taught topics such as respiratory system, excretory system, pollution and blood circulatory system. The learning objectives/basic competences were that learners should be able to:

- list features of the gaseous exchange surface in animals; discuss the significance of these features for maintaining life
- suggest how different levels of activities can influence the level of breathing
- define excretion
- identify the structure of the respiratory system
- discuss the functions of the excretory organs and the waste expelled

- discuss the importance of water balance
- identify and name the structure of the circulatory system
- outline the function of the heart, arteries, veins, capillaries and blood components
- discuss how pulse rate is related to the different levels of an activity and
- suggest how the build up of cholesterol in the circulatory system can lead to functional disorder

4.4.1 Strategies that teachers use to develop critical thinking skills

In this section I attempt to present how I examined the teaching/ learning that occurred in these two classrooms to assess the extent to which critical thinking is an integral part of the day-to-day teaching process. These observations are then linked to what teachers identified as the 'strategies they use to develop critical thinking'. The table below shows the strategies that the participating teachers refer to as tools for developing critical thinking. The first column indicates the strategies collected from interviews, class observations and documents that teachers used, whereas columns 2-4 indicate strategies each teacher used.

Table 2: Teaching strategies identified and used by participating teachers

Strategy	***Interviews***	***Lesson plans***	***Class Observation***	***Learners' work***
1. Questioning	*Penda* *Pawa* *Wetu*	*Penda* *Pawa*	*Pawa* *Penda*	*Pawa* *Penda*
2. Learners' questions	*Pawa* *Penda*		*Penda*	
3. Group/pair discussions	*Wetu,* *Penda*	*Pawa*	*Pawa*	
4. Motivation	*Penda*			
5. Tests and homework	*Penda*		*Pawa*	*Penda* *Pawa*
6. Practical activities	*Penda* *Pawa*			

7. Presentation /Reporting	*Penda*		*Pawa*	
8. Excursion and Interviews	*Penda*			
9. Diagrams/posters	*Pawa* *Penda*	*Pawa* *Penda*	*Pawa*	*Penda*
10. Role-plays and Debates	*Pawa,* *Wetu*	*Pawa*		
11. Clubs	*Wetu*			
12. Projects	*Wetu,* *Penda*			

The table indicates that all three teachers identified some of the strategies while others are exclusive to one or two teachers. I compared the strategies that were used during the lesson observations with the strategies teachers mentioned as tools for teaching critical thinking in the interviews. Following is a description of how each strategy was used by the teachers. Data were generated from the initial interview and the stimulated recall, lesson plans, learners' work, as well as the lessons observed.

Strategy 1*: Questioning*

This strategy refers to the questions the teachers mentioned in the interviews and those they asked in the observed lessons. I analysed all four lessons of each teacher. The number of questions in each lesson ranged between 11 and 14**.** Questions requiring either explanation or application were infrequent. In the course of the four lessons observed with each teacher there were only between 1 and 4 such questions asked. I classified all questions that are not open-ended as 'lower level' questions referring to the specific questions that were asked during the lessons. This is because these questions required learners to only give a one-word answer or to list factual information without thinking deeply about the concepts being taught.

Wetu indicated in the interview that she asks questions that test knowledge, those that require learners to demonstrate understanding and those that require them to analyse things. She gave an example of a question such as 'What will you do to address the problem?' which was based on the topics about littering and water pollution. This is an example of questions related to problem solving and decision-making, which

encourages explanation, application, problem solving and decision-making. Penda described the types of questions he uses in his teaching in the initial interview. He said:

> *There are many questions that one can ask. It just depends actually on the topic at hand. Now there are those questions like, list some of the aspects, learners have to list down and so on. Normally the questions are reframed from the basic competencies. There are those questions that ask learners to define terminologies; there are questions like discuss such things and so on. There are also those questions that describe even terms or the situation and so on.*

When I asked him to give examples of the type of questions he asks, Penda, in his description, provided the various action verbs used in the syllabus or in tests and examinations. For example *list, define, discuss, give the function of.* He was not aware of the cue words that guide thinking at a more critical level. Penda also spoke about what he called 'middle level' and 'high level questions'. He gave the following example of what he regards as a 'middle level' question: *'Sketch the diagram for the animal cells and for the plant cells'.* Penda regarded the following questions as 'high level', saying:

> *There are questions like, 'Give the function of nucleus', for example, or cytoplasm or the functions of all the features that are appearing in the plant cells. You see, a learner there has to think about all the functions and the features. I think these are higher-level questions.*

Penda in the interview referred only to action verbs such as list, define, describe and discuss when he was trying to indicate the type of questions he uses. These mainly require factual recall except 'discuss'. Penda used questions throughout his lessons and the following examples are a representative sample of the sorts of questioning that he used throughout, with the responses from learners.

T: What is the leaf responsible for?
L: For photosynthesis

T: What is the importance of diffusion when it comes to plant life processes?
L: It helps the plants to absorb substances.

T: What is nutrition in your own words?
L: Nutrition is about our body food and absorbing there.

T: And then group of nutrients you remember some?
L: carbohydrates, fibre (naming them from the book)

T: What is a carbohydrate? What made up carbohydrates?
(Giving an answer himself) They are organic compound consists of carbon, hydrogen and oxygen

T: What are the three categories of carbohydrates?
L: simple, complex and dietary fibre.

T: If we talk about simple carbohydrates what are we exactly talking about?
L: In number one we have monosacchraides.

T: The word mono means?
L: Means one

T: What is table sugar?
L: It is what we put in our tea.

T: What is honey?
L: Honey is oil from bees.

T: How do you find the difference between simple, complex and dietary fibre?
(This was given as homework although he did not indicate it clearly)

It was noted that in this example taken from the second lesson observed, Penda asked eleven questions but only the last one required learners to provide an explanation rather than simple factual recall. The other ten questions used cue words such as *'what'*, which typically require recall of factual information. He attempted to asked questions to encourage learners to think more about specific aspects of the concept under discussion. For example he asked, *'If we talk about simple carbohydrates what are we exactly talking about?'* However, this does not allow learners to interpret and evaluate information.

The examples below are taken from Pawa's second lesson where she was teaching about the respiratory system, which was a continuation from her previous lesson. The

questions and answers from the learners are also representative of the lessons observed.

T: We have to continue with our topic of respiratory system. What are the respiratory organs?

L: Lungs, nasal cavity, skin, nose and mouth.

T: Can you show me your nasal cavity?

L: (showing)

T: Can anyone remember, gaseous exchange? Tell me how do you understand it?

L: This is about the movement of gases in and out of the body.

T: What are these gases?

L: oxygen and carbon dioxide

T: Where does this exchange done?

L: In the lungs

T: But specifically where?(giving the answer) In the alveoli

T: Can you give me the features for gaseous exchange surface?

L: It must be moist. It must have a large surface area.

T: Another feature?

L: (reading from the note book) There must be a good supply of oxygen.

Contact with blood capillary/supply

Must have thin wall

T: Thin walls? So what? Why this wall?

L: So that, to allow gases to pass through easily.

T: What is air pollution?

Pawa asked thirteen questions. Only one question was open-ended where learners were required 'to explain how pollution is a problem to our lungs'. The learners responded to this question by giving the following answers:

L1- damage the alveoli and air passage

L2 - carbon monoxide – when it inhaled the haemoglobin in the red blood cells

L3 -It reduces the ability of haemoglobin to carry oxygen in the body

L4 -Tar - damage lung tissues that lead to the development of lung cancer

L5 -Silicon dust – damage the lung tissues and lead to the disease silicosis

All other questions were based on factual recall; even the open-ended question did not require any real explanation or application.

If we compare what Penda indicated in the interview as high-level questions these examples reveal that Penda identifies questions in terms of their perceived level of difficulty, inferring that it is more difficult to recall the functions of something than to do a sketch. Given the examples from the observed lessons it would also seem that Penda identifies questions as being related to tests and examinations and does not relate these to the questions that routinely are asked in the course of a lesson. In the interview Pawa indicated that she asks both open-ended questions and closed questions but there was no evidence of the open-ended questions encouraging critical thinking during the lessons observed.

Based on the research findings, following is the table that provides the analysis of the form of questions used by the participating teachers.

Table 3: The categorisation of the form of questions

Form	Definition	Example
Factual	Factual questions to which the teacher knows the answer: single response items	What is air pollution? What is the leaf responsible for? What is a carbohydrate? What made up carbohydrates?
Probe	Probes (teacher stays with the same child asking further questions; invites child to articulate their understanding/explain their thinking)	What do you mean by water in respiration? Can you explain that? How else do you under-stand it?
Procedural	Procedural: questions related to the organisation and management of the lesson	Do you understand? Is it clear? Did you get it? Any question or any comment?

From Hardman, 2007

The participating teachers did not use proper probing questions and problem solving questions in order to test a variety of cognitive skills using the cue words that demands more than factual recall such as: Do you think..?; why do you think..?; what do you think and why?; what reason?, etc., that demand learners not only to comprehend a situation but to analyse, sort out and make relationships, look for patterns and anomalies and then evaluate before making the decision. There was also no evidence during the lessons observed that learners were being encouraged to monitor their own thinking.

Strategy 2: *Learners' questions*

In all four lessons Penda seemed to encourage learners to ask questions. He constantly interspersed his teaching asking: *'do you understand?, 'any questions?' or*

'is it clear?' This took place five times in the first lesson, seven times in the second lesson, once in the third and twice in the fourth lesson. Although Penda indicated during the stimulated recall interview that learners asked critical questions, this was not evident in the lessons. Following are the only four questions they asked in all four lessons:

- *Is a carbohydrate only made up of three or is there other compound that forms carbohydrates?*
- *Why don't you add dietary fibres?*
- *Proteins mostly deal with tissues?*
- *People can get energy from protein?*

Penda's attempts to get learners to ask questions seemed to be primarily based on obtaining reassurances from the learners that they were following the lesson and as such tended towards rhetoric rather than a real intention to stimulate learners to contribute to the lesson through asking questions. Pawa also tried her best to ask questions but they seemed to be based on obtaining clarity that the learners understood what she was explaining and did not focus on encouraging the learners to involve themselves fully in the lesson through asking questions. The table below provides the analysis of the form of questions asked by the learners.

Table 4: The categorisation of the form of questions asked by learners

Form	**Definition**	**Example**
Factual	Factual questions to which the teacher knows the answer: single response items	Is a carbohydrate only made of three or is there other compound that forms carbohydrates
Probe	Probes (teacher stays with the same child asking further questions; invites child to articulate their understanding/explain their thinking)	Why don't you add dietary fibres?

From Hardman, 2007

The opportunities for questions from the learners were consequently limited by the teaching approach used. More importantly, given that is claimed that learning to

think critically is learning how to question, when to question and what questions to ask; these lessons provided no direction to learners about how to develop these skills.

Strategy 3: *Group discussions*

This strategy appeared to be commonly used by the teachers in this study although Pawa did not mention it in the interview while Penda and Wetu did. This included group and pair discussions in Pawa's planning. Penda planned for discussions in three different lessons, but he was not specific whether these were to be in groups or in pairs or through general class discussions. The following are Pawa's group activities in the three lessons:

First lesson: I have an activity for you, just go in your groups.
(Writing an activity on the chalk board):

Activity: Through out the day the body gains and looses water.
a) State any three ways in which the body gains water.
b) State any four ways in which the body looses water.
c) With reference to Figure 7.3 page 99 in your text book, explain with one sentence what the diagram tells you.

Second lesson: In your group, quickly scan through and list pollutant – substances that are problem to lungs.

Third lesson: I told you we are going to complete the respiratory system. I'm going to give you an activity in groups.

You look at the diagrams and you decide which activity is A, B, C, D, E, F,G and see how the activity affect the rate of breathing.

The first activity in the first lesson required learners to discuss the topic 'water balance in the human body'. Learners were working in groups and interaction among the groups was observed. Learners obtained their answers from the textbooks. The second activity in the third lesson asked learners to 'identify how activities shown in

the diagrams affect the rate of breathing and in the third lesson learners were asked 'to identify blood components in the diagrams'.

It was noted that Pawa attempted to involve learners through group discussions however these did not actually foster explanation and application of knowledge through problem solving. The activities observed did not encourage critical thinking as learners were just expected to list or state and describe. On the other hand although Penda mentioned this strategy in the interview, which was also reflected in his lesson plans; he did not give any activity or allow learners to discuss in any of the four lessons I observed.

Strategy 4: *Motivation*

It emerged from the interviews that according to these teachers motivation plays a role in developing critical thinking. All three teachers saw motivation as one of the means to encourage critical thinking. According to WCED, 2000) motivation is a key to learning, which implies that it not only helps with learning but is essential for learning. All three teachers refer to motivating learners with low self-esteem. Pawa described it as follows:

> *Maybe it can be developed by the teacher along with the learner. Now I mean motivation, which can be coming form the teacher's side, motivating learners to think critically, or maybe learners themselves developing this motivation from within themselves to think critically, because sometimes the teacher may want the learners to think critically. But there are those learners with low self-esteem; they may not be willing to engage themselves in thinking critically. I think motivation there can play a role.*

The attempt Pawa made in this regard was to allow learners time to think and the way she asked questions during her lessons appeared to support the point she made above. However, this did not actually contribute to critical thinking from which learners would develop abilities to cope with intellectually challenging tasks, leading to improved self-esteem. There was no evidence either of reflection or self-regulation observed in any of the lessons.

Strategy 5: *Homework*

This strategy emerged from the interview with Penda. He indicated that *learners are going home to carry out something.* Although he regarded this strategy as useful, it was not evident in the lessons observed. However, it is noteworthy that learners' workbooks of both teachers provide evidence of all homework done in the first term. The table below indicates different activities the participating teachers gave as homework:

Table 5: Activities set for homework

Homework	**Penda**	**Pawa**
Activity 1	-Interpret any situation that you have observed in detail through writing and drawing. -Sketch a labelled diagram of any given object	-Name types of a the parasite which cause malaria. -State the organism that spread malaria. -State the time that malaria is likely to occur.
Activity 2	-Outline the differences among the major phyla in each Kingdom	Namibian National Immunisation schedule -Indicate for what disease the child is immunized
Activity 3	-Identify two types of angiosperm -Draw and give example of flowering plants named in number 1 above	Classification of living organism -Classify a lion
Activity 4	-Define the term taxonomy -List the major levels of classification	Questions - Define a cell -Give the difference between prokaryotic and eukaryotic cells -State any two examples of living things with prokaryotic and eukaryotic -List any three concepts of the cell theory
Activity 5	-List and describe the activities which release greenhouse gases in the atmosphere	-In a table form give one function of each nutrient (protein, vitamin, fats, roughage and carbohydrates) -Define 'balance diet'
Activity 6	-Name the organ system shown (digestive system) -What is the general function of the system? -How does the pyloric sphincter musc differ from the rest of the stomach?	

As seen in the table, Penda had set six homework tasks at the time of the study while Pawa had set eight. It appeared that almost all homework tasks required learners to recall information and to have some comprehension of knowledge, but did not fully engage them in explanation and application. The questions used in the activities did not encourage

learners to solve problems and to make judgments. Furthermore there was no evidence of reflection or self-regulation in the teachers' feedback. In one of the homework tasks, Penda asked the learners to *'Interpret any situation that you have observed in detail through writing and drawing'* Here learners were required to think and write about any situation or any incident and draw it. In this case I feel that Penda attempted to plan and prepare a task that could contribute towards enhancing the development of cognitive skills. When learners observe, interpret and depict a situation, they can develop critical thinking because they are required to think and analyse.

Strategy 6: *Practical activities*

The role of practical activities also emerged from the interviews. It is interesting to note that both Penda and Pawa believe that problem solving in most cases is done through practical activities. In this regard Pawa gave the learners two practical activities to do which were evident in her lesson plans. In the first one she asked them to '*demonstrate the process of osmosis using potato chips'* while in the second one, she asked them to *'collect leaves and do the estimation and the measurements in the school environment'*. While these tasks did encourage the learners to apply their knowledge of the topics, their role in developing problem solving was fairly limited.

Strategy 7: *Presentations/reporting*

Presentations and reporting as strategies only featured during the interview with Penda. Some of the learning objectives associated with critical thinking are described as the ability to analyse complex issues and make informed decisions; to synthesise information in order to arrive at reasoned conclusion; evaluate the logic, validity and relevance of data; solve challenging problems and use knowledge and understanding in order to generate and explore new ideas and to provide evidence of this through presenting or reporting the findings. It is worth indicating that although Penda mentioned all these strategies, he did not apply any of them.

Pawa used this strategy, which is evident in her lesson plans and she also asked learners to report on the group activities carried out in two of her lessons I observed. It is through presentation and reporting that learners are provided with opportunities

to reflect and make thoughtful analysis, sound judgments and logical conclusions of situations under discussion.

Strategy 8: *Excursions and interviews*

These strategies only featured in the interview with Penda. He gave an example of sending learners for an excursion to find information from the community where they are required to construct their own questions for the interviews. He indicated that '*this can motivate learners to think critically on what questions to ask'.* Although these strategies were not evident during his lessons, Penda indicated during the stimulated interview that what he plans is that in future he will send learners to the nearby clinic so they can get information about nutrients from the nurses.

Strategy 9: *Diagrams*

Studying diagrams is one of the strategies that Pawa indicated as a useful means to develop critical thinking. As suggested, diagrams/pictures are valuable tools that can be used in various ways to develop thinking skills. Pawa gave her learners an activity that required them *'to look at the diagrams and to identify which activity is A, B, C, D, E, F,G and see how the activity affect the rate of breathing'.* Drawing diagrams is also a strategy worth mentioning because it is evident in the learners' workbooks from Penda's class. Penda asked learners to *'interpret in detail any situation that they have observed through writing and drawing'*. Diagrams are able to develop a variety of different cognitive skills such as analysis, explanation, reflection, application and evaluation.

Strategy 10: *Role-plays and debates*

Role-play and debating strategies emerged during the interviews with both Pawa and Wetu. Pawa indicated in her lesson plans that she carried out a debate as one of the activities planned for assessment stated as follows: '*Debate about traditional medicines vs modern medicines and report your findings'.* It is worth indicating that Wetu as well as Pawa regard these strategies as important as they encourage learners to think critically. Wetu was specific when she indicated that learners become better

in reasoning and judgment when they are involved in role-plays and debates. This implies that they are helped, through these approaches, to reason and to argue well and fairly developing their abilities for making sound and independent judgments. More importantly, this strategy encourages learners to think and ask questions and in so doing provides opportunities to solve problems and make informed decisions.

Strategy 11: *Clubs*

This strategy emerged during the interview with Wetu from the pilot study. She indicated that school clubs can encourage interaction, decision making and problem solving among the learners and in these situations they can initiate activities on their own. It is worth noting that Wetu values extra mural activities as a contributing factor to meaningful teaching and learning that needs to be considered in schools. Although no evidence of these ideas was found during the observation process Wetu's point has merit for developing independent learners.

Strategy 12: *Projects*

This strategy emerged only from the interview with Penda. He described this strategy as one in which '*learners are given a task to carry out something'*, for example in a period of a week. Obviously, it is expected that the natural curiosity and eagerness of all young people to learn to investigate and make sense of a widening world must be nourished and encouraged by challenging and meaningful tasks. Although projects are one of the requirements of the continuous assessment in Life Science there was no evidence of its implementation at the time of the research as well as in the previous lessons plans.

Finally I find it interesting that Pawa indicated 'learner-centred' as a strategy she uses to develop critical thinking. I did not list it as I feel that all the strategies mentioned fall under the learner-centred approach. This also raises questions about Pawa's understanding of what a learner-centred approach is.

4.5 EVIDENCE OF CRITICAL THINKING SKILLS TO BE DEVELOPED FROM THE DOCUMENTS

The documents that I looked at included the syllabus, teachers' daily lesson plans, learners' workbooks, tests examinations and examiners' reports. The syllabus revealed clear evidence of the extent to which teachers should promote learners' thinking abilities. The basic competences, and practical activities are explicitly outlined to develop critical thinking skills as indicated in Chapter 2. There is also a learning outcome that focuses on the development of higher cognitive skills that includes 'the ability to think critically in solving problems and apply them to tasks'. Following are the basic competencies used throughout the whole syllabus: *list, discuss, describe, state, suggest, outline, explain, define, distinguish, differentiate, compare, calculate, interpret and sketch.* I also looked at process verbs used for practical activities that include: *investigate and report/relate; make random sampling/model; carry out an experiment; draw a diagram and label; complete a quiz; study and state; collect specimen; measure; analyse and dissect.* Other documents also indicate process verbs used in the syllabus, types of questions with regard to levels of thinking and activities such as debates, role-plays, games, quizzes, etc.

4.5.1 **External examinations**

The syllabus revealed clear evidence of the extent to which teachers should promote learners' thinking abilities. It also explicitly outlined the basic competences and practical activities to develop critical thinking skills. It is expected that teachers link their assessment to the objectives and competencies in the subject syllabi, which is an indication of what will be assessed. Examinations are one of the assessment activities identified to be carried out that should encourage and promote the development of higher order analysis skills, thinking processes to enable learners to think critically and creatively, to solve problems, to make decisions. Based on the analysis I did of two external examinations, the following table indicates the percentage of questions

that require only description, those requiring straight recall, the percentage that require explanation and those that require application.

Table 6: Percentages of the type of questions in samples of external examinations

Examinations	Recall %	Description %	Explanation %	Application %
Regional Examination (2006)	63%	20%	18%	1%
National Examination (2005)	75%	9%	12%	1%

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Looking at the figures in the table, it seems evident that far too often examinations and tests are designed to measure the recall of disconnected bits of information. These documents also indicated that although we say we want learners to develop their ability to think critically, to compare, to analyse, to synthesize, to imagine and to innovate, in practice most of these competencies are not measured. Equally from this analysis the questions that require explanation and application do not include dimensions of problem solving or decision-making.

4.5.2 Tests and examinations, learners' written work and activities from the textbooks

Tests, examinations, homework, class work and any other assessment activities are regarded as a way to monitor and facilitate learners' critical thinking. As indicated in Chapter 2 that to serve learning well, whatever tests or examination we use need to be concerned with thinking and understanding and not simply recall. I analysed assessment activities set by both participating teachers. I looked at the type of questions and action verbs both teachers used in activities to promote critical thinking. The following are examples of questions that appeared in tests and examinations Penda set for his class. The number shows how many times they were used: *name (2), list (1), mention (1), give (2), what (2), identify (3), which (6), define (4), distinguish (1), differentiate (1), discuss (1), why (2).*

I also looked at the learners' written work given from the beginning of the year. Following are cue words and action verbs used for the activities given

name, (1), list (3), what is..(1), define (1), identify (2), list and describe (2), outline (1), suggest (1), how does..(1), draw and give example (1) and interpret in detail a situation you observed through writing and drawing (1).

The activities he took from the textbook used cue words and action verbs such as *name (2), what (2), which (1), why (1), explain (2), state (1), describe (1) and identify (1).*

Pawa also set tests and examinations for her class in which she used cue words and action verbs that include: *what (2), state (8), name (10), why (1), list (2), how (3), define (1), identify (3), how much (2), plan a menu (1), make a drawing (1), what advice do you give…(1).* In Pawa's case written activities and the exercises from the textbooks she gave her learners from the beginning of the year included the following cue words and action verbs for the activities: *name, (3), state (8), list (2), give one… (1), what is…(2), define (1), identify (3),*

The table below shows the percentage of questions that require only description, straight recall, the percentage that require explanation and those that require application.

Table 7: Percentages of the type of questions in assessment activities

Assessment activities	Recall %	Description %	Explanation %	Application %
Penda	70%	14%	13%	-
Pawa	83%	5%	5%	2%

Data collected from the learners' workbooks, tests and examinations revealed that most of them are not based on high order questions (Collins & Lacey, 1996) designed to develop learners' ability to think critically. As with external examinations these documents also indicated that although the syllabus requires the development of learners' ability to think critically by comparing, analysing, and being able to synthesize, to imagine, and to innovate, in practice, they are not being implemented. It is evident from the figures in the table what was mostly assessed is their recall of

factual information. Again the questions that require explanation and application do not include dimensions of problem solving or decision-making.

4.5.3 Examiners' reports

The examiners' reports were analysed to find the extent to which learners are able to answer high order questions in the external examinations. Although I could not find as much information on specific questions as I expected, I obtained one example of comments from the Examiners' report of 2005 on question 4 (e), which is worth noting. The question was: '*Describe how carbon dioxide released by the cell, reaches the alveolus of the lungs'*.

Following is the comment on the question from 2005 report:

> *Question 4 (e)*
> *This was a high level question and many candidates did not understand it. Candidates simply had to describe the way along which carbon dioxide moves from the cell back to the alveolus of namely; into red blood cells, through the vein into the heart, through the artery into the alveolus of the lung.*
> *From this question it became clear that very few teachers teach across the syllabus. This question combined different topics (the cell, cellular respiration and blood circulation) with each other. Candidates must understand the link between the different topics.*

Looking at the comment above it provides an impression that the examiners refer to question 4 (e) as a high level question in terms of difficulty with regard to learners knowledge and understanding of the contents of different topics, but is not linked to having the learners think critically. The comment seemed to refer only to the understanding of the link between the topics, which does not require problem solving and decision-making. I would argue that if the examinations do not expect and demand critical thinking then teachers are not going to grapple with it. It is very important that examiners, moderators and markers understand critical thinking so that that they know how to frame questions to test critical thinking. From this analysis it

appears that most of the examinations in Life Science do not assess the so-called high order thinking skills to develop critical thinking in learners.

Another aspect I found noteworthy is that the examiners' reports (2001 – 2006) used as a sample for this study, indicated every year that, '*teachers are advised to give detailed explanations to action verbs used in questions, i.e. list, name, define, describe, explain, suggest, etc'* This implies that learners have difficulty in achieving the tasks because it seems they do not understand action verbs such as describe, explain, suggest, etc. used in the tasks. At best their answers are based on listing information or providing brief disjointed descriptions. Following is an example of one of the comments from the examiners' report of the final Grade 10 Life Science Examination for 2006 on Questions 8:

> *8. The short questions on syphilis were answered well, but question (d) was too much for most candidates. Teachers must explain to candidates that they must write more that just a word when the question asks to describe. For 6 marks the candidates must make sure that they give at least 6- 10 written lines.*

From this information, it is evident that learners cannot answer questions if they do not understand action verbs such as describe, explain, suggest, etc. used in the paper; they can only provide 'short answers' or focus on recall of information. The marking schemes also give an indication that almost all the questions require recalling or recognising information from previously learned material. Thus it became evident from all the documents analysed that learners are most often expected to respond to questions requiring factual recall.

4.6 CHALLENGES IN TEACHING CRITICAL THINKING SKILLS

This section presents what teachers feel are challenges in teaching critical thinking skills. It is interesting to note that all three teachers saw the major challenge to critical thinking as being linked to the learners' capacity. Penda called these *'slow learners'*

while Pawa called them *'learners that are not that much high achievers or learners with low self esteem* and Wetu in the pilot study called them *'learners who are not really confident'*. Penda's explanation focused on the fact that there are terminologies that are not familiar to those learners, which is a challenge. He indicated that

> *these people are actually giving you tough time simply because, I don't know whether is their level of thinking or they are not well developed. Most of the problems, actually, some of the terminologies that are used in the books I think they are more higher than the level of the learners'.*

Pawa felt that those learners '*do not want to engage themselves in thinking critically'*. She indicated that '*when they are trying to say something in the class they are afraid that others will start laughing at them'*. Wetu also shared the same sentiment as she pointed out that:

> *the moment you ask even if it's just a 'why' question they just sit back; they are only comfortable with knowledge. But questions that require them to explain and demonstrate how they understand things; they are really uncomfortable and they are unable to ask questions.*

Pawa also indicated one of the difficulties she has experienced as follows:

> *The difficulty that I have experienced is with group work. Sometimes you put learners in groups, and the type of question or the activity that you give requires them to think critically. You may find only one learner who has brought up ideas, and then other learners are deprived of thinking critically.*

Penda also raised another aspect with reference to teaching instructions when he said '*maybe the instructions are not clear*.' Wetu added to this saying that learners *'lack high thinking ability';* first because of *'the fact that at lower grades they were not encouraged to reason*' *and secondly 'because of the culture'*. She claimed that learners are unable to reason because the teachers also lack the skills of testing that level. She further elaborated that *'mainly questions focused on knowledge, just to recall what was learned'* and she added that *'in our culture children are not allowed to argue'*.

It is clear that teachers face the dilemma of how to foster critical thinking with learners who vary in their need for academic guidance. Many learners with learning difficulties find it difficult to answer questions, which encourage them to think. With reference to Wetu's concern, learners are used to responding to questions needing recall but need considerable practice with the higher order questions (Collins & Lacey, 1996). What is important to realise here, are aspects such as an inadequate knowledge based on teaching critical thinking and conditions that require classroom management at the expense of academic instruction. Another aspect is that our cognitive, emotional and social development is dependent on language. Thus most learners and teachers experience difficulties in expressing themselves explicitly because of their lack of language proficiency in the language of instruction. The concern is that little is being done at present to help learners develop their thinking skills.

4.7 SUGGESTIONS FOR POSSIBLE SUPPORT TO TEACHERS IN IMPLEMENTING CRITICAL THINKING SKILLS

From the responses in the previous section on what teachers regard as challenges in teaching critical thinking skills, I found it worth asking them to suggest possible areas of support teachers need. Wetu said:

> *I think, teachers must be trained on how to ask reasoning questions. And now that will be in class tasks, tests, and examinations throughout the year. Because in some cases I mean the learners are unable to reason because the teachers also lack the skills of testing that level.*

It also worth noting another aspect that Wetu pointed out that '*schools must also support teachers to form various clubs.'*

Pawa's suggestion was:

> *The best and the better it's not the best maybe, is to, to assess the learners individually, not in groups. Ya, they can do works in groups, but maybe not for the purpose of assessment. Because sometimes it's only one learner who's doing the work and others are just reluctant because they know, I mean, this person in the group she or he will just do the work.*

It is interesting to note that she weighed up group work with individual work and she noted that she might limit group work and do mostly individual work to encourage individual learners to think critically. However, Pawa seemed to have missed the question because she focused on the strategies she can use to support the learners in developing critical thinking skills, rather the support she needed in the implementation of critical thinking.

4.8 CONCLUSION

In this chapter I have presented the findings that emerged from the data collected through conducting interviews, observation of lessons and documented evidence
In the next chapter I will discuss my findings by interpreting and explaining them based on the set of themes that emerged informed by the indicators from my literature review chapter in relation to my research question.

CHAPTER 5

DISCUSSION OF THE FINDINGS

5.1 INTRODUCTION

In this chapter I interpret my findings presented in Chapter 4 in order to make meaning of and draw conclusions from the data collected from the interviews, observation and documents analysed. My main focus is to discuss the views and perceptions of the participants about how well they understood critical thinking and how they implement it in Life Science Grade 10. In my discussion I focus on issues such as teachers' views on critical thinking, their perceived role of critical thinking in learning and their concerns about implementing critical thinking. My framework for doing the analysis of the findings is based on the relevant themes that emerged supported by the theoretical framework underpinning this study. The key indicators for critical thinking informing the study included aspects such as reflection, self-regulation, making sense, showing good judgment, asking questions, reasoning, analysis, evaluation, explanation, application, problem solving and decision making.

5.2 TEACHERS' VIEWS ON CRITICAL THINKING

In Chapter 2 I indicated that the policy document, *Toward education for all*: *A development brief for education*, claims that critical thinking develops the ability to create learning opportunities, which enable learners to explore different ways of knowing, and develop the whole range of their thinking abilities (Namibia. MEC, 1993: 81). The Life Science syllabus also requires 'learners to be given increasing responsibility to participate in planning and evaluating their own work, under the teacher's guide' (Namibia. MoE, 2007: 5), which enables them to reflect on their learning and results in learning with understanding. This implies that the role of a teacher wishing to develop critical thinking skills in learners must therefore be that of facilitator and motivator. Thus the role of teachers is to help learners learn, not just to teach. Bailin, et al. (1999: 297) view critical thinking as largely 'a matter of teaching

students to make appropriate use of concepts, standards and strategies and procedures our culture has developed for disciplining thinking and increasing its fruitfulness'.

Given the above, two of the teachers' responses focused primarily on developing capacities such as cognition, and the learners' ability to think 'more deeply' while also seeing critical thinking as a means to develop their ability to make judgments and to criticise. The third participant gave a better explanation, that of reasoning and making judgments. Costello (2000) argues that it is through critical thinking that learners are enabled to reason and argue well and fairly. What emerged in the study is that none of the teachers was able to explicitly demonstrate a comprehensive understanding of the concept either in their articulation of their theoretical understanding or in their practice.

Some examples that reveal this lack of understanding include the teachers' reference to 'higher levels' of thinking which they identified as levels of increasing difficulty based on the need to provide greater detail rather than tasks which required problem solving or any other of the indicators associated with critical thinking. Secondly, by referring to 'learner centred' as a strategy used to promote critical thinking raised questions about both their perceptions of learner centred education and knowledge about critical thinking. This is an example of how policy becomes misinterpreted and how 'myths' develop in the context of particular theories where disparate terms are equated with each other. The third example was that a learner can *'give as many facts as possible'*. Looking at these and other responses pertaining to an understanding of critical thinking highlights the need for teacher education programmes to provide teachers with a far more explicit and detailed knowledge of the theory in order to develop practice that is based on a 'deep' understanding.

The literature reviewed stresses that the teacher should organize the learning situation in a way that enhances the development of cognitive skills that lead to meaningful learning. Hence, Lambert and Balderstone (2000: 309) regard 'designing appropriate activities and strategies to facilitate cognitive conflict as an important part of a teacher's planning and preparation in enhancing developing cognitive skills'. Brightman (2008) emphasised that working in groups can be a valuable strategy if used well.

As the findings have shown the activities included in the lessons and those that were set as homework or extension tasks were unable to contribute in any meaningful way to the development of critical thinking skills. WCED (2000: 28) suggests that a teacher should 'design and set up appropriate contexts in which learners will become engaged in interesting activities that encourage and facilitate learning'. This document proposed that teacher may guide learners as they approach problems, may encourage them to work in groups to think about issues, questions and support them with encouragement and helpful criticism as they tackle real issues.

Another concern is also that although Pawa claimed to use learner centred education as a strategy to promote critical thinking, the observed teaching was mostly teacher-centred given that learners were not given opportunities to participate actively during the course of the lessons. This is what Leat cited in Lambert and Balderstone (2000) sees as a particularly serious problem in some teaching as teachers put too much emphasis on teaching and not enough on learning which leads to an emphasis on factual information and not enough on the intellectual development of learners. The Namibian education policy (Namibia. MEC, 1993: 60) emphasises that the natural curiosity and eagerness of all young people to learn to investigate and make sense of a widening world must be 'nourished and encouraged by challenging and meaningful tasks'. As I indicated in Chapter 2 educators who are agents of change should become actively involved in helping learners to develop an understanding of their own thinking and reasoning through using appropriate strategies, informed by relevant principles and theories of critical thinking.

5.3 IMPLEMENTATION OF CRITICAL THINKING

5.3.1 Importance of critical thinking in learning

According to Splitter (1991: 89) critical thinking is a 'corner-stone of education', which is also supported by Bailin et al. (1999) who claimed that developing critical thinking is an important goal of education that 'can no longer be ignored' as it has a direct impact on children's cognitive development. The findings from the interviews

revealed that all my participants consider critical thinking to be important. From the responses, it is clear that the participating teachers have similar perceptions of the importance of critical thinking in learning. They both consider critical thinking to be '*important for academic development'* as it helps learners to learn from one another and learn better so they become successful in their examinations. These responses reveal an innate sense that there is value in thinking and that when 'critical' is added to thinking there is a sense that this is something more than thinking *per se.* What this 'something' is and how it should be implemented was, however not understood.

Penda's view that through implementing critical thinking learners would be helped to solve problems in their daily lives while Wetu, in the pilot study, and Pawa also feel that it is through critical thinking that learners will be able to make valuable decisions in life. As indicated in Chapter 2, authors such as, Splitter, (1991); Bailin et al., (1999); Paul in *The Critical Thinking Community* (2007); Hoaglund (1995) in De Klerk (200); Lau & Chan (2008); Bostwick (2008) have all emphasised how important critical thinking is in education and how essential it is in everyone's daily life. It is noteworthy that some of the roles that the participating teachers indicated are generic such as being *'important for academic development'*, and *'help learners to learn from one another*' and '*learn better so they become successful in their examinations'*. Responses such as these serve to further illustrate the perception that there is value in critical thinking and the benefits that are seen to result from developing critical thinking in a formal teaching context.

The only specific skills or competencies mentioned were those of decision-making and problem solving. The literature focuses on very specific attributes associated with critical thinking. Thus for example Bostwick (2008) identifies learning objectives associated with critical thinking as the ability to analyse complex issues and make informed decisions; to synthesise information in order to arrive at reasoned conclusions; evaluate the logic, validity and relevance of data; solve challenging problems and use knowledge and understanding in order to generate and explore new questions. One of the related problems revealed in this study is that while problem solving and decision making are seen as educationally important and linked to critical thinking there is also little real understanding of what problem solving involves, what

it is, the cognitive and recursive processes that are an intrinsic part of problem solving or of the specific cognitive skills that are integral to problem solving.

Wetu sees critical thinking as helping learners to feel proud of themselves and gain confidence when they make valuable decisions. This view is affirmed by Lambert and Balderstone (2000) who pointed out that critical thinking develops learner's ability to cope with intellectually challenging tasks, leading to improved self-esteem through genuine achievement. The study revealed that although teachers seemed to be aware of the role of critical thinking they did not apply it effectively so as to allow learners to analyse issues, make decisions and solve challenging problems using knowledge and understanding.

5.3.2 Development of critical thinking skills

While teachers were able to identify and list a number of strategies that they claimed to apply as indicated in Chapter 4, there were instances which revealed that other valuable strategies are either not used, or are not used particularly effectively. Hence it would not be correct to label them as critical thinking strategies as they were not designed in such a way to encourage actions such as explanation, application, problem solving and decision-making. As indicated in Chapter 2 critical thinking is described as a total approach to understanding how to make sense of the world (Chaffee, 2005; Gibson, 2003; Splitter, 1991), which should be applied by allowing learners to think and reflect critically through meaningful activities in order to gain a sound understanding of the world in which they live (Namibia, MEC, 1993). The way the teachers in this study viewed and used some of the strategies, would seem to indicate that they lack real understanding of how strategies could be best applied to allow learners to interpret and evaluate information and experiences as indicated in Chapter 2.

Chapter 4 revealed that during the interviews and in the lesson presentations the teachers identified various strategies and indicated that they used them to develop critical thinking skills. Rusbult (2006) noted that in order to teach thinking, we need instruction that encourages thinking, thus for teachers to bring about meaningful learning they should be able to encourage learners to develop their own understanding

by involving them in intellectual activities at any level. The results from the observations and the document analysis revealed a concern that no such strategies were implemented. The following sections analyse the various strategies used in the lessons observed.

5. 3.3 The nature of strategies teachers used

5.3.3.1 Questioning

The participating teachers showed a degree of understanding the importance of questions as good tools for teachers to use in teaching. Lambert and Balderstone (2000: 308) suggested that the teacher then 'takes on more direct control' using direct questions to explore learners' thinking, clarify, understanding and establish patterns in the reasoning used. In fact, teachers attempted to ask as many questions as possible during the lessons, which was also evident in the documents analysed. However, the findings revealed that more than 95% of the questions used during the lessons presentations observed and in documentary sources required learners to only give one word answer or to provide factual information without thinking deeply about the concept being discussed. This does not allow the learners to interpret and evaluate information and experiences, which is a vital cornerstone of critical thinking as indicated in Chapter 2. It is important that learners develop intellectual thinking through questions that stimulate reflection, comparison and exploration, continually building on the knowledge acquired. Another aspect is that classroom practices also revealed that most of the questions asked did not encourage critical thinking. Looking back at my findings, the questions both Penda and Pawa asked in all the observed lessons were mainly used to ensure that the learners were kept alert as the lesson progressed. Key questions that should be used in the course of any teaching/learning situation are those that lead to speculation and discussion, which activates and stimulates learners' thinking (Lambert & Balderstone, 2000). Furthermore in the teachers' feedback there was no evidence of reflection, self-regulation, and evaluation.

5.3.3.2 Learners' questions

Doyle and Mallet (1994) have revealed how important it is for learners to ask questions and to be encouraged to set questions that serve to shape a learning situation. The Western Cape Education Department (2000) also proposes that learners must be encouraged to ask questions, to argue and to challenge and to be challenged. Unlike Pawa, Penda did attempt to get learners asking questions during the lessons presentation but as seen from the findings these were not developed or encouraged in a manner that would develop learners' critical faculties. For example, as indicated in Chapter 4, the only four questions that learners asked were not critical and could make an impact on the learners' thinking ability. Therefore teachers need to teach learners to examine, probe, question and reflect on what they have learned (Brightman, 2008).

This in turn raises a concern that although Penda attempted to get learners to ask questions it seemed to be primarily based on obtaining reassurances from the learners that they were following the lesson so tended towards rhetoric rather than a real intention to stimulate learners to contribute to the lesson through asking questions. It was noted that Pawa did not focus much on encouraging the learners to ask questions. The opportunities for questions from the learners were consequently limited by the teaching approach used. More importantly, given that is claimed that learning to think critically is learning how to question, when to question and what questions to ask; these lessons provided no direction to learners about how to develop these skills. Instead this questioning attitude was largely discouraged.

5.3.3.3 Group discussions

As Brightman (2008) proposed, working in groups can be a valuable strategy if used well. Wood (2000: 28) also suggested that the teacher may encourage learners to work in groups to think about issues, questions and should guide learners as they approach problems and support them with encouragement and criticism as they tackle real issues and subjects. Findings in this study revealed that the participating teachers understood the value of this strategy as they indicated in the interviews and as reflected in the lesson plans. It is also noteworthy that although one teacher did not mention it in the interview, she

included group and pair discussions in her planning and attempted to involve learners through group discussions during the lessons I observed. Learners were working in groups and interaction among the groups was observed. However, the degree at which these discussions took place did not actually foster explanation and application of knowledge through problem solving. The activities observed did not encourage critical thinking as learners were just expected to 'list' or 'state' and 'describe' and there was no problem-solving involved in these activities.

Chapter 2 discusses the value of learners learning through understanding, but this seemed to be interpreted as being required to recall. Mere recall does not allow for meaningful learning, as the learners do not get the opportunity to reflect, compare, explore and evaluate through interaction.

5.3.3.4 Motivation

All three teachers see motivation as one of the means to encourage critical thinking. According to WCED (2000) motivation is a key to learning, this implies that it not only helps with learning but is essential for learning. As Pawa indicated during the interview learners with low self-esteem might not be willing to engage in thinking critically, but through motivation they can acquire the necessary courage which would lead to better thinking.

The attempt Pawa made to allow learners time to think, and the way she was asking questions during her lessons as I indicated earlier, appeared to support the point she made above. However, these did not actually contribute to learners' development of abilities to cope with intellectually challenging tasks, leading to improved self-esteem. Thus equally there was no evidence of reflection and self-regulation.

5.3.3.5 Tests and homework

Bostwick (2008: 5) claimed that if one wants to teach critical thinking, 'one devises exercises that require students to practice critical thinking' and at the same time allows them to 'demonstrate their progress in achieving the complex skills' inherent in this type of

thinking. The article "*Teaching Critical Thinking*" (2008: 6) also argued that the ability to think critically develops through 'practice and exercise'. This study revealed that this strategy appeared to be commonly used and was regarded as useful by the teachers observed. Findings indicated that teachers gave homework tasks and tests using a variety of different activities. However as I showed in Chapter 4 it appeared that almost all these tasks required learners primarily to recall but did not fully engage them in explanation and application. The tasks set did not encourage learners to solve problems and to make judgments. Furthermore there was no evidence of reflection of self-regulation in the teachers' feedback. It is important that assignments involve the tasks of critical thinking and must offer meaningful feedback and model critical thinking in the way they are presented (*Teaching Critical Thinking*, 2008).

5.3.3.6 Practical activities

Findings in this study indicate that teachers believe that problem solving is best done through practical activities. These findings are aligned with (Lambert & Balderstone's, 2000) view that teachers are required to change their own view of teaching and learning from one that assumes that intelligence is fixed to one that assumes that it is fluid and can therefore be developed through involving learners in doing things and thinking about the things they are doing. This principle, as revealed in Chapter 4, was put into practice. For example, Pawa gave the learners two practical activities to do which were evident in her lesson plans. This seemed to be good planning and preparation as it indicated the intention to engage the learners fully in a range of thoughtful thinking activities. However, I feel that teachers did not apply this strategy effectively. This was partly due to overcrowded classes and group size which hampered discussions, but when the activities are analysed their design is essentially flawed, as they do not promote the attributes associated with critical thinking.

5.3.3.7 Excursion, Interviews and Presentation /Reporting

According to Bostwick (2008) some of the learning objectives associated with critical thinking are described as the ability to analyse complex issues and make informed decisions; to synthesise information in order to arrive at reasoned conclusion; evaluate the logic, validity and relevance of data; solve challenging problems and use

knowledge and understanding in order to generate and explore new ideas. Looking back at my findings, the teachers did, to some extent; attempt to use these strategies in their teaching. This featured during the interview with Penda. Pawa also used these strategies, which was evident in her lesson plans and she also asked learners to report from the group activities carried out in two of her lessons I observed. However, findings indicate that the level of activities carried out did not allow learners to reflect and make thoughtful analysis, sound judgments and logical conclusions. This implies that teachers do not apply inquiry methods that provide opportunities for learners to learn and practice critical thinking skills in meaningful contexts.

Penda mentioned all of these strategies but he did not apply any of them, which reveal a superficial understanding of the theory, and no practical implementation. He could have asked learners to report or present their findings from the discussion which would allow them the ability to analyse and make informed decisions and to make reasoned conclusion. It is through applying these strategies that learners acquire the necessary learning objectives associated with critical thinking. Findings indicate that where teachers used examples of reporting or of assignments they were hampered by their lack of real knowledge relating to what critical thinking is or how it can be taught. Consequently the tasks they set for learners were primarily related to recall and in a few instances to superficial explanation.

5.3.3.8 Role-plays, Debates and Projects

Findings in this study indicated that the participating teachers regarded these strategies to be important. Huitt (1998) suggested that it is important to understand that critical thinking is a complex activity and we should not expect that one method of instruction would prove sufficient for developing each of its component parts. Thus it is necessary that these inquiry methods and problem solving activities be applied to provide learners with experiences that will stimulate them to think and ask questions. This emerged during the interviews with two of the participating teachers. In addition, one of them indicated in her lesson plans that she carried out a debate as one of the activities planned for assessment as shown in Chapter 4. However, in the process, research has shown that teachers rarely use these strategies. For example, these strategies did not reflect in any of Penda's practices nor during the interview with

him. This study also revealed that the teachers do not implement projects, although it is a requirement of the Life Science syllabus. This would enable learners to reason and to argue well and fairly thus resulting in making sound and independent judgments. More importantly, these strategies would stimulate learners to think and ask questions thus allowing them the opportunity to solve problems and make informed decisions.

Looking at these results a fundamental problem is highlighted. Neither the teachers nor the learners fully understand learning. Without a deep and explicit understanding of what learning is and how learning occurs through a multifaceted, integrated and interdependent series of processes it is not likely to be really understood (van Harmelen, 2006). Equally without a real understanding of how learning can be mediated it is unlikely that the reform ideals of learning with understanding can be achieved and less likely that critical thinking will be a reality.

5. 4 CHALLENGES IN IMPLEMENTING CRITICAL THINKING

Some of the challenges in teaching critical thinking include aspects such as an inadequate knowledge based on teaching critical thinking and conditions that require classroom management at the expense of academic instruction (*Critical Thinking and Teacher Education*, 1988). Elder and Paul (1996) also claimed that most teachers do not seem to be aware of how unaware most students are of their thinking. This study revealed a number of challenges that teachers face in attempting to develop critical thinking:

- The study revealed that teachers face the dilemma of how to foster critical thinking with learners who vary in their need for academic guidance (Muirhead, 2002). A related problem observed was that teachers asked few questions that stimulated learners to reason and make sound judgments through thinking critically. This is part of a broader problem of teachers' understanding of questioning techniques in the context of learner centred education.

- Another issue, with reference to one of the teacher's concerns, is that learners are used to responding to recall but need considerable practice with the higher order questions (Collins & Lacey, 1996). It seems that little is being done at present to help learners 'discover' their thinking. I found as a result that many learners find it difficult to answer questions which encourage them to think.

- Fluency in the language of instruction is another serious challenge to the development of critical thinking. Findings revealed that most learners and teachers experience difficulties in expressing themselves clearly because of a lack of proficiency in the language of instruction.

- It is also worth noting that findings revealed that the syllabus seemed not to be explicit on how to teach critical thinking skills thus teachers need guidance and continuous support in this regard through training and professional development courses.

- Because of the continued focus on normative assessment and examinations teachers tend to focus on memory recall at the expense of providing opportunities for learners to demonstrate their thinking abilities. Examinations, tests and class work activities seem not to be effective enough in promoting critical thinking in terms of the level of the questions used.

5. 5 TEACHER DEVELOPMENT AND SUPPORT

As indicated in Chapter 2, to improve learners' performance in developing critical thinking skills teacher education programmes need to be improved (*Critical Thinking Skills and Teacher Education*, 1988). Findings in this study indicated that it is also important to consider more in-service training to expose all teachers to a variety of approaches most appropriate to the teaching of critical thinking skills. This provides teachers with an opportunity to share effective strategies for enhancing critical thinking skills and to give them practice in a variety of real life contexts. For example from the responses of the participating teachers it is indicated that teachers must be trained in how to ask reasoning questions in class tasks, tests, and examinations throughout the year. This is based on the fact that in most cases learners are unable to reason because the teachers lack the ability to test reasoning skills. It is also important

to consider teachers' upgrading and professional development courses which would allow the teachers an opportunity to improve their language proficiency and enable them to understand the significance of critical thinking in learning.

5.6 CONCLUSION

In this chapter I have discussed the findings presented in Chapter 4 with reference to my theoretical framework. I have discussed how the teachers understand and develop critical thinking skills. The findings in my study reveal that teachers have a good idea of the role of critical thinking, although their actual practice lacked any real implementation of this understanding. The participating teachers in this study showed that they are aware of the possible strategies to be used in developing critical thinking skills. However, they could only use some of the strategies during the lesson presentation and these were not effective in terms of developing critical thinking skills.

I have discussed challenges and the problems that teachers experienced in relation to the implementation and development of critical thinking skills. Support that teachers need in implementing critical thinking was discussed. As an Advisory Teacher I regard this as one of the challenges for me personally and for the education sector at large as we need to ensure that critical thinking is effectively implemented in school to enhance learning with understanding. In the next chapter I will reflect on what I learnt and give tentative suggestions about issues that need to be addressed in the light of my research.

CHAPTER 6

CONCLUSION

6.1 INTRODUCTION

In this chapter, I provide a critical overview and reflective summary of the main findings that emerged from this study. In the first section I present a critical reflection on what prompted the research and why it was considered worthwhile. In the same section I give a critical reflection of the research process and why I selected this particular research design. I end this section by giving an overview of the key findings. In the third section I discuss the lessons learnt from the study. I then provide a brief discussion of the limitations of the study. Thereafter, I provide possible suggestions to be considered based on the research findings and discussions. Finally, I present possible areas for future research.

6.2 PURPOSE OF THE STUDY

A central tenet in the literature and that of the Namibian educational reform epistemology is that of learning with understanding. The literature examined pointes to understanding as a process that is recursive, developmental and complex, one that leads to increasing sophistication in terms of being able to describe, explain and apply the phenomena we have internalised and of which we have made meaning. The learner centred approach that is based on constructivist epistemology aims at helping learners to think independently and critically through mastering strategies for identifying, analysing and solving problems. The literature also reveals that there are challenges in teaching critical thinking such as an inadequate knowledge base for teaching critical thinking and conditions that require classroom management rather than simply academic instruction. A concern is that in most cases even students entering colleges lack critical thinking skills, which they should have learned during their primary and secondary education. This study aimed at understanding the perceptions of Grade 10 Life Science teachers about critical thinking and its role in learning. It sought to investigate how the participating teachers in this study

implement critical thinking as well as the challenges that are experienced in its implementation.

This research enabled me to concentrate on a small sample using a case study approach in order to understand the Life Science teachers' perceptions and practices in developing critical thinking skills. I hoped to get clarity not just on what these teachers could and could not do and what they thought and said, but to reach an understanding of their practice. The aim of my research was to reach an understanding of the situation in the context of my case study and to identify problems. Thus my research questions were aimed at ultimately finding answers to inform my own professional context. Through this overview of the findings, the lessons learned and the tentative conclusions I am able to reveal and describe the extent to which this study has served its purpose.

6.3 OVERVIEW OF THE STUDY

In this overview I reflect on the study. I begin by considering the research design and the research process and this is followed by a critical reflection of the findings.

6.3.1 Research design and process

As I indicated in Chapter 1, I adopted an interpretive orientation using a qualitative case study approach. This approach provided me with the opportunity to engage with my respondents regarding my topic and to make sense of what they said and did. This has been made possible through the integration of three methods, which are, interviews, class observation and document analysis. Each of the methods made a contribution to the whole.

By using the set of data collection instruments that I selected I had the opportunity to gain access to and understand the participants' beliefs, feelings and experiences pertaining to my study. Data obtained were combined through triangulation to get the necessary in-depth insights to address my research question. I began the conversations with the teachers through semi-structured interviews, focused primarily on their perceptions and views of critical thinking. I realised that interviews only alone would not cover all aspects of my study so I employed other methods such as document analysis and classroom

observation. The observation of lessons provided me with an opportunity to verify some of the claims that the participants made during interviews as well as allowing me access to the teachers in their own classrooms. The document analysis was also crucial to my study as it exposed me to new insights through scrutinising the teachers' lesson plans, learners' workbooks, syllabus, tests and examinations as well as the examiners' reports. These methods helped me triangulate and cross-check data.

I did encounter some difficulties. Although I managed to examine how teachers understood critical thinking, I feel that it was not enough. I feel I missed extended stimulated recall interviews after classes due to the teachers' other commitments. Although I managed to conduct one with each teacher, I feel I did not completely exhaust all the pertinent issues that needed clarification. Another reason for this was the reactions from the teachers. There were times when the teachers found the questions intrusive. This did contribute to some of the gaps that I noticed during the analysis process.

6.3.2 Main findings

The main findings of this study are influenced by my research question. First, this study looked at the teachers' understanding of the role critical thinking plays in learning and the second focus is pedagogical content knowledge. Although it was not easy to effectively measure the teachers' understanding of the concept 'critical thinking', findings have shown that teachers demonstrated a fairly good understanding of the role that critical thinking plays in teaching and learning and the strategies they can use to develop related skills. The teachers demonstrated their understanding through interviews and lesson planning and in the lesson presentations. For example, they mentioned various strategies within the adopted learner centred approach to develop critical thinking skills. Secondly, they seemed to realize that critical thinking helps learners to solve problems and enables them to make valuable decisions in life as well as developing learners' self-esteem and confidence**.** Thirdly, they attempted to use some of the strategies during their lesson presentation.

Conversely, of concern is their theoretical and pedagogical knowledge. While the teachers seemed to be aware of the role and the strategies to be used in developing critical thinking,

they fell short in the actual implementation and design of the strategies they identified. The way the teachers handled the strategies and the nature of the strategies they used reveal their lack of understanding of the pedagogy of critical thinking and exposed a lack of deep understanding of the concept. Almost all of the tasks given in the classroom required learners to recall information and to have some comprehension of knowledge, but did not fully engage them in explanation and application. Secondly, the questions used in the activities did not encourage learners to solve problems and to make judgments.

The implication then is that the teachers lack a proper understanding of the role that critical thinking plays in learning and the importance of using various strategies in developing critical thing skills. Another indicator of the teachers' lack of understanding is revealed through the nature of activities. This study has shown that learning with understanding is achieved when learners describe, explain, evaluate and apply new knowledge to other situations. The results showed that the teachers in this study did not afford those opportunities to learners. Learners spend the majority of the time listening to the teacher talking. Although one may argue that it brings about learning, research has shown that it is not as effective as an approach that allows learners to actively participate in the learning process. This is one of the fundamental issues that need to be addressed.

On the one hand, as indicted in Chapter 5**,** there are a number of contributing factors that exacerbate the situation. These have contributed to the lessons learned from this study. One of the main problems is that of an overloaded curriculum further exacerbated by classes that are too large for effective interactions. Teachers are forced to rush their teaching resulting in a need to cover up to two new topics in one lesson. This does not allow learners to ask questions and to have good quality activities that enhance critical thinking. Secondly, the standard 40 minutes for a lesson is typically too short to properly use various approaches and strategies. This issue is a concern and is linked to the fact that teachers could not plan activities such as role plays or debates and excursions because they could not carry them out within the given time frame. Thus learners were not provided with opportunities to analyse, solve problems and make decisions.

Thirdly, existing learning support materials seldom use a scaffolding approach to develop learners thinking ability. This implies that the activities teachers get from textbooks and questions from external examinations do not provide good examples for promoting critical

thinking. The questions used did not encourage critical thinking, as most of them required learners to recall information. It is important that assignments involve the tasks of critical thinking and must offer meaningful feedback and model critical thinking in the way they are presented. Lastly, teachers have a superficial understanding of a learner centred approach; as a result, it is often poorly applied.

The results have also revealed that the syllabus it is not explicit in directing teachers how to foster critical thinking in terms of pedagogical or content knowledge. It was revealed in this study that even the teachers who seemed to understand the role that various strategies play in developing critical thinking could not apply them effectively. It seems that they do not really understand how learners learn and how to design activities that target the development of critical thinking skills.

What was most significant in these findings was the sense that the teachers' use of teaching and learning strategies is based more on intuition than a real understanding of the underlying theory. Thus what this study affirmed is that these teachers' views and practices are mainly part of who they are and where they have come from. I believe, therefore, that these findings serve to emphasize the need for and the value of small-scale studies such as this, if we are to build up a picture to help us understand the need for change and how to implement it.

Given these findings the following needs to be considered:

- Firstly there is a need for ongoing teacher development. In spite of their understanding of the role of critical thinking and the strategies to be used, the participating teachers in my study needed additional support as they lack the necessary skills. They need ongoing in-service training and professional development opportunities in order to be in the position to model critical thinking to their learners and explicitly teach them to think critically. Monitoring of implementation during training should be conducted to render ongoing support in schools.
- Secondly, the curriculum content needs to be reduced to allow enough time for proper teaching in terms of the necessary strategies and approaches to be carried out.

- Thirdly, double periods should be instituted to allow effective implementation of learner centred approaches. Examinations and tasks from the textbooks should model critical thinking.
- Lastly, teacher-training programmes should teach about and for cognitive skills and in so doing develop the teachers own skill before expecting them to implement these skills with their learners.

6.4 LESSONS LEARNT

From doing this research I have learnt a number of things. I have learnt about the whole research process, including the topic researched, and I have grown as a researcher and education officer as a result of the findings.

6.4.1 The research topic

Through my literature review in Chapter 2, I discovered the importance of the historical background and context of the situation under investigation. I have also come to the realization that how teachers understand and develop critical thinking skills in Life Science and in other disciplines is under-researched in Namibia. To find relevant information for my topic I had to rely on other studies conducted around the world. I have come to understand my research question better, resulting in a clearer focus on my research goal. As a novice researcher I have gained research skills through using research instruments such as interviews, class observations and document analysis.

6.4.2 The research process

Through this process, I have developed a number of key skills. Firstly, I have gone through the process of proposing a research topic; compiling data lists and appropriate interview questions; selecting an appropriate paradigm in which to locate the study, choosing the right methodology and successfully collecting data. Secondly, I have gained experience on how to review literature regarding the research topic. This allowed me to have a deeper understanding of the context and the situation under investigation. Thirdly, I

have learnt how to logically group ideas to form patterns that make sense to the reader. Lastly, I have also gained experience and skills in analysing data collected. This allowed me to look critically at the situation and to reach appropriate and reliable conclusions.

6.4.3 From the findings

The main findings of this study have taught me a number of lessons. I was particularly concerned with the lessons that affected me directly as an advisory teacher so I have concentrated on those lessons that relate directly to my professional practice.

I have learnt that although teachers claimed to be aware of the role and the strategies to be used in developing critical thinking, they lack understanding about the pedagogy of critical thinking. Therefore, as an advisory teacher my role is to assist and support teachers to gain the necessary understanding in their teaching and learning contexts.

I was also exposed to problems I was unaware of. I found that the learner centred approach is not being effectively implemented. Learners spend the majority of the time listening to the teacher talking; as teacher-tell strategies were commonly used during the lessons so their active involvement was very minimal.

I also came to realise that there is a lack of appropriate instructional activities and exercises that promote internalisation of critical thinking skills. This means that the teachers still focus on questions that require factual recall rather than using strategies that contribute to a better development of critical thinking. It seems that they do not really understand how learners learn and how to design activities that target the development of critical thinking skills.

The study also revealed that the curriculum is overloaded in terms of the subject matter as stipulated in the syllabus. Therefore teachers are forced to rush in order to cover the syllabus due to external examinations which results in paying less attention to allowing learners to analyse issues, make decisions and solve challenging problems.

I came to realise that the activities teachers get from textbooks and questions from external examinations do not provide good examples of critical thinking. The level of the questions used did not encourage critical thinking.

I have also realised that a lack of language proficiency in the language of instruction contributes to teachers' and learners' difficulties in expressing themselves explicitly. Therefore this hampers the enhancement of critical thinking abilities during the teaching and learning process.

Findings have also revealed that the syllabus is also not explicit in directing teachers about how to foster critical thinking in terms of pedagogical knowledge

6.5 ISSUES TO BE ADDRESSED

Drawing on the findings of this study some issues emerged that need to be addressed. These are as follows:

- As far as the teaching of critical thinking for conceptual understanding is concerned, there are issues that need to be attended to in order to realize this. Teachers need to be assisted with the quality of questions to ask. Questions should encourage learners to apply, evaluate and relate the information under discussion to real life situations. Teachers should be encouraged to use teaching strategies other than questioning when dealing with problem solving and decision making issues.

- Pre-service and in-service programmes should focus their attention on the understanding and development of critical thinking skills. Teachers should be encouraged to design better-structured activities in order to actively involve learners in the learning process and not to be mere receptors of facts. Intensive monitoring after training should also be done.

- The teachers need ongoing in-service professional development opportunities in order to be in the position to model critical thinking to their learners and to teach them to think critically.

- Despite the professional training teachers received, there is a need for continual support to be trained on how to teach the learners to practice critical thinking throughout the course of the year in order to do well in the examinations.

- The syllabus should provide explicit guidance on how teachers should develop critical thinking skills and the examinations and tests must also encourage critical thinking.

- Language across the curriculum should be emphasised in education because it is through language that the entire communication process occurs. Learners should get the opportunity to think, ask questions and discuss in groups thus constructing their own understanding and making sense of their experience.

- The curriculum content needs to be reduced to allow enough time for proper teaching in terms of using the necessary strategies and approaches to foster critical thinking.

- Schools should establish clubs and projects to support teachers in involving learners through activities such as planning, debating, role-playing, reporting and interviews. Learners will be encouraged to interact and express their opinions freely so that their language proficiency improves.

6.6 LIMITATIONS

The primary limitation of my study is that it was a small-scale research in which the findings cannot be widely generalized. Therefore my findings are exclusive to the three participants in my study. There was also a limitation regarding the information gained from the interviews as one of the participating teachers was not comfortable with answering the questions during the stimulated recall interview. The other limitation worth

mentioning is the vastness of the region and the time constraints; therefore the study had to be limited to only two schools in the region which offer junior secondary education.

6.7 CONCLUSION

This case study has provided me with valuable insights into the issues regarding the implementation of critical thinking. The study indicates that there is a need for teachers to give attention to the development of critical thinking skills. Research has also shown that if teachers do not have a deeper understanding of the role of critical thinking and its implementation, no meaningful learning will take place. Therefore, pre-service and in-service programmes should pay attention to the development of critical thinking skills and pedagogical content knowledge. The curriculum should be more explicit in this regard in order to support teachers in their daily practices. The findings from this study serve as a challenge to me as an education officer. I need to be able to offer assistance to the teachers in the region to improve their practices with regard to the implementation of critical thinking. The experiences gained through this study will inform and aid my future practice as an advisory teacher.

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APPEDIX A

Ongwediva Teachers Resource Centre
Life Science Advisory Services
Private Bag 5550 **Tel:**+264 065 230057 / 232018
Oshakati **Fax:** +264 065 230035
Namibia
Omusati Region

28 January 2008

To: The Regional Director of Education
Omusati Region
Outapi

Dear Mr Kafidi

SUBJECT: Request for permission to conduct research in schools

As I am currently studying as a part time student for a Master's degree in Education (General Education Theory and Practice) at Rhodes University, I have successfully completed the course work of the Master's programme. As part of my study I am required to carry out a research project on the topic I have chosen that is linked to an aspect of the work undertaken in the course work. The aim of my research is to investigate how Grade 10 Life Science teachers understand and promote critical thinking specifically looking at the aspect of its implementation at classroom level.

I therefore kindly request your office to allow me to use two schools as my research sites for the research project. I also intend to observe lessons and to look at learners work as well as to interview Life Science teachers at the selected schools. I am expected to complete this activity by not later than the end of May 2008. These schools will finally be identified as soon as permission has been granted.

The schools and participants will be assured of confidentiality and anonymity in the final research report. They will also receive drafts of the report and will be invited to provide corrections if need be to ensure that the information is accurately recorded and reported.

I will be grateful if my request receives your highest consideration.

Sincerely yours

.....
Mrs Ndiyakupi Avia: (AT - Life Science)

APPENDIX B

REPUBLIC OF NAMIBIA

MINISTRY OF EDUCATION
OMUSATI REGION

Tel: [065] 251700/
Fax: [065] 251722

P/Bag 539
OUTAPI
NAMIBIA

To: Mrs. Ndiyakupi Avia
P/Bag x 5550
Oshakati

11 February 2008

RE: Permission to conduct research at Schools in Omusati Region

Dear Mrs Avia

We hereby acknowledge receipt of your letter dated 28 January 2008 requesting permission to do research at any two schools in Omusati Educational Region. It is a pleasure to inform you that permission is granted to you to carry out your study at any two schools of your choice under the following conditions:

- Permission of principal should be secured on time.
- Class visit can be done at the Life Science classes at two schools of your choice.
- No disruption of normal school programme.
- Interviewees should participate on voluntary basis.

We wish you all the best in this endeavour and hope you will be at liberty to share your thesis with our Directorate.

Sincerely yours,

.....
MR. LAMEK T. KAFIDI
REGIONAL DIRECTOR

Cc: All Inspectors of Education

APPENDIX C

CONSENT FORMS

Consent form 1

I hereby agree to participate in an interview with Ndiyakupi Avia. I understand that she will be inquiring about my understanding of critical thinking skills and how I implement it with regard to the teaching of Life Science in Grade 10 classroom.

Signature:..... Date:.....

Consent form 2

Ndiyakupi Avia is hereby given permission to record an interview conducted with me as part of the process of her data collection for a research report that she will be writing for the completion of her Masters. degree. I understand that transcripts will be made of the interview and that extracts from these may be used in the final report.

I have been assured that my school, my learners and I will have anonymity in the report. I have been further assured that I have the right to quit the research at any time. The phone number where I can reach her is 065-230057 (Work) or 065-230153 (Home).

Signature:..... Date:.....

APPENDIX D

Data List

Part A: What I need to know/get from the teachers to show their understanding of teaching critical thinking (CT) skills:

1. Teachers' understanding/background knowledge

- whether teachers are familiar with the concept 'critical thinking'
- their views on what it means to think critically
- where and how they came across it
- how it is linked to the syllabus
- types of questions they use/ask and why? (open ended questions – why?, how?, what if, what reason what do you think and why? ….)
- necessary skills for developing CT skills
- whether they teach CT skills consciously

2. Implementation

- types of activities planned
- which sort of activities promote problem solving skills
- whether they give learners chance to analyse information carefully and logically, (e.g. game, (Oshana game, pictures, etc.)
- how they involve learners in making and taking decisions (any example – planning role plays, drama, projects, etc.)
- if they allow and teach learners to ask questions – (how to question, what to question and when to question, e.g. formulate Qs about a picture)
- how they encourage learners to share ideas and express their opinions - (examples of strategies used - e.g. group discussions/work, debates, role plays, displays, games, drama, projects, model making)

3. Benefits

- why are these strategies important
- what benefits do they have

4. Challenges and recommendations

- what they think are problems/difficulties in developing CT skills
- what can be done about these problems for improvement

5. Assessment of CT skills

- how to assess CT skills - types of assessment strategies used (topic tasks, topic tests, examinations, assignments, projects and practical work)

I want to look at:

- the cue words used in the tests, examinations, assignments, practical work, etc.
- any questions that promote:
  - application
  - reasoning
  - problem solving and
  - decision making

Part B: Document analysis, observation and interview

1. Document analysis

I want to look at:

- lesson plans
- learners' work
- tests
- examinations
- assignments, worksheets and homework
- examiners' report

2. Observation

Post observation interview:

- reason for the type of questions and or strategies used
- sort of skills developed
- any significant or unusual thing happened
- possible problem experienced - reason
- how could it be done better
- anything interesting to share

APPENDIX E

Information needed from data collection sources (generated through the source questions):

Interviews	• Information about the teacher • Teachers' perception and understanding of CT • The role of CT in teaching and learning • Strategies that teachers use to develop CT skills • Activities given to learners to encourage CT • Strategies used to assess CT • Challenges in teaching CT skills • Other issues relevant to the study
Class observations	• Strategies the teacher used to develop CT skills • Types of questions asked by the teacher • Learners' questions • Activities given to learners to promote CT • Other aspects arising from the observation
Lesson plans	• Does the teacher use basic competences as outlined in the syllabus for developing CT skills • Types of questions planned to develop CT skills • Activities planned to encourage CT
Learners' work	• Activities done to promote CT • Strategies the teacher used to develop CT skills • Types of questions used to encourage CT • Evidence of the learners' ability to think critically
Documents (Syllabus, tests, exams, examiners' report	• Basic competences from the syllabus for developing CT skills • Do the syllabus help the teacher easily identify CT skills to be developed? • Types of questions asked to assess CT skills • Evidence of the extend to which learners are able to answer questions of high order thinking • Other issues relevant to the study

APPENDIX F

Interview Questions Schedule

Subject: Life Science Grade 10

Thank you for agreeing to this interview. The purpose is to look into your views of critical thinking and how you implement it.

1. How long have you been teaching Life Science?
2. What kind of teaching training did you do?
3. Could you share your opinions why you think Life Science is an important subject?
4. What do you think are Life Science competencies that other subjects do not cover?
5. Are you familiar with the term critical thinking? What does it mean to you?
6. Where did you first meet with the idea or term critical thinking? How did it happen?
7. What sort of questions do you use in teaching? Can you give some examples of these types of questions? Why these questions?
8. Do you have any idea about different thinking levels? What are they?
9. What do you think are possible strategies suitable for developing critical thinking?
10. What sort of activities do you set for your learners to encourage them to think critically? (Can you tell more about the problem solving activities your learners did?)
11. How do you encourage your learners to make and take decisions? Any example?
12. Then why do you think these strategies are important? What benefits do they have?
13. How do you assess critical thinking in your teaching? (be in setting homework, projects, tests, exams, topic tasks, assignments, etc.)
14. In your opinion, do exams encourage critical thinking? How?

15. How do you think these activities shape and develop learners' cognitive skills? Do you think these activities make learners think better? How? Why is it important for learners to think better or critically?

16. What benefits do you think learners have in developing critical thinking skills?
17. What kind of difficulties do you experience in carrying out these strategies that promote critical thinking skills?

18. Do you have any suggestion on what you think are possible ways to support you in or teachers in implementing critical thinking skills?

19. Do you have any interesting thing to share with me? (Be a successful lesson in terms of critical thinking aspects or so)

APPENDIX G

Transcribed Stimulated Recall Interview

Thank you very much again Mee Rauha for your time and for everything. I now have few follow up questions to ask in order to get clarity on some of the aspects that I have observed during the lesson.

Av: The first question to you is: As you were teaching this week, do you recall some strategies that you were using and you think they promote critical thinking?
Ra: Strategies..? Okey, I think.., learner-centered can be a strategy that I have been using,

Av: Mmmhm!
Ra: ..where I have posed questions to the learners, to think more about what they have come up with or to think more about certain concept just look for clarity or how they understand it.

Av: Mmh! You refer to questions..,
Ra: Mmmh!

Av: Okey, Now Any other thing that you maybe giving or doing as a…, a way to, to promote critical thinking apart from questions?
Ra: But maybe I did a lot of questions,

Av: Mmh!
Ra: and maybe it's only when they are working in groups and they ask themselves questions and help each other as peers or they discussed and ask each other questions.

Av: Mh!
Ra: Can also be critical thinking because sometimes they may debate of which one is a correct answer.

Av: Mmh!
Ra: I think this may also help them to think critically.

Av: Do you remember any example of a question that you may have posted? Just an example.
Ra: I'll come back..,

Av: Maybe not exactly, but maybe referring to a situation for example

Ra: I mostly ask 'why' questions like maybe they give answers then if I need clarity on the learners answers, then I ask them why?

Av: Mmmh!
Ra: Which I need them to explain.

Av: Okey! That's good. Which critical thinking skills were developed during this lessons we have been together? (long pause) Here I refer to skills.

Ra: They only mm…, say they have developed if I have tested them? If I have given them a test then.., If I'm at the end of the test. At this stage I cannot say they have developed.

Av: But through the questions or through the strategies that were used.., you were using, don't you think you aimed at some or developing a certain critical thinking skill?
Ra: …,they have developed. As normally I use to, to teach them the same way. So now I do not say they have. I normally teach them in that way ,

Av: Mh!
Ra: where I have to, to ask for them or to leave them to such away that they have to think more about what they are saying.

Av: Maybe to reason..
Ra: Ya, to reason.

Av; Yaa-aa. And you might have not sort of asking them to make decision or to solve any problem?
Ra: Maybe it is difficult a bit. (laughing)

Av: Mmh..,You might have done it unconsciously.
Ra: Ya.

Av: Okey. Can you share anything interesting or unusual that happened during these lessons?
Ra: What I can say that they were more interested than ever, maybe because (laughing) somebody is in, they were.., even those learners who use just to sit quiet, only talk when you ask them to do so, they were active.

Av: Mmh,
Ra: So they were very eager to participate.

Av: Mh.
Ra: It's something I observed in learners.

Av: Mmh! Mmm, Is there any problems that you might have experienced during these lessons?
Ra: Nothing.

Av: Mh. So, at least the way you teach you think they have aa, developed maybe conceptual understanding, just very simply or has there been any problem that you might have…,

Ra: No, I haven't experienced anything. I don't think they might have any problem, because they haven't ee, shown any sign not maybe they understanding or having any problem to catch up with the lesson.

Av: Mh.

Ra: So, I must say that (very soft, not clear)

Av: Do you recall some specific activities that you think in away involved learners in thinking critically? Can you give some examples of some activities?

Ra: Yaa. Like maybe I can remember that I have given them today,

Av: Mmhm!

Ra: ..to identify the activities. I think they have been thinking critically, and when I was walking around, I can see they are like, you see, they are talking to each other. One say, one is saying this is what and this is.., so. So, sometimes you find them like confusing concepts, but through helping each other, I think they can get things right. And sometimes if maybe a learner has said something, or maybe a term has been confused with another, that learner can also say, or maybe I have said something wrong, then he or she start thinking again, maybe this is the right answer. So I think, mentioning something that is not correct, and now looking at the others how they are reacting, this learner is going back to his mind and ..(here, too soft not clear) ..,but he thought of something.

Av: Okey. Thank you very much Mee Rauha. I don't think whether you do have anything else maybe just to share or to say before I close our discussion.

Ra: Thank you mem, I don't have anything from now. I say thank you for your stay with me. You are still welcome if maybe need be.

Av: Thank you very much. Thank you very much also for the documents that I got from you as you have just said if I may need more information I may come back and I'm very much appreciating that you aa, a, already mentioned that I may come back. Thank you once again and God bless you.

Ra: You are welcome.