

**Investigating the inclusion of Environmental Learning in the Life Science
Grade 10 curriculum: A case study of three Namibian schools**

A half thesis submitted in partial fulfilment of the requirements for the Degree of
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ABSTRACT

This study was carried out to investigate how Grade 10 Life Science teachers in three schools in the Omusati region of Namibia are including Environmental Learning (EL) in terms of the curriculum policy. A qualitative approach was used to generate data through document analysis, interviews and classroom observations to investigate the application of the policy of including environmental learning in classroom curriculum practice. The research was primarily directed towards examining constraints and enabling factors in the context of the three schools that participated in the study.

The study revealed that teaching strategies for the inclusion of environmental learning were not widely evident, suggesting disparities between the policy of enabling environmental education through the inclusion of environmental learning across the curriculum. It was notable that teacher knowledge and interest in environmental education influence how they include environmental learning and that assessment practices narrow the scope of environmental learning in ways that do not include critical thinking and problem solving skills. The study concludes that despite diverse constraints inhibiting inclusion, the evidence suggests that the inclusion of environmental learning in Namibia's Life Science curriculum can enable environmental education.

The above main findings are used to make recommendations toward strengthening environmental content knowledge of teachers and to improve assessment practices. It was also noted that some of the environmental learning constraints could be transformed into enablers with more teacher support and by making a better link between environmental learning theories and practices. This will involve a redirection of the curriculum documents as well as the provision of other learning support materials to support environmental learning.

The study has enabled me to conclude that what is happening should be encouraged so that it continues and is strengthened although the implementation of environmental learning is not as clear as the policy had mapped out.

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LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|------|---|
| AIDS | Acquired Immune Deficiency Syndrome |
| BETD | Basic Education Teachers Diploma |
| CFCs | Chlorofluorocarbons |
| DESD | Decade on Education for Sustainable Development |
| DRFN | Desert Research Foundation of Namibia |
| EE | Environmental Education |
| EL | Environmental Learning |
| ESD | Education for Sustainable Development |
| HIV | Human Immune deficiency Virus |
| MBEC | Ministry of Basic Education and Culture |
| MEC | Ministry of Education and Culture |

| | |
|--------|---|
| MOE | Ministry of Education |
| NAMCOL | Namibia Collage of Open Learning |
| NEEC | Namibian Environmental Education Certificate |
| NEEN | Namibian Environmental Education Network |
| NEEP | National Environment Education Programme |
| NJSC | Namibia Junior Secondary Certificate |
| LS | Life Science |
| PCK | Pedagogical Content Knowledge |
| SADC | Southern Africa Development Community |
| SDF | School Development Fund |
| SEEN | Support Environmental Education in Namibia |
| STDs | Sexually Transmitted Diseases |
| UN | United Nations |
| UNDESD | United Nations Decade of Education for Sustainable Development |
| UNEP | Unated Nations Environment Program |
| UNESCO | United Nations Educational Scientific and Cultural Organisation |
| WCED | World Commission on Environment and Development |
| WESSA | Wildlife and Environmental Society of South Africa |

CHAPTER 1

OVERVIEW OF THE STUDY

1.1 BACKGROUND OF THE STUDY

Namibia got its independence in 1990. Since independence, the Namibian government has given a high priority to environmental concerns. Statements within the National Constitution and Vision 2030, Namibia's long term plan stresses that the promotion of environmental education among children is essential when it comes to national development (Namibia, Ministry of Education [MoE], 2009). In the National Constitution, (1990) Article 95 emphasises that all Namibian people be provided with access to environmental education within formal and non-formal levels. This resonates with Brown, (1992) who stated that, "to enable Namibians to move from environmental awareness to understanding and action, the Namibian government will aim to provide all Namibians with access to environmental education, whether at the formal or non-formal level" (p.39).

The Namibian education system is described in the policy document; *Toward Education for All* translates the Namibian philosophy on education into concrete and implementable government policies. It is detailed and comprehensive, thus covering all important facets of education in relation to vision 2030 as a curriculum for the future. In line with this the Namibian Ministry of Education [MoE], (2006) states that, it is important for learners to acquire knowledge and skills which will foster understanding of the interaction of human beings and the environment in order to satisfy human needs. It must be understood in a holistic manner by the society in order to sustain the natural resources.

Du Tiot, & Sguazzin (1995) noted that the Namibian government acknowledges that environmental education is one of the essential instruments for empowering individuals and communities to take meaningful action and positively shape the future of their own environment and themselves.

The Namibian Ministry of Education has also shown commitment to the concept of environmental education by making it one of the aims of basic Education system. Aim, 3.10 of Basic Education is:

... to develop a holistic understanding of the dynamic interdependence of all living things and their environment; to develop a sense of responsibility toward restoring and maintaining ecological balances through the sustainable

management of natural resources; and to promote learners involvement in practical activities to preserve and sustain the natural environment (Namibia. Ministry of Education and Culture [MEC], 1993, p. 32).

This resonates with the Namibian Ministry of Education [MoE], (2008) by ensuring that a cross curricular approach to environmental education is promoted by the Ministry of Education. This means that teachers of all subjects, at all levels (i.e. Junior Primary, Senior Primary, Junior Secondary and Senior Secondary), need to incorporate environmental issues into their teaching. For example, all topics, including social interactions, civic affairs, politics and policy, economics, natural and cultural factors, sustainable development, and health and Agricultural practices need to be guided by a sound background knowledge of the Namibian environment. The Ministry of Education and Culture also encourages the community to play a more active role in the education of the child. This stimulates teachers to take their children out of the classroom and to address real issues in the social and natural environments surrounding the learner (Du Toit and Sguazin, 1995).

One milestone in the history of environmental education in Namibia is the establishment of the Namibia Environmental Education Network (NEEN) which is a national network, facilitating information sharing in environmental education. The Namibian Environmental Education Network policy aims to empower Namibians to take strategies that are contributing to environmental sustainability, hereby states that:

Namibia will actively encourage, support and implement environmental education as a means of achieving and fulfilling Article 95 of the constitution. Environmental education should aim to Empower Namibians, from all sectors, and to critically evaluate environmental information and options, to make informed decisions, and take actions that will contribute to the goal of environmental and economic sustainability (Namibia Environmental Education Network [NEEN], 1999, p. 1).

In the light of the history of environmental education curriculum in Namibia, internationally funded development projects such as the Support Environmental Education in Namibia, Life Science project and Enviroteach project has also been influencing the environmental education curriculum and these projects targeted teachers development, supporting environmental learning in the curriculum reform process and developing learning support materials and other activities through workshops (Simalumba, 2011).

Environmental Education is a cross curricular concern that is broad, this study will only pay attention to the Life Science curriculum for grade 10 which according to the Namibian Ministry of Education [MoE], (2006), is developed to describe the intended learning

outcomes and assessment practices for the Junior Secondary phase within the science mainstream. The learning experiences and subsequent outcomes in Life Science are tailored towards promoting the learners' knowledge and understanding of the economic, social, physical and biological world of which they are a part of. The subject Life Science places more emphasis on the learners' understanding of the physical and biological world around them at a local, regional and international level. It therefore includes how the society uses natural resources to satisfy its needs and how the environment may be changed in ecologically sustainable way. The context of the study is embedded in the Life Science curriculum for grade 10, because it is my area of specialization. This will enable me to broaden my knowledge and understand the inclusion of environmental learning.

1.2 MY ROLE AND MY INTEREST IN THE RESEARCH

The research focus for this study arose within my role as a Life Science teacher as well as my current position as a school principal which entails monitoring, supporting and guiding teachers on curriculum implementation. I worked for the Ministry of Education as a Life Science teacher for 10 years and taught the Junior Secondary Phase (Grade 8-10).

I have been actively involved in extracurricular activities such as tree planting at school, monitoring of the school garden and facilitating the school environmental club. And apart from that, I also served as the chairperson of the environmental committee at school. The mentioned extracurricular activities aimed at promoting environmental consciousness and sustainable development within the school and its surrounding. During my studies and work experience, I got limited exposure to environmental learning. This triggered my curiosity, interest and inspiration for environmental learning, engagement in environmental education and the use of sustainable practices.

Due to my interest in environmental learning, I enrolled for an honours degree course specialised in environmental education the objective was to gain more knowledge and understanding on environmental concerns at local and global level. It was during the honours degree program that I was able to obtain insights on how the history and aims of environmental education influenced the curriculum as well as how learning is facilitated in both formal and non-formal education sectors in reaction to the complexity of environmental issues and concerns at local, national and global level. It was also during the honours

program that I was eager to address the issues of deforestation at local level and as a result I developed a plant nursery at school. I became more active in tree planting activities not only at school but also in the community.

In the light of the above background information and ideas of Kethloilwe (2008) who argued that in order to reinforce and widen teaching and learning approaches for pertinent quality of education in environmental and sustainability education in Southern Africa, epistemological and pedagogical issues need to be researched. The variance in research aspects should point towards a curriculum which is adjusted to knowledge building, methodological improvement and situated learning. In the same note, Nsubuga (2008) reiterated that environmental education inclusion in the curriculum remains under researched and undocumented. The above regional research recommendations promoted my interest in deciding to carry out this study, which aims to investigating how Life Science teachers include environmental learning in order to make sure that learners obtain knowledge and skills to attain vision 2030. Samuel (1993) however, raises a concern that, although literature contains much speculation as to the best ways to integrate environmental education into school system, very little research has been done to explore how well environmental education has actually been integrated.

Another motive behind my study was encouraged by Robertson and Krugly-Smolska (1997) who stated that over the past 30 years individuals and involved groups have raised concerns regarding the consequence of human activities on the environment. Reacting to this, some schools changed their curriculum to include environmental learning. In addition, some School Board members and interested groups made a range of resources accessible to teachers. Teachers are however complaining that there is still a gap between many of the expectations of environmental learning and what they are capable and eager to do in their own teaching practice (*ibid.*). This study was aimed at exploring how teachers include environmental learning in grade 10 Life Science curriculum. In this study I investigated how this was done in three Junior Secondary schools in Omusati region, northern part of Namibia. My specific interest was to investigate whether teachers really include environmental learning in the Life Science curriculum, the constraints and enablers thereof.

Hopefully the study results will help me reflect on my own teaching and contribute to a broader understanding on how to facilitate and promote environmental learning. This will also lead to the improvement of my effectiveness as a teacher. The results of the investigation will also inform my work as a school principal to assist me to provide the necessary support

and guidance to teachers on how to include environmental learning in Life Science curriculum. The study results contribute to a broader understanding and existing knowledge of environmental learning in Life Science curriculum. The study offers a profound insight of what happens in selected Life Science classroom concerning environmental learning practices including teaching strategies Life Science teachers may use to teach environmental topics.

The study findings helped me to come up with recommendations concerning the inclusion of environmental learning which may be used by other teachers or the Namibian Ministry of Education to improve environmental learning inclusion processes in Junior Secondary schools, in particular Grade 10, for the benefit of Life Science teachers and Namibian learners. The study findings will also hopefully be used to strengthen and improve environmental education in Namibia.

1.3 RESEARCH SITE

Namibia is found on the Atlantic coast of Southern Africa. The country is divided into fourteen political as well as educational regions. The Omusati region is one of the fourteen regions of Namibia (see the Omusati region in the figure 1.1 below).

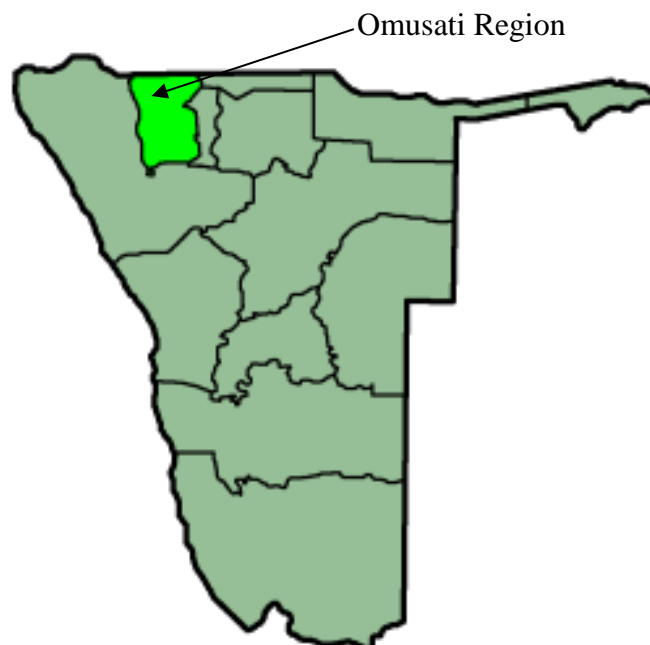


Figure 1.1 location of Omusati region in Namibia

The study was conducted in the Omusati region. Omusati region is in the northern part of Namibia (see figure 1.1), and its capital city is Outapi. In the north, Omusati shares borders with the Cunene province of Angola. Domestically, it shares borders with the following regions:

- Oshana- East
- Kunene- South West

The region occupies a total area of 26, 551 km^2 and has a population of 242 900 (This is approximately 11% of the Namibian total population which is estimated to be 2 182 852) (Namibia. Statistic Agency, 2012). Mopane tree is the dominant species; the Makalani palms decreases rapidly west wards from the border with the Oshana region. The change in vegetation type reflects ecological conditions forming a natural boundary between the two regions.

The northern part of the Omusati region is densely populated than the south, where the grazing is of poor quality and the water generally saline. The region is predominantly an agricultural region in which mahangu (millet) is cultivated successfully. With intensive fertilization and the tilling of the soil, self sufficiency is attainable. A canal carries water from the Kunene River (in Ruacana) to Oshakati, passing through Outapi (the capital city) and the water from this canal is also used at Etunda Irrigation Scheme, government-run farm in the region, where crops from maize to watermelons to bananas are grown, however non-agricultural employment opportunities will need to be created.

The Omusati region is traversed by a high standard road which provides a direct link to adjacent regions and the rest of the country. The region has small hospitals and a network of clinics in Outapi and Okahao which provide basic services. The provision of schools is also inadequate and improvement in the position is expected. The majority of people in Omusati region live in rural areas and the unemployment in the region is at 28.9% (Namibia. Statistic Agency, 2013).

There are about 1703 schools in Namibia, of which about 100 are privately owned. Omusati region has 274 schools with a total of 86 365 learners (Namibia. Ministry of Education, 2011).

1.4 THE STUDY GOALS AND RESEARCH QUESTION

The study is guided by the following research goals:

- To gain insight on how Life Science teachers are integrating Environmental Learning (EL) in Life Science
- To identify the teaching strategies used by Life science teachers to teach environmental topics
- To understand what influences the inclusion of Environmental Learning in the Life Science curriculum and
- To understand what enabling and constraining factors influencing Environmental Learning in Life Science

Research Question

The research question is:

How do teachers include Environmental Learning (EL) in teaching the Grade 10 Life Science curriculum?

1.5 OVERVIEW OF THE CHAPTERS

Chapter 1 gives an overview of the study. The chapter provides the context of the study and an overview of the area in which the study conducted. It outlines my role and interest in the study. The chapter also provides information on the purpose and goals of this study.

Chapter 2 reviews literature on environmental learning within the curriculum in the global, regional and national context. The chapter further provides an overview of literature relevant to the topic that was investigated. It also provides the conceptual framework to the study.

Chapter 3 presents a description of the research methodology. The chapter discusses the interpretive case study method deployed and the data generation techniques used as well as methods used to analyse data. It also explains how validity, trustworthiness and ethics were dealt with in this study.

Chapter 4 presents the data generated document analysis, semi-structure interviews and lesson observations. The chapter also highlights emerging categories from the processed data.

Chapter 5 discusses the research findings presented in chapter 4, in relation to the literature review in chapter 2. Data was compacted in to analytical statements, which attempt to answer the research question outlined in chapter 1.

Chapter 6 presents the conclusion of the study by providing a summary of findings of the research process. The chapter also presents recommendations arising from the study and recommendation for further research.

1.6 CONCLUSION

The chapter started off by providing a description of the context of the study. It further described the reasons for conducting the study, specifically my aspiration to investigate the inclusion of environmental learning in the Namibian grade 10 Life Science curriculum. The chapter further provided a brief history of the research site and research interest. It also presented the research goals and research question. Finally the chapter provided an overview of different chapters of this research report. In the next chapter, I present further insight into the context of the study and its theoretical foundation.

CHAPTER 2

LITERATURE REVIEW

2.1. INTRODUCTION

In this chapter I review the literature, in order to strengthen the theoretical perspectives of this study. I review literature in the context of environmental learning in formal education; the integration/pedagogical practices of environmental learning within the curriculum in different contexts and the influences thereof. I further review literature on barriers and opportunities as these reflect my interest in enabling and constraining factors for support of environmental learning in the curriculum. In the two last sections, literature on the pedagogical content knowledge (PCK) and Situated Learning is reviewed in order to help me understand environmental learning inclusion in the selected Life Science classrooms.

2.2. ENVIRONMENTAL EDUCATION (EE)

Environmental education is an educational process dealing with the inter-relationships among the natural world and its man-made surroundings. It is experienced based, interdisciplinary in its approach. It is a continuous, lifelong process that provides the citizenry with basic knowledge and skills necessary to individually and collectively encourage positive actions for achieving and maintaining a sustainable balance between men and the environment (Palmer, 1998).

If we look at the above explanation, environmental education may be better understood as a process of change across individuals' life spans. It is not limited to one school subject in the curriculum but a cross cutting process creating the possibility for people to take collective actions which leads to improvement in living standards of the people and health of the environment. The notion is also supported by the ideas of Fien (1993) on environmental education which can be resonated with education *for* the environment as it seeks to develop an active and informed citizenry committed to the values and practices of ecological and social sustainability. According to Du Toit & Sguazzin (1995) Environmental Education (EE) as an approach to education has been integrated in all the subjects of the school curriculum. In Namibia, there are ministerial documents that support the incorporation of EE within the curriculum. Even though there are documents that support this, EE continues to suffer barriers that hinder its effective integration into the curriculum. EE aims at preparing

individuals to be responsive to a rapidly changing technological world, to understand modern world problems and to provide the skills needed to play an effective role in the improvement and maintenance of the environment (Kanyimba, 2002).

According to Wals and Corcoran (2012, p. 9) “both EE and ESD consider education and learning as a key in re-orienting lifestyles, communities and, ultimately, societies and the values on which they are based, in a direction that will allow the planet to go on indefinitely with human beings as permanent inhabitants among many other species”.

Environmental Education is therefore a process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among people, their culture and their biophysical surroundings. The environmental dynamics and cultural diversity demands that people should participate in decision making and the self-formation of codes of behaviour about issues concerning environmental quality (Palmer & Neal, 1990). The explanation resonates with Fien’s (1993) interest in assisting learners to understand the relationship between people and their surroundings, appreciate and use their environment as classrooms for learning and develop their concerns for the environment. The World Commission on Environment and Development [WCED] (1987), *Our Common Future* suggests that education should provide comprehensive knowledge, encompassing and cutting across natural sciences, social science and humanities, thus providing an insight into the interaction between natural and human resources, development and environment.

Environmental education as an approach to all education originated more than 30 years ago. “Now it has gained worldwide recognition forming the basis of major national and international environmental strategies...” (Fröhlich, 2006, p. 33). Since then, the notion has been given various definitions and brands but most of them have similar basic goals (Du Toit and Sguazzin, 1995). However, looking at environmental education from the image of the Ahmedabad Declaration of 2007, produced at the fourth International Conference of environmental education, to mark 30 years of international environmental education, states that:

Our vision is a world in which our work and lifestyles contribute to the well-being of all life on Earth. We believe that through education, human lifestyles can be achieved that support ecological integrity, economic and social justice, sustainable livelihoods and respect for all life. Through education we can learn to prevent and resolve conflicts, respect cultural diversity, create a caring society and live in peace. We can learn from indigenous and

traditional patterns of living that respect and honour the Earth and its life-support systems and we can adapt this wisdom to our fast-changing world. We can make individual, community, national and even global choices with due consideration for the collective good. Individuals including youth, civil society, Governments, businesses, funding partners and other institutions can appreciate that their daily actions can shape a viable future of which all can be proud (UNESCO, 2008, p. 1).

The Ahmedabad Declaration 2007, which is the fourth international conference on environmental education, was held in Ahmedabad, India in 2007 within the framework of the UN Decade on Education for Sustainable Development (DESD). It builds on the first three international conferences of environmental education and calls for education processes that are important, reactive and accountable. According to UNESCO-UNEP (1988), the first set of international recommendations to guide environmental education was made in Tbilisi, Georgia in 1977. The Tbilisi Declaration recommended that environmental education should be life long, integrated, active and inclusive. The conference also recognized the complex and multi-dimensional nature of environmental issues and the need to investigate the core causes of environmental problems. Recommendations of environmental education were reviewed in 1987 in Moscow, focused on institutional strategies and action plans to strengthen environmental education. The third international conference took place in 1997 in Greece and debated the role of environmental education toward contributing to sustainable development. Following the World Summit on Sustainable Development in 2002, a UN Decade on Education for Sustainable Development (2005-2014) was launched, and was based on Agenda 21, Chapter 36 recommendations. The fourth international conference on environmental education was then the Ahmedabad declaration (*ibid.*).

UNESCO-UNEP (1988) indicates that the Ahmedabad declaration reaffirms recommendations made by the third international conference. Some of the recommendations made by the Ahmedabad conference were; to stimulate learners to achieve sustainability, urge them how to respect and live within the limits of nature and to evolve social, production, technological and economic systems that are creative, innovative, equitable and sustainable.

The Ahmedabad declaration recommends the promotion of education that builds capacity to engage critically with contemporary development discourses and practices that nurture and strengthen dialogues and advocacy skills. The declaration promotes also the use of evaluation practices designed to be a valuable learning process for all involved, and employ pedagogies in schools as a means of integrating environmental education and ESD principles and transformative learning approaches across the entire curriculum and all the aspects of

schools. The Life Science syllabus (MoE, 2006) aims and assessment objectives reflected some of these recommendations.

Loubser, (2008) expresses that environmental education is often connected mainly with the natural environment and not with social, political and economic concerns. One of the earlier critiques of environmental education was that it has not taken a critical enough stance on the political, social and economic systems that are responsible for the environmental crisis. This has, though, been widely addressed by environmental education scholars such as Fien (1993); Gough & Robottom (1993) and many southern African environmental education scholars such as O'Donoghue (1993) and Lotz-Sisitka (2004) who substantively developed the field of environmental education from a critical perspective. UNEP (2006) supports this development in the field of environmental education, by noting that, resolving environmental issues requires social, cultural, economic and political solutions (amongst others).

According to Monroe & Kaplan (1988), environmental education aims at creating citizens who can help resolve environmental issues. Efforts to achieve this goal have created curricula that sensitize learners to nature and raise awareness about environmental issues. Elements important in solving environmental problems are; knowledge of the environment and its related concerns, skills in action taking, sense of responsibility and commitment (*ibid.*). O'Donoghue (1993) and Jensen & Schnack (2006) also emphasised the idea of using action oriented approaches to create awareness, foster knowledge and promote participation in environmental education. It is thus also pertinent to investigate whether Life Science teachers consider these elements of solving environmental issues during their classroom practice.

2.3. ENVIRONMENTAL LEARNING (EL)

Environmental Learning (EL) is defined as learning that occurs when learners engage with content that pertains in some way to the environment (not just physical or natural) or environmental issues (Kanyimba, 2002). According to the Columbian Ministry of Education (2007, p. 3) environmental learning is “a range of approaches to environmental issues including environment education, ecological education and education for sustainable development”. The Columbian Ministry of Education (2007) notes that EL occurs when learners engage with content that pertains in some way to the environment (not just natural or physical) or environmental issues. Drawing on the ideas of Chi-chung Ko & Chi-kin Lee

(2003), for the purpose of this study, EL will be defined as the learning associated with teaching of environmental issues within the curriculum, where learning outcomes relating to knowledge, skills and attitudes are environmentally focused. According to Lundholm & Plummer (2010), EL can enable learners to develop environmental ethics, accountability as well as responsibility. Support Environmental Education in Namibia (SEEN) (2005) asserts that EL in Namibia focuses on the skills, values and attitudes informing decisions and actions rather than just the 'facts'. Jensen & Schnack (2006) also see environmental education as a development chain of competence for decision making and action taking.

The Columbian Ministry of Education (2007) distinguishes between Environmental Education and Environmental Learning by stating that, environmental education is a way of understanding the environment and how humans participate and influence these environments. Environmental Learning is facilitated through environmental education by incorporating environmental themes into teaching and learning. Such themes in Life Science for example are; Diversity of organisms and Ecology. Learners should be aware of both how and why the environment has an impact on their daily lives and what kind of impact their daily lives have on the environment. Therefore, they need to develop the necessary skills for solving environmental problems that they encounter in their daily lives (Du Toit and Sguazzin, 1995). Sharing the same sentiment, O'Donoghue (personal communication, 2014) distinguished between Environmental Education and Environmental Learning by stating that environmental education is an academic field while environmental learning is a curriculum perspective. This implies, the environmental education field looks at the environmental learning curriculum and identifies environmental learning cross cutting strategy into each learning area or subject which is an environmental education strategy at the level of the curriculum. He further states that environmental learning is the term used for the Namibian curriculum strategy and environmental education is the field of study. This study was a half thesis research aimed at examining environmental education in the Namibian curriculum and the curriculum strategy used in Namibia is Environmental learning. For instance when teachers are implementing the Namibian curriculum and are implementing environmental learning, they are doing environmental education. Therefore the distinction between Environmental Education and Environmental Learning is that environmental learning is a curriculum strategy in the Namibian context and environmental education is the term for the field of study or practice.

The strategy of environmental learning in the Namibian curriculum is an environmental education strategy. In the South African context, environmental education is topic based. Therefore one could say environmental topic based approach is environmental education but environmental learning is what is happening in topic based. Environmental Learning is the process of children learning and it is the strategy that is used in the learner centred approach in Namibia. Therefore it is on the above distinction that environmental learning is an approach to environmental education.

Rickinson & Lundholm (2008) indicate that even though Environmental Learning has become a feature of many countries' formal education systems, very little is known about what such a provision looks like. Rickinson (2006), argued that most environmental education research has overlooked the meaning of learning in environmental education, learning processes and apparent reluctance to engage with learning theory; thus he recommended that we need to think of what 'learning' means in environmental education, "we need to think carefully not only about 'the what' (i.e. foci and outcomes) but also about the 'the how' (i.e. processes) of environmental learning" (p. 448).

On a constructive note, Rickinson, (2006) stated that there have been signs of constructive development and growing recognition of the centrality of learning within debates about sustainability, and there are also promoting signs in an increasing number of studies that take seriously the way learners are making sense of their experience in environmental education and evidence of efforts to explore how more general theories of learning might inform research in environmental education. According to Loubser (2008), we have had Environmental Learning for over 30 years now, but the environmental crisis continues to get worse. Investigating how selected Life Science teachers in this study integrate environmental learning has the potential to illuminate some aspects of these questions. Stewart (2001) describes Environmental Learning (EL) as an important component of efforts to solve environmental problems. Environmental learning must constantly adapt to the rapidly changing social and technological landscape while ensuring that it stays pertinent to the needs and interest of the community. He further explained that, "environmental learning has become increasingly difficult to understand and to evaluate, yet environmental issues are more often expressed in 'sound bites' than explained by sound reasoning" (p. 283). New knowledge and techniques are required to strengthen the standards of EL and reduce environmental issues. Furthermore, reasonable treatment of environmental concerns often

falls prey to the political agendas of those who have a vested interest in unsustainable, resource-extractive approaches to economic development. Stewart (2001) concludes that the challenge is to express the complexity of modern environmental issues in ways that are comprehensible and attracting. At the same time, it is necessary to ensure that the curriculum continues to play a vital role in explaining and evaluating environmental issues and creating solutions to those environmental problems.

2.4. NAMIBIA'S SOCIO-ECOLOGICAL ISSUES AND ASSOCIATED RISKS

According to Enviroteach (1995), Namibia is the driest country south of the Sub-Sahara with no perennial rivers except at the borders. Namibia experiences unpredictable annual rainfall except in the northern parts of the country. Its environment is semi-arid and fragile, yet the majority of its population depend upon the land for living. Before independence, many Namibians lacked appropriate skills and knowledge for sustainable living. This led to some cases of environmental mismanagement, whereas in certain areas of the country environment degradation and habitat destruction such as deforestation, wastelands and bush encroachment is clearly visible (Joseph, 2013). Urgent attention was therefore needed to create an environmentally literate and responsible nation, which understood the consequences of the past. People who have the competence to take necessary action to live sustainably for the benefit of the present and future generations. In addition to the above, Namibia also faces political, economical and social problems that contribute to environmental problems.

According to SEEN (2005), Namibia's soil every year continues to blow off the land leaving the land degraded and everyone poorer. Overgrazing and tree cutting in areas of marginal agricultural productivity threatens habitats and wildlife. Off the coast, overfishing by commercial interests continues to erode traditional Namibian livelihoods. HIV infections and deaths from AIDS continue to rise, placing ever-increasing stress on the resources of the communities. Water usage is inefficient and inequitable, and the productivity of the land continues to be held back by inappropriate distribution, tenure and use. The loss of biodiversity threatens livelihoods and future development (*ibid.*). Some of these named environmental issues resonate with UNEP (2008) which also identifies and describe the following environmental issues as common in Namibia:

- Land degradation and desertification - desertification is the foremost environmental

problem in Namibia. Despite the scarcity of arable land, almost half of the population is involved in agriculture. Evidence of desertification includes declining groundwater levels, soil erosion, reduced soil fertility and loss of woody vegetation.

- Aridity and water scarcity - water availability is the single greatest factor limiting development in Namibia. Extreme temporal variability and uneven spatial distribution of water resources constrain livelihoods. There are limited perennial surface water sources. Groundwater accounts for roughly half of all water consumption.
- Threats to loss of biodiversity - Namibia is home to abundant biodiversity, including sole desert-adapted ecological communities and productive coastal fisheries. The Succulent Karoo of the Namib Desert is one of the few arid biodiversity hotspots in the world. It contains the richest collection of succulent flora. Threats to this region include grazing, agriculture, and mining. Namibia also has one of the largest remaining populations of black rhinos, a highly endangered species threatened primarily by poaching. Namibia's fisheries are some of the most productive in the world (UNEP, 2008, p. 257-258).

Confronted with these challenges, Namibia is working on the way to meeting Environmental Sustainability as defined by the United Nations Millennium Development Goals 7. Although Namibia has seen an increase in the access of its people to clean water sources, the country's primary environmental concerns remain water pollution and insufficient water resources for its growing population. Deforestation and soil erosion still threaten Namibia's land. The percentage of protected land area remained constant between 1990 and 2005 (UNEP, 2008). Fröhlich (2006) reports that environmental issues and risks in Namibia, have increased so much and so fast over the last century due to the greater pressure on resources, increased human population, unsustainable practices, human power relations and greed, people's ideas of progress, industrialization and independence from colonial powers. Thus, all the critical environmental issues in Namibia have a history in the local socio-ecological history. Their history has been influenced by pre and post independence events. The following section will look at how Namibia is responding to her environmental issues and risks.

2.5. NAMIBIA IN RESPONSE TO THE ENVIRONMENTAL ISSUES AND ASSOCIATED RISKS

2.5.1 Education as a response to environmental issues and risks in Namibia

UNEP (2006) argues that environmental issues are now invasive and ingrained within our cultural ways of being. UNEP further states that we can no longer look at science alone to solve these problems. In many countries including Namibia, environmental learning is incorporated in the curriculum. The Enviroteach project, Life Sciences project (1991-2000) and the SEEN project (established in 2001) have all supported early environmental education

development programmes funded by the Danish government as a key response to environmental issues in the Namibian curriculum. These projects, similar to other international environmental education policies all motivate for and explain that, environmental learning is one of the most important factors in tackling environmental problems. As part of environmental learning across the curriculum, learners are provided with necessary skills and knowledge that can help them to understand how to deal with environmental problems such as land degradation and pollution (Fröhlich, 2006). As indicated in chapter 1, the research question important to this study is to investigate how selected grade 10 Namibian teachers include environmental learning in Life Science so that learners may gain the knowledge, awareness, values and skills to solve environmental problems.

As part of the response to Article 95 of the Namibian Constitution,(1990) similar to many other countries there were several debates and discussions on how environmental education should be dealt with in the curriculum; as a separate subject or integrated across the curriculum (Gough, 1997; Lotz-Sisitka, 2002). Many more authors argue against the establishment of environmental education as a separate subject, because of epistemological reasons. As environmental concerns cannot be isolated and confined to one single discipline they have an important contribution to make to the development of more holistic forms of EL (*ibid.*). This interdisciplinary character of environmental education, has led to environmental education being placed as an orientation in the curriculum within different disciplines and subjects due to practical and epistemological factors. Environmental issues are complex thus should be discussed across different disciplines (Enviroteach, 1995; SEEN, 2005). Based on this epistemological logic, environmental education has been integrated as a cross curricular theme within the broad curriculum and each subject has integrated aspects of environmental education. This approach to environmental education has been supported by the three major environmental education development projects in Namibia i.e. Life Science Project, Enviroteach and Supporting Environmental Education in Namibia (SEEN).

2.5.2. The Life Science Project

The Life Science project runs for nine years in Namibia from 1991 to 2000. The project was introduced before independence in the Namibia Secondary Technical School in Exile in Loudima, Congo-Brazzaville from 1986 to 1990, the aim was to teach learners in a practical and hands on way about food production in an African rural setting. I particularly took part in

this project as one of the learners in the abovementioned secondary school. That is where I completed my grade 10. After independence the Life Science project was introduced in the formal national Namibian school system, it started at Mweshipandeka Senior Secondary school in the northern part of Namibia where most learners from Loudima were placed (Kristensen & Andersen, 2001).

Van Harmelen (2000, p. 2) states that the major components of the Life Science project were:

- Curriculum development and the production of learning materials. In this regard the project assisted the National Institute for Education Development. Members and conveners of various ministerial working groups and curriculum coordinating committees in the development and revision of syllabi. A new subject syllabus for Life Science was produced and revised over the project period. The Life Science project developed and distributed textbooks and other learning support materials.
- The supply of teaching equipment to schools/institutions. The project identified, purchased and distributed basic laboratory and field equipment to all upper primary and junior secondary schools, teacher training colleges and teacher resource centres.
- In-service and pre-service teacher education through in-service development either at national, regional or local workshops, cluster meetings or school visits. The in-service programme was designed to develop subject knowledge and teachers' pedagogical knowledge, through enhancing their methodological and didactic skills to enable them to adopt a learner-centred approach.

The Life Science project has supported learner-centred education and was dedicated to encouraging learners to solve their own problems, to promote critical thinking, practical work and self confidence. Central to learner centred education is the assumption that knowledge is created by individuals through a process of making sense that involves establishing a link between prior knowledge and new information. The process happens both individually and socially by constructing, de-constructing and reconstructing knowledge (Kristensen & Andersen, 2001). This example inspired other subjects, thus becoming one of the front runners of the educational reform in Namibia supporting the goals of the Ministry of Education's policy document "Towards Education for All", the cornerstones of which are access, equity, quality and democracy (Bones, 1994).

The Life Science project supported Namibian education in the areas of production of materials, revision of syllabus, teaching equipment and more importantly, maintaining the training of pre-service and in-service teachers (the project managed to train 1, 800 teachers at Junior Secondary level by the end of its cycle). By the time the project completed, Life Science was a fully developed subject and teachers were trained to teach it as an ongoing

process. Life Science as a subject is among the Natural science subjects. According to the Namibian Ministry of Education (2009), Natural Sciences (Biology, Life Science and Natural Science and Health Education) are offered in the following three phases:

- Life Science is partly introduced at Upper Primary level (Grades 5 to 7) as Natural Science and Health Education;
- At the Junior Secondary Phase (Grades 8 to 10), although taught separately, Life Science is part of the Natural Scientific area of learning together with Physical Science and Agriculture; and
- At the Senior Secondary Phase (Grades 11 and 12) Biology Syllabus.

The basic aims of the Biology, Life Science and Natural Science and Health Education syllabi are the same for all learners, whether or not they intend to go on to study of Science beyond this level. Relevant to EL, the Natural Science subjects have common environmental topics integrated in them but learning objectives are at the different levels. The cross-curricular issues serve as a direct link of the Natural Science syllabi to other subjects in the Namibian school curricular.

2.5.3. The Enviroteach project

The Enviroteach project was an environmental education programme of the Desert Research Foundation of Namibia (DRFN). It was established in 1992 and completed in 1999 and was also funded by the Danish government. The aim of its establishment was to spearhead and strengthen a cross curricular approach to environmental education in Namibia since the Life Science project only worked at the level of one subject. According to Enviroteach (1998), when the Enviroteach project started, environmental education was not part of the curriculum, except for a few brief sections in certain carrier subjects, mostly Geography and Natural Sciences; it was only being developed within the Life Sciences subject at the time. DRFN explored options for effective incorporation of relevant environmental information into formal education. As a result, an agreement between DRFN and the Ministry of Education was signed, allowing for the introduction of the Enviroteach programme within the formal education programme.

Enviroteach's main goal was to address the issues of environmental education through the education reform process. The project investigated ways in which environmental education could be best included in the formal curriculum. The implications of inclusion of environmental education in formal education as a distinct separate subject or infusion or

integration of environmental education across the curriculum, were carefully studied at that time, and the project chose “the infusion and integration of environmental education across the curriculum” Enviroteach (1995, p. 33), based on the epistemological argument discussed above. The project promoted the importance of environmental education by equipping teachers and learners with skills and challenges involving sustainable living. This was done as an outreach programme through which environmental education was introduced as a cross-curricular theme. Environmental education was seen as not only contributing to an environmentally literate society, but also to the education reform process by promoting cross-curricular and learner centred approaches to teaching and learning (Enviroteach, 1998).

The Enviroteach project implemented ways and methods for integrating environmental education into the Namibian formal education system. The Enviroteach project also developed books that were Namibia focused. The books had cross-curricular linkage and a focus on a wide variety of environmental issues. The books were written from a holistic viewpoint encompassing social, economic and political aspects of the environment. They designed as resource manuals rather than textbooks, providing ideas for information, activities and projects for environmental education. Therefore, the Enviroteach projects had three major components; curriculum development and production of learning support materials, supply of teaching equipment to schools and institutions and in-service training and pre-service teachers’ education. By the time the project came to an end, environmental education was recognized as a cross curricular learner-centred concern in the Namibian curriculum, but further impetus was needed to train teachers and curriculum advisors on this new cross curriculum issue, and the SEEN project was established as a follow on project from the Life Sciences and the Enviroteach projects.

2.5.4. Support Environmental Education issues in Namibia (SEEN) projects

As noted by Janse van Rensburg & Le Roux (1998), Namibia is a country with few opportunities for education and training within the field of environmental education. It was also struggling to implement the ideals of education reform, which promotes education for all through learner-centred education, based on principles of social constructivism. The area of environmental education is also relatively new on the Namibian education landscape, the result of which is few environmental education practitioners who are both confident to, and capable of, implementing environmental education along the lines of current education reform principles.

To address the shortcomings highlighted above the SEEN project was established in 2001 to develop professional development courses in environmental education for adults in the non-formal and formal education sectors. This was to help build a foundation of critical, reflective and active environmental education practitioners. There was a need for the SEEN project to incorporate the professional development of the formal education sector practitioners as there was little capacity or time available to develop a separate course for this sector. As a result, an indigenous environmental education course, the Namibian Environmental Education Certificate (NEEC) was born in 2001.

Janse van Rensburg & Le Roux (1998) added that as part of the outputs for the SEEN project, accreditation for the Namibian environmental education certificate was acknowledged as a priority. Among other reasons, the Namibian environmental education certificate was accredited for employment opportunities within the environmental education field, for further education opportunities, to raise the profile of environmental education within organizations, for study opportunities amongst the marginalized and to promote environmental education. SEEN (2005) identifies six broad environmental learning themes to be addressed across the curricula; natural resources and their management, poverty and inequality, society and governance, development and the environment, health and the environment and globalisation. SEEN (2005) also indicated that Natural Sciences should address the learning theme on natural resources, health and environment.

According to SEEN (2005), the aims and objectives of environmental learning in the Namibian curriculum are to:

- Encourage and promote in learners a holistic understanding of the dynamic interdependence of all living things and their environment;
- Promote a sense of responsibility toward restoring and maintaining ecological balances through the sustainable management of natural resources; and
- Encourage an involvement in practical activities to preserve and sustain the natural environment through ... a learner-centred methodology that promotes learning through understanding ... and introduces practices that reflect and reinforce both the values and practices of democracy.

The SEEN project supported the cross curricular approach to EL in the Namibian curriculum and developed a number of curriculum guidelines documents to show how the environmental focus and topics could be addressed in the various subjects. For example, Home ecology and Life Skills deal with issues that inform us about how people live together (social), Science

and Agriculture deal with living things and life support systems (biophysical), Business Studies, Economics, Geography deal with jobs and money issues (economic) and Social and Development Studies deal with issues of power, policy and decisions (political). SEEN also dealt with pedagogical issues and for example, provided guidelines on issues based approaches to environmental learning (SEEN, 2005). The project supported the assumption that solving environmental problems depends to some extent on *if* and *how* environmental learning is integrated in schools. Bones (1994, p. 15) reiterates that “Today’s students are tomorrow’s leaders and decision makers; they need to learn and practice the skills necessary to protect, preserve and restore the environment”. This view is supported by UNESCO (1997) in the following citation:

It is widely agreed that education is the most effective means that society possesses for confronting the challenges of the future. Indeed, education will shape the world of tomorrow. Progress increasingly depends upon the products of educated minds: upon research, invention, innovation and adaptation. Of course, educated minds and instincts are needed not only in laboratories and research institutes, but in every walk of life. Indeed access to education is the *sine qua non* for effective participation in the life of the modern world at all levels. Education, to be certain, is not the whole answer to every problem. But education, in all broadest sense, must be a vital part of all efforts to imagine and create new relations among people and foster greater respect for the needs of the environment (paragraph 38).

The SEEN project also raised awareness of the need for Namibians to engage with the UN decade of ESD, a process which has been taken forward into the development of an ESD strategy for Namibia, which is still ongoing. The UNDESD supports the role of environmental education and ESD in contributing to educational relevance and quality. These issues of concern for the environmental learning focus in the Life Science curriculum which forms the next part of the literature review.

Having looked at the broader perspective of how education responds to environmental problems in Namibia, this review of literature will specifically focus on formal education and Life Science curriculum for two reasons. Firstly, there is a perception that Life Science is one of the subjects that broadly cover environmental topics, and secondly Life Science is my major subject of specialization. Therefore, the following section looks at how the Life Science curriculum responds to Namibia’s environmental challenges.

2.6. ENVIRONMENTAL LEARNING IN LIFE SCIENCE CURRICULUM

Life Science is defined in the Namibia syllabus as “... the study of dynamic interactions between organisms and their natural environment” (MBEC, 1995, p. 1) It advocates a thematic approach which tackles the everyday problems and challenges of Namibian society. Therefore, the basic curriculum consists of a variety of subjects guided by a ‘broad curriculum’ and a range of syllabi. A number of cross-curricular themes including environmental education form part of the broad curriculum. Subjects such as Life Sciences (grades 8-10); Natural Science and Health Education (Grades 5-7), and Environmental studies (Lower Primary grades 1-4) have specific environmental education content (DANCED, 2001, p. 19).

According to the Ministry of Education [MoE], (2006) the cross-curricular issues, including Environmental learning form an essential part of the natural science curriculum. The cross-curricular issues thus serves as a direct link of natural science syllabi to other subjects for the Namibian school curricular. Each of the issues deals with particular risks and challenges in the Namibian society. It is indicated in the Life Science syllabus, (MoE, 2006, p. 3) that, all our learners need to:

- Understand the nature of these risks and challenges;
- Know how they will impact our society and the quality of life for our people now and in the future;
- Understand how these risks and challenges can be addressed on a national and global level;
- Understand how each learner can play a part in addressing these risks and challenges in their own school and local community.

In the perspective of constitutional responsibilities, all syllabi including Life Science should address environmental issues. According to the Namibian Ministry of Education (2008), aims, the Life Science syllabus are to enable learners to:

- Develop an understanding of biological and ecological principles and interactions in the environment, and encourage them to use the environment in a sustainable way;
- Develop an understanding of the basic functions of the human body, be aware of diseases and the importance of a clean environment in order to maintain a healthy lifestyle;
- Develop a responsible attitude with regard to family planning and sexuality, importance of decision making and impact of HIV/AIDS on one’s health;

- Acquire sufficient understanding and knowledge to become confident students in a technological world;
- Develop an awareness that the study of Science is subject to health, social, economic, technological, ethical and cultural influences and limitations, understand that Science has and that the application of Science may be both beneficial and detrimental to the individual, the community and the health of the environment; and
- Acquire understanding of knowledge in Natural Sciences through a learner-centred approach and stimulate interest in and care for the environment.
- Develop a sense of responsibility towards the environment, relating scientific practices to sustainable use of natural resources.
- Demonstrate desirable behavioural patterns and frame of mind in interacting with the environment in a manner that is protective, preserving and nurturing.

SEEN (2005) stated that the Life Science syllabus aims at increasing the learners' knowledge and understanding of the physical and biological world. This includes understanding how people use the natural environment to satisfy human needs. The application of scientific knowledge and attitudes, in the framework of sustainable use of resources, is of relevance for the individual, the family and the society as a whole. Process and manipulative skills are essential to understand the value and limitations of natural scientific knowledge and methods, and their application to daily life. In order to meet the above aims, environmental topics have been integrated within the Life Science curriculum. This responds to the policy documents that aim at producing an ecologically and environmentally literate society.

The SEEN aims have therefore been integrated in the Life Science syllabus which aims to enable learners to acquire and develop competencies in EL. These aims are meant to be achieved through certain syllabus learning objectives, and thus can be achieved through effective integration of EL. The learning content in the Life Science syllabus is based on the Namibian context, although the themes and topics are on a range of scales to meet international standards. Teachers are therefore urged, where appropriate, to use local examples to demonstrate scientific issues, concepts and processes (MoE, 2006). This idea is shared with Hogan (2008) who indicated that educational approaches must look into strengthening situated learning while promoting capabilities.

Stevenson (1997) believes environmental thoughts and environmental ethics are dynamic, therefore our practices must also be dynamic. Recommendations from the Ahmabad declaration of 2007 for paradigm shift in our practises and the need for transformation in

environmental education is reemphasized. Much has been learned in environmental education theory and practice in southern Africa over the past 20 years (Lotz-Sisitka, 2004), which provides insight into this dynamism, which may be of value in considering environmental learning and the SEEN (2005) recommendations for environmental learning in the Life Science curriculum.

2.7 ENVIRONMENTAL EDUCATION AND ENVIRONMENTAL LEARNING IN THE SOUTHERN AFRICA CONTEXT AND ELSEWHERE

Environmental and sustainability issues in southern Africa are complex and contested. Part of the complexity lies in the historical foundations of contemporary development patterns and contemporary patterns of socio-economic policy and practice. Fröhlich (2006) and Lotz-Sisitka, Olvitt, Gumede & Pesanayi (2006) noted that Southern Africa's environmental problems (socio-ecological issues) include widespread poverty, unemployment, soil erosion, biodiversity loss, littering, urbanization, health hazards, environmental degradation, pollution, global climate change, ozone depletion, diseases (HIV/AIDS, tuberculosis, malaria) and water scarcity. Some of these are reflected in the Namibian context (as discussed in Section 2.4 above). The varied nature of the crisis means that everyone is affected in some way although some may suffer the impacts more directly than others.

Due to the above socio-ecological issues, Lotz-Sisitka (2004) and Kethloilwe (2010) found out that most of the southern African countries are engaged in a variety of initiatives to infuse environmental issues into the mainstream curriculum. Environmental and sustainability issues are cross-cutting and require multi-disciplinary responses into the mainstream curriculum. However, according to UNEP (2006), this remains a challenge. Kethloilwe (2010), writing from Botswana, notes that to implement environmental education, teachers do not only require curriculum policy changes, strategies and plans, they also need a deeper understanding of what is required and what and how to implement in particular contexts. He added that, the major challenge of environmental education is to meet the training needs of educators with the view to effect profound changes in their ways of thinking, attitudes and behaviours for sustainable development.

The Nelson Mandela Foundation in South Africa (established under the South African discriminatory apartheid policies) (2005) and Rosenberg (2008) also writing from South Africa reported that most schools in South Africa are in the former homelands, with

inadequate resources. Most teachers in these contexts were trained under Bantu education and communities in these areas are affected by poverty and socio-ecological stresses. Complex histories have not developed adequate abilities or appropriate conditions to enable epistemological access. Rosenberg (2008) further noted that education policies are focused at readdressing past inequalities, on the relevance of curriculum content and on active participation in community life. The implementation is however still falling short. The capacity to interpret policies and to effectively provide resources, staff and systems for implementation, hamper many government departments including schools education. Some schools are characterized by a lack of discipline and strife among the staff, low motivation and morale, poor management and poor leadership from the principals. Rosenberg (2008) went further arguing that research into the most effective strategies of improving the quality of education would be through interventions such as textbooks supply, better curriculum planning and leadership, better time management on the part of the teacher and high quality teacher training. Such issues are relevant more widely in southern Africa, as most countries are responding to inadequate education provision and quality related issues following colonial rule (Lotz-Sisitka, 2004).

According to Loubser (1997); Kethloilwe (2003); Kethloilwe (2007) and Hogan (2008), some of the factors that constrain educators in implementing environmental learning in Southern African schools are; a perceived lack of teacher preparation, lack of funds, teachers unwillingness/inability to implement environmental learning in their pedagogical practices, the poor relationships between school and community, lack of educational resources, an overcrowded curriculum, and teachers' resistance to change. Kethloilwe (2003) added other constraints for effective environmental learning to be skills or knowledge available at school, environmental learning concepts are difficult to interpret in syllabi and textbook, large class sizes, lack of external support e.g. from local education authorities, attitudes of some school heads, colleagues and parents and lack of adequate in-service teacher training. Kethloilwe (2007) also argued that in most cases EL is treated as an additional burden and teachers are not willing to take it up. Malcolm (undated, p. 20) argues that "environmental education development and implementation is seriously hindered by an emphasis on separate subject areas, conventional timetables, 'textbooks' learning, traditional assessment methods".

Similar to Chi-chung Ko & Chi-kin Lee's (2003) study in Hong Kong, Kethloilwe (2003) in Botswana, indicates that fieldwork is seldom done due to transport and time constraints. They

highlighted that the school environment is not conducive for implementing EL; the existing curriculum is too theoretical and not suitable for the infusion of EL. Safety problems were perceived to be a barrier to the provision of field experience, “you can’t teach environmental education without being outdoors” (Chi-chung Ko & Chi-kin Lee, 2003, p. 6). Kethloilwe (2003) added that, for a conducive learning environment to be created there should be more opportunities for fieldwork and projects to supplement theoretical classroom activities.

Peden (2008) observed that teachers are not prepared well enough to integrate environmental education in their classrooms. Teacher training programmes have limited access to environmental education content and methods. Thus, many explanations that focus on environmental learning see teachers as lacking the expertise to actively engage learners in environmental issues. This is not only a Southern African issue, but, as Ham and Sewing (1988) who reported from North American, that teachers have serious misconceptions about the nature and scope of environmental education; they see it as mostly appropriate to the Science curriculum; they have misgivings about their competence to conduct environmental education programmes; and they show perceived lack of logistical support in terms of resources, time and suitable class sizes. Shuman and Ham (1997) however insisted that despite the barriers to teaching environmental learning, some teachers pull through towards teaching environmental learning because of their positive attitudes toward environmental education and their feeling of responsibility *for* the environment. Rosenberg (2008) reports similarly on the significance of motivation and commitment of some teachers in environmental learning programmes. Rosenberg (2008) reported other enabling factors for environmental learning in South Africa as reduced numbers of learner teacher ratio in most schools, better school-community relationships, pedagogical renewal, and support by some government department and non-governmental organisations encouraging and environmental policies endorse environmental education in schools. Rosenberg (2008) also notes that, the Eco-schools programme initiative launched in 2003 by Wildlife and Environmental Society of South Africa (WESSA), improves the quality and relevance of education by: improving learner motivation, whole school management and planning, provision of resources to support teaching and learning, improved teacher competence, curriculum management and delivery.

Hogan (2008) observed that learners in mainstream schooling are overburdened with ‘isolated and meaningless facts’, schools do not provide settings for social interactions conducive to knowledge constructions. Peden (2008) and Stevenson (1997) suggest that it is

not helpful to add new facts or themes but to rather renew educational concepts and approaches by strengthening the meaning and substance given to environmental content in education. Environmental education should also develop critical thinking that induces a change of attitudes and behaviours among students. Peden (2008) added that topics that currently exist in the curriculum are not addressed in a coherent, structured and critical manner. An explicit environmental focus could be a starting point for powerful, integrated knowledge where both teachers and learners deepen their understanding on the topic and the subject. She proposes attempts to build disciplinary knowledge by introducing core environmental literacy courses early on in teachers' education programmes, so that environmental knowledge informs the pedagogy of teachers. Kethloilwe (2003) notes that most teachers felt the necessity of environmental learning in schools, because as population increases the environmental problems increase, hence, learners need to be sensitized and educated to respond to these issues. But he reports that little environmental education is taking place in most schools. There is a lack of understanding as to how environmental education implementation should proceed, lack of commitment among some education authorities and as a result environmental education is afforded a low status compared to other issues because environmental learning is not examined or timetabled and teachers concentrate on examinable subjects. In later research Kethloilwe (2007) reported that teachers tended to normalise new environmental knowledge into old forms of practice. For example, they saw all environmental education as environmental science, and tended to emphasise school ground cleaning as a main environmental education activity, reducing the possibilities for holistic development of environmental education concepts, knowledge, skills and values. He recommends stronger forms of teachers' professional development. These findings from regional research resonate with Fien's (1993) earlier research and later research by Cotton (2006) that reveals that development of critical thinking and problem solving among learners is failing because of lack of adequate support from education authorities. Since all the enabling and constraining factors given above could be applicable in the Namibian situation, there is a need to develop further an in-depth understanding of how these can be maximised (the enabling factors) and minimised (the constraints) including through improved pedagogical practices, which I turn to next. The following section looks at environmental education pedagogies that can develop learners, skills, knowledge, values, and attitudes, as this is identified as important for integrating environmental learning into subject curricular (SEEN, 2005).

2.8 APPROACHES TO ENVIRONMENTAL EDUCATION

Environmental issues are complex and they are changing all the time, therefore there is a need for methodological shifts in implementing environmental education. Kethloilwe (2010) indicates that in Southern Africa, the implementation of environmental education demands a review of current epistemological and pedagogical practices. He added that there is a need to interrogate the possible epistemological and pedagogical practices for promoting environmental education in southern Africa.

According to Kostova & Atasoy (2008), successful EL depends on the teaching and learning methods used. They indicated that it is no longer enough for the teacher to know a lot, or to be able to explain it in a simple and interesting way. The teacher should be able to facilitate EL by stimulating learners to ask questions, act in response to their answers, helping them accept challenges and disagreements, discuss contradictions, think critically and offer creative solutions.

Jensen & Schnack (2006) further argue that teachers should help learners to develop action competence, a point supported by Silo (2009). She emphasises the teachers' responsibility for strengthening learners' participation in developing action competence in response to issues in Botswana. Silo (2009) stated that in Botswana, participation in environmental learning activities has been perceived as a central component of environmental education in formal education. Her study revealed that efforts by teachers to involve learners in EL have been done, the assumption appears to be that this will transform pedagogy and consequently, change the pupils' into competent participants in environmental education. But her findings further revealed that efforts to engage learners develop tensions and contradictions between participants for developing competent learners through their participation. This gave rise to an elusive object of learner participation, as the reason for their participation in these activities is not clear.

Kethloilwe (2003) supports the use of learner-centred, participatory and active learning methodologies when facilitating EL in formal education. This is similar to Kostova & Atasoy (2008) who also argue that, a mixture of teaching and learning methods oriented towards agency, capabilities, social and structural changes are likely to achieve environmental learning objectives. Examples of these methods are; role play, active learning,

investigation/experiential learning, group work, presentations, discussions, debates, field work, homework studies, demonstrations, observations and collaboration. Loubser (2008) emphasises that, effective environmental learning has to move away from teaching and learning approaches based solely on the transmission of knowledge. It has to move towards approaches which encourage development of qualities, such as initiative, reflection and responsibility in relation to the environment. It has to foster values and attitudes which influence behaviour and action. Thus he also supports learner-centred approaches for stimulating and maintaining learners' interest in the environment. This is also supported by Lotz-Sisitka et al. (2006) in a report on ESD practices where it is noted that learner-centred, active approaches to learning are strongly supported in Southern African environmental education/ESD. Thus, as suggested by Lee (1997), educators can, and should, find ways to present environmental concepts that will allow learners to draw their own conclusions about important environmental and societal issues. Successful EL in Life Science curriculum will thus depend on teachers chosen methods for teaching and learning. Hogan (2008) supports also the use of learner-centred approaches by emphasizing the use of everyday contexts and experience for meaningful learning. She argues that using everyday contexts involve learners in classroom activities that increase learners' confidence in solving local issues. This allows learners to share responsibilities and to take control of their own learning. Hogan believes that, for environmental learning to develop learners' environmental competencies, it should promote transformative pedagogies that empower learners to link socio-ecological issues and development in local contexts. For example, in the Namibian context, environmental learning should transpire through teaching concepts like conservation and management, which has a broader scope of interpretation and could be tailor-made for the particular setting, for instance the Erongo region would look at the issues of the lagoons and how the communities could use them sustainably going into depth. Whereas, the Northern regions could tailor-make curricular to address the sustainability of the pans and the perennial rivers as well as land clearance practices. This mobilises both individual learner's prior knowledge and experience of the community people to base the base for the creation of new knowledge, hence there is learning from the known to the unknown, from concrete to abstract.

UNEP (2006) supports this by noting that the study of issues and concerns related to the environment should engage learners and should be relevant to their communities. With environmental learning, learners are viewed as constructors of their own knowledge rather than reproducers of others' knowledge. Learners should thus, take a more active role in their

own learning, and become co-learners and co-investigators with their teachers in a collaborative learning process. This is also supported by the Enviroteach and SEEN projects that emphasise enquiry based teaching approaches and action competence development. In the same vein Hogan (2008) found that integrating local environmental cultural knowledge successfully contributes to curriculum relevance both epistemologically and pedagogically. It also fosters a stronger school-community relationship. It involves teachers and communities in ethical deliberations about environmental concerns. From this perspective it is possible to surmise that environmental learning will be successful if Life Science teachers consider the context, learners' participation and involvement when planning and teaching environmental topics. Never the less Janse Van Rensburg & Lotz-Sisitka (2000), Peden (2008) and Rosenberg (2008) reiterates that learner-centred approaches to education are being interpreted in problematic ways, resulting in 'empty' superficial or incoherent learner activities with little content. They further argue that teachers trained in the Post Education system have not been prepared to integrate everyday knowledge with schools or formal knowledge. Many teachers find it difficult to use available content-rich resource materials successfully to plan and support lessons. Monroe & Kaplan (1988) writing in the USA context, claim that involving learners in action projects can help learners become environmental problem solvers. Action projects offer an opportunity to practice resolving local issues with teacher and peer support. They argue that learners would become empowered in a sense of success and develop action-taking skills. This resonates with the views of Posch (1993, p. 11) who wrote that, "an important condition to develop values which are environmentally sound is to involve students in actions in which they are able to leave traces and in which they feel that what they do can make a difference". Lee (1997) examines also that learning by *doing* is recommended. Learners acquire knowledge, skills and attitudes through practical and applied activities. He further observed that, for successful EL students should satisfy their curiosity, they should be open-minded and be actively involved in the learning process. However, Monroe & Kaplan (1988) observed that action projects are often not carried out in schools because they are associated with a variety of constraints that includes the inability to leave school, short class periods, lack of learners' knowledge and skills and lack of materials to guide the process.

As indicated by Kethloilwe (2007) and Silo (2009), teachers' normalisation practices also constrain EL it can reduce action learning possibilities if learners' participation is not given due attention. Cotton (2006) highlights that action projects provide knowledge, skills,

awareness and action to learners. They also develop ownership and pride in their schools; a point also made by Rosenberg (2008) when she states that linking environmental projects with curriculum learning provides teachers with opportunities to bridge between everyday knowledge and experiences of learners and the formal knowledge required by the curriculum.

Shulman (2004, p. 100) assumes that “most teaching is initiated by some form of 'text': a textbook, a syllabus, or an actual piece of material ...”. This assumption is affirmed by Chi-chung Ko & Chi-kin Lee's (2003) research findings that indicated that, in Hong Kong many teachers continued to use exposition methods and rely on textbooks and the syllabus when they are teaching environmental topics. The teachers' main concern is fear of “not covering the syllabus” (p.200). They also found out that teachers find the syllabus and the textbook to be overburdened with information that makes it difficult to find time for innovative methods. Also looking at the same context, Stimpson (1997) observes that, on average teachers' teaching styles were more teacher centred, teachers put more emphasis on teaching environmental knowledge, less on attitudes and least on skills. He also found out that lectures and experiments are the most popular teaching methods, some teachers occasionally use other methods such as informal discussions and group projects, computer-assisted learning activities, field trips, outdoor activities and role play were teaching methods that teachers have not used because of constraints but would like to use. In the same perspective, Palmer (1998) discusses a number of approaches to environmental education and they are as follows:

1) Problem solving approach - An approach that trains students to examine specific environmental problems. It is an approach by which students set out problems to guide their studies . Students need to investigate a problem, understand it and make appropriate decisions in response to environmental problems. For example, learners could find out 'about' the environmental problems associated with different waste management choices. They could then investigate waste disposal issues 'in' their own community and draw up a waste management plan 'for' improving the situation. The aim of the approach is to help students consolidate learned associated knowledge (Palmer & Neal, 1994).

2) Experimental approach - An approach that enables specific opportunities for students to operate environmental experiments under controllable conditions in order to gain direct experience. During experiments, students can observe and understand the origins of some environmental problems, discover some factors influencing them and arrive at some solutions

based upon experiments (Palmer & Neal, 1994). For instance, students could investigate the wastage of water 'in' the school or at home by investigating ways in which water is wasted, designing methods to measure how water is wasted, considering ways to save water or use water sustainably and considering the benefits of saving water. The aim of the approach is to help students gain perceptual knowledge and material by themselves, so that they understand new environmental knowledge better (Palmer, 1998). This enables learners to accumulate new knowledge, experiences and insight through doing.

3) Field study approach - This approach allows students to go outside to observe, problems such as environmental pollution, exhaustion of natural resources, and destruction of the ecological environment. This enables learners to draw comparisons between what is learned in class and what happened in the local environment. The approach aims to involve learners in research work and develop their observation skills. What is learned will be utilized and incorporated into their experiences in order to gain new insights relating to their study.

4) Simulated approach - With this approach, teachers create certain scenes and ask students to take the role of the necessary characters in them, that is a role play situation. For instance, the teacher can take learners to an area where deforestation has taken place and ask them to think of what caused the area to be the way it is and of solutions to this environmental problem. The aim of the approach is to help students learn to think broadly of various factors that influence the occurrence of environmental issues from the environmental values and attitudes.

Fien (1993) & Loubser (2008) drawing on Fien (1993) stated that, the range of teaching approaches and strategies used should provide opportunities for learning *about*, *in/through* and *for* the environment. Lee (1997) added that education *in/through*, *about*, and *for* the environment provides learners with opportunities to learn about the functioning of natural systems, to identify their beliefs and opinions, consider a range of views, and ultimately make informed and responsible choices for themselves, their families and their communities. The following section explains the education *in/through*, *about* and *for* the environment.

2.8.1. EDUCATION ABOUT, IN/THROUGH AND FOR THE ENVIRONMENT

This section describes three forms of environmental education (education *about*, *in/through* and *for* the environment), as identified by Fien (1993). According to Fien (1993), the first

form of environmental education is education *about* the environment. This form emphasizes knowledge about natural systems and processes and the ecological factors that influence decisions about how people use the environment. The importance of knowledge is emphasized by the belief by some educators that many environmental problems are a direct result of sheer ignorance or lack of understanding (Murdoch, 1993; Palmer 1998).

In the same sentiment, Lee (1997) states that education *about* the environment refers to the environment as a subject for investigation; it involves the provision of information on environmental issues and the teaching of appropriate technical and intellectual skills. This type of education also emphasizes knowledge about natural ecosystems and processes and the ecological, economic and political factors that influence decisions about how people use the environment. Fien (1993, p. 15) perceives this education “as solely based on building learner’s cognitive ability without any action taken to promote sustainable living”. Lee (1997) notes that, methods associated with this approach are most often ‘show’ and ‘tell’. This approach can be effectual if learners are provided with opportunities to do projects that allow them to find information about the environmental issues. Learners can then analyse the information, compare, predict and draw conclusions based on the knowledge they have acquired.

Martin, cited in Martin & Wheeler (1997, p. 24) explains that "education *about* the environment centres on the acquisition of knowledge and understanding about the environment". He argued that the acquisition of knowledge and understanding about the environment will enable pupils not only to hold a store of relevant concepts, facts and figures; but also to critically evaluate issues and situations in the light of informed understanding (Palmer, 1998). Fien (1993, p. 15) points out that "knowledge of the interaction between natural systems and social systems is an essential requirement for resolving local, national and global environmental issues and for managing the environment responsibly". In this case, the environment provides the learning situation in which a range of skills can be developed to achieve desired knowledge. Education *about* the environment is the most common form of environmental education as knowledge about environmental education "develops learner's understanding of changing social formation and their use of nature" (Blight, Soutter, Sibly & Smith, 1990, p. 123). This will develop in learners an understanding of how the transformation of nature allows social development, how human environments are socially constructed and how social relations shape environmental relations. The second form of environmental education is education *in/through* the environment.

Education *in/through* the environment involves the use of real-life situations as a basis for inquiry teaching (Lee, 1997). This type of education uses learners' experiences in the environment as a medium of learning. Teaching methods related to this learner-centred approach include solitary, encounter, dialogue, discussion and reflection. This approach according to Thomas (2005), should supplement learners' knowledge and facts about the environment through direct contact with it.

Similarly, Murdoch (1993) indicates that education *in/through* the environment can be the most powerful way to learn about and appreciate the way the natural world works. It is a pedagogical technique that uses the environment as a resource for learning. It does this to add reality, reference and practical exercise to learning and to provide students with an appreciation of the environment through direct contact with it (Fien, 1993). The environment is a resource which enables the development of a greater deal of knowledge and understanding as well as skills in investigation and communication. The aim of this pedagogical technique is to increase environmental awareness through experience in mostly natural settings. Fien (1993, p. 17) suggested that "such activities in the environment tend to be learner centred and may include skills such as observation, photographs and using scientific instruments". With this pedagogical approach, students can develop and use skills through direct experience in the environment. Direct experience, investigation and problem solving in the environment enable reflection and the development of critical awareness and concern. Palmer (1998, p. 44) maintained that "working in the environment leads to the acquisition of a greater deal of knowledge and understanding as a result of first hand experiences, as well as to the refinement of skills such as those needed for investigation and problem solving". Education *through* the environment may also foster environmental concerns if learners become captivated by the importance and fragility of ecosystems and the beauty of landscape, or immersed in the values conflict over an environmental issue (Fien, 1993).

The third form of environmental education is education *for* the environment. Huckle (1998, P. 197) states that:

Education *for* the environment is a combination of radical environmentalism and education which regards environmental well-being as its goal. The curriculum is designed to increase pupils' awareness of the moral and political decisions shaping their environment and give them the knowledge, attitudes and skills which will help them form their own judgments and to participate in

environmental politics. Such objectives are realized through issues-based projects in the immediate environment, which seek to cultivate awareness and understanding and culminate in some forms of community actions.

Similarly, Murdoch (1993) reiterates that education *for* the environment encourages children to reflect on their learning and to develop the skills to act on what they have learned. It affirms the relationship we all have with the environment and is grounded in real life, active experience. It teaches children to use problem solving and decision making skills to help bring about a change. Education *for* the environment requires teaching strategies consistent with its goals (Fien, 1993). The Belgrade and Tbilisi international agreements (UNESCO-UNEP, 1987) encourage teachers to use a wide range of teaching and learning techniques emphasizing practical activities and firsthand experience. Education *for* the environment investigates environmental problems with the intention of resolving them. Palmer & Neal (1994) pointed out that education *for* the environment encourages pupils to explore their personal responses to and relationships with the environment and environmental issues. This is linked to the development of attitudes and values, including elements of human understanding and behaviour necessary for the development of sustainable and caring use of the environment. This experience develops in learners an informed concern for the environment and teaches them skills that will help participation in environmental politics.

Fien (1993) further explained that education *for* the environment engages students in the exploration and resolution of environmental issues in order to promote lifestyles that are compatible with the suitable and equitable use of resources. This is supported by Fien & Gough (1996) who stated that education for the environment aims to promote a willingness and ability to the lifestyles that focus on students working individually and in groups towards the resolution of environmental questions, issues and problems. In doing so, it builds on education *about* and *through* the environment to help develop an informed concern for the environment, a sensitive environmental ethic, and the skills for participating in environmental protection and improvement.

According to Gayfold (1991), these three forms should not be seen as mutually exclusive but they are clearly interrelated. However, different emphases have often been placed on each of the forms, depending on the teaching context. Blight, Sautter, Sibly & Smith (1990) emphasized that each of these approaches can encourage students to respond actively if the teacher believes this to be the objective. However, Palmer and Neal (1994) believed that, in

the hands of experienced and committed teacher educators, education *for* the environment will be the most effective way to help students become empowered and participate actively to build a better environment for all. Fien & Gough (1996) cautioned that education *about* and *in/through* the environment are only helpful if they provide the skills and knowledge to support *education for* the environment.

2.9 ENVIRONMENTAL EDUCATION AND ENVIRONMENTAL LEARNING IN THE NAMIBIAN CURRICULUM

2.9.1 Pedagogical approaches for environmental learning in Namibia

In Namibia, teaching methods have shifted from early positivist approaches, where environmental education was about transferring information and raising awareness towards participatory methods based on social constructivism, influenced by Life Sciences projects, Eviroteach and SEEN projects and the learner-centred education policy in Namibia. New methods are now emerging which are ontologically situated, for example the inquiry-based methods promoted by SEEN (SEEN, 2005).

In the Namibian context, curriculum builds on learner-centred education in accordance with the 'Towards Education for All' policy (Namibia. MEC, 1993). Learner-centred education is a Namibian conceptual policy framework, which encourages learner participation and involvement in pedagogy. With regard to EL, learner-centred education will promote critical thinking and problem solving skills in learners. Learner-centred education sees a learner as an active, inquisitive human being, eager to learn, to investigate and make sense of his/her surrounding world. The learner brings knowledge from home, the community and environment to school, which should be utilized and drawn into teaching and learning. Learner-centred education takes into account that learners are individuals with their own needs. The Namibian Ministry of Education (2009) thus emphasises that in the classroom, attention should be given to individual differences through differentiation of teaching methods and teaching materials. Kanyimba (2002) bring to light that this is often a challenge for most teachers, as in the integration of EL it promotes progressive constructivist pedagogy, integration of disciplines and use of everyday knowledge related to disciplinary knowledge and structure.

Mubita (1998) highlights that learner-centred education focuses on the learner and not the teacher. This has direct implications on the role of the teacher and the teaching approach in terms of teaching and learning, instructional materials, and the way teaching is organised. A teacher, in learner-centred education guides the learners in acquiring new knowledge and skills. This does not mean that the teacher is the source of knowledge, but rather that she/he facilitates the learning processes of the learners. The learners should be empowered to think and take responsibility not only for their own but also for other people's learning and development. The classrooms should stimulate learning; allow aspects of problem solving and cooperative learning. Learner-centred education techniques are based on involving the learners in the learning process. This is done by using different teaching techniques such as group work, project work, eliciting prior knowledge, drama and role-plays. Learner-centred education allows learners to use their own knowledge to construct meaning and the teacher has the role of a facilitator in the learning process. This provides opportunities for addressing other goals of education such as democracy. It is claimed that with a clear understanding of the why and how learner-centred education is to be implemented many of the education goals would be achieved using different techniques (Namibia. MoE, 2009).

However, Mubita (1998) explains that the teacher, the learners, the curriculum and the community should be considered in learner-centred education. He added that this will bridge the gap between society and school. This will help both parents, schools, teachers, learners and curricula unit planners to become one society or community with one goal in educational development. He added that it takes more than one person to educate a child towards becoming a better citizen. According to Dahlstrom (1995) a learner-centred curriculum is a holistic and integrated curriculum. He added that integrated and holistic refers to the notion of connectedness in the sense that the learner will be able to make connections of what he or she learns. Thus, home and school curriculum should be interrelated in order to make sense for the learners. Therefore in designing the curriculum, the learner must be considered first and should be placed in the centre of the design. The experiences of the learner, both in school and outside school, should be taken into consideration.

Hoabes (2004) conducted research into how teachers were implementing learner-centred education and environmental learning aspects in the Namibian Life Sciences. She found that lack of resources and big class size impede the fostering of EL in a learner-centred way, she also found that teachers were mainly interpreting learner-centred education in terms of

changes in methods only. Some teachers appear to have little understanding of their own practices as being learner-centred. Teachers are not in agreement whether learner-centred education works. She recommended that continued support should be provided to teachers in the form of in-service training to help teachers understand learner-centred education better and to understand how the methods they use reflect learner-centred education (*ibid.*). Various other studies have also pointed to distortions and misunderstanding by teachers around learner-centred education. For example, Kanyimba (2002) indicated that learner centred education and related pedagogical approaches which are currently offered in Namibia are currently being challenged for not meeting the educational goals of social justice and denying learners access to powerful knowledge systems. Haingura (2009) appear to agree with him by recommending that there is a need to strengthen teachers' knowledge of learner-centred education and how to plan and implement it in Namibia. The next section will look at the challenges and successes for environmental learning in Namibia.

2.9.2 Challenges and successes of environmental education and environmental learning in Namibia

As indicated in Section 2.2, environmental education as an approach to education has been incorporated in all the subjects of the school curriculum. As mentioned earlier in this chapter, in Namibia, there are ministerial policy documents that support the incorporation of environmental education within the curriculum. Despite all these efforts, environmental education continues to suffer from constraints that hinder its effective incorporation into the curriculum. Environmental education aims at preparing individuals to be responsive to a rapidly changing technological world, to understand contemporary world problems and to provide the skills needed to play an effective role in the improvement and maintenance of the environment (Kanyimba, 2002).

Enviroteach (1998) reported that in Namibia environmental education opportunities in the curriculum increased after independence but not much progress has been made as there are/were a lot of constraints relating to integration of environmental education such as lack of appropriate resources and lack of knowledge. The Namibian Ministry of Environment and Tourism (2006) explained that, the major challenges of meeting the EL goals are to translate these goals into realistic ones. The goals of EL are to develop and adopt a set of interventions which will eliminate environmental problems. This can be achieved by establishing sustainable systems and producing knowledgeable, competent and innovative graduates that

will solve environmental problems. The Ministry of Environment and Tourism (2006) went further to explaining that, among many, some of the challenges of environmental learning are the provision of human resources and ensuring that the policies in place are implemented by all stakeholders. In the same note, Uugwanga's (1998) research found that, despite the good endeavour by the Namibian Government to provide distinctive education, there are many factors that hamper the delivery of a most wanted quality education. These factors include poor physical facilities, higher learner-teacher ratios, inequalities in resource allocation in educational regions and lack of qualified teachers, schools lacking basic education facilities such as textbooks, stationary, poor inadequate lesson preparations by the teacher, poor school management, administration and demoralised principals. In the same line, some of these highlighted problems experienced during the implementation phase of the Enviroteach project are: - The resistance to change on the part of the teachers, school management, learners and parents; - Lack of confidence and experience on the part of the teacher; - Lack of support from school management who in many instance do not understand new methodology being promulgated through educational reform; and - Lack of relevant, appropriate and user-friendly resources (Enviroteach, 1998, p. 16).

Kasanda, et al. (2005) clearly indicated that in Namibia, the 'empowerment' interpretation of learner-centred education (where learners determine the direction of the learning experience), is not implemented. Therefore, a large number of learners have a poor match between their everyday world and their school world. Kasanda et al. (2005) further indicated that there is little evidence of group work and project work that would support learner-centred education. Kanyimba (2002) found out that there is a need for teacher education and training in environmental education, appointment of environmental education coordinators in schools, environmental education policies for schools, interdisciplinary collaboration, and fieldwork as an instructional technique and strengthened capacity of NEEN. These were recommended to increase the success of EL in Namibian schools. Another study carried out in Namibia by Haingura (2009) on enhancing learner-centred education through the Eco-schools framework, found that integrating Eco-schools framework across the curriculum provides opportunities to enhance learner-centred education, to strengthen school-community interactions, enabling active involvement of learners in decision making. Haingura (2009) also found out that the Eco-school initiative enhances learner-centred education in relation to diverse needs, and allowed for learner initiated contributions. His study recommends more support from the Principal and Ministry of Education for the success of integrating the Eco-school framework.

It is clear that there is much more enabling education reform in Namibia including an environmental focus in Life Science (Namibia. MoE, 2009).

Hoabes (2004) noted that most teachers are qualified to teach the subjects they teach. The teachers do receive support through workshops that accustom them with subject content and methodology both at national, regional and cluster level, but the support is insufficient for environmental learning integration. Hoabes (2004) therefore echoed that teachers still need support to integrate environmental learning focus for example, by using learners in planning lessons, using visual aids and materials in ways that involve learners, using local environment when teaching environmental topics to contextualise this within learners' prior knowledge and experience. To provide further strength of the insight into inclusion of environmental learning in the context of pedagogical processes, knowledge and learner-centred policies, I drew on both Pedagogical Content Knowledge (PCK) and Situated Learning theory as these provides an integrating lens for understanding the research question. I discuss these theories in the following sections: 2.10 and 2.11.

2.10. SITUATED LEARNING

Lave & Wenger (1991), as they draw and expand on the work of theorists such as Dewey and Vygotsky, developed a theory of situated learning. They argue that knowledge is constructed when learning is socially situated and when learners are engaged in an authentic task, in an authentic context and in interaction with one another in a community of practice. Herrington & Oliver (1995) defines situated learning as a pedagogic strategy where learners use real life situations to construct knowledge. This is supported by Schudel et al. (2008, p. 53) when they pointed out that “ for Environmental Education to be meaningful, the context in which learning takes place needs to be determined and taken into consideration”. This means that environmental topics in Life Science must be taught in ways that are relevant to learners' contexts. Therefore, this study drew its contextual background from situated learning theories. According to Brown, Collins & Duguid (1989, p. 32) “knowledge is situated being in part a product of the activity context and culture in which it is developed and used”. Knowledge needs to be presented and learned in an authentic context and learning requires social interactions and collaborations. Kethloilwe (2008) and Hogan (2002) agrees that for environmental learning to be of quality in education and to develop learners' environmental competencies, it should have a qualitative approach to life for people to interact better with

the environment, implying a situated learning pedagogy. A relevant quality environmental and sustainability education should promote learner centred and transformative pedagogies that are both situated so that they empower learners to link socio-ecological issues and development in local contexts.

In the situated learning approach, knowledge and skills are learned in the contexts that reflect how knowledge is acquired and applied in everyday situations. Situated cognition theory imagines of learning as a socio-cultural phenomenon rather than the action of individual acquiring general information from a de-contextualized body of knowledge (Kirshner & Whitson, 1997). The Namibian Life Science curriculum (2006) builds on learner centred approaches and suggests that Environmental Education should engage in situated learning by using the immediate environment and everyday situations to strengthen learners understanding on the value of the natural environment. Teacher's pedagogical strategies should be contextualised.

2.10.1. The concept of situated learning

As an instructional strategy, situated cognition has been seen as a means for relating subject matter to the needs and concerns of learners (Shor, 1987). Learning is basically a matter of creating meaning from the real activities of daily living. By inserting subject matter in the ongoing experiences of the learners and by creating opportunities for learners to live subject matter in the context of real-world challenges, knowledge is acquired and learning transfers from the classroom to the area of practice. To situate learning means to place thought and action in a specific place and time. Situate means to engage other learners, the environment, and the activities in order to create meaning. In other words to situate means to locate in a particular setting the thinking and doing processes used by experts to accomplish knowledge and skill tasks (Lave & Wenger 1991).

A situated learning experience has four major premises guiding the development of classroom activities (Anderson, Reder, & Simon 1996; Wilson 1993): (1) learning is grounded in the actions of everyday situations; (2) knowledge is acquired situationally and transfers only to similar situations; (3) learning is the result of a social process encircling ways of thinking, perceiving, problem solving, and interacting in addition to declarative and procedural knowledge; and (4) learning is not separated from the world of action but exists in vigorous, complex, social environments made up of actors, actions, and situations.

These four premises differentiate situated learning from other experiential forms of acquiring knowledge. In situated learning, students learn content through activities rather than acquiring information in distinct parcels organized by teachers. Content is inherent in the doing of the task and not separated from the noise, confusion, and group interactions prevalent in real work environments. Learning is dilemma driven rather than content driven. Situations are presented that challenge the intellectual and psychomotor skills learners will apply at home, in the community, or the workplace (Lankard, 1995).

David (1998) contends that situated learning uses cooperative and participative teaching methods as the means of acquiring knowledge. Knowledge is created or discussed through the interactions of the learner with others and the environment. Subject matter emerges from the cues provided by the environment and from the dialogue among the learning community. The structure of the learning is implicit in the experience rather than in the subject matter structured by the teacher. Knowledge is acquired by the processes described as "way in" and "practice." (Lave, 1997). *Way in* is a period of observation in which a learner watches a master and makes a first effort at solving a problem and *practice* is refining and perfecting the use of acquired knowledge (Lave, 1997, p. 21). Applied to the classroom, situated learning is not only reflecting upon and drawing implications from previous experiences but is immersion in and with the experience (David, 1998).

2.10.2. Elements of situated learning

Situated learning places the learner in the centre of an instructional process consisting of content--the facts and processes of the task; context--the situations, values, beliefs, and environmental prompts by which the learner gains and master content; community--the group with which the learner will create and negotiate meaning of the situation; and participation--the process by which learners working together and with experts in a social organization solve problems related to everyday life circumstances (Brown, Collins, & Duguid 1989; Lave 1988; Shor 1987). Learning becomes a social process dependent upon transactions with others placed within a context that resembles as closely as possible the practice environment. Situated learning in the classroom integrates content, context, community, and participation (David, 1998).

Mclellan (1996) suggests key components of situated learning model which can help researchers determine the extent to which the teacher is using situated learning approaches.

The model of situated learning is based upon the idea that knowledge is contextually situated and is fundamentally influenced by the activity, context and culture in which it is used (Brown, Collins, & Duguid, 1989). This view of knowledge as situated has important implications for our understanding of learning and also for the design of instructional experiences and activities (Mclellan, 1996).

The key components of situated learning are:

- Cognitive Apprenticeship (learners observe others and later become active participants). According to Brown, Collins & Duguid (1989) cognitive apprenticeship methods try to engage learners into real practices through activity and social interaction. They further indicate that Cognitive Apprenticeship supports learning in a area by allowing students to acquire, develop, and use cognitive tools in authentic area activity. This forecaster describes that “learning, both outside and inside school, proceed through corroborative social interaction and the social construction of knowledge” (p. 34).
- Collaboration (learners work together and interact with one another). Mclellan (1996) indicates that Collaboration is also a vital aspect of cognitive apprenticeship and situated learning. Brown, Collins & Duguid (1989) identified strategies for promoting collaborative learning and they are: (1) Collective problem solving; (2) displaying multiple roles; (3) Confronting ineffective strategies and misconceptions; and (4) providing collaborative work skills which according to Schrage cited in Mclellan (1996, p. 10) “are increasingly important in the emerging age of telecommunications: computers networking and conferencing, groupware, multi-user simulated environments and other innovative tools for communication and sharing of information”. “Learners need to be taught collaboration skills in order to work effectively in the age of tomorrow” (Mclellan, 1996, p. 11). Therefore this model put more emphasis on peer teaching, small group work, and teamwork. Every student in the classroom is not only included but also needed, and in the end each student can identify his or her specific trample upon the attempt or rather effort (Mclellan, 1996).
- Reflection (learners use their prior knowledge to predict and experiment in order to solve problems). According to Mclellan (1996) situated learning offers a model for

achieving a greater integration and balance between experiential and reflective cognition. Mclellan (1996) further states that the situated learning model provides a promising mechanism for reintegrating reflective into learning activities. Norman (1993) concluded his discussion of experiential and reflective cognition as follows: “may be this is the environment we need for education, whether in school, at work, or by oneself at home: continual stimulation, simulated worlds, and the proper social interaction with other players and teachers to ensure that there is guidance and feedback, so that the activity is a true learning, coaching, training activity so that it is educational” (p.23). Therefore, situated learning presents an approach to structuring learning experiences that take into consideration both experiential and reflective dimensions of cognition.

- Coaching (teacher provides the skills and strategies where learners lack knowledge to solve a problem; the teacher facilitates the learning process). According to Mclellan (1996) coaching is central to cognitive apprenticeship and situated learning in the sense that it involves observing learners while they carry out a task, providing a “guide on the side” who intervenes and provides scaffolding for learning to progress when necessary, but otherwise fades in to the background, providing learners with opportunities for initiative and self-directed problem solving leading to constructive learning. This model emphasises that “the role of the teacher must be that of collaborator and team leader and guide rather than boss. Therefore the teacher monitors the academic and social growth of every student, leading each in to new areas of understanding and competence” (Hands on, 1992, p. 5).
- Multiple practice (the learners are exposed to a demonstration or oriented to a lesson before they are given a chance to participate). Mclellan(1996) states that multiple practice is a central feature of situated cognition where skills are honed through practice in which the student progress on their own, without the support of the teacher. Wigginton (1991, p. 106) specifies that:

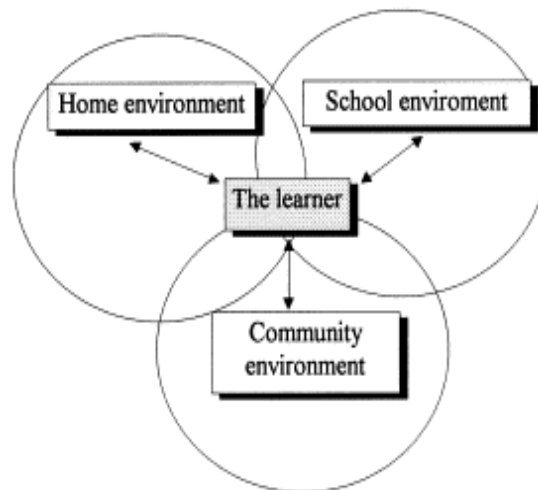
The work is characterised by student action, rather than passive receipt of processed information. Rather than students doing what they already know how to do, all must be led continually into know applied to new problems in new ways. Because in this classroom students are always operating at the very edge of their competence, it must also be made clear to them that the consequences of mistakes by the rest of the class in an atmosphere where students will never be embarrassed.

Regular practice presents to test, refine, and extend skills into a web of increasing expertise in a social context of collaboration and reflection. “Skills are honed and learners become accustomed to deploying them, so that these skills become deeply rooted, and automatically mobilised whenever relevant” (McLellan, 1996, p. 8).

- Articulation (learners acquire knowledge to discuss and debate on a topic under discussion and present their findings). According to McLellan (1996) articulation includes two features. First, it refers to idea of articulating or separating out different part skills in order to learn them successfully. Second, articulation refers to the purpose of getting students articulate their knowledge, reasoning, or problem-solving processes in a domain. By articulating thinking and problem- solving processes, students are able to improve understanding of their thinking processes, and they are better able to describe things to themselves and to others.

Figure 2.1 below indicates how the three learning environments of the home, the school and the community should be interlinked within a contextualised and situated learning approach.

Figure 2.1: Links between the Three learning Environments in Situated Learning approach



Source: Taylor & Mulhall, 2001

2.11 Pedagogical Content Knowledge (PCK)

Van Driel, Verhoop & de Vos (1998, p. 690) state that PCK in science is “the most regular taught topics in one subject area, the most useful forms of representations for those ideas, the most powerful analogies, illustrations, examples, explanations and demonstrations, in a word, the ways of representing and formulating the subject that makes it comprehensible to others”. PCK emphasises that teachers construct their PCK through thinking how best to represent content knowledge to their learners therefore; an expert teacher must demonstrate knowledge of the subject being taught (Shulman, 2004). In the same vein, Shalem and Pendlebury (2010) noted that PCK is an overlap between subject knowledge and pedagogic knowledge as indicated by Shulman (2004) in the following figure:

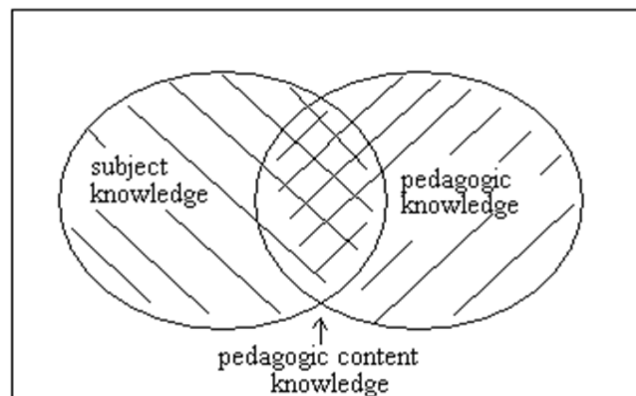


Figure 2.2: Overlap between pedagogic knowledge and content knowledge

Shulman (2004) created a model of pedagogical reasoning which comprises of a cycle of several activities that a teacher should complete for good teaching such as comprehension (the process of understanding subject matter), transformation (the process of configuring subject matter knowledge for teaching), instruction (aspect of active teaching discovery or inquiry), evaluation (assessing student and teacher accomplishments), reflection (critically analysing one’s teaching performance) and new comprehension (the process of understanding new subject matter). This model helps to understand the different ways Life Science teachers might facilitate the inclusion of environmental learning and what factors enable and constrain Life Science teachers from effectively integrating environmental learning.

The model of pedagogical reasoning and action was explored by Wilson, et al. (1987) in a longitudinal research study of pre-service teachers making the transition into the classroom.

They reported that a linear relationship existed among these components of pedagogical reasoning and action. Pedagogical reasoning begins with the comprehension of subject matter and continues with new comprehension after reflection on instruction. At the centre of this self-perpetuating process was the transformation of knowledge. They argue that the transforming of knowledge contains five sub processes: preparation, representation, selection, adaptation, and tailoring (Wilson, et al., 1987).

□ *Preparation* involves the examination and critical interpretation of knowledge of subject matter. In this first step, teachers winnow and reconceptualise their subject matter knowledge for pedagogical consideration.

□ *Representation* entails the repackaging of subject matter in a manner suitable for instruction. These repackaged ideas included analogies, metaphors, stories, or any number of other representations.

□ *Selection* comprises the choosing of appropriate educational strategies. These strategies accommodated some characteristic that will facilitate specific subject matter content.

□ *Adaptation* includes the alteration of subject matter to fit the characteristics of specific students. Considerations of students' prior knowledge and the pedagogical objectives for the lesson influence adaptation.

□ *Tailoring* results in a special configuration of subject matter for students with individual needs.

With regards to PCK among teachers in Namibia, the Enviroteach programme was implemented in the teachers' colleges to sensitize teacher educators involved with Basic Education Teachers Diploma (BETD) and students to environmental issues, and to encourage them to promote learner-centred education, activities-based lessons and cross curricular approaches to teaching using environmental education at all levels of the formal system. The Enviroteach integrated environmental themes and activities into the BETD modules, integrated environmental themes and activities into teachers' guides appendices and investigated approaches to environmental education within the SADC region and identified how they could be adopted in Namibia or how Namibia's approaches could be shared elsewhere. All this was done to improve teachers' pedagogical knowledge and content knowledge for environmental learning.

The Life Science and SEEN projects also played a role through NEEC for professional growth of teachers in the field of environmental education. All three projects (Life Science,

Enviroteach and SEEN) have made contributions to PCK, supporting teachers for inclusion environmental learning in Namibia, as shown in Table 2.1 below.

Table 2.1 PCK guidance to Life Science teachers by a variety of projects for improved environmental learning inclusion

| Projects | Subject matter | Pedagogical guidance | Assessment guidance |
|--------------|---|--|--|
| Life Science | <ul style="list-style-type: none"> •Food production, livestock • Tree planting, impact of global warming • Using natural resources sustainably • Human Biology and health | <ul style="list-style-type: none"> •Practical skills •Focus on environmental projects •Professional development | <ul style="list-style-type: none"> •Practical assessment •Reflection |
| Enviroteach | <ul style="list-style-type: none"> •Booklets on environmental issues, indigenous and local knowledge | <ul style="list-style-type: none"> •Local issues analysis. •Integration of EL across curriculum, •Professional development, | <ul style="list-style-type: none"> •Assess knowledge, values and skills. |
| SEEN | <ul style="list-style-type: none"> •Teaching and learning materials such as fact sheets, notes, curriculum guidelines, booklets, on environmental issues in Namibia, focused on conservation and development issues, | <ul style="list-style-type: none"> •Promote enquiry based and active participation approaches, •Integration of environmental and sustainability issues into curriculum, •Professional development (NEEC), •Cluster system, •Whole school approach | <ul style="list-style-type: none"> •Assess knowledge, values, skills and action • Reflection |

Relevant to this study was thus to observe whether the Life Science teachers do plan lessons that incorporate PCK’s cycle of activities to be contained in teaching, and whether guidance for PCK and environmental learning has influenced Life Science teachers in the study. Shulman (2004) clearly states that, lesson plans ought to show learning and teaching support materials, and assessment approaches to be used. This helps teachers to review their lessons afterwards, which then constitutes reflection. Thus, to plan meaningful environmental learning in Life Science, teachers need to know how to design appropriate activities that will stimulate learners.

The PCK theoretical framework in this study also helped to analyse and explain not only what environmental learning teachers teach, but *how* and *why* Life science teachers include environmental learning the way they do. Shulman (2004) further indicated that, a skilful teacher figures out what students know and believe about a topic and how learners are likely

to hook into new ideas. Teachers should foster individual excellence involving equality of opportunity and equity among students of different backgrounds and cultures. Rosenberg (2008) and Haingura (2009) both reinforced that environmental learning helps to understand and use learners' prior knowledge and experiences and make learning connections.

Just like Stevenson (1997), Shulman (2004) noted that, teachers need several kinds of knowledge about learning. Teachers also need different kinds of materials for different purposes, to identify learners' strengths and weaknesses, curriculum resources, technologies that help learners explore, acquire and synthesize information, and frame and solve problems and make sense of the world. Teachers need to know about collaboration, how to structure interaction among students. PCK includes an understanding of the conceptions and preconceptions that students of different backgrounds bring with them to learning.

Beyer, Delgado, Davis & Krajcik (2009) observed that teaching is a complex practice. In order to deal with its complexity, teachers need strong subject content knowledge. But Kapyla, Heikkinen & Asunta (2009) argued that, knowing the subject content is not enough. Teachers also need to know how to teach it and how to help their learners understand it. Therefore, PCK entails having knowledge of the difficulties learners face in learning the subject matter and how to deal with such difficulties. According to Van Driel et al. (1998), PCK develops through teachers training and teaching experience. They further stated that lack of PCK influences the planning of the lesson and probably would also make the real teaching difficult. Kapyla et al. (2009) state that teachers in general are faced with insufficient content knowledge which results in insufficient learners' knowledge, lack of time, motivation and discipline. Thus, with regard to helping students develop their understanding of environmental learning in Life Science, teachers need to develop their PCK on environmental topics; they need to have knowledge of their students' ideas about environmental learning. According to Beyer et al. (2009), that's a curriculum designed to promote teachers' learning about the subject matter. They further stated that curriculum materials are connected to the teacher's daily work and thus can situate their learning in their own practice.

In terms of teaching environmental learning in Natural Science (i.e. Life Science), Peden (2008) proposes that to adequately address environmental issues, deep knowledge from Natural Science and Social Science is a prerequisite for critical thinking. She argued that, without an understanding of the science of key environmental issues one is doomed to superficial and inappropriate responses. Rosenberg cited in Peden 2008) observes that weak

Natural Science knowledge of teachers in South Africa leads to the exclusion of the natural environment from environmental education; this may also be the case in Namibia. Peden (2008) indicates that teachers have superficial knowledge on environmental issues, a finding also reported in the Life Science, Enviroteach, SEEN and South Africa NEEP projects. Peden further indicated that although environmental education is meant to cut across the entire curriculum, it is rarely addressed by teachers other than those in Geography and Natural Science.

Fien (1993) and Cotton (2006) clearly note that, what the teachers teach is considerably influenced by what they know and feel. They further explained that untrained teachers cannot produce environmentally literate learners. Hence, teachers are the key determinants in environmental learning inclusion in class and their concerns and attitudes are in turn an influential factor. Stimpson (1997) argued that, the more successful teachers in including environmental learning are those who have university degrees, those who are more interested in the environment, those who have more students who showed interest in the environment, and those who use different teaching strategies.

Delpit (1995) criticizes some of the assumptions of PCK, and notes that the relationship between knowledge of the learners and pedagogical content knowledge might be more significant than the relationship between subject matter content knowledge and pedagogical content knowledge. However Lotz-Sisitka (2009) in a research paper shows that PCK is a vital element to the teachers as it enables learners' knowledge to be successfully mobilised in the teaching and learning process. Delpit (1995) argued that a consideration of cultural influences on teaching styles must accompany any teacher assessment strategy. In contrary Grimmett & MacKinnon (1992) placed special emphasis on knowledge of motivation, knowledge of resources and technology, and knowledge about collaboration, they also considered the recognition of the problems individuals have learning, knowledge about how individuals' best learning, and learner motivations as part of pedagogical learner knowledge. The above findings and Cotton's (2006, p.237) clear observation that "teaching of environmental issues raises a number of pedagogical challenges for teachers" indicates the importance of a focus on PCK for understanding how Life Science teachers include environmental learning.

2.12. CONCLUSION

This chapter attempted to offer a contextual and theoretical framework for the study specially relating to the state of environmental education in Namibia, as well as other parts of the world. The topics on the integration of environmental education into existing curricula, methods of teaching and challenges faced by educators in teaching, have comprised the immensity of the discussion in this chapter. Many of the environmental education related challenges projected in the literature, can be empirically investigated in the Namibian education scenery with particular reference to environmental learning in the Life Science curriculum. Insights generated through this literature review helped me make sense of the data to be collected in this study. In the next chapter I discuss the research methodology.

CHAPTER 3

RESEARCH METHODOLOGY: Research Design and Decisions

3.1 INTRODUCTION

This chapter presents the description and justification of the choice of research methods for the study. It provides an explanation of the interpretive design of the research and discusses how the research was developed as a case study. The chapter also describes the participants in the study and the data collection methods used. It goes further to explain how the data was analysed. This includes description of the validity and ethical issues i.e. trustworthiness of the findings. The chapter ends with a brief discussion of some of the limitations of the study.

3.2 RESEARCH METHODOLOGY

3.2.1 Research orientation

This study is a qualitative case study that is guided by an interpretive paradigm. It is interpretive because it recognises that “individuals’ assumptions and experiences contribute to the ongoing construction of reality” in this case how teachers include environmental learning in their teaching of the Grade 10 Life Sciences curriculum (Wahyuni, 2012, p. 71). Interpretive orientations allow for an opportunity to understand the situation of the phenomena being studied by learning through the process of interaction. Cohen & Manion (1994, p. 37) stated that “interpretive researchers start with individuals and set out to understand their interpretations of the world”. Qualitative research allows getting a holistic picture of what goes on in a particular state of affairs, in this case a Life Science classroom. Terre Blanche, Painter & Durrheim (2006) explain that interpretive case study is characterized by a particular ontology, epistemology and methodology.

Ontology specifies the nature of reality that is being studied, and what can be known about it. Epistemology specifies the nature of the relationship between the researcher and what can be known. Methodology specifies how researchers may go about practically studying whatever they believe can be known (p. 6).

The researcher working in this custom presumes that people’s subjective experiences are genuine and should be taken gravely, so that we can understand other’s experience by interacting with them and listening to what they are telling us. Therefore it is against this

backdrop, that the study was planned to offer wealthy insights and understanding of the participants' views, perspectives and practices regarding the inclusion of Environmental Learning in Life Science.

3.2.2 Case Study Method

This study follows an interpretive case study method that involves three Junior Secondary Schools in Omusati Region, Namibia. It is a case study because, "it provides unique examples of real people in real situations" where the curriculum policy on environmental education is being implemented (Cohen, Manion & Morrison, 2007. p. 253). Ary, Jacobs, Razaviech & Sorensen (2006) assert that a case study seeks to understand the whole individual or phenomenon in the totality of that individual's or phenomenon's environment. Not only the present actions of an individual but his or her past environment, emotions and thoughts can be provided. A case study therefore enables the researcher to describe a particular case in depth, in detail, in context, and holistically (*ibid.*). Patton (1990) examined that case studies become chiefly useful where one needs to understand a particular group of people, a particular problem or a unique state of affairs in great depth, and carry out the issue of context and the past of the issue under investigation. In this case the group involved was science teachers as outlined above, the problem is lack of a researched understanding of implementation of environmental education as outlined in the policy and the unique state of affairs the classroom context and each of the teachers involved. Here in line with Stake (1995) who describes how a case study allows the collection of information that is specific to the particular case. I have tried to generate data to understand the inclusion of environmental education in the contexts examined.

Denzin (1989) argues that case studies will often be the favoured method for interpretive research because they are epistemologically in harmony with the reader's experience and thus to that person's natural basis for generalization. On the other hand Clough & Nutbrown (2007) argue differently when it comes to the generalization of what a case study is. According to Clough & Nutbrown (2007) case study results are particular to a context and can thus not be generalized since they cannot be simulated in different settings. Le Roux (2001) support this view by indicating that data acquired in a case study gives a description of present circumstances and a series of case studies (one or more) may disclose information that may help in forming a new idea for further research. This means that for the study the data generated will not be used for generalization but will be treated as context based and

thus useful for insights into the inclusion of environmental education. In this way the findings of this study may not be used to generalize how Life Science teachers include Environmental Learning, but will be used to produce recommendations for further research (see chapter 6) and improvement and strengthen environmental education in the Namibian context.

3.3 SAMPLE AND SITE

According to Mertens (2005, p. 69) “sampling refers to the process of defining the population on which the research will focus”. He further expounded that sampling process is a method used to select a given number of people (sample) from a population. In the same note, Hodgskiss (2007) states that “sampling in field research involves the selection of research site, time and events” (p. 33). Because this study is an interpretative case study and I will not be doing any statistical analysis, the sample size is not significant. My main concern here was that the cases selected should be characteristic of the science classrooms where environmental education is intended to be included.

This study was conducted in Omusati Region, Namibia. The region has 224 Junior Secondary schools that offer Life Science at Grade 8-10 level (Namibia. MoE, 2011). Only a sample of three public Junior Secondary Schools (coded S1, S2 and S3) was used for this study. Purposive sampling was used to select the three schools. Leedy & Ormrod (2005) stated that, in purposive sampling, participants are chosen on purpose, as they are likely to be knowledgeable and informative about the phenomena the researcher is investigating. I considered this approach to be the most suitable for selecting my sample of schools so that they were characteristic of the norm in the region and accessible to me.

The participants were a total of 3 Grade 10 Life Science teachers comprising of one male teacher and two female teachers (index code T1, T2 and T3) from three different schools (index coded S1, S2 and S3) respectively. These three schools have been chosen because they are closer to my work place, they were most easily accessible. I had easy access to these particular schools and the three teachers who participated were already known to me, because we teach in the same educational circuit. I met all teachers several times (see Table 3.1 below for details of the visits conducted with different teachers) this made it easier for me to get used to them and continue communicating with them after the data collection. Table 3.1 below shows the number of times I met the teachers, the dates and the purpose for the visit.

Table 3.1: Records of Teachers visits during the study

| Teacher | Date | Purpose of visit |
|----------------|--------------|--|
| T1 | 19.03.2014 | Explain purpose of visit, signed consent letter, collected timetable, set date for interview |
| | 24.03.2014 | Interview (I1), set dates for observations (LO1 and LO2) |
| | 17.06.2014 | Observations (LO1 and LO2) |
| T2 | 03. 06. 2014 | Explain purpose of visit, signed consent letter, collected timetable, set date for interview |
| | 18. 06. 2014 | Interview (I1), set date for observation |
| | 24. 06.2014 | Observations (LO3 and LO4) |
| T3 | 19. 06. 2014 | Explain purpose of visit, signed consent letter, collected timetable, set date for interview |
| | 26. 06. 2014 | Interview(I3), set date for observations |
| | 02. 07. 2014 | Observations(LO5 and LO6) |

3.4 DATA GENERATION METHODS

According to Patton (2002), a qualitative inquiry is best responded through in-depth, open-ended interviews, direct field observation and document analysis. He further argues that these methods capture and give insight in to what happened and report the experiences of the participants. Interviews provide information about people's experiences and knowledge, while observations allows the researcher to give detailed descriptions of peoples' activities, and the documents that could be analysed are official publications. The choice of data generation techniques to be used was informed by the study's research goals. The three techniques are:

- Document Analysis
- Semi structured interviews and

- Lesson observations

Each of these data generation methods are discussed in detail below.

3.4.1 Document Analysis

Schwandt, as quoted by Hodgskiss (2007, p.38) states that, “documents analysis refers broadly to various procedures involved in analysing data generated by the examination of documents and records relevant to a particular study”. Stake (1995, p. 68) adds that gathering data through studying documents follows the “same line of thinking as observing and interviewing”. Hopkins (1993) indicates that document analysis is essential based on the fact that it provides information and understanding of what is taking place in the classroom. This resonates with Hodgskiss (2007, p. 38) in her research work, when she states that “documents of all types can help the researcher uncover meaning, develop understanding and discover insights relevant to the research problem”. Therefore, it is for these reasons that I decided to use this strategy. Document analysis gave me evidence of how Life Science teachers are expected to include environmental learning in their classrooms based on the Namibian Ministry of education requirements. Analysis of documents was done throughout the study. The preliminary analysis of documents was used to serve as a framework which informed the interview schedule and the observation checklist. After interviews and observations, analysis of documents was done as a means of reference on what was observed and said during the interviews and observations

For this study the following main documents were analysed, indexed and given a code for easier data analysis:

- The syllabus- D1
- The textbook- D2
- The subject policy-D3
- The teachers’ guide-D4

I reviewed and analysed the content of the official Life Science curriculum documents such as the syllabus, the textbook, the subject policy and the teachers’ guide as the first baseline analysis and helped me get insight into the expected environmental learning inclusion in Life

Science classrooms and to find out what mandates and guidelines they present regarding the inclusion of Environmental Learning in Life Science classrooms. Content analysis in documents was guided by the research question and it was done by extracting the relevant text and analysing it. Lesson plans and teaching materials were analysed to help me see if there is any linkage between what the documents say and what has been observed. Pedagogical Content Knowledge in documents was analysed to identify how environmental learning should be taught. Documents were also analysed to find out how much they refer to situated learning.

A sample of past question papers were analysed to gain insight on how environmental learning is examined and to see whether that has an influence on inclusion of environmental learning. Analyses of past question papers was also done to see patterns across the papers, to identify which areas of environmental learning are examined most and to see which assessment objectives are examined more frequently in environmental learning. However, only the specimen papers for Grade 10 level that were compiled with the introduction of the NJSC (Namibia Junior Secondary Certificate) Life Science were used for in-depth analysis. The papers were analysed based on the syllabus assessment objectives (see Table 4.1B). Table 3.2 Shows the Life Science textbook that was used.

Table 3.2: Life Science textbook used

| Grade | Authors | Year | Title | Place of publication | Publisher |
|--------------|----------------|-------------|--------------------------|-----------------------------|------------------|
| 10 | Chikarango, T | 2008 | Discovering Life Science | Namibia | Zebra Publishing |

3.4.2 Semi structured interviews

It is stated that “interviews enable participants...to discuss their interpretations of the world in which they live and express how they regard situations from their own point of view” (Cohen, Manion & Morrison, 2000, p, 267). According to Leedy & Ormrod (2005), interviews allow the researcher to investigate and prompt things that cannot be observed. They further indicate that through semi structured interviews; the researcher is able to probe an interviewee’s views, thoughts, feelings, values and perspectives.

It is for this purpose that, I conducted semi-structured interviews with 3 Life Science teachers (T1, T2 and T3) to get rich responses from them as to how they include environmental learning and to find out more about what influences their integration of environmental learning in Life Science. Here I looked for their perspectives on enabling and constraining factors influencing the effective inclusion of Environmental Learning.

I developed an interview schedule which served as a flexible guide during the interview process (see Appendix 2). Drawing from Terre Blanche et al (2006), regarding the quality and understanding of the questions I used in interviews, I pilot tested the interview schedule with two Life Science teachers before it was used in the actual study. This (piloting) was done to assist with the formulation or re-direction of the questions in order to enable teachers to give detailed descriptions on how they integrate or include Environmental Learning as well as the enablers and constraints thereof. The following symbols: I1, I2, and I3 were used on behalf of the interviews (see tables 3.1 and 3.4).

During interviews each teacher was asked questions that enable them to reflect on their professional influences as well as experiences that might contributed to the inclusion of Environmental Learning. Probing was made when the participant did not clearly answer the question or the main point happens to be raise whereby clarification was needed.

All interviews were conducted at school, where teachers felt comfortable and were scheduled in the afternoons in order to prevent disturbances or disruption to teaching and learning activities or whole functions of the schools. I found the use of the semi-structured interviews valuable because they enabled me to get rich and detailed answers from respondents. The interview allowed respondents to have freedom and this lead to wealthy conversations whereby respondents could freely and easily explore their thoughts without any fear of being limited by closed ended questions.

Using the idea of Clough & Nutbrown (2007), permission was requested from participants in order to use an audio recorder as this enabled me to easily obtain interview data and to avoid missing some comments. The audio recorder was also used to capture the respondent's unique expressions and to enable me to transcribe the interviews. I found the audio recorder convenient as the researcher has to concentrate on eliciting responses without missing out what is being said while taking notes. Using an audio recorder saves time i.e. is less time consuming as one can maintain the interview sessions without breaking for note-taking. Due

to ethical reasons of anonymity, teachers' names were not attached to the interview questions transcription. Indices were used (see tables 3.1 and 3.3).

3.4.3 Observations

After document analysis and interviews, classroom observations were done to give me an opportunity to build on and confirm the responses given by the respondents in the interviews. Stake (1995, p. 60) indicates that, the importance of using observation is to increase understanding on the case being studied. In addition, Bell (1993, p. 109) notes that “direct observation may be more reliable than what people say in many instances. It can be particularly useful to discover whether people do what they say they do, or behave in the way they claim to behave”. Cohen, Manion & Morrison (2007, p. 396) state that observation “offers an investigator the opportunity to gather ‘live’ data from naturally occurring social settings”, thus the researcher can look directly at what is taking place *in situ* instead of relying on second-hand accounts. They point out that observation has the potential to produce more valid or genuine data than reading a written account by someone else. Similarly, the strength of observations is that it gives direct access to social interaction. Observation data enriches and supplements data gathered by other methods and thus allows triangulation (Simpson & Tuson, 2003).

Two lessons were observed and videotaped from each of the 3 selected schools in grade 10 and a total of 6 observations were done for the study and they are index coded LO1-LO6. The choice of lessons to be observed depended on the Environmental Learning topics being taught, those that were selected being lessons that learnt themselves to the inclusion of environmental learning. A video recorder was used to capture the teaching and learning processes. I took note of everything in the lessons and that helped me make sense of them before I could go on with the actual observation for the study. The time of observation was determined by the school timetable and the duration of observation was determined by the lessons duration, whereby most lessons lasted for 40 minutes.

Classroom observations were followed by a stimulated recall session with the teacher. Stimulated recall session was done with the Life Science teachers in order for them to highlight what their intentions were and describe how they have gone about including environmental learning and also to clarify issues or matters that arose during their lesson presentations.

The main focus during lesson observation was to gain insight on how Life Science teachers are integrating environmental learning and also to understand the teachers' interactions with the learners and the teaching methods used and the teachers' state goals compared with the actual content and activities during classes, and types of assessment. Observations also had to centre on events as they happen in the Life Science classroom for example the number of learners in the classrooms, activities, the teaching and learning materials used to present the Environmental Learning lessons as well as the sitting arrangements in the classrooms. I also observed specific factors influencing the lessons (for example class size, resources used and time management) to provide further a perspective towards identifying enabling and constraining factors of Environmental Learning inclusion. It was also necessary to observe the teachers' non-verbal gestures to see how confident they are in presenting the lesson and as an indicator of interaction. I was a non-participant observer; just observing what was happening, I sat at the back of the classroom and not participating in the class activities. I deployed a semi-structured observation checklist directed at the inclusion of environmental education perspective and local context and included ideas associated with the framing of PCK processes of comprehension, transformation, instruction, evaluation and new comprehension (see section 2.11). An observation schedule was developed but the observations were not limited to these (Appendix 3). The observation schedules were assigned the symbols as indicated in table 3.3 below.

Table 3.3: Symbols used to identify schools, teachers and observations

| Schools | Teachers | Observations |
|----------------|-----------------|--------------------------------|
| School 1 (S1) | Teacher 1 (T1) | Observation 1 and 2 (LO1, LO2) |
| School 2 (S2) | Teacher 2 (T2) | Observation 3 and 4 (LO3, LO4) |
| School 3 (S3) | Teacher 3 (T3) | Observation 5 and 6 (LO5, LO6) |

The following table shows the methods which were used in generating data in this study, as explained above.

Table 3. 4: Summary of methods used for data collection

| Methods | Number | Symbol |
|---|------------------|---------------------------------|
| Document Analysis <ul style="list-style-type: none">• Syllabus (D1)• Textbooks (D2)• Subject policy (D3)• Teachers' guide (D4) | 1 2 1 1 | D1 D2 D3 D4 |
| Lesson Observations(LO) | 6 | LO1, LO2, LO3, LO4, LO5, LO6 |
| Interviews | 3 | I1, I2, I3 |

3.5 DATA MANAGEMENT

My data came mainly from three different data generation techniques as discussed in section 3.4 above. I stored my data in labelled envelopes as it come, with interview schedules in their own envelopes, observation schedules and documents for analysis in their own envelopes respectively. This was very helpful for me in keeping my raw data in one place, for easy retrieval, which occurred quite often as I went from one data generation process to the other.

All the interviews and observations were transcribed, coded with colour to denote the categories important to the study and recorded in computer files. Transcription of interviews was somewhat of a tedious process at first, with the need to rewind the recording several times in order to capture what was said and write it down on paper. The process became more efficient as I acquired experience, and the use of slow playback motion. I was fortunate that the quality of recording was generally excellent; it was audible with no background noises.

3.6 DATA ANALYSIS

Gay, Mills & Airasian (2006) states that data analysis is the process of making sense and finding meaning in the data, interpreting what has been seen and what has been said. Qualitative analysis is a systematic process of coding, categorizing and interpreting data to

provide explanations of a single incidence of interest, in my case the cross-cutting inclusion of environmental learning. Data generated was inductively analysed, because the focus was on how Life Science teachers include environmental learning in their classrooms. Through the use of inductive analysis, categories and patterns primarily emerge from the data, rather than being imposed on them prior to collection (Davies, 2007). Data noted were colour coded to assist develop categories in making sense by identifying themes and patterns that reflected how environmental education was playing out in practice.

All interviews were transcribed (see appendix 4) and the transcriptions of observations were combined with the corresponding field notes. Data generated through interviews was analysed under broad themes and writing of summaries and tables, which are related to the interview schedule (see appendix 2) and the questions asked during the interview procedures. These were then organised into categories and subcategories using a constant comparative approach, reading across all the transcripts. During analysis, the data was revisited often to ensure that themes and categories authentically emerged and were not imposed and the essence of the dialogue was preserved (Patton, 1990). Analytical memos were produced containing broad themes and headings (see Appendix 5). The analytical memos were determined by the interview questions. I have used extensive direct quotations from the teachers to allow their ideas to come through in this study. I was able to produce analytical statements to help with data reduction. Analytical statements are based on raw data but speak directly to the research questions (Bassey, 1999).

Data produced through reviewing of documents and observations was also analysed by writing up summaries, inductively coding it and then interpreting it; using the pedagogical reasoning model (Shulman, 2004) to track evidence of knowledge; comprehension, transformation, instruction, evaluation, reflection and new comprehension. The coded data was also represented in analytical memos so that evidence of Pedagogical Content Knowledge and Situated Learning is documented in analytical statements.

3.7 VALIDITY/ TRUSTWORTHINESS

Validity is “an important key to effective research” (Cohen et al, 2000. p.106). The readers and users of this research would want to be assured that the data and research findings are valid and reliable (Maxwell, 1996) and not influenced by the researcher’s perspectives and

ideologies. It is therefore in this context that I did the following to ensure the validity of data generated:

- Interpret the data based on theory and not on my views and opinions,
- Conduct multiple observations to gain more insight into the phenomenon (that is, prolonged engagement in the field [Cohen et al, 2000]),
- Audio record and transcribe interviews, and video record classroom observations so that I re-viewed the data as many times as I needed to, Member checking involved circulating the transcripts and my data summaries to the research participants for them to confirm that this reflects their views and experiences accurately.

According to Bassey (1999, p. 75) “validity is an extent to which a research fact or finding is what it is claimed to be”. To ensure validity in my study, I used three methods of data collection: document analysis, interviews and classroom observations. The use of multiple methods to track themes and processes from policy through to teacher lesson planning and into teaching and learning practices while at the same time compensating for potential weaknesses in any single approach ensured validity and trustworthiness (Patton, 1990). Triangulation verified and looked for consistency, patterns and discontinuities in the data collected.

For validity, I also used interpretative validity and descriptive validity. Maxwell (1992, p. 288) states that the term “Interpretive is appropriate primarily because this aspect of understanding is most central to interpretive research, which seeks to comprehend phenomena not on the basis of the researcher’s perspective and categories but from those of the participants in the situation studied”. For Descriptive validity, I paid attention to “issues of omission as well as commission” acknowledging that “no account can include everything” (Maxwell, 1992, p. 287). However, I ensured that accounts are accurate and constructs are those presented by respondents. My interpretation of interviews relied as much as possible on the participants own words and concepts (interpretative data). The use of audio recording and observation guide to capture data reflected what have been interpreted.

Using stimulated recall interviews and member checking gave me an opportunity to share the interpretations with the Life Science teachers in order to verify the data. Reflexivity was considered throughout the research process, as Bassey (1999) stated that interpretive research requires researchers to be aware of the standpoint from which they conduct the research. I

kept on reflecting on my intentions throughout the data collection process. I was also aware of my role within the research process and how that could influence the participants and data generated. In order to guard against being biased, I examined my assumptions critically as potential threats to validity.

3.8 ETHICS OF THE STUDY

Ethics are defined as a set of widely accepted moral principles that offer/provide rules for, and set behavioural expectations of the most correct conduct towards experimental subjects or respondents, other researchers, assistants and students (Strydom, 2002). Careful attention was given to ethical issues that confronted the researcher. According to McMillan & Schumacher (2006) this includes policies regarding informed consent, safety, deception, confidentiality, anonymity, privacy and caring. Permission to conduct research at the schools was first requested from the principals by writing a letter seeking consent and from the Life science teachers (see appendix 1a and 1b). Informed consent forms contained the following information, which was drawn from Leedy & Omrod (2005, p. 102); a brief description of the nature of the study, voluntary participation, guarantee that all responses will remain confidential and anonymous, a place for participants to sign and date, the letter indicating agreement to participate, researcher's name, plus information about how the researcher can be contacted. I informed the participants on the goals of the research. Only those who granted me permission to be interviewed were interviewed. Participants were given the assurance that the data collected will be dealt with confidentially. Drawing from (Basse, 1999) a formal agreement was negotiated with participants in which I informed them about their rights to withdraw from the study any time should they feel that it was needed without penalty. Permission to record the interviews was requested from the participants and they were informed that the recording will be stopped at any time that they wished. Participants were guaranteed of their full rights to verify the data and to get a copy of the final research findings if needed.

3.9 LIMITATIONS

The study has only used three schools in Omusati region. Therefore as indicated earlier in Section 3.2.2 the data may not be used to generalize how Namibia Life Science teachers include environmental learning in Grade 10. The findings although of interpretative interest were not a full enough representation of how environmental learning is taught in all the grade 10 classrooms in Namibia. The research results would in all likelihood have been more

diverse if educators from various areas, such as urban, semi-urban and rural areas were involved in the study. This was impossible because of financial and time constraints. Despite these limitations, the study provided an initial understanding of Life Science teachers' ways of including environmental learning in the Namibian schools involved in the study.

3.10 CONCLUSION

In this chapter I have presented details on the research design decisions which informed the research process, the methodology which was chosen for approaching the research and the methods used for carrying it out. The justifications for choosing those particular orientations, approaches and methods were explained. The methods for coding the data were elucidated. The chapter explained how I attempted to reduce the bias through constant comparison of data using triangulation and reflexivity. Finally the chapter has provided an exposition regarding ethics and limitations of the study. In the next chapter I present the data.

CHAPTER 4

DATA PRESENTATION

4.1. INTRODUCTION

In this chapter I have compiled data that emerged from a preliminary analysis of the semi structured interviews, selected curriculum documents and lesson observations. The data describes how teachers include environmental learning within the Life Science curriculum, at Grade 10 level and how they understood the teaching of the environmental topics in three selected schools in Omusati region of Namibia. The presentation of data uses the following analytical categories: curriculum expectations on the inclusion of environmental learning (Section 4.2); teachers' views on environmental learning (Section 4.3); and teaching practices which describes actual teaching practice (Section 4.4). Enabling and constraining factors are identified throughout. These factors draw on the structure of the interview and a thematic approach for interpreting environmental learning in syllabus, the textbook used and the lessons taught. 'Thick descriptions' were used where relevant to add to the genuineness of data and description.

4.2 CURRICULUM EXPECTATIONS ON THE INCLUSION OF ENVIRONMENTAL LEARNING.

4.2.1 The syllabus

4.2.1.1 Content, skills and values

The syllabus is a policy document designed to inform and shape all teachers' teaching. It provides guidelines on what teachers should teach in order to develop learners' understanding on the specific topics, specifying the general objective and specific objectives that learners should achieve. The Life Science syllabus is designed as a course after the completion of the Primary Phase. It is to be covered over a three year period in Grade 8 to 10.

The rationale of the Life Science syllabus is to promote learners' knowledge and understanding of the physical and biological world of which they are part of (Namibia, Ministry of Education [MOE], 2006). The environment component includes understanding of how people use the natural environment to satisfy human needs, and how the environment may be changed in ecologically sustainable ways. Critical thinking, investigating phenomena, interpreting data and applying knowledge are emphasised as practical skills that are essential

for understanding the value and limitations of natural scientific knowledge and methods, and their application to daily life. At this phase and subject area, the application of scientific knowledge and attitudes to health is of special relevance for the individual, the family and society as a whole.

Some of the Life Science issues and activities are closely related to the environment and hence Environmental Learning. The syllabus analysis identified the syllabus issues which are more explicit to Environmental Learning aspects. The aims of the Life Science syllabus are more or less consistent with Environmental Education Policy Framework of Namibia. An example of the explicit aims of the syllabus in relation to environmental education policy is highlighted as follows: *“To stimulate interest in, and care for the environment and to promote awareness that the application of science may be both beneficial and detrimental to the individual, the community and the environment”* (pp.2-3). The broad aims specify ‘care for the environment’ as a requirement and an awareness of the limitations of science and the impact of science on the environment has not been completely addressed within the specific curriculum content (Namibia, MoE, 2009).

The syllabus themes, topics, general objectives and specific objectives revealed a considerable amount of explicit information covering environmental issues. Section 8 of the syllabus is about ‘Ecology’. This section covers the following topics:

- Global warming: understand how some gases create a greenhouse effect causing global warming
- Depletion of the ozone layer: realise the role and importance of the ozone layer to living organisms and know human activities which cause the depletion of the ozone and how the use and realise of CFCs can be reduced and
- Human biology and health: know ways in which people’s health can be affected by the physical and psychological dimensions of the environment and the importance of the human biology in promoting healthy living
(Namibia, MoE, 2006, pp. 32 -33).

Some learning objectives and topics relevant to Environmental Learning that are also covered in the syllabus, includes:

- *Characteristics, classification and diversity of living organisms:* Understand the diversity of organisms and their adaptations to different environments (should be illustrated by Namibian examples wherever possible);

- *Sexually Transmitted Diseases (STD's)*: Describe the cause, symptoms, signs, effects and methods of transmission of STD's and the ways in which it can be prevented from spreading. Discuss the increased vulnerability of Namibians to other illness due to the HIV and AIDS pandemic for Namibia;
- *Infectious diseases*: Discuss the social implications and transmission of common infectious diseases, including malaria in Namibia. Describe the life cycle of malaria parasite and describe the symptoms of malaria, the impact of malaria on one's health and discuss ways of treating the disease.

(Namibia, MoE, 2006, pp. 23 & 27).

The Life Science syllabus stipulates that Environmental Learning is one of the cross-curricular issues which form an integral part of the Life Science curriculum. The cross-curricular thus serves as a direct link of the Life Science Syllabus to other subjects for the Namibian school curricular. Each of the cross-curricular issue deals with particular risks and challenges in the Namibian society. It is indicated in the syllabus that all learners need to:

- Understand the nature of these risks and challenges;
- Know how they will impact our society and the quality of life of our people now and in the future;
- Understand how these risks and challenges can be addressed on a national and global level;
- Understand how each learner can play a part in addressing these risks and challenges in their own school and local community.

(Namibia, Ministry of Education, 2006, p. 3)

The syllabus also stipulates that using the learner-centred and local context approaches for teaching, learning and assessment is essential for environmental learning inclusion.

4.2.1.2 Assessment

The syllabus suggests the end of year examination in Life Science at the end of grade 10, relating to the learning objectives and basic competences of the syllabus. The summative assessment of grade 10 is a national examination. A variety of question types are considered to test a broad range of skills. The summative assessment consists of both continuous assessment (CA) and final written examination (WE). As indicated in table 4.1 B below, learners are required to demonstrate the assessment objectives in the context of the content and skills prescribed. Continuous assessment counts 35% and the final examination counts 65%.

Table 4.1A End of year examination: Description of papers

| Component | Description | Duration | Marks |
|----------------------------------|---|--------------------|--------------|
| Written Examination (WE) | Written Examination; Consist of one paper consisting of two sections: SECTION A: 30 multiple choice questions(30marks) SECTION B: Variety of structured questions (100 marks) | 2hours 15minutes | 130 |
| Continuous Assessment (CA) | <ul style="list-style-type: none"> • Topic Task • Topic Tests • Practical Investigations/projects • End of Term Test | | 70 |
| | | TOTAL MARKS | 200 |

(Source: Namibia. MOE, 2006:38)

Table 4.1B The mark weighting allocated to each objective for both the written Examination and Continuous Assessment.

| Components | Weighting % | Total % |
|---|--------------------|----------------|
| 1. Written Examination | 65 | |
| 2. Continuous Assessment | 35 | 100 |
| Assessment Objectives for Written Examination | | |
| Objective A Knowledge with Understanding | 30 | |
| Objective B Handling Information, Application & Solving Problems | 70 | 100 |
| Assessment Objectives for Continuous Assessment | | |

| | | |
|--|----|------------|
| Objective A Knowledge with understanding | 10 | |
| Objective B Handling Information, Application & Solving Problems | 40 | |
| Objective C Practical(Experimental and Investigative) skills | 50 | 100 |

(Source: Namibia. MOE, 2006: 38)

The Life Science syllabus shows these three assessment objectives in Life Science and are to a certain extent in line with those enclosed in the environmental education framework as stated in the following statement taken from the Life Science syllabus, “*The assessment will include, wherever possible appropriate, personal, social, environmental, and technological applications in a modern society*”(p. 35). The information is enclosed in different Assessment Objective areas of the syllabus, for instance:

Assessment Objective A: Knowledge with understanding. Requires learners to identify, give examples, name, list, state, indicate, give reasons, suggest ways, recognise, define, discuss and outline. Therefore this assessment objective assesses learning content that learners need to recall and explain.

Assessment Objective B: Handling information, Application and solving problems. This assessment objective requires learners to use principles and concepts within the syllabus and apply them in a logical and deductive manner to a novel situation. The objective requires learners to predict, relate, describe, calculate, find, estimate, determine, sketch and select, analyse, extract, synthesize, compare and discuss, deduce, explain, distinguish, suggest, interpret and evaluate.

Assessment Objective C: Practical (Experimental and Investigative) Skills. This objective assesses learners’ practical skills. It enables learners to use and organise techniques, apparatus and materials; observe, measure and record; handle, process and evaluate experimental observations and data; and plan investigations. (Namibia, MoE, 2006, pp. 35-36).

Table 4.1A above shows the description of continuous assessment and written examination and Table 4.1B shows the weighting components of written examination paper and continuous assessment. In written examination 30% assess knowledge with understanding and 70% for handling information, application and solving problems. While in continuous

assessment 10% is placed for assessing knowledge with understanding, 40% for handling information, application and solving problems while practical skills weight 50%. These tables were used as a framework to analyse the examination papers to see how much environmental learning is covered in the exam and to see whether that influences the inclusion of environmental learning (see section 4.2.5). The Life Science syllabus has suggestions for assessment tasks relevant to Environmental Learning that are considered essential and which all learners should be exposed to. Examples of these assessment tasks are:

Practical Investigations: For example, some of the practical investigation activities suggested relevant to environmental learning are:

“Investigate and report on the impact of global warming on the ecosystem” (p. 33).

“Do a survey of the local environment and relate it to the health of the people” (p. 33).

“Collect local plant and animal species as examples to classify” (p. 25).

“Investigate and collect statistics on the impact of AIDS in Namibia and plot a graph” (p. 24).

“Collect and report on locally used examples of traditional medicine and discuss how and for what they are used” (p.24).

Topic tasks: Examples of some topic tasks activities suggested relevant to environmental learning are: “Analyse food composition tables and food labels and calculate the energy value for the different age group” (p.28). “Report how you would improve your diet to make it a balance diet” (p. 28).

Projects: These activities gives learners an opportunity to complete an investigation in to one of the themes, topics outlined in the syllabus especially environmental learning topics. Examples of project activities suggested relevant to Environmental Learning are:

“Make compost” (p.14). “Construct a garden or visit any local gardening projects and record the importance of maintenance, rotation and the adding of fertilizers to the soil” (p. 14).

Topic tests: Are done after completing topics in this case environmental learning topics, to indicate the achievements of the learners in these topics.

End of term test: This is more comprehensive topic test of the term’s mark, and should not be seen as an examination.

(Namibia, MoE, 2006. PP. 36-37).

The syllabus also indicate that, the learning content delineated in the syllabus is intended to provide guidance on what will be assessed in general evaluation of learners, but is not intended to limit teaching in any manner.

4.2.2 The Textbook

The Life Science textbook (Discovering Life Science) has been written to prepare students for the Namibia Junior Secondary Certificate (NJSC). They are tailor-made to suit the NJSC

syllabus. The textbook has subject matter that is structured in a logical way in agreement with the syllabus objectives. The Environmental Learning topics in the textbook are similar to the syllabus topics such as global warming, depletion of ozone layer, human biology and health, diversity of living organisms, nutrition, sexual transmitted diseases including HIV and AIDS (see section 4.2.1.1). The textbook consists of stimulating activities which guide the inclusion of Environmental Learning. The activities are intended to encourage critical thinking and to facilitate learning and assess skills and knowledge. For example the life science textbook indicates that environmental Learning should be included through the following activities: -Investigation, Teacher Demonstration, Research, Outdoor tour. The textbook emphasises these activities to be carried out either in groups or pairs.

The activities in the textbook are clearly linked to the syllabus learning objectives and instructions for activities are clearly stated and practical investigations relevant to environmental learning are outlined step by step (see Appendix 8). The life science textbook addresses local environmental issues such as deforestation, soil erosion and pollution that are all common in Namibia.

As mentioned earlier, the life science textbook has suggestions for practical activities or demonstrations but not to a large extent, thus they are more theoretical and focus more on the subject content than skills development. The life science textbook does not fully promote the goals of the “key transferable skills”, which include, critical thinking, analytical skills, problem solving, interpersonal relations, communication skills, numeracy skills, information skills, self-management, competitive skills, study skills and creative skills which are vital when it comes to the inclusion of environmental learning, as they will develop individual understanding, creativity, the ability to construct alternative solution to problem, in this case environmental problems and to make informed decisions in real-life situation(Namibia, Ministry of Education, 2009).

4.2.3 The subject policy

The subject policy is a Ministry’s policy document that should be conducted on a regular basis by all subject teachers to make sure that they teach within the Ministry’s guiding principles in relation to content, pedagogy and its contextualisation. This policy document guides individual teachers to take initiatives, especially in presenting the subject content and facilitating learning in relation to the local context. The subject policy put emphasis on the learner-centred and local context approach for teaching, learning and assessment in Life

Science. The subject policy stresses that making use of learners' prior knowledge in teaching and learning is important for environmental learning. The subject policy states some environmental education aspects more clearly, namely that the learning process may be enlarged by linking science and real life situations in the environment. The subject policy also states that learners should get well planned homework every day. And, regardless of class size or teacher's timetable, the teacher should personally mark and monitor the work of each learner regularly. This helps them pick up academic constraints among certain learners. Teachers should write a critical reflection on lessons, noting how strategies could be changed to meet the lesson objectives and how the lesson should then be changed for future alteration for teaching success.

The subject policy indicates that a range of materials must be used to enhance and help in achieving lesson objectives. Relevant to environmental learning, the subject policy states that teachers must improvise teaching and learning by using easily available objects in the immediate environment. Local environment and community can be used both as a field to be researched on, or as resources to get information, that arouse investigation, for inquiry and creativity when including environmental learning. The subject policy also states that every teacher should meet the requirements of the syllabus and should develop an effective scheme of work from the syllabus. The scheme of work should be customized if the syllabus changes. Written lesson preparation is obligatory for every teacher, irrespective of experience. A successful lesson plan should include the topic, teaching aids, learning objectives, basic competencies, monitoring of homework, introduction, presentation of the subject content and assessment.

The subject policy tends to put emphasis on the availability of extracurricular activities relevant for environmental learning inclusion for learners to practice their knowledge and skills. The following main issues relevant to the scope study are emphasised by the subject policy:

4.2.3.1 Inclusion

The subject policy indicates that environmental learning is included across the curriculum. It states that teachers should, at every opportunity, refer to cross-curricular issues so as to have holistic learning, in which the learner develops in to a more complete individual ready to positively influence the development of Namibia and the world in general. The subject policy

also indicates that cross-curricular themes concern aspects of life, which are important throughout life and which should be considered at all stages of learning and beyond. They contribute to the formation of attitudes and values, may inspire socialising and link school and society.

According to Namibia, Ministry of Education [MoE], (2008) the following themes are integrated across the curriculum and the teachers should inculcate these cross-curricular issues: the Environmental learning, HIV and AIDS education, health and wellness education, human rights and democracy and information and communication technologies. Each of these issues deals with particular risks and challenges in the Namibian society. Some of the main risks and challenges have been identified as:

- The challenges and risks we face if we do not care for and manage our natural resources
- the challenges and risks caused by HIV and AIDS
- the challenges and risks to health caused by pollution, poor sanitation and waste
- the challenges and risks we face from globalisation...

(Namibia, MoE, 2008, P. 4).

The subject policy stipulates that all learners need to understand the nature of these risks and challenges, and how they will impact the society and the quality of life of people now and in the future. “They must understand how these risks and challenges can be addressed on a personal, local, national and global level and how they can play a part in addressing these risks and challenges in their own school and local community”(Namibia, MoE, 2008, p.4).

4.2.3.2 Support

The subject policy indicates that effective inclusion of environmental learning depends on a good communication network between teachers, management, suppliers of material and equipment, community or/and parents, advisory teachers and other stakeholders in Science education by putting emphasis on the following:

Subject meetings and class visits: The department of Sciences should conduct regular subject meetings in order to guarantee a better inclusion of the Natural Sciences, hence environmental learning. These meetings should make sure that there is a lively process of feedback in both directions, from management to teachers and vice versa. Meetings should serve as a tool for planning, the comparing of schemes of work and activities, such as the setting and moderation of examination papers, in-service training, workshops and temporary

or permanent change of staff. Class visits should be conducted regularly by the school management, subject head and even senior teachers. These visits which should be done at least once per term, they must be constructive, giving positive feedback. In areas of concern, the supervisor should lead the discussion in such a way as to make the teacher aware of possible shortcomings.

Continuous professional development: There should be workshops and in-service training of teachers. Teachers should share information, experiences and strategies they were equipped with during training. To excel as a teacher and to constantly develop teaching and management skills, the teacher should be engaged in continuous development programmes. Subject heads and heads of department should have the experience and training to assess the needs of the members of their staff. If the necessary expertise for the development of management skills to facilitate creative teaching is absent, then outside help (e.g. subject advisor) is required. *“An advisory teacher has extensive knowledge of the relevant subject areas and their responsibilities are, amongst others, to ensure quality in education through rendering liaison services and subject guidance” (p. 15).*

The school should fully make use of the expertise provided by advisory teachers. Alternatively school cluster meetings can be organized. There must be department training activities; these can be shared in cluster groups, and in the process with neighbouring schools.

Cluster subject groups: The cluster subject group meetings improve competency, build capacity and empower teachers. Attending and participating in cluster subject activities can play a positive role in collaborative development and improving quality teaching and learning.

4.2.3.3 Resources

The subject policy emphasise that teachers in Life science should be creative and innovative to produce their own teaching and learning materials linked to practice. Additional to the textbooks, each school should have a teachers’ guide, equipment used for laboratories, one or two teacher textbooks to use for class preparation and other resources (including ICTs). The supply of appropriate teaching aids that will guarantee effective teaching must be seen as a combined responsibility between the school and the Ministry of Education. Making use of these enhances learning and makes teaching amusing.

Classroom displays and arrangement: All classrooms should have displays such as wall charts, artefacts and learners' work which makes learning interesting. Materials can be organized following discussion of the learners' experiences, stories or ideas. Teachers should encourage learners to add and change displays regularly. It should be the ambition of the teacher to create an exciting, interesting and encouraging learning environment. The way in which teachers systematize their classrooms and activities will have an effect on the atmosphere in the classroom as well as the activities. The seating plan may depend on the kind of activity or method planned for a particular lesson, example, demonstration, experiment.

Textbooks and exercise books: The ideal situation is that every learner has a textbook for Life Science and a note book/ exercise book.

Equipment, practical lessons and laboratories: In lessons where the teacher plans to conduct some practical work by demonstration, learners themselves must be carefully prepared, and tasks tried out before hand. The time factor should always be taken into consideration in such a way that the activity can be mastered within the available time, or mechanisms should be developed for carrying on even more than one day.

Teachers' resource centre and school library: Teachers are encouraged to make use of the resources and facilities obtainable at teachers' resource centres. If a definite item is not available at the local/regional centre, it is possible to make inter-library or inter-teachers resource centre loans.

4.2.3.4 Time and time management

Success of environmental learning depends on maximum time on task and it is expected for the teacher and learners to attend every class as indicated on the timetable, the teacher and learners should arrive punctually in the morning for school and for every class. Lessons are planned so that there is as much time on the task as possible. When it comes to the timetable, the subject policy recommends that in the timetable, Grade 8- 10 should have 4 Life Science periods in a 5 day cycle or 6 periods in a 7 day cycle period with a minimum of 40 minutes duration per period. Natural Science (which includes Life Science) should get at least two double lessons a week to provide sufficient time for discussions, practical work or experiments.

4.2.3.5 Teachers' knowledge/qualification

The subject policy states that teachers should be qualified to teach the subject phase and should have knowledge of subject matter. Therefore, in this case Life Science teachers should have a qualification to teach Life Science at Grade 8 to 10 level, hence environmental learning within Life Science.

4.2.3.6 Learners' discipline and motivation

The subject teacher should create a favourable environment in the classroom for quality teaching and learning and set up a disciplined teaching and learning environment in the class.

4.2.4 The teachers' guide

The teacher's guide is an official document, intended to guide teaching and learning in the classroom and should be therefore fully used for class preparation thus it can be used as a lesson preparation tool. The Life Science teacher's guide is not a prescription but rather a guide for Life Science teachers and it provides an overview of strategies and teaching approaches to the NJSC syllabus. It includes comments and recommendations made by examiners and markers on past examination papers. The teacher's guide has been developed to complement the Life Science textbook and syllabus Grade 8 to 10 and not to be used alone. The content in the teacher's guide focuses on concepts, instructional text as well as laboratory activities that promote learners' expectations. It comprises ideas on possible difficulties and misconceptions that could be a barrier to learners' understanding Life Science. It also includes practical demonstrations and guidelines on marking practical work.

The teachers' guide also has worksheets and suggested activities which are consistent with achieving the goals of the syllabus. The guide consists of assessment criteria that assists the teacher to assess learners' performance, for example, for the topic of agriculture it suggests that, by means of tables learners should compare the advantages and disadvantages of the use of modern technology in food production, briefly describe the undesirable effects of deforestation and to discuss the effect of nitrates from fertilizers to the organisms living in the pond of water. Teachers are not necessarily expected to follow the pattern of the guide precisely, but they are encouraged to adopt it and/or make changes where needed to suit their unique teaching environments. The teachers' guide has suggestions for materials to be used for certain topics, to make the lessons more practical, relevant and interesting and reflects the

use of daily and local examples, such as for the impact of global warming, it suggests that learners should carry out the following activities:

Visit a local environment officer or the teacher can arrange to invite the officer as a resource person on pollution and global warming, learners can cite examples of pollution in their local areas and suggest ways of reducing the pollution, learners can also research and bring articles and published stories on pollution, learners can make posters with information on awareness against pollution”(p.99), for malaria and its transmission, it suggests that, “learners should collect newspaper cuttings showing articles on malaria or learners should also take steps to control malaria/mosquitoes-according to the methods outlined on p45, learner’s book” (p. 65), for sexually transmitted, it suggests that “learners may design posters showing the dangers of STI’s. OR they may collect newspaper cuttings which have articles on HIV (p.65).

For the study purpose, only the topics that were taught by the teachers observed were analysed in the teachers guide.

4.2.5 The examination question and test papers

The grade 10 Life Science learners write one compulsory examination question paper at the end of the term or year. In preparation for the examinations learners write tests. It was therefore necessary for me to analyse some of the examination and test papers to get insight on how environmental learning is assessed through the tests and how it is examined.

From my analysis, it was clear that in terms of assessment objectives, the exam paper and tests both are consistent with the syllabus requirements. In the examination paper, most questions are assessing the assessment objective A: which is about knowledge with understanding. Thus most questions require learners to name, list, state, define, give examples, and suggest ways. Therefore this assessment objective assesses learning content that learners need to recall and explain. But, there are very few questions testing assessment objective B of the syllabus which has to do with handling information, application and solving problems (see section 4.2.1.3 and Appendix 9).

Regarding environmental learning coverage, environmental learning content in the examination papers is less. In section A of the Life Science examination paper of 2013, only one question on the life cycle of malaria and in section B, there are few questions on HIV/AIDS, monocotyledons and dicotyledonous plants, some questions on adaptation of the Tilapia and few questions on greenhouse gasses and one question on suggesting ways how global warming will affect life in Namibia.

4.3 TEACHERS' PERSPECTIVES ON ENVIRONMENTAL LEARNING (EL)

The interviews covered a range of aspects of how environmental content is covered in the syllabus, how the syllabus guide the inclusion of environmental learning, what knowledge do textbooks provide on the inclusion of environmental learning, what teaching strategies the teachers use to include environmental learning in life science, what influences their inclusion and what enables and constrains the inclusion of environmental learning. The results from the interviews are presented in the section below, and discussed in relation to other data sources in chapter 5.

4.3.1 Teachers' profiles

The profiles of the three teachers who participated in the study were compiled during the individual semi-structured interviews. This was part of the introduction that was used to get the information on teachers' qualifications and teaching experience (see Table 4.2 below).

Table 4.2. Composition of teachers' qualifications and teaching experience

| School | Teacher | Qualification | Years of teaching Life Science |
|--------|---------|---|-----------------------------------|
| 1 | T1 | BETD(Life Science & Agriculture) Further Diploma (Biology) | 8 |
| 2 | T2 | BETD(Life Science & Agriculture) Further Diploma (Biology) | 12 |
| 3 | T3 | BETD(Life Science & Agriculture) Further Diploma (Biology) | 7 |

Table 4.2 shows that all teachers who participated in this study have Diplomas in Education with Life Science as one of their majors. Their years of teaching Life Science range between 7 and 12 years.

4.3.2 Teachers' views on environmental learning (EL) in life science syllabus

All teachers interviewed indicated that environmental learning is about topics that are related to the environment and they indicated that Life Science does cover environmental learning topics, but inadequate thus there are few environmental learning topics in Life Science syllabus Grade 10. Teachers involved in this study except T2 suggested for more environmental learning topics to be added in Life Science syllabus Grade 10. They all stated that topics such as global warming, greenhouse effects, the depletion of ozone layer and health education lead themselves to the inclusion of environmental learning.

T1 described Environmental Learning (EL) as follows:

EL has to do with teaching and learning about the ecological aspects of the environment, it's about taking care of the environment and environmental issues in life science this includes topics like global warming, depletion of ozone layer and human biology and health (I1T1).

T1 pointed out that the life science syllabus needs to be broadened to allow more environmental learning topics because he is of the opinion that they are inadequate.

More environmental learning topics need to be added in Life Science syllabus because environmental coverage in the syllabus is not substantial and more information on how to include environmental learning in Life science need to be added in the syllabus (I1T1).

He estimated environmental content in the syllabus to be about 15%. T1 indicated that examples of environmental learning in life science include learning about ecology which includes topics such as global warming and depletion of ozone layer. T1 gave other examples of environmental learning in life science such as learning about the diversity of organisms and health education which cover the following topics: sexually transmitted diseases, HIV and AIDS and infectious diseases (I1T1).

T2 define EL as follows:

I do understand that environmental learning is whereby learners learn about their physical and biological world around them at local, regional and international level. And it includes how society uses the natural resources in order to satisfy its needs (I2T2).

She indicated that an example of environmental learning in life science she can give is when learning about ecology which includes the following topics: global warming, depletion of the ozone layer and human biology and health. T2 also stated that there is few environmental learning in the Life Science syllabus but she feels that it is not necessary to add more environmental learning content; learners with an interest in environmental learning can

proceed with it to tertiary level. She indicated that apart from the syllabus and the textbook, the type of learners she has and the love for nature influences her teaching of environmental topics. She then estimated environmental learning content in the syllabus to be at 10% (I2T2).

T3 stated that: *“Environmental learning is when you are studying about the environment, looking at the aspects like how abiotic and biotic factors are interacting in the ecosystem”*.

She indicated that an example of environmental learning in life science is when studying about the monocotyledon and dicotyledon plants and when studying about ecology whereby looking at issues like global warming, greenhouse effects and the depletion of ozone layer. T3 also feels that environmental topics in Life Science syllabus are few; she is of the opinion for more environmental learning topics in the syllabus. She estimate 15% of the syllabus to be environmental learning and indicated that:

I think they should increase the environmental learning topics in the syllabus. We need to look more on the sustainability of the environment, the impact of human activities on the environment, we can even start with the animals the way they are grazing, we do have overgrazing that is caused by animals, we do have deforestation caused by human activities and pollution caused by human activities and therefore if we could make environmental learning more without only focusing on global warming, it will broaden the knowledge of both teachers and learners on how to take care of the environment (I3 T3).

4.3.3 Guidance on the inclusion of environmental learning by the syllabus and subject policy

Teachers were asked on how the syllabus and the policy guide the inclusion of environmental learning. All teachers indicated that environmental learning is taught across the curriculum, making its inclusion a relatively simple matter.

T1 indicated that the syllabus states that environmental learning should be taught across the curriculum, it should be a cross curricular issue, this makes it easier for the inclusion. He said:

the syllabus and the subject policy guide the inclusion of environmental learning by stating that the inclusion of environmental learning should be in such a way that teaching goes together with environmental learning and they guide some of the topics that whenever teachers are teaching them they should emphasis or include environmental learning cause teaching does not only take place in the classroom(I1T1).

T1 further stated that the syllabus suggests that learners should be taken out in the environment to experience the issues discussed in the classroom- outdoor teaching for example taking learners for a planned tour, around the school area or nearby community to do

a survey, projects and research. He also said that the syllabus also guide the inclusion of environmental learning by providing the practical activities relevant to the inclusion of environmental leaning.

That's why my teaching is mostly informed by the syllabus because I find it effective when it comes to the inclusion of environmental learning. The textbook also inform my teaching because it covers the syllabus objectives (I1T1).

T2 stated that the syllabus guides the inclusion of environmental learning by stating that it should be taught across the curriculum which makes the inclusion easier because some of the topics in life science like global warming is also part of geography so learners come in with knowledge from other subjects. She said that the syllabus guides the inclusion of environmental learning by providing activities which support its inclusion and helps with the identification of suitable themes in life science. She indicated that she mainly uses the syllabus and the textbook during teaching and learning and not the other curriculum documents because she does not find them useful (I2T2).

T3 indicated that the syllabus states that teachers should include environmental learning in themes like ecology and diversity of living organisms. She added that the syllabus states that when teachers are teaching learners the difference between monocotyledon and dicotyledon plants, learners can be allowed to study these plants in the environment, for example they can make a survey in the environment, collecting those plants and bring them in the classroom. T3 also stated that the syllabus indicates that environmental leaning should be taught across the curriculum and these made the inclusion easier because learners will come with environmental knowledge from other subjects like geography, agriculture and physical science. She said that she does not have the subject policy or the teacher's guide and therefore her teaching is primarily informed by the syllabus and the textbook because they are available and find them relevant. (I3T3).

4.3.4 Teaching methods for including environmental learning

Teachers stated that they use variety of teaching methods to include environmental learning in life science. They all indicated that they include environmental learning in their teaching of life science by giving research projects, investigations, surveys, topic based presentations, group discussions and outdoor tours.

T1 specifically said,

I take learners outside the classroom to get more information on a certain topic discussed in the classroom or do a survey where I take them to an expert for example to a nurse, a doctor or an extension officer to ask for information and get information (I1T1).

T1 further indicated that he take learner into the community where they are able to relate what they have learned in the classroom with the information they get from the community or with what they will see in their environment. T1 also said that the main aim of using the methods mentioned is to expose learners to more information related to the topic discussed inside the classroom so that they are able to relate them to the environment and to the concrete examples that they will come across in their environment, “*thus exposing them to real situation so they are able to learn about the environment not only in the classroom but they have this opportunity to go outside and touch things, look at things in real situation*”(I1T1).

Therefore, his main method of teaching environmental learning is by exposing learners to real issues or situations although he also use other methods like surveys, research projects, investigations and making use of experts.

T2 said

I use to send learners either to the parents or to the community to find certain information prior to the lesson, for instance it can be about infectious diseases for example I let learners find some of the traditional ways on how to prevent the spread of malaria than after collecting information, learners will come back discuss in groups and present what they found (I2T2).

She indicated that her usual methods of teaching environmental learning are asking learners to find information prior to the lesson, group discussions and presentations. She finds these methods effective, for example group discussions and presentations enabled learners to learn from one another and also allow cooperative learning and sending learners to find information prior to the lesson allows learners to find more information than those required by the syllabus.

T3 in particular stated that

I normally use learner centred method because it makes learners to understand better when doing things on their own, using their prior knowledge so it enable them to be active participants and allows them to learn by doing and are able to learn from each other (I3T3).

She further stated that

Learner centred includes letting learners discuss for instance environmental learning topics in groups and present to the class. I also let learners do projects, investigations and surveys in the local environment on environmental learning topics (I3 T3).

All teachers indicated that there are some methods they would like to use to teach environmental learning but they are constraints. They all indicated that they would like to use more environmental learning materials such as audio visuals, games, pictures, charts and posters.

T1 said *“I would like to use audio visual such as video clips, games and pictures to teach environmental learning but this is not possible because they are nowhere to be found at school, not even in the school library” (IIT1).*

T2 stated that she want more audio visuals, charts, posters and games for environmental learning. T3 shared a similar sentiment by saying,

I would also like to use video clips in order to expose learners to environmental issues such as pollution, deforestation and flood and also to use posters, games, pictures or charts to teach environmental learning but they are not available at school (I3T3).

However, all teachers revealed that they do experience some problems when involving learners in environmental learning lessons. T1 said lack of learners’ interest in sex related topics lead to poor participation of learners and he also indicated that (few) learners are not exposed to environmental learning thus their knowledge is limited.

T2 pointed out that (some) learners do not consider themselves as part of teaching and learning and as a result they do not participate in the class. T3 said she encounter lack of knowledge among (some) learners when engaging them in environmental learning lessons.

4.3.5 How environmental learning is included in life science

Teachers were asked on how they included environmental learning in life science and this is what they said:

T1 indicated that he included EL in life science in the sense that when he teaches he does not only teach sitting in the classroom with learners but use to go out, around the school or nearby community, looking at things , making surveys and doing projects outside. Apart from that, he stated that he use to assign learners to ask parents or community members information related to the topic discussed in the classroom.

For example I give learners a project to go and classify things. We are having this topic of classification of living organisms so I let learners go to the environment and they classify and group things according to what they observed and I also use local examples that learners are familiar with or what they will be able to relate to when teaching(IIT1).

T1 however, pointed out that

there are lots of best ways to include EL you might just include it inside the classroom, you can call one expert for example we are having this topic of conservancies, just call an expert from a certain conservancy and come into the classroom where now he/she gives learners more information about the topic (IIT1).

Apart from that, T1 also indicated some best ways to include EL such as taking learners outside for example nearby school surrounding to familiarise themselves with the real situation or giving a project, an investigation or a research for learners to go and ask information related to the topic the teacher want them to find or downloading a DVD with topics related to environmental learning and present it to the learners. He also pointed out that making use of posters, using local examples that learners are familiar with and are able to relate to when teaching as some of the best ways also to include environmental learning (I1 T1).

T2 stated that she included EL in life science by telling learners the importance of plants when dealing with plants and global warming.

I let learners do projects, surveys and practical investigations on environmental topics and also ask them to find information prior to the lesson, group discussions and presentations and use examples of things that are known by the learners when teaching (I2T2).

While T3 said that she included environmental learning in life science for instance in grade 10 in topics such as global warming, green house effect and depletion of ozone layer. She further indicated that

when it comes to ozone layer, I ask learners for example to bring some products which release CFCs in the atmosphere and explanation how the ozone depletion will affect the living organisms in the environment and I give examples of things that learners are familiar with (I3T3).

She also stated that when coming to topic like global warming, she use to ask learners to collect pictures illustrating human activities which can contribute to global warming for example releasing carbon dioxide in the atmosphere, “they may also bring pictures of deforestation or slash and burn farming practices or may be combustion by cars or factories”(I3 T3).

T2 and T3 however, said that the best ways to include EL are to let learners find information from the community or immediate environment and present what they have found in the classroom.

“Learners should be allowed to do inquiry, investigation and collect information from the community or from their immediate environment and present that information in the class” (I3T3).

T3 further indicated that the best way to include environmental learning is that, it should be taught across the curriculum “*not only in life science but it should also be taught in other subjects like geography, agriculture etc*”. Apart from that, T3 also emphasised that environmental learning should be taught in a learner centred method which allows learners to

practice and do things on their own, using their prior knowledge instead of teaching it as a theory (I3T3).

In the same sentiment, T2 stated that;

the best ways to include EL are to let learners find information from parents or community prior to the lesson, discuss in groups and report back, using the immediate environment as a teaching aid, practical investigations and also experimental methods (I2 T2).

All teachers recognised the importance of the assessment methods as a way of testing learners understanding of environmental learning and indicated that they use various assessment methods as indicated in Table 4.3 below:

Table 4.3 Summary of assessment methods used by teachers

| Teachers | Assessment type |
|----------|--|
| T1 | Projects, research, assignments, topic tasks, topic tests and practical investigations |
| T2 | Projects, topic tasks, topic tests and practical investigations |
| T3 | Topic tasks, assignments, practical investigations, projects and tests |

Table 4.3 Shows that the main assessment methods used are topic tests, topic tasks, projects and practical investigations. But giving assignments are also common. Regarding assessment teachers involved in this study indicate that they assess learners continuously because they are promoting assessment *for* learning but not necessarily assessment *of* learning.

T1 explained that assessment is a continuous process and when the teacher assess *for* learning, he/she uses assessment as a tool to assist the learning process were by the teacher is not only assessing what learners have learned but also what they did not learn. Therefore assessment for learning gives the teacher an opportunity to see what learners have learned and what is needed in order for the teacher to build on for learners to be able to know something. He however indicated that

environmental learning can be assessed through projects, can be research, can be assignments or you can assess through practical investigations, topic tasks or topic tests where you include what you discuss with your learners inside the classroom or outside the classroom to see now if they gain something or did not gain anything so that you can improve your strategies to teaching and learning (I1T1).

T1 also indicated that the assessment is related to the formal assessment in the life science syllabus. *“For example topic tasks should be only out of 10” (I1T1)* (see section 4.2.1.3).

T1 and T2 however mentioned that assessing learners enables them to reflect in order to see what have been covered and attained. They further indicated that reflecting on the lessons helps them strengthen teaching where needed (I1T1, I2T2). T3 on reflections indicated that she only do reflection sometimes because she has too many subjects to teach therefore does not get enough time to do reflection for every subject due to workload. She however explained that it is essential to do reflections as it allows one to go through the syllabus, look at what has been achieved or covered in order to improve the speed of teaching.

T2 mentioned that projects, topic task, topic tests and practical investigations are the assessment methods recommended by the life science syllabus (I2T2). In the same sentiment, T3 added that

we normally use formal assessment whereby we give tests, topic tasks, assignments and practical activities for instance when it comes to monocotyledon and dicotyledon plants, I let learners go into the environment and collect those types of plants from the environment and bring them in the classroom so that they classify them (I3 T3).

In terms of examinations, teachers indicated that environmental learning is less examined thus there is usually less environmental learning examined. They estimated that only 3% of the total exam marks are environmental learning. Teachers stated that sometimes environmental learning does not even exist in section A (multiple choice questions section) and very few environmental learning in section B (structured questions section) of the exam paper and it just depend on the examiners.

T3 added that little coverage of environmental learning in the examination influences her inclusion of environmental learning. She further indicated that environmental learning topics do not have much impact on learners due to how the set up is, *“environmental learning is the last on the syllabus, and is very few and some learners do not have environmental learning knowledge” (I3T3).*

4.3.6 How textbooks and other materials are used in the teaching of environmental learning in Life Science

All teachers pointed out that there is a shortage of the prescribed textbooks such as Discovering Life Science and Life Science in Context as well as extra support materials at schools such as charts and posters, audio- visual materials and games.

T1 stated that learners do have prescribed textbooks but they are not enough for every learner, “they are sharing these textbooks”. He further stated that other supporting materials available at school for teaching environmental learning are internet, ecology posters which

the school got from Enviroteach projects, NAMCOL DVDS: consisting of presented lessons including environmental learning topics and the Biology models which he bought from NAMCOL bookshop and also borrowed them from nearby senior secondary schools “but all these extra support materials are not enough, they are in short” (I1T1).

T2 added “about textbooks learners do have prescribed textbooks but they are not enough for all learners, that is why sometimes some learners use to share these textbooks” She further stated that other supporting materials at school are reference books from the school library which are also in short and also making use of experts for example a nurse from the nearby clinic to give information on topics related to health education. T2 also stated that “I also use the community as an extra support material whereby I use to send learners to get information on a certain environmental learning topics” (I2T2).

T3 also indicated that textbooks are not enough because learners are sharing the available textbooks at school. She also indicated that apart from textbooks, other support materials for teaching environmental learning at school include the local environment, polystyrene products (polystyrene cups and fast food containers) which release CFCs in the environment as well as body spray cans and air conditioners from nearby suppliers which she uses in the classroom when teaching about environmental topics such as global warming and the depletion of ozone layer (I3T3).

4.3.6.1 Knowledge textbooks provide on the inclusion of environmental learning

T1 said:

the knowledge in the textbook is based on the content thus the textbook provides subject content but it is not that clear when it comes to the inclusion of environmental learning cause the textbook is just describing or giving notes on a certain topic but not clearly stating that when you are teaching a certain topic, this is how you can include environmental learning. The textbook is consistent with the syllabus learning objectives for example the Discovering Life science ones and the syllabus is clear when it comes to the inclusion of environmental learning. I use both the syllabus and the textbook as my main resources because I find them effective and useful than other curriculum documents which are in my position like the subject policy (I1T1).

He indicated that he does not have the teachers’ guide that’s why he does not make use of it. T1 further indicated that the textbooks are based on theory and tend to focus more on the subject content but they provide activities which guide the inclusion of environmental learning (I1T1).

T2 stated that:

The textbooks we are using provide relevant content knowledge to the learners in case of to be aware of problems occurring in their environment especially the problems which are caused by global warming, human activities that contribute to global warming and again textbooks also provide knowledge on how to compact the spread of sexually transmitted diseases and infectious diseases in the community (I2T2).

T2 also said that the textbooks suggest relevant activities which guide the inclusion of environmental learning although these activities are few. The textbooks seem to provide more theory than practice but they are in line with the syllabus objectives and she stated that her teaching is mainly informed by the textbook and the syllabus because she finds them relevant. She indicated that she has the subject policy as well as the teachers' guide but she rarely use them because they are not as important as the textbook and the syllabus (I2T2).

T3 said:

the textbooks focus more on theory and are more focusing on topic content for example the textbooks highlight more on what is greenhouse effect, global warming and ozone layer, the importance of ozone layer in the environment and the causes of global warming and how should we prepare ourselves especially as Namibians for global warming. They also provide activities which support the inclusion of environmental learning such as outdoor tours, research and investigations (I3T3).

T3 stated that she mainly use the textbook for teaching and the syllabus when planning her lesson plans and find the two documents effective. She also indicated that she does not have the subject policy as well as the teachers' guide but has gone through them but did not find them useful in fact they are time consuming (I3T3).

4.3.7 Teachers' views on enabling and constraining factors influencing the inclusion of environmental learning

The teachers were asked about the support they received from different stakeholders and schools to help with the inclusion of environmental learning.

Table 4.4 below gives the summary of the teachers' responses regarding the support provided on the inclusion of environmental learning.

| Teachers | Training/workshop/ Guidance from subject advisor | Management | Other teachers | Parents/Community |
|----------|--|------------|----------------|-------------------------|
| T1 | One | Supportive | Supportive | Involved to some extent |
| T2 | None | Supportive | Supportive | Involved |
| T3 | None | Supportive | Supportive | Involved |

4.3.7.1 Support

Table 4.4 above shows support rendered from different stakeholder for effective inclusion of environmental learning.

Teachers were asked about training/workshop and guidance they received from the subject advisor on the inclusion of environmental learning. Here are their responses: T1 said, the subject advisor conducted one workshop three years ago and in this workshop there was a sub topic on inclusion of environmental learning. He said every teacher was asked how they teach certain topics and how they include environmental learning in those topics.

Everybody was giving his/her ideas and by listening to different ideas given by other life science teachers on how they integrate environmental learning is when I got lots of information on how to integrate EL in different topics in life science (IIT1).

T1 felt that time during the workshop was not enough and he would like these kinds of workshops to be conducted on a regular basis so that life science teachers acquire more information about the inclusion of EL in life science because he feels that teachers are not well prepared when it comes to environmental learning inclusion through training. He said:

Teachers need to be well prepared so that they are aware of how they should include environmental learning in life science. The problem is only when we were trained as teachers this topic was not discussed in more detail so you find yourself teaching but the moment you are teaching you include environmental learning but you are aware that you are already including environmental learning in your teaching (IIT1).

T1 also added that when he was in grade 10, he attended a workshop conducted by Enviroteach project which was about environmental learning. He said, in the workshop they were given a certain topic which he cannot remember, on how to link this topic to environmental learning. *“When I become a teacher I realise that this workshop was connecting subjects to environmental learning”*. T1 acknowledged that both workshops were useful and the school received resources from Enviroteach project which he is using when including environmental learning in life science (IIT1).

T2 indicated that she received several training workshops on teaching environmental education topics in life science and these workshops were conducted by the life science project *“but nowadays no training workshops from this subject advisor of us”*. She indicated that teachers need to be well prepared on inclusion of environmental learning and stated that the subject advisor must be committed and train teachers on how to go about the inclusion of environmental learning because most teachers lack this knowledge. She further stated that *“the*

workshop I got in the 1990s was very useful because some of the information and material I am working with among my learners are from those workshops” (I2T2).

While T3 said she attended several workshops conducted by circuit life science facilitators on identifying topics which life science teachers have problems in teaching them and teachers show each other on how to go about including environmental learning in the topic identified. She added that *“up to now so far, I did not get any training or guidance on the inclusion of EL in life science from the subject advisor” (I3T3).*

In terms of support from the management, T2 said that the management support the inclusion of EL by including environmental activities in the school calendar of activities such as cleaning campaign for the school environment and the labour day celebration in which learners and staff members do plant trees at school and there are also planned tours on the school calendar (I2T2).

While T3 said *“the school management give us money to buy fruit trees extra support materials such as spray cans and polystyrene products to use in the classroom” (I3T3).*

T1 shared the similar sentiment by saying, *“the school management support us financially by giving us money to go buy other support teaching materials such as biology modules at NAMCOL centre”*. He added that apart from financial support, the management also provide opportunity for learners to be taken out for tours. T1 further indicated that he get support from the management example HODs on how to include EL in topics like global warming (I1T1).

Coming to the support provided by the school policies and practices, T1 said, the school policy gives opportunities for outdoor teaching including tours, for instance the school policy stipulates that learners should be given projects, research or assignments to go and ask experts information on a certain covered topic in the classroom. He further stated that *“in the school policy it is clearly stated that if you want to take your learners for a tour and there is enough money or you are having a transport, you are free to do it” (I1T1).*

T2 said, the school policy has allowed them to come up with the school garden, provide opportunity for life science teachers to purchase garden tools, seeds, seedlings and anything needed in order to develop the school garden (I2T2).

T3 also indicated that the school policy has allowed them to come up with an orchard which they make use when learning about some of the environmental learning topics. She added that *“the school also allowed us to explore the environment for instance leaving the school and go to the nearby environment around the school” (I3T3).*

All teachers acknowledged the support they received from parents and community members.

the parents in our community do also take part in activities related to environmental learning especially when I send my learners to them for assistance from them, then they will just respond positively for instance if I ask learners to go and ask information from them on deforestation, soil erosion etc (I2 T2).

T3 acknowledged that

yes parents and community members support us a lot because if I happen to assign learners to do something and if that something needs the input of the parents, parents use to assist the learners for instance I use to ask learners to get some information from parents related to environmental learning and they do provide (I3T3).

T3 also added that parents do contribute financially towards school activities such as tours and cleaning campaigns (I3T3).

T1 indicated that parents get involved very well when asking for information based on topics like ecology, cleanliness and classification of living organisms, here parent or community members do provide lots of information

But when asking information based on the topic of sex education, you will only find few who will be interested to provide the information required. Some will not give learners more information due to cultural background and traditions that parents or elders should not discuss sex related issues with children (I1T1).

T1 added that parents do also support the school by paying School Development Fund (SDF) and this money are used to buy extra teaching materials that support the inclusion of environmental learning. He also said *“parents and community members are always willing to contribute toward school tours” (I1T1).*

All teachers indicated that other teachers at school are supportive when it comes to the inclusion of environmental learning.

T1 said that he use to get support from the agriculture and geography teachers on topics like global warming and deforestation.

I use to ask them if I got stuck for example in geography when it comes to ecology, I go and ask for more information example how they do tackle this topic and how do they attach it to environmental learning, and these teachers are always willing to help (I1 T1).

T2 stated that

when it comes to the teachers at our school, they are very supportive for instance if we produce products from our garden, they use to buy them and sometimes they use to remind my learners to go and do their garden activities especially to go and water the garden.

She also said that she use to get support especially from the geography teachers when she is teaching the topic of global warming (I2 T2).

While T3 said

teachers support positively especially the agriculture teacher because we work together when coming to activities like growing fruit trees in the orchard. I also use to conduct the geography teacher like when it comes to global warming topic for instance how to present it to the learners and when it comes to plants, I use to ask the agriculture teacher for support and these teachers respond positively (I3 T3).

Teachers also named some enablers and constraints that influence the inclusion of environmental learning.

Table 4.5 below provides a summary of the named enabling and constraining factors of environmental learning inclusion.

Table 4.5 Summary of teachers' views on enabling and constraint factors of environmental learning inclusion

| Teacher | Constraints/Enabling |
|---------|---|
| T1 | Time, lack of resources, money, lack of transport, insufficient information from parents, passive participation of learners in sex education, cross curricular, teachers' interest, community support, school policies and practices, class size, lack of exposure, internet |
| T2 | Insufficient time, lack of resources, parents involvement, cross curricular, other teachers, community support, management support, school policies and practices, vastness of the syllabus/topics, lack of environmental learning materials(charts, games, audio visuals), learners interest, lack of textbooks, teachers' experience, learners not seeing themselves as part of teaching and learning |
| T3 | Lack of environmental teaching materials(posters, pictures, charts) time, lack of textbooks, lack of concrete materials, teachers' interest, cross curricular issues, parental involvement, class size, management, community support, other teachers' support, school policies and practices, learners interest, lack of knowledge among learners. |

4.3.7.2 Resources and textbooks

One can deduce from teachers' responses (Table 4.5) that lack of resources is some of constraints to effective inclusion of environmental learning. All teachers indicated that generally resources to teach environmental learning are not sufficient. They pointed out that they experienced challenges such as lack of environmental learning materials (such as posters, audio-visuals, charts, pictures and games), reference books and shortage of textbooks. For example T2 said that learners do have textbooks but they are not enough, they do share but each learner need to have his/her own textbook especially the Discovering Life Science textbooks are effective because they cover the syllabus objectives. She added that *"we have a library that does not provide enough reference books to provide relevant information about environmental learning"* (I2T2).

T3 said she experienced problems like shortage of teaching materials for example concrete materials that can really make learners understand such as video clips, charts, games pictures and posters. She added that *"when coming to teaching materials, I have to struggle to get real teaching materials to get into the classroom but... that cannot really prevent us to like going ahead with the topic"* (I3 T3).

4.3.7.3 Time and time management

All teachers said that time allocated for life science which encompasses environmental learning is not enough.

T1 said:

time given to life science which include environmental learning is not enough, for instance I have to send my learners to go in the community to find information on a certain topic, if you are doing this during the lesson/period, time will not be enough cause the moment you go there, you find that learners want to get more information so they are asking lots of questions so 40 minutes will be over without completing what you were doing. That's why practical activities and research, I normally use to do these activities during the afternoons; this also allows me to complete the syllabus because it's too broad. Actually 40 minutes is not enough for EL inclusion because it requires practical activities which requires learners to go into the community and local environment to identify and look at environmental issues or do researches on environmental issues in their community (I1T1).

T1 however, indicated that afternoon classes are always a challenge because in the afternoons the number of learners is ever decreasing. *"Learners are always in small numbers during afternoon activities"* (I1T1).

And T2 explained that:

Time is not sufficient to make teaching and learning process of EL more effective because life science is given only 4 periods a week even though the syllabus is too long especially that one for grade 10 and that's way it will be good if additional two periods will be given to life science to be six periods a week. This can be better because it will enable us to complete the syllabus on time and will enable us to use the additional periods for practical activities and carry out projects with learners. I use to manage my time properly, if not I could not cover my syllabus because my first priority is to make sure that I complete the syllabus (I2 T2).

T2 said because 40 minutes is not enough, she is forced to teach in the afternoons in order to complete some tasks “*this is a problem again as learners are always missing afternoon classes*” (I2T2).

T3 indicated that:

There is no specific time for EL but time that is allocated to life science lessons it is not enough for us to explore the environment and to include EL in our lessons especially life science lessons. So our 40 minutes is insufficient, there is no double periods and this is a major concern we have been raising, because sometimes one need more than 40 minutes but you just can't, so you are forced to do projects and researches or practical activities in the afternoons but sometimes learners are missing out so the number of learners in the afternoon is always not the same (I3T3).

She stated that teaching in the afternoons enables them to complete the syllabus because the grade 10 content is too broad (I3T3).

4.3.7.4 Teachers' knowledge and experience

All teachers indicated that they acquire environmental knowledge necessary for environmental learning inclusion through workshops, studies and experience. They indicated that they are fairly knowledgeable when it comes to environmental learning and they have no doubts when teaching environmental learning. T1 and T2 said the experience they have makes them better prepared in terms of teaching and assessment strategies and because of their experience, they are more comfortable teaching environmental topics. T3 estimated her environmental knowledge to be 70% by saying,

I think I am more exposed in terms of knowledge in environmental learning and the experience I have play a major role when it comes to the inclusion of environmental learning. To me teaching environmental learning is an advantage because I am a science teacher and I have been exposed to environmental learning during my studies at the college and university so I have covered 70% of environmental learning (I3T3).

T1 said he acquired environmental learning knowledge through Enviroteach project workshop while he was in grade 10, where they were addressed on a certain topic on how to link that topic to environmental learning. He also said he acquire environmental learning knowledge through his study at the college of education although he feels there were few

environmental focus or content in the course (BETD course). He further indicated that he acquire environmental knowledge through life science workshop conducted by advisory teacher and also from other teachers at school or neighbouring schools by asking them how to go about certain topics and how to include environmental knowledge.

T2 indicated that

I acquire the environmental knowledge necessary for inclusion of environmental learning just through learning/studying and in the early 1990s the Ministry of education use to give us workshops through this Danish project called life science project and is where I acquired some of the environmental knowledge (I2 T2).

T3 said:

I acquire environmental learning knowledge through circuit based workshops conducted by life science facilitators whereby life science teachers come together and identify topics which they have problems including environmental learning, and we show one another on how to present topics identified. And I also get this knowledge when I was studying at the college and at the university but during our time environmental learning content were few (I3 T3).

4.3.7.5 Learners participation

T1 mentioned that some of the factors constraining environmental learning are lack of learner participation in some topics due to cultural believes and exposure of few learners to environmental learning.

He said:

Learners respond according to the topic being discussed, if the topic is interested or learners are more interested in a certain topic, you see everybody is fully involved or participating. But coming to topics like sex education only few will be participating otherwise learners are more passive in this topic because of culture or traditional background for instance in our culture things related to sex are not openly discussed and elders do not discuss this issues with children so this lead to lack of interest among learners in sex education leading to poor participation. But if you come to topics like classification of living organisms, ecology here almost everybody will be more active, actively participating (I1T1).

T1 also indicated that few learners in my class are not exposed to environmental learning so their knowledge is limited and so their participation.

While T2 indicated that

for instance in response to what learners are asked to bring, for example if I ask them to bring example different plants to the classroom to be used to differentiate between monocotyledon and dicotyledon plants, most of my learners try by all means to do or bring what they are asked to do, which means that most of my learners respond positively to practical activities which are related to environmental learning although there are few learners who do not participate because they do not see themselves as part of teaching and learning (I2 T2).

And T3 stated that:

Learners respond positively to environmental learning, they really like it because they are familiar, like if you are talking about plants they are familiar to plants, there are plants in their environment even in their villages there are plants and if you are talking about the deforestation, learners are familiar to deforestation and it's taking place in their community, they really respond positively to environmental learning but the problem I am experiencing here is lack of knowledge among learners for example if you ask them the effect of deforestation to organisms, they will be struggling to get the correct answers (I3 T3).

4.3.7.6 Project work on environmental learning at schools

Teachers were however asked if there were any project work that has been done on environmental learning at their schools. All teachers indicated that there are projects at their schools that help with the inclusion of environmental learning. T1 and T2 said that they have gardens at their schools where learners do practical activities such as planting crops, learning how to prepare the soil or how to sow; the depth or space between plants, practicing mulching and also practicing the process of transpiration i.e. how plants lose water through leaves, this enables learners to practice their knowledge as well as their skills. They also indicated that apart from project work, they do cleaning campaigns at their schools to keep their school surroundings clean and the cleaning campaigns are in the schools' calendar of activities. *"Cleaning campaigns enables learners to understand the importance of keeping the school clean"* (I2T2).

T3 said:

The project work that have been done so far at school to support environmental teaching about monocotyledon and dicotyledon plants, to look at the leaves, flowers and they can also figure out the types of roots which are there example tap roots, that is the only way you can use an orchard(I2T2).

T3 added that the school also do cleaning activities in order to keep the school ground clean (I3T3).

4.3.7.7 Class size

T1 and T3 explained that class size is a constraint to effective inclusion of environmental learning. They stated that some classes have 40 to 42 learners. They indicated that even if they put learners in groups, groups are too large and a 40 minutes lesson is not sufficient to supervise every group. T3 added that, *"yes learner centred should be used...but when it comes to large classes it's just impossible to make use of learner-centred"* (I3T3). But T2 said she has 29 learners in her class which are controllable.

4.3.7.8 Teachers' interest and experience

T1 and T3 indicated that their interest for environmental learning enables them to teach environmental learning.

"The love I have for nature makes me interested in teaching environmental learning topics in life science. My love and interest for nature influence my interest in teaching environmental related topics" (I1 T1).

And T3 said she finds environmental learning interesting because of her interest, it allows both teachers and learners to explore their environment and find possible solutions to environmental issues such as deforestation overgrazing and pollution (I3T3). T2 stated that because of the experience she has, she finds it easier to include environmental learning in life science, because she already know what and how to teach and what types of projects to give to learners in different environmental learning topics. *"Teaching the same thing for a long period and teaching it over and over it becomes easier" (I2T2).*

4.3.4.9 Inclusion

All teachers indicated that environmental learning is taught across the curriculum, which makes it easy to include it.

4.4 TEACHING PRACTICES

This section will present data of what was observed in the different environmental learning lessons. The data includes the methods used by teachers to present environmental leaning as well as other aspects that helped me answer the research question. As stated in the methodology chapter, 6 lessons were observed for this study and they are coded LO1 to LO6. (See Appendix 7). The lessons have been numbered according to teachers and not necessarily according to when observed.

4.4.1 Written teaching preparations

In all lessons observed, only in LO3, LO4, LO5 and LO6 (See Appendix 7) teachers had lesson plans that reflected and specified the inclusion of environmental learning in some way. The written lesson plans followed standard form for lesson planning designed for each school. Some lesson plans were incomplete for example T2 lesson plans did not indicate monitoring of homework done and no reflections.

T3 indicates that there is no monitoring of homework done and did not also indicate reflection. Different teachers planned different lesson based on the syllabus topics and lesson objectives. Topics covered are shown in Table 4.7.

Table 4.6 Lessons observed from different teachers

| Teacher | T1 | T2 | T3 |
|-----------------|--|----------------------|---------------------------------|
| Lessons | LO1 – LO2 | LO3 – LO4 | LO5 – LO6 |
| Topics observed | Infectious diseases, Prevention & curing of diseases | Global warming, STDs | Six kingdoms, Global warming |

Table 4.7 below provides an extract from the syllabus to show how the topics, the learning objectives and basic competencies to be achieved are represented

Table 4.7 A sample of learning objectives and basic competencies in the syllabus.

| TOPIC | LEARNING OBJECTIVES LEARNERS WILL: | BASIC COMPETENCIES LEARNERS SHOULD BE ABLE TO: |
|---|--|--|
| 1.3 Infectious diseases (T1) | -Understand the transmission, symptoms, effects, transmission of common infectious diseases, including malaria in Namibia | - List common infectious diseases in Namibia and discuss their social implications - outline different ways of infectious diseases - Describe the life cycle of the malaria parasite - Describe the symptoms of malaria, the impact of malaria on one's health and discuss ways of treating the disease |
| 1.4 Prevention & curing of diseases (T1) | -Understand vaccination as a defence mechanisms against infectious diseases and realise the importance of traditional medicine in the prevention of diseases | -Recognise vaccination as a defence mechanism against infectious diseases -Explain vaccination as immunization process -Discuss the importance and role of traditional medicine in the prevention of diseases |
| 8.1 Global warming | - Understand how some gases create | - Identify carbon dioxide, methane, |

| | | |
|--------------------------|---|--|
| (T2 and T3) | gases a greenhouse effect causing global warming - Know local and global ecological effects of global warming on the environment | CFCs and nitrous oxide as gases causing global warming - List and describe the activities that release carbon dioxide, methane, CFCs and nitrous oxide in to the atmosphere |
| 1.2 STDs (T2) | - Understand the transmission, symptoms, effects, treatment and ways of preventing the transmission of common (STDs) | - Describe the transmission, symptoms, effects and treatment of common sexually transmitted diseases and suggest ways how to prevent transmission of STDs |
| 5.1 Six kingdoms (T3) | - Realise that organisms are divided into six kingdoms and know diagnostic features of each group | -Describe the diagnostic features of a monocotyledons and dicotyledons as found in their local environment |

(Source: Namibia. MOE, 2006)

The topics indicated in the table above represent the topics, learning objectives and basic competencies taught by different teachers during observations.

4.4.2 Teaching strategies observed

Some of the teaching strategies observed are as follows:

Teaching strategy1: Use of learners' prior knowledge

The lesson observed did not really show how the teachers used the learners' prior knowledge; although there were some instances in the lessons where teachers drew on their knowledge. For example in LO1 the teacher asked learners to tell what is an infectious disease and asked them to name any diseases they know, write them on the chalk board and let learners identify among the diseases they mentioned, the common infectious diseases in Namibia. This leads to T1 explaining different ways of transmission of common infectious diseases in Namibia.

In some lessons, example in LO2, the teacher asked learners to come up with traditional medicines they know or use at home, introducing the topic on prevention and curing of diseases. While T2 wrote different diseases on the chalk board and asked learners to identify diseases which are known as STDs and asked them to define what does STDs stands for. In LO5 the teacher asked learners to identify plants in their environment that belong to the class of monocotyledon and dicotyledon. And in LO6 the teacher asked learners to define greenhouse effect, global warming and let them come up with different greenhouse gases they know as an introduction to global warming.

Teaching strategy 2: Use of local example

The use of local examples was one of the strategies used by all teachers when explaining and clarifying things to learners. However, the examples did not really spark off discussions during lessons.

In LO3 and LO6 the teachers gave local examples of human activities practiced in the community which contribute to global warming such as deforestation.

people in our community are cutting down trees to build traditional houses, for fire wood and to make mahangu fields, these lead to increased levels of carbon dioxide as plants and trees help to reduce the amount of carbon dioxide in the air by photosynthesis (T3).

T2 gave example of flood which used to occur in the northern part of Namibia as a result of global warming. In LO5, the teacher used local plants like mahangu (millet), beans and local grasses to describe the diagnostic features of monocotyledon and dicotyledon plants as found in their local environment. And in LO6, the teacher shows learners some of the products that release CFCs in to the atmosphere such as spray cans; polystyrene products and she refers learners to the local environment to observe activities such as deforestation and fuel consumption at home that release gases into the atmosphere.

Teaching strategy 3: Asking questions and teacher presentation

The strategy which was used mostly by all teachers was questioning. Questions were the predominant method through which content was taught to the learners. Teacher presentation was also regularly used as every question asked was usually a result of teacher presentation or accompanied by teacher presentation. Here are some examples of how teachers used questions during the lessons:

Example 1: LO1

T1 had just finished introducing the lesson with a short recap of what was done on Sexually Transmitted Diseases (STDs) in the previous lesson. He then asked some questions:

Teacher: *What is an infectious disease?*

Learner: *is a transmissible disease caused by parasitic foreign organisms in the body.*

Teacher: *Name any infectious diseases you know?*

Learner1: *Tuberculosis, cholera and malaria.*

Learner2: *Bilharzia and dysentery.*

Teacher wrote the diseases mentioned by learners on the chalkboard and asked them to identify the common infectious diseases in Namibia among the diseases learners mentioned.

Learner: *Common infectious diseases in Namibia are tuberculosis and malaria.*

Teacher added common infectious diseases in Namibia apart from the one mentioned such as STDs, bilharzia, cholera, dysentery and influenza.

Learner: *Sir how are these diseases passed on from one person to another?*

Teacher explained more on how different infectious diseases are transmitted and gave examples.

Learner: *Is AIDS also one of the infectious diseases?*

Teacher: *Yes AIDS is also one of the infectious diseases (Teacher explained and gave examples).*

Teacher: *How do infectious diseases affect the society?*

Learners: *Children become orphans because some fatal infectious diseases like AIDS, malaria and tuberculosis take lives of parents, leaving some children as orphans.*

Teacher explained more on the social implications of infectious diseases and explained more on the life cycle of malaria parasite using the diagram in the textbook page 44.

Teacher: What are the symptoms of malaria?

Learner1: *High blood temperature reaching up to 40 degrees Celsius and vomiting.*

Learner2: *Severe headache and sweating.*

Teacher added high fever, severing and colds at regular intervals and anaemia due to destruction of red blood cells.

Teacher: *What are the impacts of malaria on one's health?*

Learners: *Cause death, weakens the body and reduces labour and manpower.*

Teacher added some points on the impacts of malaria on people's health and explained ways of preventing and treating malaria wrote a short summary of main points and homework on the chalkboard and then, asked learners to copy into their books.

Learners started copying the summary and the homework; bell rang while they were still copying.

Teacher: *Make sure you are done copying before you go.*

Example 2: in LO4

Teacher: *What is global warming?*

Learner: *is the raise of temperature in the atmosphere all over the world above normal.*

Teacher: *What are gasses causing global warming?*

Learner1: *Carbon dioxide, methane.*

Learner2: *CFCs and nitrous oxide.*

Teacher: *What are the activities that release carbon dioxide, methane, CFCs and nitrous oxide into the atmosphere?*

Learner1: *Carbon dioxide is released by activities such as fuel combustion at home, in factories, mines and motor vehicle engines and cutting down of trees.*

Learner2: *Nitrous oxides are produced when people are driving cars.*

Teacher: *How does driving cars produce nitrous oxides?*

Learner: *Oxide of nitrogen are produced when nitrogen gas in the air burns in a car engine and the oxides of nitrogen come out of the car engine through the exhaust as exhaust fumes.*

Learner: *But Mrs. What activities release CFCs?*

Teacher explained with examples on the activities that release CFCs, Carbon dioxide, methane and nitrous oxide into the atmosphere.

Teacher: *What are the ways of reducing the release of gases causing global warming?*

Learner: *Come up with local measures such as sensitising people on the effect of air pollution and global warming.*

Teacher added that people can be educated on how to avoid heat stroke and how they can modify their houses to keep them cool in hot weather without the use of air conditioners.

Teacher: *How life in Namibia might be changed by global warming?*

Learner: *Global warming may cause flood which may result in the raise of sea level and flooding of coastal towns of Swakopmund and Walvisbay.*

Teacher explained with examples more on how life in Namibia might be changed by global warming, wrote a summary of main points and homework on the chalkboard. Learners copied the summary and the homework in their books.

The teachers asked lots of questions and most of questions asked in the lessons promoted factual recall for instance in LO1, teacher asked “*what an infectious disease*”? “*Name any types of diseases you know*”? “*What are the symptoms of malaria*”? in LO3 “*What does STDs stands for*”? in LO4 “*What is global warming*”? in LO6 “*What is greenhouse effect*”? “*What is global warming*”?

In some cases teachers also probed further in order to encourage critical thinking among learners, for instance in LO1, LO2 and LO4 learners were asked the following questions:

“How do infectious diseases affect the society”?, “*What are the impact of malaria on one’s health*”? “*How life in Namibia might be changed by global warming*”? “*How does driving cars produce nitrous oxide*”? “*What are the importance and role of traditional medicines in the prevention of diseases*”?

Teaching strategy 4: Explaining and giving summaries/Notes

In all lessons, teachers explaining content was as common as the questioning strategy. Each lesson presented to the learners was fully explained and explanations were sometimes supported with examples. However, theoretical understanding in learners coming from these explanations was an issue of concern especially since their explanations were supported by examples from the textbook which is the only reference they used for the subject. In most lessons learners were not shown practical examples except in LO5 and LO6, were in LO5 the teacher showed learners local plant specimens to describe the diagnostic features of monocotyledon and dicotyledon plants and in LO6, the teacher showed products such as spray cans and polystyrene products when explaining different products that release CFCs in

the atmosphere. It was however observed that all teachers gave learners comprehensive and understandable summary of the main points for almost every lesson taught.

Teaching strategy 5: Projects and investigations

As indicated in section 4.2.1, the syllabus has suggestions for investigations, for example for the topic of STDs taught in LO4 learners should be given opportunities to visit the clinic, hospital or health centre to collect information on STDs.

Learners were asked to describe the transmission, symptoms, treatment and to suggest ways to prevent the transmission of (STDs) syphilis in particular in LO4 but did not have a chance to visit the clinic, hospital or health centre.

In LO6 learners were assigned to do a research on global warming whereby they had to bring articles and published stories on global warming. Learners were also assigned to make posters with information on awareness to reduce gases causing global warming. Although the syllabus suggested for investigation and report on the impact of global warming on the ecosystem, this was not done in LO6.

In LO5, the teacher assigned learners to collect diagrams of monocotyledons and dicotyledons and study their differences and similarities. While in LO1 learners were assigned to collect information at a local clinic on how to reduce the prevalence of malaria.

In LO2 learners were given an assignment to collect and report on locally used examples of traditional medicine and discuss how and for what they are used.

Teaching strategy 7: Assessment

Various assessment methods were observed in some of the lessons. For example, home work was given in all lessons observed i.e. LO1-LO6, test were announced in LO3, LO6 and LO1. It was observed that assessment was mostly done individually than groups or pairs.

Teachers gave clear instructions for assessment, normally by writing on the chalkboard for example, in LO3 the teacher wrote on the chalkboard: Homework: The distraction of Namibia woodlands may lead to global warming; suggest the role of trees in the prevention of global warming. And in LO4 “Homework: collect information from the parents how a syphilis infected person should be traditionally identified.” Even though there was assessment done in all the said lessons, no individual marking or monitoring of work or feedback was

given in the observed lessons. This made it impossible to analyse learners' work and progress in different lessons. Some questions given for assessment were more structured (See appendix 6).

4.4.3 Other enabling and constraining factors influencing environmental learning as observed

4.4.3.1 Learner participation and motivation

According to my observations there was minimal learners' engagement in most lessons; in all lessons, it was observed that the teachers talked most of the time. They initiated the content and activities, learners experience and knowledge were not explicitly used in instructions. Learners mostly sat listening to the teacher presenting the lesson, except taking notes and reading sentences in their textbooks and answering questions asked by the teachers and very few ask questions. This was evident in LO1, LO2 LO3, LO4 and LO5 but in LO6 learners were involved in group discussions and presenting their findings or answers. Learner to learner interaction was only observed in group discussions in LO6 thus there was hardly learner to learner interaction observed in LO1, LO2 LO3, LO4 and LO5. Most interactions happened between teacher and learner.

4.4.3.2 Using teaching aids and textbooks to bring out environmental learning

In my observation, the chalkboard and the textbooks were the main teaching aids used (See Appendix 7). The lesson topic, lesson objectives, summaries and instructions were all written on the chalkboard. However, even though the chalkboard and the textbooks were the main teaching aids used, they did not fully engage learners except to copy the notes, instructions for the home work and read sentences in the textbooks based on the topic discussed. In most cases learners were not able to complete copying summaries.

In LO5 and LO6, the teacher used various teaching aids such as such as plant specimens, polystyrene products and spray cans. These teaching aids engaged learners as they were able to observe the specimen plants and describe their diagnostic features. And learners were able to see different products that release CFCs in to the atmosphere and ask questions on how these products release CFCs. This leads to learners suggesting measures to be taken against products that release CFCs in the atmosphere.

It was observed that in most lessons learners had textbooks which they were sharing. The textbooks were used either to teach learners in the classroom or for learners to complete the

tasks. In some lessons, the teacher referred learners to the textbooks for clarity of the content being taught or for homework. For example in LO3, *“for more information on syphilis and its transmission, signs and symptoms, effects, treatment and prevention, go to page 42 of your textbook”* and in LO1 *“for homework, go to page 46”*. I observed that T1 and T2 classes had no displays on the walls. In T3 class there was a lot mixed wall displays among them were four posters made by learners and three posters on different ecosystems.

4.4.3.3 Time and time management

All lessons observed were on a 5 day cycle, 40 minutes each and there are no double periods (See Appendix 10).

4.4.3.4 Classroom conditions

Some classes are full; T2 class does not have enough desks therefore in LO3 some learners remained standing for the whole lesson due to lack of chairs. All classes have a random sitting arrangement.

4.4.3.5 Inclusion

In some lessons, the teacher encouraged learners to use knowledge from other subjects to answer questions for example in LO3 and LO6 teachers asked learners to use their geography knowledge to define global warming and deforestation and to use their physical science to describe the composition of gases in the air. Teachers were asked after the lesson observations on their intentions and how and where they included environmental learning in their lessons. Here is what they said: In LO1, the teacher indicated that his intention was to make learners understand the social implications and transmission of common infectious diseases including malaria in Namibia. The teacher stated that he included environmental learning in his lesson by letting learners list common infectious diseases in Namibia and state their social implications. *“I also included environmental learning when I assigned learners to collect information from a clinic or hospital on how to reduce the prevalence of malaria”*. T1 further said that environmental learning was also included in the lesson when he described the symptoms of malaria, the impact of malaria on one’s health and explained ways of treating the disease.

In LO2, the teacher said that the intention of the lesson was to let learners know ways in which people’s health can be affected by the physical and psychological dimensions of the environment and the importance of human biology in promoting healthy living. *“In this*

lesson, I included EL when I ask learners to tell how people's health depends on and can be affected by psychological imbalances, example stress and physical condition". Apart from that, the teacher also indicated that he included environmental learning in the lesson when he explained to the learners how social living conditions and the functioning of the human body can contribute to healthy living. T1 also indicated that he included EL when he assigned learners to do a survey of the local environment and relate it to the health of the people.

In LO3, the teacher said that her intension was to make learners aware about the problems that occur in the environment especially the problem of global warming. She further stated that *"I think the whole topic is about environmental learning especially when we talked about the destruction of plants that it can cause or is the main cause of global warming".*T2 indicated that when she explained how global warming occurs and its causes for example when she asked learners to mention human activities that contribute to global warming; this is where she included environmental learning. She further indicated that the home work she gave to learners also allowed her to include environmental learning (See Appendix 7).

In LO4, the teacher indicated that her intension was to make learners aware of the dangerous STDs among them, to let learners know how to prevent themselves from being infected and also to know the effects which might result when they are infected. T2 said

"I think I included EL in this lesson when I asked learners to give the effects of syphilis and when I asked them to explain how the disease is treated for them to know whether the disease can be treated or not and also to know how to prevent the spread of syphilis".

T2 further said that she also included environmental learning in her lesson through asking questions on the transmission, prevention and treatment of syphilis and the main cause of the disease.

LO5, the teacher said that her intension was to let learners aware about the monocotyledon and dicotyledon plants in the environment, to be able to identify them and identify their differences and similarities. She stated that she included environmental learning in her lesson when she asked learners to identify some of specimen plants and also to give some examples of dicotyledons and monocotyledons found in their environment apart from the one in the classroom.

Therefore, I included environmental learning by letting individual learners identify those plants into monocotyledons and dicotyledons, looking at their characteristics and that is how I included it.

T3 also indicated that by assigning learners to collect diagrams of monocotyledons and dicotyledons and study their differences and similarities also showed an inclusion of environmental learning.

And in LO6, the teacher stated that her intension was to let learners aware about what is global warming and the effects of global warming in the environment. The teacher said,

I included environmental learning when I refer learners on activities like deforestation, when people are cutting down trees to make their houses which will lead to the increase carbon dioxide in the atmosphere. I also included EL when I showed learners some of the products which release CFCs in the atmosphere

She further indicated that she included environmental learning when she asked learners to list and describe the human activities in their groups that release carbon dioxide, methane, CFCs and nitrous oxide into the atmosphere. The teacher also indicated that environmental learning was included when she assigned learners to do a research on global warming whereby they have to bring articles and published stories on global warming and also to make posters with information on awareness to reduce gases causing global warming.

4.4.3.6 Teachers knowledge

It was evident from my observation that teachers were confident when teaching environmental learning especially the way they introduced and used new concepts; this was observed in terms of body gestures and language used a lot of environmental knowledge terminologies with ease. For example deforestation, global warming, and combustion and the way teachers spoke with confidence. Teachers did have knowledge on the learning objectives presented and had, in most cases, addressed the assessment objective verbs (See section 4.2.1.3). In most lessons there were no detailed explanations that went beyond the syllabus objectives.

4.4.3.7 Teachers' pedagogical style

The teachers' pedagogical style seems to prepare learners for both examinations and everyday life. Teachers used almost similar pedagogical methods to present the content during the observed lessons.

4.4.4 The learners' work/handouts and resources

Learners were given handouts in some lessons. In LO3 and LO6 they were given handouts for the summary on global warming, in LO5, they were given handouts on classification of the plant kingdom (plantae) and comparison between monocotyledons and dicotyledons.

In LO2 learners were given handouts on human biology and health. In LO4 was a question and answer lesson, thus the questions on the handouts were on the questions done in the

classroom (see Appendix 11). It was observed that teacher ask more recall questions and few questions that encouraged critical thinking (See Appendix 6).

4.5 CONCLUSION

In this chapter I have presented findings from interviews, lesson observations and document analysis. I shared information on how environmental learning is taught in Namibia, in life science curriculum. It provided a profile of all the participants in the process and a detailed description of the study is through ‘thick description’. There were few disparities between the curriculum, what the teacher said and what they did in their actual practices. A number of enabling and constraining factors were identified through the analysis. The next chapter reviews the findings as presented in this chapter in more depth. It provides a critical discussion of these, drawing on insights into curriculum inclusion and the Namibian education system as outlined in chapter.

CHAPTER 5

DISCUSSION OF FINDINGS

5.1 INTRODUCTION

In this chapter I discuss the insight on inclusion of environmental learning in the Life Science curriculum. The discussion is authenticated by pointing to the evidence as presented in chapter 4 and making reference to main ideas and concepts highlighted in the literature review. In discussing the findings I came up with analytical statements that directly relate to the research question informing this study as described in chapter 3. In line with the goals of the study, six analytical statements are discussed, out of which I will make my concluding remarks regarding the inclusion of environmental learning in the context of Namibia's Life Science curriculum practice.

- Analytical statement 1: Teaching strategies for the inclusion of environmental learning are evident in life science curriculum practices.
- Analytical statement 2: Teacher knowledge and interest in environmental education influence how they include environmental learning.
- Analytical statement 3: Disparities exist between the policy of including environmental learning (theory) and its inclusion in teaching practices.
- Analytical statement 4: Teaching of environmental learning is mostly informed by the textbook.
- Analytical statement 5: Assessment practices narrow the scope of environmental learning in ways that do not include critical thinking and problem solving skills.
- Analytical statement 6: Despite diverse constraints inhibiting inclusion, the evidence suggests that the existing policy of including environmental learning in Namibia's Life Science curriculum can enable environmental education.

These analytical statements will be discussed in detail and will be used to make main recommendations in chapter 6.

5.2 Analytical statement 1: Teaching strategies for the inclusion of environmental learning are evident in Life Science curriculum practices

From the evidence obtained through interview interactions with life science teachers and document analysis, the study found a range of teaching strategies and best ways to include environmental learning, this includes learner centred method, outdoor tours, making use of experts, using the local environment and community, inquiry, practical investigations, surveys, group work and presentations and experimental methods (DI, D3, T1, T2, T3) (see section 4.3.4, 4.3.5 and 4.2.1.1). In this regard, Kostova & Astasoy (2008) noted that successful inclusion of environmental learning depends on the teaching and learning methods used. In the same sentiment, KethLoilwe (2003) supports the use of learner centred, participatory and active learning methodologies when including or facilitating environmental learning in formal education. Kostova & Atasoy (2008) also argues that a mixture of teaching and learning methods oriented towards agency, capabilities, social and structural changes are likely to achieve environmental objectives and examples of these methods are; active learning, investigation/experimental learning, group work, field work, observations and collaboration. In support of this, the Namibian Ministry of Education (2009) states that learner centred education techniques are based on involving learners in the learning process. This is done by using different teaching techniques such as group work, project work, eliciting prior knowledge, drama and role plays. Loubser (2008) emphasises that effective inclusion of environmental learning has to move away from teaching and learning approaches based solely on transmission of knowledge. It has to move towards approaches which encourage development of qualities such as initiative, reflection and responsibility in relation to the environment. It has to foster values and attitudes which influence behaviour and action. Thus he also support learner centred approaches for stimulating and maintaining learners' interest in the environment. This is also supported by Lotz- Sisitka et al. (2006) by reporting on ESD practices and noting that learner centred, active approaches to learning are strongly supported in Southern African Environmental Education/ESD. In the same note, Lee (1997) states that successful inclusion of environmental learning in life science curriculum will depend on teachers chosen methods for teaching and learning. Hogan (2008) also supports the use of learner centred approaches, where she emphasises the use of everyday contexts and experience for meaningful learning. She argues that using everyday contexts involve learners in classroom activities that increase learners' confidence in solving local issues.

UNEP (2006) supporting Hogan (2008) argues that study of issues and concerns related to the environment should engage learners and should be relevant to their communities. With environmental learning, learners are regarded as constructors of their own knowledge rather than reproducers of others' knowledge. Learners should thus, take a more active role in their own learning, become co-learners and co- investigators with their teachers in a collaborative learning process. This is also supported by the Enviroteach and SEEN projects that emphasise enquiry based teaching approaches and action competence development. In this regard Hogan (2008) found out that integrating local environmental cultural knowledge successfully contributes to curriculum relevance both epistemologically and pedagogically. It also fosters stronger school-community relationships. It involves teachers and communities in ethical deliberations about environmental concern. From this status it is possible to deduce that the inclusion of environmental learning will be successful if life science teachers consider the contexts of learners' participation and involvement when planning and teaching environmental topics.

Monroe & Kaplan (1988) claim that involving learners in action projects can help learners become environmental problem solvers and this is what life science teachers have indicated with regard to environmental learning inclusion i.e. that is one of the ways they include environmental learning in life science. For example taking learners outside the classroom to a nearby environment to familiarise themselves with the real situation or giving projects or research for learners to go and ask information related to environmental topic the teacher want them to find. Once again, Monroe & Kaplan (1988) supports action projects due to the fact that they offer opportunity to practice resolving local issues with teacher and peer support. They argue that learners would become empowered in a sense of success and develop action-taking skills. This resonates with the views of Posch (1993, p. 11) who stated that "an important condition to develop values which are environmentally sound is to involve students in actions which they are able to leave traces and in which they feel that what they do can make a difference".

Lee (1997) also recommends learning by doing. Learners acquire knowledge, skills and attitudes through practical and applied activities. He further observed that, for successful inclusion of environmental learning students should satisfy their curiosity, they should be open-minded and be actively involved in the learning process. Some of the ways of including environmental learning presented in chapter 4 concurred with a number of approaches to

environmental learning as discussed by Palmer (1998) (see chapter 2, section 2.8). However Fien (1993) and Loubser (2008) drawing on Fien (1993) suggested that the range of teaching approaches and strategies used should provide opportunities for learning *about, in/through* and *for* the environment. In addition, Lee (1997) states that education *in/through, about* and *for* the environment provides learners with opportunities to learn about the functioning of the natural systems, to identify their beliefs and opinions, consider a range of views, and ultimately make informed and responsible choices for themselves, their families and their communities.

Evidence from this study shows that teachers use the local environment as a teaching and learning recourse. This resonates with education *in/through* the environment which involves the use of real life situations as a basis for inquiry teaching (Lee, 1997). This type of education uses learners' experiences in the environment as a medium of learning. Teaching methods related to this learner centred approach include *solitaire, encounter, discussion* and *reflection*. This approach according to Thomas (2005) should supplement learners' knowledge and facts about the environment through direct conduct with it. Similarly, Murdoch (1993) indicates that education *in/through* the environment can be the most powerful way to learn about and appreciate the way the natural world works. It is a pedagogical technique that uses the environment as a resource for learning. It adds reality and practical exercise to learning and provides students with an appreciation of the environment through direct conduct with it (Fien, 1993).

The study also shows evidence of situated learning in the inclusion of environmental learning such as *group work; presentation, using local context* and *considering prior knowledge* of learners (see section 4.3.4 and 4.3.5). This is supported by David (1998) when he explains that situated learning uses *cooperative and participative teaching methods* as the means of acquiring knowledge. He further emphasized that situated learning integrates *content, context, community and participation*. This resonates with Lave & Wenger (1991) who noted that knowledge is constructed when learning is socially situated and when learners are engaged in a real task, in a real context and in interaction with one another in a community of practice. In this regard Herrington & Oliver (1995) comment that situated learning pedagogic strategy allows learners to use real life situation to construct knowledge. This is supported by Schudel et al. (2008, p. 53) by pointing out that "for environmental education to be meaningful, the context in which learning takes place needs to be determined and taken into

consideration". This means that environmental topics in life science must be taught in ways that are relevant to the learners' context. In support of this is also the Namibian Life Science Curriculum (2006) which suggests that environmental education should engage in situated learning by using the immediate environment and everyday situations to strengthen learners understanding on the value of natural environment. Teachers' pedagogical strategies should be contextualised. (See section 2.10).

5.3 Analytical statement 2: Teacher knowledge and interest in environmental education influence how they include environmental learning

Environmental learning has been integrated in the Life Science curriculum policy documents that guide teaching with the objective to advantage learners and society (D1, D2, D3 and D4). The views uttered by the teachers about the infusion of environmental learning correspond with those of Enviroteach (1995); Gough (1997); Lotz-Sisitka (2002 and SEEN (2005) that environmental learning is included in many policy documents and across the curriculum. Environmental topics are across the curriculum, but the infusion of environmental topics in Life Science Grade 10 is insufficient, therefore more environmental learning should be added to the Life Science Grade 10 curriculum (T1, T3). In this view, Stevenson (1997) and Peden (2008) disagree that there is no need to add new facts or themes in education but to rather renew educational concepts and approaches by strengthening the meaning and substance of environmental learning content. Teachers involved in this study articulated optimistic views about the importance of environmental learning (see section 4.3.2). This coincide with Stewart (2001); UNESCO (2008) and Lundholm & Plummer (2010) who put emphasis on the importance of environmental learning as an important component to solve environmental problems. However, as the result show, these optimistic views don't seem to be interpreted in to practice given the number and types of amenities not available at schools.

The outcomes of the study showed that successful teachers in inclusion of environmental topics are those with environmental knowledge and those more interested in teaching environmental learning topics, as well as those who had more students who showed interest in environmental topics (T1 and T3). This is supported by Shuman & Ham (1997) who noted that despite the barriers to teaching environmental learning, some teachers pull through towards teaching environmental education and their feeling of responsibility for the environment (see section 2.7). It is evident that teachers who are interested in and have a positive attitude toward the environment do more to teach environmental topics despite some

of the constraining factors to teaching environmental learning (see section 4.3.7.4 and 4.3.7.5). Rosenberg (2008) also supports this by emphasising the significance of teachers' motivation in environmental learning.

Teacher training programmes have limited environmental education content and methods thus limiting access to environmental learning (T1, T3). Environmental learning development projects reported that developing an environmental education perspective has posed pedagogical challenges for life science teachers. However, life science teachers are fairly knowledgeable about environmental learning and have no doubts when teaching environmental topics. The teachers gained their environmental knowledge through workshops, experience and studies which is an indication that the Basic Education Teachers Diploma [BETD] environmental learning initiatives (Life Science, Enviroteach, SEEN projects) had some influence on teachers environmental knowledge as some teachers indicated that they got their environmental learning knowledge through life science projects and Enviroteach workshops (see section 4.3.7.4). Teachers demonstrated knowledge on the learning objectives presented even though in most lessons there were no detailed explanations that go further than the syllabus objectives. In this regard Peden (2008) and Uugwanga (1998) commented that teachers are not well prepared to integrate environmental learning in their classrooms. The table below shows evidence of teachers' knowledge in lessons observed in relation to the curriculum expectation

Table 5.1 Teachers knowledge and curriculum expectations

| Teacher | Syllabus knowledge expectations | Teachers knowledge: evidence in Lessons |
|----------------|---|--|
| T1 | Understand the social implications and transmission of common infectious diseases including malaria | -Linking the lesson objectives to learners' experience -Use known examples to explain the social implications of infectious diseases -Use local examples to explain different ways of transmission of common infectious diseases -Use the diagram to describe the life cycle of malaria |
| T2 | -Understand how some gases create a greenhouse effect causing global warming | -Made use of the diagram showing the greenhouse effect of carbon dioxide to explain the effect of carbon dioxide on global warming -use known examples to describe activities that release gases causing global warming -Drew on learners' prior knowledge to explain the effect of global warming |
| T3 | Know diagnostic features of a monocotyledon and dicotyledon as found in their local environment | -Use learners' prior knowledge to identify plants in their environment that belong to the class of monocotyledon and dicotyledon |

| | | |
|--|--|--|
| | | -Use local examples of monocotyledon and dicotyledon plants(e.g. millet, beans & local grasses to describe their diagnostic features |
|--|--|--|

Untrained teachers cannot produce environmentally literate learners. Therefore, the teachers are the major determinants in environmental learning inclusion in class and their concerns and attitudes are in turn an influential factor (Fien, 1993; Cotton, 2006). The data showed that all teachers were appropriately qualified to teach life science (see section 4.3.1). The teachers' knowledge influences their pedagogical content knowledge; this is discussed in the next section.

5.4 Analytical statement 3: Disparities exist between the policy of including environmental learning (theory) and its inclusion in teaching practices

The major elements of environmental learning identified in this study are theory and practice, learner centred methods, field work, learner participation, learners' prior knowledge, project work and education *for* the environment. These major elements are discussed further to show the disparity between environmental learning theories and practice.

- **Theory and practice**

The data in chapter 4 showed that, the Life Science Curriculum environmental learning orientation is more theoretical (see section 4.2.2). It was argued in chapter 2 that environmental learning is both taught and learnt when theory and practice are joint together (Chi-Chung Ko & Chi-Kin Lee, 2003; Ketlhoilwe, 2003). The environmental learning inclusionary policy indicates that for environmental learning to be a success, it should be included both inside and outside the classroom condition. The aim of the life science curriculum is to develop skills among learners (see section 4.2.1.1). The learning process is amplified by linking science and real life situations in the environment (D2, D3, T1 and T3). It is reported in chapter 4 that teachers use local context and familiar examples where possible to explain and clarify things to the learners. However the examples used did not actually spark off discussions during the lessons (see section 4.4.2). The use of local examples and context is believed to enhance meaningful learning as argued by Monroe and Kaplan (1988); UNEP (2006) and Hogan (2008) who highlight the importance of using everyday context and experience in environmental learning.

The Namibian Life Science Curriculum (2006) also supported the use of local contexts by suggesting that environmental education should engage in situated learning by using the immediate environment and everyday situations to reinforce learners understanding on the worth of the natural environment. Lave & Wenger (1991) are in support of using local context in including environmental learning (see section 2.10).

- **Learner participation**

Regardless of the policy focus on learner centred strategies reflected in the document analysis in section (4.2.3), participation of learners is not being respected in environmental learning lessons. Teachers participated in this study pointed out that they engage learners in environmental learning lessons (see section 4.3.4 and 4.3.5), but it was observed that learners' engagement and participation in most lessons was minimal except for coping summaries, read sentences in the textbook and answering the questions posed by the teachers and in few cases they asked questions (see section 4.4.3.1). Learner to learner interaction is not valued in most lessons. This does not fully support D3, Lee (1997); Mubita (1998); Kethloilwe (2003); Lotz-Sistka et al. (2006); Kostova & Atasoy (2008) who all emphasise the importance of learner-centred approaches, actively involving learners in the learning process. Learners should be involved as partners in rather than receivers of education (Namibia. MoE, 2009). Dahlstrom (1995); Mubita (1998); Hogan (2008), however, also note that learner-centred approaches involve community members in formal education, hence environmental learning; this would help viaduct the gap between schools and communities. Kethloilwe (2007) and Silo (2009), commented that teachers' normalisation practices also constrain the inclusion of environmental learning and can reduce action learning possibilities if learners' participation is not given due attention.

- **Learner-centred methods**

Life science teachers use various teaching methods to include environmental learning and among them are learner-centred methods (see section 4.3.4 and 4.3.5). As observed, common teaching methods are explanations and the question & answer. Teacher-centred methods were given a high priority (see section 4.4.2). Some teachers use other methods such as discussions and asking learners to find information prior to the lessons. Most teaching strategies were often used in technical rather than reflective or problem familiarized manner. Use of audio-visual materials (example showing video lips), charts, posters games and taking learners out

on field trips or outdoor activities were the teaching methods that teachers did not use (due to unavailability of the mentioned materials at schools, transport, cost implications and time constrains) but would like to use. Stimpson (1997) argued that, on average teachers' teaching styles were more teacher-centred and lectures were the most popular teaching methods. He found that experiments were also a well-liked teaching method for environmental topics but in this study no experiments were carried out as a way to include environmental learning.

- **Field work**

The findings of the study shows that field work is seldom conducted because of transport, cost implications and time constrains (T1-T3) although teachers were conscious of the value and need for it. All teachers teaching methods limited them to the classroom, no outdoor lesson was observed (see section 4.4.2). Evidence from the study shows that teachers who participated in this study were aware that environmental learning is practical based and cannot be taught without outdoors (T1-T3). They would like to take learners out in to the field and expose them to real environmental issues, but there are constraints such as time, transport and cost implications (see table 4.7). This resonates with Chi-chung ko & Chi-kin Lee (2003) and Kethloilwe (2003) who noted that school environments should be created at schools to supplement theoretical classroom activities.

- **Prior knowledge**

Evidence in D3 shows that the use of learners' prior knowledge in teaching and learning is important for the inclusion of environmental learning (see section 4.2.3). The data in chapter 4 shows that teachers use learners experience and knowledge. Although teachers use learners' experience and knowledge, it was not clearly indicated in the lesson instructions. The lessons did not show how teachers used learners' prior knowledge; although there were some instances where the teachers drew on learners' knowledge (see section 4.4.2). However, T2 does not totally concur with the opinions about learners being able to use their prior knowledge, her opinion is similar to those of Kasanda et al. (2005) who found out that learners cannot relate their daily experiences, as they do not see themselves as being involved in the teaching and learning process. This results in a disparity between learners' everyday world and school world.

- **Projects work and education *for* the environment**

Extracurricular activities or projects provide knowledge, skills and awareness and action to learners and communities (Monroe & Kaplan, 1988; Lee, 1997; Cotton, 2006; Rosenberg, 2008). Therefore schools should have environmental projects or clubs and promote project work in lessons in order for learners to practice their knowledge and skills (D3, D4). The data of this study revealed that there are projects on environmental learning at schools involved in the study which helps with the inclusion of environmental learning and enable learners to practice their knowledge and skills (see section 4.3.7.6). The data also shows that cleaning campaigns are done at schools and they are included in the school calendar of activities, and this can help learners to understand why it is important to keep their surrounding clean (T1-T3).

On the same note, Kethloilwe (2007) notes that teachers tend to emphasise school ground cleaning as a main environmental education activity, but in this study it was not the case, schools ground cleaning supplement other projects at schools. Involving learners in action projects can empower them in a sense that they develop action taking skills, thus helping learners become environmental problem solvers as argued by Jensen & Schnack (2006) that using action oriented approaches are important in the field of environmental education to create awareness and foster environmental knowledge. Apart from that, the study data shows that action projects are not carried out in life science lessons due to constraints including insufficient time and short class periods (see section 4.3.7.3). This findings are however similar to those of Monroe & Kaplan, 1988; Kethloilwe, 2003; Kasanda et al., 2005 and opposed to Fien (1993) and Lee (1997) who argue that a range of teaching approaches and strategies should be used to provide opportunities for learning *about*, *in/through* and *for* the environment. It is evident in this study that similar to Fien's (1993) observation that teachers put more emphasis on the approaches of education *about* and *through* the environment, discarding education *for* the environment.

This is despite the fact that the Namibian curriculum documents note that education for the environment encourages critical thinking and promotes environmental consciousness (Namibia. MoE, 2009) and also despite the SEEN and Enviroteach projects emphasis on the importance of environmental education. This implies that the way teachers interpret the curriculum documents has an influence on their teaching practices regarding education *for* the environment. The following analytical statement discusses how the curriculum documents inform teaching of environmental topics.

5.5 Analytical statement 4: Teaching of environmental learning is mostly informed by the textbook

Curriculum documents are designed to promote teachers' learning about the content and pedagogy (D3) (see section; 4.2.3). These documents can be modified to suit certain topics and contexts. Teachers can thus situate the curriculum materials to their own situation. Although there are a variety of curriculum documents, the main source of information for teachers in this study was the textbook (see section 4.4.3.2). Teaching and learning was mainly determined by what is in the textbook. Some attempts were made to acclimatize the textbook knowledge to learners own situations. Apart from the syllabus and the textbooks, other curriculum documents were not often used by teachers in this study to inform teaching and learning. It was found that teachers either do not have the documents or they do not find them useful or effective for environmental learning inclusion (see section 4.3.3). This finding disappoints Beyer et al. (2009) who place more emphasis on the importance of curriculum documents in teaching.

D3 emphasised that teachers should meet the requirements of the syllabus. All teachers involved in this study, prioritised covering the life science syllabus objectives. They found textbooks to be in line with the syllabus learning objectives; especially the Discover Life Science ones (see section 4.3.6.1). Most learners observed in this study were sharing textbooks. The textbooks are mostly used to teach learners in the classroom or for learners to complete tasks on their own or for homework. In some lessons, teachers referred the learners to the textbooks to find solutions to the problems, for clarity of content being taught, or for homework (see section 4.4.3.2) for examples of those practices. Therefore, Similar to Chi-Chung Ko & Chi-Kin Lee (2003) findings ,the study showed that many teachers relied on textbooks when teaching environmental topics and that teachers main concern was fear of “not covering the syllabus” (p. 200).

Despite the effectiveness of the textbooks and the syllabus as pointed out by teachers, both the textbooks and the syllabus have suggestions for practical work or demonstrations, but not to a large extent. The textbooks are more theoretical and focus more on the subject content rather than skills development as reported in section 4.2.2. This might be a contributing factor to the earlier insight that teachers tend to put more emphasis on teaching knowledge, rather than attitudes and skills in their teaching of environmental education. However, they aim at focusing more on attitudes. This was to some extent corresponding with the observations and

findings of Chi-chung Ko & Chi-kin Lee (2003) that while teachers believed that farming of environmental attitudes was important in environmental education, they tend to use textbooks which facilitate the transmission of knowledge and the coverage of the syllabus. This increases questions for the future development of environmental education in the science curriculum such as what environmental values and attitudes should be encouraged in the science curriculum and teaching and how could these be offered in the syllabus and the textbooks?

The study also shows that the life science textbook (Discovering Life Science) does not fully encourage the goals of “key transferable skills” (Chikarango, 2007). These include critical thinking, analytical skills, problem solving, communication skills, numeracy skills, information skills and creative skills among others. However, because of the main emphasis on learner-centred approaches, the textbooks do promote participation, cooperative learning and action taking (see section 4.2.2). As indicated in chapter 2 (see section 2.5.1) the SEEN, the Life Science and Enviroteach projects have helped with materials development for environmental learning. This is evident in this study finding as teachers involved in the study did mention the support and materials they got mainly from the Life Science and the Enviroteach Projects (see section 4.3.7.1).

The disparity between teachers’ practice and the curriculum expectations could be because the teachers participated in this study do not make use of the curriculum documents or they do not have the documents. The next analytical statement discusses how assessment is included in the teachers’ lessons and its impact on inclusion of environmental learning.

5.6 Analytical statement 5: Assessment practices narrow the scope of environmental learning in ways that do not include critical thinking and problem solving skills

The life science teachers involved in this study acknowledged assessment as important for testing learners’ understanding of environmental topics. As reported in section 4.2.1.2 and 4.3.5 and also table 4.3, different methods are used to assess learners’ performance on environmental topics. Some of the questions given for assessment were more structured to test how learners operate at and beyond comprehension level. Lessons observed in this study; showed that questions were the major form through which environmental topic content was conveyed to the learners (see section 4.4.2). But the questions asked did not encourage critical thinking and problem solving. However, there was a visible connection between the

textbook activities, informal questions asked in the class and examination questions. Most questions asked by teachers in this study appeared to encourage factual recall and not learners' critical thinking nor do problem solving skills (see section 4.4.2). This is in contrast with the aims of the syllabus and environmental learning objectives of encouraging critical thinking and problem-solving skills. This seems to be an extensive issue, though, Malcolm (undated: 20) argues that "environmental education development and implementation is seriously hindered by an emphasis on traditional assessment methods". Kostova & Atasoy (2008) explains that in order for environmental learning to be a success, teachers should show the ability to include environmental learning by stimulating learners to ask questions, responding to their answers, helping them to accept contradictions and challenges, think critically and present creative solutions.

The data gathered in this study shows that assessment of environmental topics can help teachers to reflect critically on lessons (D1, T1-T3); however, in some teachers' cases, this is not always practical due to lot of work (T3). In this view, Shulman (2004) reiterated that teachers' lesson plans have to show assessment approaches to be used. This assists teachers to re-examine their lessons after teaching, which then comprises a reflection. There are also, however, other constraints that make it difficult for teachers to meet the environmental learning aims discussed in the analytical statement which also deals with how constraints can potentially be changed into enablers for successful inclusion of environmental learning.

5.7 Analytical statement 6: Despite diverse constraints inhibiting inclusion, the evidence suggests that the existing policy of including environmental learning in Namibia's Life Science curriculum can enable environmental education.

- **Inclusion**

The study shows that since there are few topics that include environment and these are seldom included in examinations, the inclusion of environmental learning is not a priority for most teachers. T1, T3 indicated that more topics should be added for environmental learning to ensure a positive impact in their inclusion and also for all learners to show interest. There are a number of personal as well as logistical obstacles that prevent the successful inclusion of environmental topics such as class size; lack of resources; lack of support; insufficient time; insufficient in-service training; learners' interest, subject knowledge; lack of lesson preparation and the vastness of environmental issues at schools (see more in table 4.5). All

stated constraints are similar to those listed by Loubser (1997); Uugwanga (1998); Kethloilwe (2003); Hoabes (2004) among others in chapter 2. These constraints are discussed below and all the said constraints have a possibility to be changed into enablers for successful inclusion of environmental learning. This is possible through involvement of various stakeholders in education and organizations, for example by providing knowledge-rich resources for environmental learning as recommended by Rosenberg (2008).

- **Resources**

A number of materials are used to enhance and help in achieving lesson objectives (D3). The teachers manage teaching and learning by making use of available resources in the immediate environment (T1-T3). The resources at schools are insufficient for environmental learning inclusion. This feature is highlighted by teachers in the interviews. Teachers stated that they do not have enough of the teaching and learning resources such as textbooks and environmental learning materials such as audio visuals, pictures, posters, charts, and games (see section 4.3.6). This indicates that the inclusion of environmental learning in life science is compromised. This is supported by Uugwanga (1998); Hobes (2004); Hogan (2008) and Rosenberg (2008) who reported resources as barriers to environmental learning.

- **Insufficient time**

Insufficient time allocated for life science as a subject is one of the major constraints to effective inclusion of environmental learning. The time allocated for environmental topics is insufficient to combine theory and practice in teaching environmental topics. The periods allocated for life science on the timetable of the involved schools was a matter of concern (T1-T3). Instead of allocating double periods as stated in D3 in order to provide enough time for discussions, practical work or experiments, single periods were allocated throughout the timetable and life science has only four periods a week (D1). It is unlikely that a single period of a maximum of 40 minutes will accommodate both theory and practice. Double periods would have been more appropriate to help in allowing time for both theory and practice in order to help learners make a connection. Teachers do sometimes arrange afternoon classes to cater for practical activities, but this is a serious concern due to the fact that learners do not turn up in numbers in the afternoons (T1-T3). This resonates with Ham and Sewing (1988) who note that, lack of class time and preparation time were perceived as the greatest barriers for inclusion of environmental learning

- **Lack of support**

The successful inclusion of environmental learning depends on a good communication network between teachers, management, community or parents and advisory teachers (D2). Data from the study shows that most teachers involved in the study felt the need of environmental learning, although little environmental learning is taking place in their life science environmental learning lessons. This may be due to lack of commitment and support from advisory teachers and parents in the inclusion of environmental topics (see section 4.3.7.1 and table 4.6). This is supported by Kethloilwe (2003) and also resonates with Fien (1993) who revealed that development of critical thinking and problem solving among learners has failed because of lack of support from education authorities. Uugwanga (1998); Hoabes (2004); Cotton (2006); Rosenberg (2008) also note that lack of inadequate support from school management, the Education Department and some community members is a constraint to effective inclusion of environmental learning.

- **insufficient in-service training**

Evidence from D3 emphasise on professional development of teachers through in-service and pre-service training. Workshops and in-service training of teachers should be considered to enable teachers to share information, materials, experiences and new strategies. But the teachers' workshops and in-service training are inadequate in life science, particularly regarding the inclusion of environmental learning (T1-T3) (see table 4.4 and section 4.3.7.1). This indicates that there is a need for more teachers training. Kethloilwe (2003); Hoabes (2004) and Peden (2008) supported this by indicating that there is a need for teachers' in-service and pre-service training.

- **Subject knowledge**

Evidence from D3 indicates that teachers should be qualified to teach the subjects and should have the subject matter (see section 4.2.3.5). Teachers participated in this study indicated that they are fairly knowledgeable when it comes to environmental learning and they are all qualified to teach life science (see table 4.4). This resonates with Hoabes (2004) who approves that teachers are qualified to teach the subject they teach. But Uugwanga (1998); Kethloilwe (2003); Nelson Mandela Foundation (2005); Rosenberg (2008), T1 and T2 indicated that such teachers are not well prepared to include environmental learning.

- **Class size**

Data from this study revealed that class size limit the effective inclusion of environmental learning (T1 and T3). Big class groups make it not viable to effectively use group work and other learner-centred activities. In the same vein Uugwanga (1998) and Kethloilwe (2003) state that large class sizes constrain the inclusion of environmental learning.

Despite the scope and depth of constraints examined here, the evidence of the environmental learning generated from teachers and through lesson observations suggest that there is some merit in the policy that calls for the incursion of environmental education in this contextualising and additive way.

5.8 CONCLUSION

The chapter has offered an interpretation and discussion of the data as presented in chapter 4 making use of some of the literature reviewed in chapter 2. Insights were reported according to analytical statements, and each was discussed in detail, the analytical statements in this chapter will be used to make main recommendations in chapter 6.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

This chapter provides a summary of the study and major findings in relation to the research question on how teachers include Environmental Learning (EL) in their teaching of the Grade 10 Life Science curriculum. It also presents some recommendations on how environmental topics may be included in the Life Science curriculum at Namibian Junior Secondary Certificate level [NJSC]. The final part of this chapter includes some reflections and recommendations for further research.

6.2 SUMMARY OF THE STUDY

The study reported how the selected Life Science teachers in the Namibian context include environmental learning. It noted that some key teaching strategies for the inclusion of environmental learning are evident in life science curriculum practices. There are, however, disparities between the policy of including environmental learning and its inclusion in classroom teaching practices and use of the local environment. Teacher knowledge and interest in environment and environmental concerns are key influences on how they include environmental learning. Teaching practices on environmental topics are mostly informed by the textbook and assessment practices narrow the scope of environmental learning in ways that do not include critical thinking and problem solving skills. It was also found out that there are a wide range of constraints that influence the inclusion of environmental learning, amongst them are:

- inadequate resources,
- lack of support for teachers from different stakeholders,
- lack of interest among some learners,
- fieldwork are sometimes not carried out because of transport and cost implications,
- insufficient time allocated for environmental learning and
- lack of in-service training for teachers involved in this study.

Despite these the evidence suggests that the existing policy of including environmental learning in Namibia's Life Science curriculum can enable environmental education.

The study found that, Life Science teachers involved in the study do implement environmental learning but not to a large extent. The teachers used a range of teaching strategies to include environmental learning in Life Science topics but the most common methods used were teacher-centred. The study also found that Life Science teachers involved in the study had a fair knowledge and experience of including environmental learning but on a small scale. Their attitudes and interest towards environmental learning influenced the way they facilitated environmental learning in their classrooms.

The research concludes that the inclusion of environmental learning can be improved in the Life Science classrooms involved in the study by transforming many of the constraints into enablers and by supporting teachers to maximise the enablers. My overall impression is that the policy of achieving environmental education through the inclusion of environmental learning is ambitious and is not yet being achieved in the classrooms examined in this study. Despite this I have to conclude that the small amount of evidence of the effective inclusion of environmental learning is encouraging. This enables me to finally conclude that the policy is worth continuing work to support teachers to expand the strategies that they have been able to deploy to make learning more relevant and to engage environment and sustainability concerns.

The evidence and findings summarised above allow me to make the following recommendations to improve environmental education through working with teachers to strengthen the inclusion of environmental learning in the curriculum and their teaching practices.

6.3 RECOMMENDATIONS

Some of the recommendations related with the study findings include the following:

1: Strengthening of the environmental education content of teachers

The study found that teachers involved in the study do not have enough knowledge of environmental learning, due to lack of in-service and pre-service training as the major contributing factor. All Life Science teachers involved in the study did not receive much environmental education when they were student-teachers. The study thus recommends for more comprehensive environmental education in-service and pre-service programmes for

Life Science teachers involved in the study on environmental learning. Teachers involved in this study need to be trained in order to be able to gain the knowledge that will enable them to address environmental issues sufficiently. As reported by Peden (2008) that deep knowledge is a prerequisite for critical thinking. Without an understanding of the science of key environmental issues responses will remain superficial and inappropriate. Considerable environmental education should be provided for pre-service teachers. If more teachers understand the need and approaches related to education *for* the environment, promotion of environmental education among teachers will be easier. Teacher training is also of necessity because environmental knowledge informs the pedagogy of teachers. If teachers themselves do not receive enough environmental education, it will be impossible for them to teach actively *for* the environment. Therefore, teacher education for environmental education should also be given attention. More projects on environmental education initiatives or similar to SEEN and Enviroteach projects should be established to encourage environmental education for teachers or current SEEN projects can be extended to reach more Life Science teachers.

2: A link should be there between environmental learning theories and practice.

Teachers involved in this study relied more on the same type of teaching methods especially question and the explanation of subject content. The study found that most teachers involved in this study use teacher-centred methods as a way of transmitting knowledge. The study therefore recommends that: Teachers should move away from teacher-centred approaches to learner-centred approaches such as group work, experiential learning, enquiry method and debates. The Life Science teachers involved in this study should find flexible and open-ended ways to present environmental concepts that will allow learners to come up with their own conclusions about important environmental and societal issues.

Regarding teaching methods, the study also recommends that a favourable school and community learning environment should be shaped to provide more opportunities for outdoor activities and projects in order to supplement more theoretical classroom activities. Teachers should be supported to use visual aids and materials in ways that involve and engage learners. The teachers should also be supported to use the local environment when teaching environmental topics. All this needs to be contextualised within the learners' prior knowledge and experience, this enables more problem based approaches in local context.

As suggested by Kethloilwe (2010) on environmental learning epistemology and pedagogical practices, there is also a need to cross-examine the possible epistemological and pedagogical practices in the Life Science curriculum to find new ways of including environmental topics to enhance learners, expand their agency, and improve reflexivity and responsiveness to risks. This can be done through a participatory method by stakeholders from diverse formal and informal education sectors.

3: Redirection of curriculum documents as well as other learning support materials used for environmental learning

The study found that, teachers involved in the study greatly depend on the syllabus and textbook for teaching environmental topics. The study recommends that all necessary curriculum documents be revised accordingly and be made available to schools, specifically to teachers. Materials that will encourage environmental learning links to learner's everyday lives contain opportunities for promoting discussion around values, beliefs and promote linking of theory and practice that encourage learners' participation and decision making. The study therefore recommends that the Life Science textbook should include more local examples and practical activities. The study also found out that the Life Science textbook is based on theory and focus more on the subject content rather than on skills development. More practical situations from the local sources should therefore be added to the Life Science textbooks. The study also recommends that advisory teachers should provide support to Life Science teachers to use learners' prior knowledge and experience in ways that are contextual and not just syllabus based.

4: Improvement in assessment approaches

The study found out that very few environmental topics are examined in Life Science. The types of questions in the past examination papers and other assessment activities did not promote critical thinking and problem solving. It was in fact a promotion of factual recall. Questions asked were more based on assessment objective A (Knowledge with Understanding) than assessment objective B (Handling information, Application & solving problems). This outcome is in contrary with the assessment policy which requires all the assessment objectives to be considered in assessment activities. It is also against the aims of the syllabus and environmental learning objectives of promoting critical thinking and problem solving skills. This situation hampers environmental education development and inclusion. The study therefore recommends that environmental learning topics assessment

activities and questions (examinations, tests and other classroom activities) should include all assessment objectives required. On assessment, it is necessary for teachers to assess learners as part of their pedagogy. In this regard, the study recommends that, more activities and questions asked should mobilise learners' prior knowledge, promote critical thinking, reasoning and engagement of learners in problem solving. Without the required skills, and knowledge learners will not become problem solvers.

5: Environmental learning constraints should be transformed into enablers

The study found that in the case of inadequate resources, field trips not carried out due to no funding of transport costs are some of the main constraints. Other major constraints are inadequate time and lack of audio visuals materials. The study thus recommends provision of teaching materials such as video clips for teaching. Making available field trip resources such as prepared and guided environmental tours, preferably related to environmental learning would be useful to the promotion of education *in* the environment. Environmental education resources could also be produced by nongovernmental organizations and teacher education institutions as has been done by DRFN on Enviroteach projects and Polytechnic of Namibia on the SEEN project. The resources may be designed to support participation, and to present learners with opportunities to interact with the local environment. Learners could investigate possible positive action projects that would enable them to improve their surroundings.

The study also recommends the establishment of Environmental Education Resource Centres throughout the country for both teachers and learners to get information related to environmental education. This will increase their knowledge and assist in the supply and improvisation of teaching and learning materials necessary for environmental learning.

Concerning other constraints, the study further recommends that,

- Teachers involved in the study receive more support from the Education Ministry, particularly from subject advisors, on environmental learning inclusion, strategies for involving learners while working with large groups, planning with large groups, making use of the local environment when teaching environmental topics and to contextualise it within the learners' prior knowledge and experience. Teachers involved in the study should also receive further support from school management, community members and cluster schools. Support rendering is vital for advanced level of change.

- On time allocation for environmental learning, the study recommends Life Science periods to be changed from 4 periods a week to 6 periods a week and should include double periods, to allow enough time for practical activities and outdoor teaching.
- Life Science teachers involved in the study should be encouraged to improvise teaching materials necessary for environmental learning and use the local environment as a teaching resource instead of just relaying on textbooks. Therefore teachers involved in this study should be empowered to realize their dream of acting as mediators for social change and working to make the environment a better place. These teachers should have a chance to communicate environmental values and viewpoints and act upon curriculum decisions related to environmental learning rather than just depending on textbooks. In order to develop environmental learning in the Life Science curriculum, constraints to teaching environmental topics should be minimized and the enablers should be increased.

6.4 REFLECTIONS

The results of the investigation helped me reflect on my own teaching as well and also contributed to a broader understanding on how to implement environmental learning and improve my effectiveness as a Life Science teacher. The results of the study also contribute to a broader understanding and knowledge of environmental learning in the Life Science curriculum. The study was only carried out in three schools due to limitations such as finance and time. However despite these limitations, the study managed to provide an essential preliminary understanding of how Life Science teachers are including environmental learning in the Namibian schools involved in this study. In the process some insinuations for curriculum and teachers' development for environmental learning in the future became evident. The findings from this study will however not be used to generalize how Namibia Life Science teachers include environmental learning in Grade 10 because they are not a full enough representation of how environmental learning is taught in all the grade 10 classrooms in Namibia.

6.5 RECOMMENDATIONS FOR FURTHER RESEARCH

- Further research may be conducted on appropriate ways of supporting teachers to use a range of strategies for including the environmental learning focus in the Life Science curriculum in Namibia.

□ Further research could be done on the same topic, but including more stakeholders such as learners, school management, parents/community members, advisory services and environmental education officials.

□ Further research is needed to consider how teachers can be helped to move away from a teacher-centred approach to a learner centred approach as means of fostering environmental education that stresses the cultivation of students' optimistic attitudes towards the environment?

6.6 CONCLUSION

This chapter has summarised the findings of the study and made recommendations in relation to the case study context with recommendations for further research. In a concluding chapter it is important to note that, the study has investigated how the Life Science teachers in a specific context facilitate environmental learning for learners to acquire relevant knowledge, awareness, values and skills. An analysis of teachers' responses, curriculum documents and lesson observations was described in Chapter 4. The findings were discussed in Chapter 5. It was concluded that Life Science teachers include environmental topics but to a limited extent. This is because of many constraints and teachers normalised practices that hamper maximum inclusion of environmental topics. As indicated in this chapter this means there is a need for the Ministry of Education to get involved to ensure that teachers get the necessary support, resources, and training among others. This will enable school to produce environmentally literate and knowledge-based citizens in the near future.

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APPENDICES

Appendix 1a: Consent letter

To: Mr. /Ms. T1, T2 and T3

S1, S2 and S3 Combined School

Oshakati

Namibia

Dear Sir / Madam

I am a registered Masters student in Environmental Education at Rhodes University in South Africa. As part of my degree I am investigating how Grade 10 Life science teachers include Environmental Learning (EL) in their classrooms. As part of the study, I intend on answering the following questions:

- How is Environmental Learning being integrated in Life Science?
- What are the enabling and constraining factors in the inclusion of Environmental Learning in Life Science?

To answer these questions, I need to interview grade 10 Life Science teachers and observe some of their lessons as well as analyse some of the relevant documents. I have thus chosen your school and you as a grade 10 and Life Science teacher to participate voluntarily in this study. All interviews will be recorded. Ethical issues such as confidentiality, right to privacy, dignity, and honesty will be maintained. Your name will not be revealed anywhere in the study.

If you agree to participate in this study, please sign the consent letter in the space below,

Signed _____ Date _____

Your positive regard on this matter will be highly appreciated.

Yours faithfully

Cecilia Joseph (0811483380 or joseph.cecilia@yahoo.com)

Appendix 1b: Consent letter

The principal

S1, S2 and S3 Combined School

Oshakati

Namibia

Dear sir /Madam

Re: Request for a research site

I am a registered Masters student in Environmental Education at Rhodes University, South Africa. To qualify for this degree, I am required to carry out a research study. I have chosen to do an Investigation on how Grade 10 Life Science teachers integrate environmental learning in their classrooms.

I am therefore requesting to do my study in your school. The school's participation in this study is voluntary; this means the school will participate willingly and can withdraw from the study at any time.

If I am allowed to carry out my research at your school, I will spend about three days at the school and will be involved with Grade 10 Life Science teachers, have interviews with them and observe some of their lessons. The interviews and discussions shall be recorded. Ethical issues such as confidentiality, right to privacy, dignity, and honesty will be maintained. No names will be revealed.

If the school is willing to participate please sign the consent letter in the space below.

Principal signature _____ Date _____

Your positive regard on this matter will be highly appreciated

Yours sincerely

Cecilia Joseph (081 1483380 or joseph.cecilia@yahoo.com)

Appendix 2: Interview schedule

Semi structure interviews

Introduction

My name is Cecilia Joseph, a Masters of Education student at Rhodes University majoring in Environmental Education. I would like to ask you some questions regarding the inclusion/integration of Environmental learning (EL) in Life Science. The aim of the interview is to get insights into your classroom practices especially in the inclusion of EL.

Your responses will be treated as confidential and you will be given a chance to review and modify your responses at the end of the interview. You are free to withdraw from the interview at any stage when feeling uncomfortable; however your participation will be of great value to this study, especially when it comes to improving and strengthening of environmental education in Namibia.

School and Teacher profile

Name of school

Location

Pupils' numbers in G10 LS classes

Professional Qualifications of teacher

Years of teaching Life Science at grade 10 level.

Influences on the integration of EL in the Life Science classroom.

1. What do you understand by Environmental Learning? (Give example of Environmental learning in Life Science).
2. How does the syllabus and policy guide the inclusion of EL?

Experience of integrating EL in the Life Science classroom.

3. How have you included EL in your teaching of Life Science? (Give examples)
4. In your experience, what topics lend themselves to the inclusion of EL?
5. Do you experience any challenges in the inclusion of EL in your life sciences program?(describe them)
6. What methods do you mainly use for including EL in Life Science? and why?
7. How is EL assessed? (Formal assessment)
8. How do learners respond to the inclusion of EL in your lessons?
9. Overall, how much time is allocated for EL in Life Science?
10. Overall, what do you see are the best ways to include EL?
11. Are there comments/ suggestions you would make on the constraints and enabling of EL?

Environmental learning knowledge, selection, methods and teaching materials

12. How did you acquire the environmental knowledge necessary for the inclusion of EL?
13. Do learners have Life Science prescribed textbooks?
14. What knowledge do textbooks provide on the inclusion of EL?
15. Apart from the textbooks, what other supporting materials are available for teaching EL in Life Science? (Where /how did you get these?)
16. How do you make use of these extra support materials to teach EL topics in Life Science?

General support for EL

17. What training and guidance from subject advisors have you had on the inclusion of EL (Was the training useful to you?)
18. What project work on environmental topics has been done at your school?
19. How do school policies and practices support the inclusion of EL? (How is the inclusion of EL supported at school?) Does this constrain and enable things in any ways?
20. In what ways does the school management support you to integrate EL?
21. Do parents (community) support you and the learners to integrate EL?
22. How supportive are the other teachers to the inclusion of EL in your classes
23. Is the time given to EL sufficient in your opinion? (Why?)

Appendix 3: Observation Schedule

Observation guidelines

| Aspect observed | comments |
|--|----------|
| <p><i>Lesson objective</i></p> <p>Expectation from lessons about EL in lesson.</p> | |
| <p><i>Instructions / teaching methods</i></p> <p>Instructional strategies / method of presentation, nature of activities, use of EL terminologies</p> | |
| <p><i>Learners engagement</i></p> <p>Learners engaged, in what, to what extent do learners participate, teachers' role in the lesson , learners encouraged to do and not do, learners given opportunities to interact with the materials and how, how are learners exposed to the teaching/ learning.</p> | |
| <p><i>Assessment/ evaluation</i></p> <p>Kinds of assessment, content and focus , time is allocated to activities, the teacher –learner relationship with regard to teaching/learning of EL.</p> | |
| <p><i>Learning interactions</i></p> <p>Context of interactions occur, where interactions begin, type of learning/ teaching resources/ aids used by teacher during EL lesson? Where they appropriate for the learners and did they support the inclusion of EL?</p> | |
| <p><i>Other observations</i></p> <p>Class arrangement, size, displays, timetable etc.</p> | |

Appendix 4: A sample of interview transcripts

Responses to semi- structured interviews

Interview 1(I1)

Teacher 1(T1)

School (S1)

Date: 25 March 2014

Pupils in grade 10 Life Science classes: 40

Professional qualifications of teacher: BETD (Agriculture and Life Science) & Further Diploma in Education (Biology)

Years of teaching LS at grade 10 level: 8yrs

Q1.What do you understand by environmental learning? (Give example of environmental learning in Life Science)

Environmental Learning has to do with teaching and learning about the ecological aspects of the environment, it's about taking care of the environment and environmental issues in Life science, this includes topic like global warming, greenhouse effect and depletion of ozone layer to mention just a few. Examples of environmental learning in Life Science include learning about Ecology which includes topics such as global warming, greenhouse effect and depletion of ozone layer. Other examples of EL in life Science are Diversity of living organisms and Health education this includes the following topics; sexually transmitted, infectious diseases and HIV and AIDS.

I think environmental learning topics in life science Grade 10 syllabus are few they should be increased. More environmental learning topics need to be added in Life Science because environmental learning coverage in the syllabus is not substantial and more information on how to include environmental learning in Life Science need to be added in the syllabus.

Follow up questions (FQ). Approx EE Life Science content coverage in the syllabus? I think environmental content in the syllabus are about 15% that's why I say they are insufficient.

Q2. How does the syllabus and policy guide the inclusion of EL?

It is stated in the syllabus that environmental learning should be taught across the curriculum, therefore it should be a cross curricular issue and it makes the inclusion easier. The syllabus and the subject policy guide the inclusion of environmental learning should be in such a way that teaching goes together with environmental learning and they guide some of the topics that whenever teachers are teaching them they should emphasise or include environmental learning cause teaching does not only take place in the classroom, of course you have to take your learners outside so that they can have a clear picture of what you have taught them inside the classroom- outdoor teaching. For example you can take your learners for a planned tour, it can be around the school areas or nearby villages to go and ask for information or take them out to do a survey on a certain topic.

Life science syllabus states or stipulates that whenever you are teaching learners you should take them out so that they can see the real situation. Here now I refer you can take them out to do for example a survey on a certain topic, you take them to a tour or just outside the classroom nearby village to ask for some information.

The syllabus indicates practical activities which are essential to environmental learning inclusion, that's why my teaching is mainly informed by the syllabus because I find it effective when it comes to the inclusion of environmental learning. The textbook also inform my teaching because it covers the syllabus objectives.

Q3. How have you included EL in your teaching of Life Science?

ok, you see you know I am having may be this one is my 8th years of teaching life science and during teaching I include environmental learning in the sense that when I teach I not only use to teach sitting in the classroom with the learners, we use to go out moving around the school or the nearby community looking at things, making surveys, projects outside, asking people more about the topic we discuss with learners in the classroom or I assign learners to go ask themselves, can be they go to their parents or they go to other people in the community and ask lots of information related to the topic discussed in the class or I can for example give them a project to go classify things we are having this topic of classification of living organisms so I let learners go to the environment and they classify and group things according to what they have observed. And I also use local examples that learners are familiar with or what they will be able to relate to when teaching.

FQ. For example which people are you referring to here?

Here now I refer for example we are having a topic of health education where we are to discuss about sex education, sexual transmitted diseases I can send them to a clinic to ask for example a nurse or a doctor or this people who are working with TB.. I don't know whether they are facilitators or educators in the community or to go and ask this people working with pear education for example those ones who are teaching Window of Hope, M y Future is my Choice and those from Catholic AIDS Action and Elcin AIDS Action to get more information.

FQ. Do you also consider community/parents on some of the topics?

Yes, like elderly people when trying to find indigenous knowledge from them on how they do things.

FQ. Do you encounter any problem while involving learners in activities? Yes, I experienced lack of learners' interest in sex education topic which leads to poor participation of learners. And there are few learners who are not exposed to environmental learning therefore their knowledge is limited.

Q4. In your experience, what topics lend themselves to the inclusion of EL?

Ok like I have already mentioned Health education which includes sexual transmitted diseases, infectious diseases and HIV and AIDS we also have Diversity of living organisms then we have this topic of ecology which is having global warming and green house effect.

Q5. Do you experience any challenges in the inclusion of EL in your Life Sciences program?

Ya, here now challenges will be always there for example like i mention this topic of sex education i will take out my learners to certain old people to ask and you find he/she will not give all the information which is needed or required by the learners based on the cultural background cause some

of those topics elders are not suppose or allowed to discuss them in to deeply with children and the other challenge could be you want to take your learners for example for a tour to Etosha, the challenge could be there will be no transport, there will be no enough money to take your learners there or you want to do a certain research you send learners or you take learners to a nearby community there it might be the information you wanted to get the people whom you are going to ask they might not be that confident enough(lack of confident) to give you all the information or lack of communication can also be a challenge and the other challenge in the inclusion of EL is that you know you take your learners outside for a certain topic you know there are certain topics that are interesting to the learners , if they are not much interested-lack of interest, they will not ask what you want to get. Then there now if you find learners are interested in the certain topic you say now let's go and do this or ask about this everyone will be happy you ask them lets go and ask on this topic sometimes you find they are not interested only few who will go and ask thus those not interested will not ask or do anything. Some of the topics say sex educations, it's culturally believed that is not allowed to discuss it in public or with the young ones is also a challenge which will prevent learners getting information from elders, this lead to lack of interest among learners in sex education leading to passive participation of learners in this topic.

Another challenge I experienced is shortage of textbooks and lack of environmental learning materials such as audio-visual (e.g. video clips), games, charts and pictures. Time is also another challenge, 40 minutes is not enough for environmental learning inclusion because it requires practical activities, therefore I am left with no option but to teach in the afternoons which is also a challenge because not all learners are present during afternoon activities. Another challenge I do experience is the large class. This is a challenge to effective inclusion of environmental learning for instance in my case I have 40 learners in my class, even if I divide learners in groups, groups are too large and 40 minutes is inadequate to monitor each group.

FQ. When you said luck of communication is it within the official language which might be a problem?

You see some times you are making a research, the questions are in English now the problem will be there when a learner now because I will not be there some times iam there sometimes I am with the other group the other groups I will attend to them later, the problem when learners are trying to translate what is in English in to their local language it might be they will not translate it correctly so that parents or community members could understand and give the clear information.

Q6. What methods do you mainly use for including EL in Life Science and why?

Here we use lots of methods, cause you look at life science need practical methods; research, survey, even a group discussion method-(learner centred method) now under these methods for example research is where I take learners outside to get more information on a certain topic discussed in the classroom or do a survey where I take them to an expert for example to a nurse, a doctor or to an extension officer and they ask information or to an extension officer to ask information and get information or they make research themselves they go around see the nature and they come out with their conclusion and allow them to present their findings, how this is like this, how this is like that or I take them into the community where now they relate what they learn or taught inside the classroom with what they will get from their community or with what they will see within their environment and let them present their findings.

The main aim of using the methods mentioned is to give a clear picture to the learners with the aim of giving them or expose them to more information related to the topic discussed inside the classroom and now how now they relate that topic within their environment or how they relate them with concrete examples that they will see from their environment thus exposing them to the real situation, so they are able to learn about the environment not only in the classroom but they have this opportunity to go outside and touch things, look at things in real situation. Then they will gain more information. Therefore based on what I have just said, my main method of teaching environmental learning is by exposing learners to real issues or situations but I also use other methods like surveys, research projects, investigations and making use of experts.

FQ. Are there any alternative teaching methods you would like to use to teach environmental learning but cannot use them?

Yes, I would also like to use video clips, games and pictures to teach environmental learning topics but this is not possible because they are nowhere to be found at school, not even in the school library.

Q7. How is EL assessed? (Formal assessment)

Well, assessment is a continuous process therefore when teachers assess *for* learning, they use assessment as a tool which help the learning process, where the teacher is not only assessing what learners have learned but also what they did not learn. It is on this basis that assessment *for* learning gives the teacher an opportunity to see what learners have learned and what is needed in order for the teacher to build on, for learners to learn something. Therefore I do assess learners continuously because I am emphasising assessment *for* learning and not necessarily assessment *of* learning and this helps me to see what learners have learned and what they did not master so that I can build on, for learners to know something.

Here now, environmental learning can be assessed through projects, can be research, can be assignments or you can assess through practical investigations, topic tasks or topic test where you include what you discuss with your learners inside the classroom and outside the classroom to see now if they gain something or did not gain anything, so that you can improve your strategies to teaching and learning. Assessment can be from a survey or a discussion with an expert somebody or from what they have observed within the environment. The assessment is related to the formal assessment in the Life Science syllabus. For example topic tasks should be only out of 10. If you make it out of twenty then you convert to 10, or you find the topic is bigger then you divide it into three or four topic tasks out of ten.

Environmental learning can also be assessed through examinations but is less examined, maybe only 3% of the total examination marks are environmental learning and sometimes you cannot even find environmental learning in section A which is a multiple choice section and in section B, you can find very few questions on environmental learning. This is also a problem when it comes to the inclusion of environmental learning.

FQ. Do you think assessment is important? Yes. Assessment is very important because it enables me to reflect and this helps me to see what have been covered and achieved. Reflecting on the lessons assists with the strengthening of the teaching whenever needed.

Q8. How have learners responded to the inclusion of EL in your lessons?

Ok, here like I have mentioned it already that learners respond according to the topic being discussed, if the topic is interesting or learners are more interested in a certain topic, you see everybody is more or is fully involved or participating. But coming to topics like sex education only few learners will be participating otherwise learners are more passive in this topic because of culture or traditional background for instance in our culture, things related to sex are not openly discussed and elders do not discuss these issues with children so this leads to lack of interest among learners in sex education topic, leading to poor participation. But if you come to topics like classification of living organisms, ecology here almost everybody will be more active, actively participating. In most cases learners respond according to topics being discussed. But I also realised that few learners are not exposed to environmental learning so their knowledge is limited, and this also leads to poor participation.

Q9. Overall, how much time is allocated for EL in Life Science?

The problem here, the whole subject or lesson for life science is 40 minutes, but there in the syllabus is where now the problem is, it is clearly stated that if teaching this subject, you want to include this you will be given extra minutes. Here now time will only be enough especially if you go outside but inside the classroom time will not be enough but the lesson is only 40 minutes it does not matter whether including EL or not.

Q10. Overall, what do you see are the best ways to include EL?

There are lots of good ways to include EL you might just include it inside the classroom, you call one expert for example we are having this topic of conservancies, just call an expert from a certain conservancy and come into the classroom where now s/he tell or give learners more information about the topic or you can take your learners outside, it can be at a certain place, it can be just nearby the school surrounding where they can familiarise themselves with the real situation or you can give the project, an investigation or a research where learners can go and ask something related to the topic you want them to go and ask or I said we are having some posters so you bring posters to the learners to identify how the topic link to the environment just by looking with their eyes on the poster or you download a DVD having a certain topic presented in a way that is connected to the environmental learning. Another best way to include environmental learning is by using local examples that learners are familiar with and are able to relate to when teaching.

Q11. Are there comments/suggestions you would make on the constraints and enabling of EL?

What I could first comment is that environmental learning topics must be emphasised at the college of education and student teachers must be trained on the inclusion of EL, not only in Life Science but also in different subjects and the Ministry of Education should put up more programs to train teachers and advisory teachers on the inclusion of environmental learning in life science because teachers are not well trained. Teachers need to be well trained because when we were trained as teachers, environmental learning topics were few and were not discussed in details and I also emphasised that more time should be given whenever you are including environmental learning and school management should be trained so that they could understand what is environmental learning so that they will be able to facilitate and guide environmental activities at schools. The grade 10 Life Science syllabus should also be broadened to allow more environmental education topics and more information on how to include EL in Life Science need to be added in the syllabus.

Another comment is that, insufficient teaching materials like textbooks, posters as well as time and other environmental learning materials such as games, charts, pictures and audio-visuales are constraints to effective inclusion of environmental learning inclusion.

Q12. How do you acquire Environmental knowledge necessary for EL?

Ok, this one now I acquire it I remember when i was in grade 10 there was a programme called enviroteach and we were addressed by one man (he was a white man) on a certain topic which I cannot remember, on how to link this topic to environmental learning and through my training at the college of education we also discuss about EL but not that much deeply. The other things where I get EL knowledge i remember we were having a Life Science training or rather workshop conducted by the LS advisory teacher at Okatana mission .There was a certain topic about EL where now we discuss how to link our topics in LS with EL. This one was also not discussed deeply but from there is when i use to ask colleagues especially if you are teaching the same subject like I am teaching at this school and there are other LS teacher at neighbouring schools now if I got stuck somewhere i ask e.g. how do you tackle this topic? , how do you attach this topic to EL? Otherwise that's how I got EL knowledge.

FQ. How would you describe your EL knowledge? I think I am fairly exposed in terms of knowledge in the area of environmental learning and I can say my EL knowledge is about 80% because I was also trained on how to go about environmental learning at the college of education although not in detail.

The experience I have play a major role when it comes to my EL knowledge and this experience I have make me better prepared when it comes to teaching and the assessment strategies to use and because of my experience, I feel more comfortable when teaching environmental learning topics. Another thing is that, the love I have for nature makes me interested in teaching environmental learning topics in Life science. My love and interest for nature influence my interest in teaching environmental related topics.

Q13. Do learners have LS prescribed textbooks?

Yes, learners do have prescribed textbooks but not enough for every learner, so they are sharing these textbooks. We are using two textbooks: Life Science in Context and Discovering Life Science and they are all enough to our learners.

Q14. What knowledge do textbooks provide for the inclusion of EL?

The knowledge in the textbook is based on the content, thus the textbook provides subject content but it is not that clear when it comes to the inclusion of EL cause the textbook is just describing or giving notes on a certain topic but is not clearly stating that when you are teaching a certain topic, this how you can include EL. The textbook is in consistent with the syllabus learning objectives for example the Discovering Life Science ones and the syllabus is clear when it comes to the inclusion of environmental learning. The textbook gives information on topic content but not how to include EL although it provides activities which guide the inclusion of environmental learning such as investigations, researches and outdoor activities on certain EL topics. I can say the textbook is more theoretical and tend to focus more on the subject content rather than skills development although it provides activities which guide the inclusion of EL. Therefore, I use both the syllabus and textbook as my main resources because I find them effective and useful than other curriculum documents.

FQ. Do you have other curriculum documents for example the teachers' guide to the text book you are using? I do not have the teachers' guide that's why I don't make use of it.

Q15. What other supporting materials are available for teaching EL in LS?

Ok well, here now I will start with my colleagues, you know we are having, each department is having heads of department for example we fall under Maths and Science department. If now we are a lot of teachers there some are for LS, Agriculture, Maths and physical science. Who find a certain topic taught in agriculture or LS or there half physical science is where now you go ask other teachers or HODs how now did you integrate this topic to EL and give you information or I ask colleagues who are teaching the same subject how they do it. The other advantage we are having here at school we are having internet is where now I can download a DVD where there is a teacher presenting a lesson and I see how he or she integrate that topic to EL or I download just topic, EL and I see what is it how you should integrate it when it comes to teaching. There are also some environmental learning posters, we do have these NMCOL DVDs there are also very nice presented lessons there almost include EL. I also get Biology modules for grade 12. These Biology modules some of them I bought them at NAMCOL bookshop some of them like last year I went to borrow them at Nuuyoma senior secondary school and we make use of them and once we cover the topic we make copies then we take them back. They are very much useful because our learners get a lot of information. But all these extra support materials are not enough, they are in short

There are certain environmental learning posters like we are having this one for ecology, it shows global warming and green house effect for example I use this poster to ask learners to look at it and discuss how global warming affect the environment, the negative effect of global warming and how people will now prepare themselves to phase changes which will be brought up by global warming and what we can do to make sure we do not pollute the atmosphere for example by burning fossil fuel by not chopping down all the trees, by not using all those chemicals which could destroy the ozone layer and bring about global warming and green house effect. But still these posters are not enough.

FQ. Where did you get these posters?

Some of these posters were donated by enviroteach project and some of them were made by learners. You see for example you are teaching global warming and green house effect, you just say ok, draw or design a poster where now you include the effect of global warming to the environment, how to reduce global warming on the environment or the negative effect of global warming or you let them design a poster about how people will prepare themselves to phase changes that will be brought about by global warming. These activities use to be given to learners as practical activity for assessment or just for learning.

Q16. How do you make use of these extra support materials to teach EL topics in LS?

Well in my case I like to use these extra support materials for example I cover a topic during the lesson you know the lesson is only having 40 minutes now once I cover the topic for example during the study time is when I will take my learners to the internet to see or to compare the real situation in the classroom and they compare now how the topic we discuss how we will attach it to environmental learning or I take my learners outside the classroom and we look at the environment, we ask experts who are also having more information on a certain environmental learning topic or like posters ,we discuss the topic and I show these posters to the learners for them to see and to identify what they can see in the posters. So I also use these posters to check the prior knowledge of learners before I start a new topic by doing that iam checking learners' prior knowledge. The other thing we can for example let me say iam going to teach about classification of living organisms, I can send them outside then I let them move around the school environment and you note any living organism you find and have a note book, a fly, they write we saw a fly, a frog, snake and so on then goats, sheep then inside the

class now I ask them to group those organisms into groups. I ask them why you group them like this and not like this. Is for them now to answer the question is when now we go together later with them.

Coming to the use of biology modules as extra support materials to teach EL topics in LS is that the Biology modules are more self explanatory and the topics are more in detail than the prescribed text books because the textbooks for grade 10, the topics are divided into basic competencies. For grade 10 we are having less or few basic competencies than for grade 12 therefore for 12 is broader than for grade 10 that's why I consider making use of the Biology modules also.

Making use of Internet as an extra support material, i use two ways, i can go there to look for the information by writing a topic and go through and i see now how this topic is or how this one is presented in the sense that you integrate it to the environmental learning or i download a DVD then i will allow my learners to listen to the teacher who is presenting that lesson and to see how that topic may be included to the environmental learning.

Q17. What training and guidance from subject advisors have you had on the inclusion of EL (was the training useful to you?)

Okay like I said it already I attended a workshop three years back and in this workshop there was a sub topic on inclusion of environmental learning in Life Science but the whole workshop was not about inclusion of Environmental Learning it was just a sub topic. The workshop was useful to me cause I got knowledge on how to include environmental learning in Life Science, only that time was limited and every teacher was asked let me say you are teaching this topic how now you include environmental learning in the topic? Everybody was giving his/her ideas and by listening to different ideas given by other Life Science teachers on how they integrate EL is when I get lot of information on how to integrate environmental learning in different topics in Life Science. And when I was in grade 10 I attended a workshop conducted by enviroteach project I remember it was all about environmental learning. Now when I become a teacher I realise that this workshop was connecting subjects to environmental learning. This workshop was also useful me as I do reflect back when including environmental learning in Life Science. The enviroteac gave the school resources such as books and posters about environmental learning and I am using these resources when I am teaching environmental learning topics in Life Science.

From the subject advisor that was the only workshop I attended which had a sub topic on the integration of EL in Life Science and it was really useful. I think these kinds of workshops need to be conducted regularly for the Life Science teachers to get more information on the inclusion of environmental learning in Life Science. Honestly speaking teachers are not well prepared in terms of environmental learning inclusion in Life Science through training.

Q18. What if any, project work on environmental topics has been done at your school?

I think here we do lots of projects on environmental topics; number one you see i am also teaching Agriculture grade 10 and we are having that topic of the digestion system, learners are allowed to see the four chamber stomach of a ruminant animals and they are allowed to see those large intestines, liver, pancreas etc. Know we did this one we bought a goat and we dissect it, not inside the classroom but outside the classroom. Then there learners identify these parts themselves. The other one we use to have lots of research projects, we move around or we assign learners to go outside the school they can go either to the clinic to ask a nurse or we take them to a tour for example to Etosha is where now they can see different varieties of living organisms, different types of wild animals is where now they compare the Etosha biodiversity within the biodiversity from their area, is where now they classify

and differentiate between types of ecosystem example in grade 7 natural science, grade 8 and 9 life science there is a half question of that topic-ecosystem.

FQ. How do you celebrate/participate in the Arbour day?

I remember it was last year I went to Ongwediva Rural Development Centre, the main aim was to collect lots of plants then we come and plant them here, the moment I went there I found a lot of teachers, lot of people who are to collect plants and I remember I only brought 4, We plant them at school and the only problem is only that we don't have a strong fence some of these plants are now destroyed by animals like goats and cattle but if the fence was that strong enough then the moment you enter you could see lots of plants. We also have a school garden, mostly used to plant crops and trees. In the garden is where we use to carry our practical activities and projects like for transpiration looking at how plants loss water from leaves we put some plastics on the leaves for few minutes and we compare loss of water or some of the plastic we tie on the side of the sunlight some in the shade and we compare the water we found in those plastics doing all of these enables learners to practice their skills and knowledge. We also do cleaning campaigns to keep the school environment clean and these campaigns are in the school calendar of activities.

Q19. How do the school policies and practices support the inclusion of EL?

Ok, well the school policy is also support the inclusion of environmental learning cause in the school police is where now its stipulated clear that or we are given this chance of not only teaching our learners inside the classroom otherwise we can take them out, we can give them for example project, research or assignments where they can go and ask other people who are also having more information on a certain covered topic and in the school policy it's clearly stated that if you want to take your learners for a tour and there is enough money or you are having a transport, you are free to do it. The thing now that will limit us to do this properly is lack of finance and transport. Therefore, the constraints are money, transport, sometimes time. Otherwise the school policies enable things and support the inclusion of EL where possible e.g. the school can give as money to go for a tour or buy extra support materials for teaching EL.

FQ. The school does not put time aside for inclusion of EL?

Is not really enough time otherwise if you take your learners out, sometimes you will be given enough time on the process you go there you want to ask something might be those people you want to interview, they are like not having that communication skill is like they are afraid to give all the information is like they are afraid to talk to your learners and so on.

FQ. So people where you are going to visit may be a constrain that they might not give enough evidence or information you are looking for?

Ya, depending on the certain topic you want to discover, thus limited information from community members and official due to lack of confident.

Q20. In what ways does the school management support you to integrate EL?

Okay well here the school management like we ask them, we want to take our learners outside, there they can allow as or we say are planning to have a tour or to visit a certain place because we want our learners to gain information on certain topic there if there is money no problem they can give us this opportunity. The other support we get from the school management is what I mentioned already that if there is a certain problem in a certain topic you go to the management e.g. HODs, you ask them how

to include environmental learning in certain topics such as global warming, then they can help you or direct you go to this teacher he/she also teach the same topic then you see now how that teacher will help you. For example we are having this topic of ecology it's in life science grade 10 and is also in geography grade 10. I remember a teacher for geography came to me one day and ask me, how did I tackle this topic and I give him some of the information and later I go to her again to ask how he relate the effect of global warming to EL and he helped me. The management support us financially by giving us money to go buy other extra support teaching materials such as Biology modules at NAMCOL centre.

Q21. Do parents/community supports you and the learners to integrate EL?

Now here parents you can say parents can support very well, the problem came when it comes to the topic you want to cover like you go there asking about cleanliness, classifying of living organisms or diversity of living organisms, you go there asking information about ecology there they can give you lot of information. But when asking information based on the topic of sex education, you will only find few who will be interested to provide the information required. Some will not give learners more information due to cultural background and traditions that parents or elders should not discuss sex related issues with parents but other topics they can help.

Parents do also support the school financially by paying the School Development Fund (SDF) and this money can be used to buy extra teaching support materials at school to support the inclusion of environmental learning. Parents are always willing to contribute toward school tours.

Q22. How supportive are the other teachers to the inclusion of EL in your classes?

Okay now this one other teachers in supporting that's way I say you find you are having almost related topic in life science, Agriculture, physical science or geography here now you go ask other teachers how do you tackle this topic?, how did you relate this topic to EL or how did you attach this topic to the environment? This one they almost help. The problem is only when we were maybe trained as teachers this topic of environmental learning was not that much discussed in more detail so you find yourself teaching but the moment you are teaching you include EL but you are not aware that you are already including EL in your teaching. Teachers need to be well prepared so that they are aware of how they should include environmental learning in Life Science.

Other teachers are willing to support because I use to ask them for example in geography when it comes to ecology I go ask for more information example how to tackle this topic and how do they attach it to environmental learning and these teachers are always willing to help.

Q23. Is the time given to EL sufficient in your opinion and why?

Time give to Life Science which include environmental learning is not enough, for instance I have to send my learners to go in the community to find information on a certain topic, if you are doing this during the lesson/period, time will not be enough cause the moment you go there, you find that learners want more information so they are asking lots of questions so 40 minutes will be over without completing what you were doing. That's way practical activities and research; I normally use to do these activities during the afternoons as this also allows me to complete the syllabus because it's too broad. Actually 40 minutes is not enough for environmental learning inclusion because it requires practical activities which require learners to go in to the community and local environment to identify and look at environmental issues in their community. Afternoon classes are always a challenge

because learners number is always decreasing, learners are always in small numbers during afternoon activities.

Interview 2(I2)

School 2(S2)

Teacher 2(T2)

Date: 18 June 2014

Time: 14:00

Pupils' number in grade 10 Life Science classes: 29

Professional qualifications: BETD (Agriculture & Life Science) + Further Diploma in Education (Biology)

Years of teaching Life Science at grade 10 level: 12

1. What do you understand by environmental learning? (Give example of environmental learning in Life Science)

In my opinion as I understand it, I do understand that environmental learning is whereby learners learn about their surroundings and understand their physical and biological world around them at the local, regional and international level. And it includes how society uses the natural resources in order to satisfy its needs. An example of environmental learning in Life Science I can give is ecology is ecology and it includes the topics such as global warming, depletion of the ozone layer and human biology and health. There are few environmental learning topics in Life Science grade 10 syllabus but I feel that it is not necessary to add more environmental learning content because those learners with an interest in environmental learning can just proceed with it to tertiary level.

Follow up question (FQ). Approx EE Life Science content coverage in the syllabus?

I think environmental learning content in the syllabus is about 10%. But to me this does not matter. Apart from the syllabus and the textbook, the type of learners I am having and the love I have for nature influence my teaching of environmental learning topics whether they are less or more.

2. How does the syllabus and policy guide the inclusion of environmental learning?

The syllabus states that environmental learning should be taught across the curriculum and this makes the inclusion easier due to the fact that some topics in Life Science such as global warming is also in geography thus learners can come in Life Science class with knowledge from other subjects like geography. The syllabus guides the inclusion of environmental learning because it provides activities which support the inclusion of environmental learning and assists us to identify environmental education themes in Life Science. But when it comes to the inclusion of environmental learning, I mostly use the syllabus and the textbook during teaching and learning and I do not use other documents like the subject police because I do not find them useful.

FQ. Does the syllabus guide how you should include EL in the lesson?

Not a clear picture on how to do it, sometimes you can just on your own on how to include it but there are activities e.g. practical activities which guide the inclusion of EL.

3. How have you included environmental learning (EL) in your teaching of Life Science? (Give examples)

I included EL to my teaching by telling learners the importance of plants as an example if I am dealing with plants. I let learners do projects, surveys and practical investigations on environmental learning topics and also ask them to find information prior to the lesson, group discussions and presentations and use examples of things that are known by the learners when teaching.

FQ. Do you encounter any problem while involving learners in activities?

Yes, some learners do not see themselves as part of teaching and learning, this result on them not participating in the class.

4. In your experience, what topics lead themselves to the inclusion of EL?

In my opinion I think topics such as global warming, green house effect, diversity of living organisms, health education and the topic of the ozone layer, I think these are some of the topics which lead themselves to the inclusion of EL.

5. Do you experience any challenges in the inclusion of EL in your life sciences program? (Describe them)

Yes sometimes, some of the challenges I have experienced in the inclusion of EL in Life Science program includes insufficient time, insufficient time to make teaching and learning process of EL more effective. Time is not sufficient and again we have a school library that does not provide enough reference books to provide relevant information about environmental learning. Textbooks are also not enough; learners are having textbooks but each learner need to have his or her own textbook particularly the Discovering Life Science textbooks because they are effective as they cover the syllabus objectives. Another challenge I experience is a shortage of environmental learning materials such as games, charts and pictures and also the audio visual cassettes. Poor participation of some learners because they do not see themselves as part of teaching and learning is also another challenge I experienced.

6. What methods do you mainly use for including EL in Life Science? And why?

For including EL I mainly use a method, not really a specific method but I use to send learners either to the parents or to the community to find certain information prior to the lesson for instance it can be about infectious diseases for example I let learners find some of the traditional ways on how to prevent the spreading of malaria then after collecting information, learners will come back, discuss in groups and report what they found. My usual methods of teaching environmental learning actually are asking learners to find information prior to the lesson, group discussions and presentations allow learners to learn from each other and allow cooperative learning and the method of sending learners to find information prior to the lesson enables learners to find additional information than the syllabus requires.

FQ: Are there any alternative teaching methods you would like to use to teach environmental learning but could not use them?

Yes, I want more audio visuals, charts, posters and games for environmental learning inclusion.

7. How is EL assessed? (Formal assessment)

Assessment should be done continuously in order to encourage assessment *for* learning instead of assessment *of* learning. Assessment is important because it enable me to test the understanding of learners when it comes to environmental learning and it also allows me to reflect so that I am able to see what I have covered and achieved , again reflecting on the lessons assist me to strengthen teaching where necessary. The following assessment methods are recommended by the syllabus: topic tests, topic tasks, projects and practical investigations. Environmental learning is also assessed through examination but there is always few EL questions in the examination, maybe only 3% of the total exam marks are EL and usually these EL questions are only found in section B(structured question section) but you can hardly find EL questions in section A(multiple choice questions section).

8. How do learners respond to the inclusion of EL in your lessons?

For instance in response to what they are asked to bring, for example if I ask them to bring e.g. different plants to the class to be used to differentiate between monocotyledons and di-cotyledons, most of my learners try by all means to do or to bring what they are asked to do, which means that most of my learns respond positively to practical activities which are related to EL although there are few learners who do not participate because they do not see themselves as part of teaching and learning.

9. Overall how much time is allocated for EL in Life Science?

I don't think there is specific time allocated to EL in life science, but me I use to integrate EL within the time allocated to life science periods which is 4 periods a week and the teaching length is 40 minutes and I think this is not enough for environmental learning inclusion. I therefore would like to ask from the ministry of education at least to add more two periods to the life science subject per week so that they will become six periods per week.

10. Overall, what do you see are the best ways to include EL?

The best ways to include EL are to let learners find information from the parents or community prior to the lesson, discuss in groups and report back, using the immediate environment as a teaching aid , practical investigations and also experimental methods. Using support materials to get more information such as reference books from the library or other books can also be the best way to include EL.

11. Are there comments /suggestions you would make on the constrains and enabling of EL?

Here I can just comment to the additional periods to life science because time is not sufficient and if time is not sufficient, this will prevent the effective inclusion of EL in Life Science. Lack of textbook and other resources to teach environmental for example environmental learning materials such as audio visuals, games and charts are constraints to effective inclusion of EL in Life Science. However I have a manageable number of learners in my class which is 29 learners and its controllable and this enable the inclusion of EL effectively especially when it comes to monitoring of learners in groups.

12. How did you acquire the environmental knowledge necessary for the inclusion of EL?

I acquired the environmental knowledge necessary for the inclusion of EL just through learning / studying and in the early years of 1990s the ministry of education use to give us workshops through this Danish project called life science project and is where I acquired some of the environmental knowledge.

FQ. How would you describe your environmental knowledge?

I think my environmental knowledge is about 72%. This is because of the experience I am having and this experience made me better prepared when it comes to teaching and assessment strategies to use when including environmental learning. And it is because of my experience that I feel more comfortable when teaching environmental learning topics. Because of the experience I have, it is easier to include environmental learning in Life Science because I already know what and how to teach and what types of projects to give to learners in different environmental learning topics. Therefore, teaching the same thing for a long period and teaching it over and over it becomes easier.

13. Do learners have Life Science prescribed textbooks?

Yes, about textbooks learners do have prescribed textbooks but they are not enough for all learners, that's why sometimes some learners use to share these textbooks. We are using two books: Discovering Life Science and Life Science in Context. Discovering life science textbook has more information compared to the other one.

14. What knowledge do textbooks provide on the inclusion of EL?

The textbooks we are using provide relevant content knowledge to the learners in case of to be aware of the problems occurring in their environment especially the problems which are cause by global warming, human activities that contribute to global warming and again textbooks also provide knowledge on how to compact the spreading of sexually transmitted diseases and infectious diseases in the community. Apart from that, textbooks also suggest relevant activities which guide the inclusion of environmental learning even though these activities are few. The textbook appear to provide more theory than practice but they are in line with the syllabus objectives that's my teaching is mainly informed by the textbook and the syllabus because they are relevant.

FQ. Do you have other curriculum documents for example the teachers' guide to the textbook you are using?

Yes, I have the teachers' guide as well as the subject policy but I don't really use them because I think they are not as important as the textbook and the syllabus.

15. Apart from the textbooks, what other supporting materials are available for teaching EL in life science? (Where/ how did you get these?)

At our school I use to make use of the reference books and I use to take them from our school library and they are also not enough and I also use to ask either a nurse from the nearby clinic to give relevant information on a certain topic, topics which are related to health education sometimes I use to do so. And the other ways I also use the community as an extra support material whereby I use to send learners to get information on certain environmental learning topics.

16. How do you make use of these extra support materials to teach EL topics in Life science?

I just use to integrate these supporting materials in my lessons as a part of it just for teaching and learning process in a particular environmental learning topic and I also use them the time I am preparing my lessons related to environmental learning I can make use of them to get more or additional information which are not in the prescribed textbooks.

17. What training and guidance from subject advisors have you had on the inclusion of EL (was the training useful).

I received several training workshops on teaching environmental education topics in life science in the early 1990s and that training was provided by this WUS – Denmark-Life Science Project in collaboration with the ministry of education and culture in those years. But nowadays no training workshops received from this subject advisor of us. The workshops I got in the 1990s were very useful because some of the information and the material I am working with among my learners are from those workshops. I am therefore of the feeling that teachers need to be trained, to be well prepared on the inclusion of environmental learning. Subject advisor must be committed and train teachers on how to go about the inclusion of environmental learning because most teachers lack this knowledge.

18. What project work on environmental topics has been done at your school?

Here at our school we are having a school garden and in that school garden is where by learners or life science learners do or practice garden activities. I think that is the only project we are having at our school. In the past we use to keep chickens where learners are taught about poultry farming but now it's no more there. When it comes to life science for instance, in the school garden learners do practice practical activities such as; learn how to plant crops, how to prepare the soil or how to sow; the depth or the space between the plant, practicing mulching and also planting trees. Those are the things they are suppose to know. This allows learners to practice their knowledge and skills. Apart from the school garden, we also do cleaning campaigns at school in order to keep the school surrounding clean. These cleaning campaigns are scheduled in the school calendar of activities. Cleaning campaigns enable learners to understand the importance of keeping the school clean.

19. How do school policies and practices support the inclusion of EL? (How is the inclusion of EL supported at school? Does this constrain and enable things in any ways?

The school policy allowed us to come up with the school garden, provide opportunity for life science teachers to buy garden tools, seeds, seedlings, manure or whatever is needed to develop the school garden

20. In what ways does the school management support you to integrate EL?

When the management are planning the activities of the year or the term, they use also to include some EL activities in their school calendar of activities such as cleaning campaign for the school environment and the Arbour day celebration whereby learners and staff are allowed to plant trees at school. Planned tours are also included in the school calendar.

21. Do parents (community) support you and the learners to integrate EL?

In connection with our parents, the parents in our community , do also take part in activities related to environmental learning like cleaning campaigns and especially when I send my learners to them for assistance from them , then they will just respond positively for instance if I ask learners to go and ask information from them on deforestation, soil erosion etc.

22. How supportive are the other teachers to the inclusion of EL in your classes?

When it comes to the teachers at our school, they are very supportive for instance if we produce products from our garden they use to buy them and sometimes they use to remind my learners to go and do their garden activities especially to go and water the garden, they can help to remind learners. I also use to get support especially from the geography teachers when I am teaching the topic of global warming.

23. Is the time given to EL sufficient in your opinion? (Why?)

In my opinion I think that there is no specific time which is give to EL. Time is not sufficient to make teaching and learning process of environmental learning more effective because life science is given only 4 periods a week and a period is 40 minutes although the syllabus is too broad especially for grade 10 and that's why it will be good if additional two periods will be given to life science to be six periods a week. This can be better because it will enable us to complete the syllabus on time and will enable us to use the additional periods for practical activities and carry out projects with learners. I use to manage my time properly, if not I could not cover my syllabus because my first priority is to make sure that I complete the syllabus. Because 40 minutes is not enough, I am forced to teach in the afternoons to complete some tasks, this is a problem again as learners are always missing afternoon classes.

Interview 3(I3)

School 3 (S3)

Teacher 3(T3)

Date: 26 June 2014

Time: 14:00

Pupils' number in grade 10 life science classes: 42

Professional qualifications of teacher: BETD + Further Diploma in Education (Biology)

Years of teaching life science at grade 10 level: 7

1. What do you understand by Environmental Learning? (Give example of Environmental learning in Life Science).

Environmental learning is when you are studying about the environment, looking at the aspects like how a biotic and biotic factors are interacting in the ecosystem. Example of environmental learning in life science is like when we are studying like the monocotyledons and di-cotyledon plants and when we are studying about ecology whereby we are looking at things like the greenhouse effect, global warming and the depletion of ozone layer. But I feel there is a need to add more environmental learning topics in Life Science grade 10 syllabus because they are few or rather inadequate.

Follow up question (FQ). Approx EE Life Science content coverage in the syllabus?

I think approximately environmental learning content in the syllabus is about 15%. I think they should increase the environmental learning topics in the syllabus. We need to look more on sustainability of

the environment, the impact of human activities on the environment, we can even start with animals the way they are grazing, we do have overgrazing that is caused by animals, we do have deforestation caused by human activities and pollution caused by human activities and therefore if we could make environmental learning more without only focusing on global warming, it will broaden the knowledge of both teachers and learners on how to take care of the environment.

2. How does the syllabus and policy guide the inclusion of EL?

So according to the syllabus and the policy guide of life science it states that we should include environmental learning in themes like ecology and diversity of living organisms. It's stated in the syllabus that when we are teaching learners the difference between monocotyledon and di-cotyledon plants, learners can study these plants in the environment, for example they can take something like a survey in the environment, collecting those plants and bring them in the classroom. The syllabus indicates that environmental learning is taught across the curriculum and this makes the inclusion easier due to the fact that learners will come with environmental knowledge from other subjects such as geography, agriculture and physical science. Because I do not have the subject policy my teaching is therefore mainly informed by the syllabus and the textbook because they are available and I find them relevant.

3. How have you included EL in your teaching of Life Science? (Give examples)

I include this one like in grade 10 in topics like global warming, greenhouse effect, depletion of ozone layer. When it comes to depletion of ozone layer I ask learners for example to bring some products which release CFCs in the atmosphere and explanation how the ozone depletion will affect the living organisms in the environment and I give examples of things that learners are familiar with. When it comes to topic like global warming I use to ask learners to collect pictures illustrating human activities that release gasses(carbon dioxide, nitro oxide) in the atmosphere for example they may bring pictures of deforestation or slash and burn farming practices or can be combustion by cars or factories.

FQ. Do you encounter any problem while involving learners in activities?

Yes but not that much serious. The problems I encounter is lack of knowledge among (some) learners when engaging them in environmental learning lessons, large class makes it impossible to supervise every group.

4. In your experience, what topics lend themselves to the inclusion of EL?

According to the syllabus that I am using in grade 10, global warming and green house effect, the depletion of ozone layer (under ecology theme) and diversity of living organisms and health education are the topics which lead themselves to environmental learning.

5. Do you experience any challenges in the inclusion of EL in your life sciences program? (Describe them)

I do experience some problems as such as shortage of teaching materials for example the concrete materials that we can use in the classroom that can really make learners understand such as video clips, charts, games, pictures and posters. Here I am talking of extra materials which are real teaching aids that can make learners understand. When coming to teaching materials I have to struggle to get real teaching materials to get into the classroom but...that cannot really prevent us to like not going ahead with the topic.

Insufficient time to include environmental learning is also one of the challenge I experienced and lack of knowledge among learners for example if you ask them the effect of deforestation to living organisms, they will be struggling to get the correct answers. Large class is also another challenge to effective inclusion of EL. Like in my case I have 42 learners, even if I grouped learners into groups, groups are too large and a 40 minutes lesson is not enough to monitor each group. Yes learner centred should be used...but when it comes to large classes it's just impossible to make use of learner-centred.

6. What methods do you mainly use for including EL in Life Science? And why?

I normally use learner centred method because it makes learners understand better when doing things on their own, using their prior knowledge so it enables them to be active participants and allows them to learn by doing and are able to learn from each other. And the as a teacher you will just be there as a facilitator.

Learner centred includes letting learners discuss for instance environmental learning topics in groups and present to the class. I also let learners do projects, investigations and surveys in the local environment on environmental learning topics.

FQ. Are there any alternative teaching methods you would like to use to teach environmental learning but you cannot use them?

I would also like to use video clips in order to expose learners to environmental issues such as pollution, deforestation and flood and also to use posters, games, pictures or charts to teach environmental learning topics but they are not available at school

7. How is EL assessed? (Formal assessment)

Assessment is a continuous process; this promotes assessment *for* learning rather than assessment *of* learning. Assessment is important because it allows us to test learners' understanding of environmental learning it also allows teachers to reflect on their teaching. It is important for teachers to do reflections because it allows them to go through the syllabus, look at what has been achieved or covered to improve the speed of teaching. But when it comes to me, I only do reflection sometimes; this is because I have too many subjects to teach therefore I do not get enough time to do reflection for every subject because of workload.

We normally use formal assessment whereby we give tests, we give topic tasks, we also assignments and practical activities for instance when it comes to monocotyledon and di-cotyledon plants, I let learners go into the environment and collect those types of plants from the environment and bring them in the classroom so that they classify them.

Examination is also one of the assessment methods but I observed that there is little coverage of environmental learning in the examination paper. Few EL questions are found in section B (structured question section) and very few or none EL questions in section A (multiple choice questions section). Therefore little coverage of environmental learning in the examination influences my inclusion of EL. Environmental learning topics do not have much impact on learners because of how the set up is, environmental learning topics are the last in the syllabus, and are few and some learners do not have environmental learning knowledge.

8. How do learners respond to the inclusion of EL in your lessons?

Learners respond positively to the inclusion of EL, they really like it because they are familiar, like if you are talking about plants they are familiar with plants, there are plants in their environment even in their villages there are plants and if you are talking about deforestation, they are familiar with deforestation and its taking place in their community. They really respond positively to environmental learning but the problem I am experiencing here is lack of knowledge among learners for example if you ask them the effect of deforestation to living organisms, they will be struggling to get the correct answers.

9. Overall, how much time is allocated for EL in Life Science?

There is no specific time allocated for environmental learning, it's only the time allocated for life science periods which is 40 minutes and life science has four periods a week.

10. Overall, what do you see are the best ways to include EL?

I think the best ways to include EL is that it should be taught across the curriculum not only in life science but it should also be taught in other subjects like geography, agriculture etc. EL should be taught in a learner centred method where we allow learners to do things on their own, to practice things on their own using their prior knowledge, Instead of like teaching it as a theory or something. Learners should be allowed to do inquiry, investigate and collect information from the community or from their immediate environment and present that information in the class.

11. Are there comments/ suggestions you would make on the constraints and enabling of EL?

I don't have really much comments or suggestions about constraints and enabling of EL but when it comes to topics like ecology, it's really helpful because it help our learners to know like nowadays we are experiencing a problem of global warming so it's really helping our learners to know how to take care of our own ecosystem, it can be either in the atmosphere it can be either the plants itself it really help our learners of what we must do in order to avoid future problems like global warming. In other words it enables learners to identify environmental problems within their communities and come up with possible solutions on how to prevent them. On the constraints when coming to EL is only when coming to teaching materials because I have to struggle to get the real teaching materials to get into the classroom but we can use the immediate environment or our surrounding environment to familiarise ourselves with some of the topics so we use the local environment to teach some environmental topics.

Lack of resources and textbooks are also constraints which prevent the effective inclusion of EL but my interest for EL enables me to teach environmental learning. Because of my interest, I found environmental learning interesting because it allows both teachers and learners to explore their environment and find possible solutions to environmental issues such as deforestation, overgrazing and pollution.

12. How did you acquire the environmental knowledge necessary for the inclusion of EL?

I acquire this knowledge through circuit based workshops conducted by Life Science facilitators whereby life science teachers come together and identify topics which they have problems including EL, and we show one another on how to present topics identified. And I also got this knowledge when I was studying at the college and at the university, but during our time environmental learning content was few and not usually discussed in detail.

FQ. How would you describe your EL knowledge?

I think I am more exposed in terms of knowledge in environmental learning and the experience I have play a major role when it comes to the inclusion of environmental learning. To me teaching environmental learning is an advantage because I am a science teacher and I have been exposed to environmental learning during my studies at the college and university so I have covered 70% of environmental learning.

13. Do learners have Life Science prescribed textbooks?

Yes but they are not enough, learners are sharing the available prescribed textbooks.

Yes and they are enough cause every learner has a textbook.

14. What knowledge do textbooks provide on the inclusion of EL?

The textbooks focus more on theory and are more focusing on topic content for example textbooks highlight more on what is greenhouse effect, global warming, and ozone layer, the importance of ozone layer in the environment and the causes of global warming and how should we prepare ourselves especially as Namibians for global warming. They also provide activities which support the inclusion of environmental learning such as outdoor tours, researches, and investigations.

FQ. Do you have other curriculum documents for example the teachers' guide to the textbook you are using?

I do not have the teachers' guide or the subject policy but I once went through them but I did not find them useful, I find them time wasting. I only have the textbook and the syllabus therefore I mainly use the textbook for teaching and the syllabus when planning my lesson plans and I find the two documents effective.

15. Apart from the textbooks, what other supporting materials are available for teaching EL in Life Science? (Where /how did you get these?)

Like when coming to the monocotyledon and di-cotyledon plants that we found in the environment this ones we can just make use of the local or our surrounding environment, we can get these plants from there, uproot them and bring them in the classroom. in terms of the depletion of ozone layer we use to collect some of the products which release things like CFS in the environment or rather in the atmosphere, we use to collect things like the polystyrene cups, we use to collect things like the air conditioners from the nearby suppliers and we also use to collect take a ways (the polystyrene plates) as well as body spray cans which we use to buy them from shops so that we can come and make use of them in the classroom when teaching about global warming and the depletion of ozone layer.

16. How do you make use of these extra support materials to teach EL topics in Life Science?

Like the plants that we use to collect, these ones we make use of them to distinguish between the mono and di-cotyledon plants because the syllabus states that learners must know the difference between these plants, for example these plants are different in terms of leaves some are having short broad leaves, some are having narrow leaves, even the flowers, even the roots are different some are having tap roots and some are having fibrous root system. In terms of polyester (cups and plates e.g. take a ways) these ones we make use of them like to show learners like for example if you happen to buy a take a way and you throw it in the environment, it will stay there for a long period of time and the natural process will now try to degrade it and when degraded now will release the CFCs into the atmosphere. The whole process is just to show learners the products that release CFCs in the

atmosphere and another thing that we use when coming to ozone layer we also use these spray cans I can make use of the spray cans like spraying in the class and explain to the learners that the smell which comes out it also contains some CFCs and those CFCs is the one which is released into the atmosphere. And I can also show those cans to the learners to make them aware that there are sprays written CFCs free or ozone layer friendly so when buying body sprays they should try to buy and use those written ozone friendly or CFCs free.

When it comes to using the local environment as teaching and learning material, there is where we uproot the plants to differentiate between mono and di-cotyledon plants and in our environment we have a dump site where we use to take all rubbish and we use to burn those rubbish so I use to take my learners there and show them and explain to them that when burning those rubbish, they are releasing carbon dioxide and nitro-oxide in the atmosphere and this will also increase those gasses in the atmosphere and lead to global warming. We use to explore the local environment, looking at how human activities contributing to global warming, for instance looking at the issue of deforestation in the community and explaining to the learners that our environment was not like that before but it was a forest and what happen to most of plant species that were there are cut down by community people in order to build their houses, make fields etc. I also take learners to oshans (pans) as we use to experience problem of flood and a flood is also one of the signs of global warming, I use to show those water to learners that they are there because of flood and so on.

17. What training and guidance from subject advisors have you had on the inclusion of EL (Was the training useful to you?)

Up to now so far I did not get any training or guidance on the inclusion of EL in life science from the subject advisors. I did not get any support from these people.

18. What project work on environmental topics has been done at your school?

The project work that has been done so far at school to support environmental topics is only an orchard and I use to take my learners there especially when I am teaching about monocotyledon and di-cotyledon plants, to look at features of those plants, they look at the leaves, flowers and they can also figure out the type of roots which are there, example tap roots that is the only way you can make use of an orchard. Cleaning activities are also done by the school in order to keep the school ground clean.

19. How do school policies and practices support the inclusion of EL? (How is the inclusion of EL supported at school?) Does this constrain and enable things in any ways?

The school policy has allowed as growing those fruit trees that we can make use of them when we are learning about the environment. The school policy also allows us to explore the environment for instance leaving the school and go to the nearby environment around the school. According to constrains, we don't have really any difficulties when it comes to the inclusion of EL on the side of the school policy. In other words, the school policy enables things by letting us go to the nearby environment and explore and investigate and by allowing us to grow fruit trees so the school provide money so that we buy seedlings for the orchard and come up with an orchard at school.

20. In what ways does the school management support you to integrate EL?

The school management give us some money to buy fruit trees, extra support materials such as spray cans and polystyrene products to use in the classroom.

21. Do parents (community) support you and the learners to integrate EL?

Yes, parents and the community members they support us a lot because if we happen to assign learners to do something and if that something needs the input of the parents, parents use to assist the learners. For instance I use to ask learners to get some information from parents related to environmental learning and they do provide. Parents and community do contribute financially as well as materially to school activities like tours and cleaning campaigns.

22. How supportive are the other teachers to the inclusion of EL in your classes?

Teachers support positively especially the agriculture teacher because we work together when coming to activities like growing fruit trees in the orchard. I also use to conduct the geography teacher like when it comes to global warming topic for instance how to present it to the learners and when it comes to plants, I use to ask the agriculture teacher for support and these teachers respond positively.

23. Is the time given to EL sufficient in your opinion? (Why?)

There is no specific time for EL but time that is allocated to Life Science lessons it is not enough for us to explore the environment and to include environmental learning in our lessons especially Life Science lessons. So our 40 minutes is insufficient, there is no double periods and this is a major concern we have been raising, because sometimes one need more than 40 minutes but you just can't, so you are forced to do projects and researches or practical activities in the afternoons but sometimes learners are missing out so the number of learners in the afternoons is always not the same. But teaching in the afternoons allows me to complete the syllabus because the grade 10 content is too broad.

Appendix 5: A sample of an analytic memo

Analytical memo 1: Teaching methods used to teach environmental learning

| Category | Comments/opinions/Quotes | Source |
|---|--|---|
| Current teaching methods | Learner centred methods, experiments, using demonstrations, learners' prior knowledge, and investigations. | D1, D3,D4 |
| | Use of local examples Asking questions and teacher presentation Explaining and giving summaries Use of learners' prior knowledge Assessment | LO1,LO4,LO6 LO3,LO5,LO6 LO1-LO6 LO1-LO6 LO1-LO6 |
| | Research, surveys, outdoor tours, group discussions, exposing learners, topic based presentations, research projects, asking learners to find information prior to the lesson | IIT1, I2T2, I3T3 |
| | T1 states that he uses different methods "... Life Science need practical methods; research, survey, even group discussion(learner centred method), I take my learners outside the classroom to get more information on certain topic discussed in the classroom or do a survey where I take them to an expert for e.g. a nurse, a doctor or an extension officer to ask for information & get information" He further indicates that "I take learners into the community where they are able to relate what they have learned in the classroom with the information they will get from the community or with what they will see in their environment and let them also present their findings" T1 explains that the main reason for using these methods is to expose learners to more information related to the topic discussed inside the classroom so that they are able to relate them to the concrete examples that they will come across in their environment "thus exposing them to real situation so they are able to learn about the environment not only in the classroom but they have this opportunity to go outside and touch things, look at things in real situation". Therefore, T1 states that his main method of teaching EL is by exposing learners to real issues or situations although he also use other methods like surveys, research projects, investigations and making use of experts. | IIT1 |
| T2 points out that "the teaching method applicable is mostly learner centred method which includes group discussion, presentation and projects". She emphasises that, " I use to send learners either to the parents or to the community to find certain information prior to the lesson, for instance it can be about infectious diseases for e.g. I let learners find some of the traditional ways on how to prevent the spread of malaria, then after collecting information, learners will come back discuss in groups and present what they found" T2 indicates that her usual methods of teaching environmental learning are asking learners to find information prior to the lesson, group discussions and presentations. She further indicates that she finds these methods effective, for example group discussions and presentations enabled learners to learn from one another and also allow cooperative learning and sending learners to find information prior to the lesson allows learners to find more information than those required by the syllabus. | I2T2 | |
| T3 states, "I normally use learner centred method because it makes learners to understand better when doing things on their own, using their prior knowledge so it enable them to be active participants and allows them to learn by doing and are able to learn from each other." She further states that "learner centred includes letting learners discuss for instance environmental topics in groups and present to the class. I also let learners do projects, investigations and surveys in the local environment on environmental topics" | I3T3 | |

| | | |
|--|---|------------------------------|
| Alternative teaching methods | Audio visuals such as video clips, posters, games, pictures and charts, | I1T1, I2T2 & I3T3 |
| Assessment | Tests, topic tasks, projects, practical investigations and assignments | I1T1, I2T2, I3T3 |
| Problem encountered when engaging learners | Lack of learners interest in sex education topic leading to poor participation of learners, few learners not exposed to EL thus their knowledge is limited. Some learners not considering themselves as part of teaching and learning as a result they do not participate in the class. Lack of knowledge among some learners | I1T1 I2T2 I3T3 |
| Learners engagement | Answering questions, few asking question and taking notes, read sentences in the textbooks. Group discussions and presentations | LO1-LO5 LO6 |
| Reflections | Critical reflection done on lessons Done sometimes due to workload, but it is important as it help improve the teaching process/practices | I1T1, I2T2 I3T3 |
| Using local examples | Use local examples that learners are familiar with, what they will be able to relate to when teaching Use examples of things that are known by the learners when teaching | I1T1, I3T3 I2T2 |

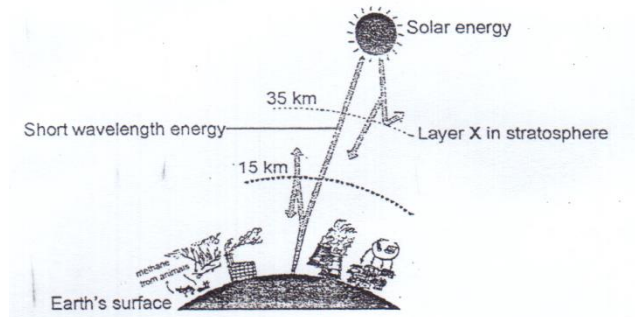
Appendix 6: Samples of learners' given test/ activities

COMBINED SCHOOL

Name----- LIFE SCIENCE GRADE 10

JULY 2014

The diagram below illustrates some ecological processes that take place on earth.



- a) Identify layer x. [1]
- b) Explain briefly the importance of layer x. [3]
- c) (i) State the name of the process given to the increase in the temperature of the earth. [1]
- (ii) Apart from CFC, list two other gases that contribute to the process mentioned in In (c) (i). [2]
- (iii) State two ways how the process in (c)(i) can influence and change life in Namibia. [2]
- (iv) Name the product that release CFC [3]

██████████ COMBINED SCHOOL

NAME----- LIFE SCIENCE GRADE 10

JUNE 2014

1. What is meant by the following terms?

a) Greenhouse effect [2]

b) Global warming [2]

2. State any three greenhouse gases. [3]

3. Explain briefly how greenhouse gases cause global warming. [2]

4. State any three likely effects of global warming to the Namibian environment.[3]

Appendix 7: Lesson plans

Lesson 3 (LO3)

| LESSON PREPARATION LO3 | | |
|--|-----------|------------------|
| TEACHER: XXXXXXXXXX | GRADE: 10 | DATE: 24.06.2014 |
| SUBJECT: LIFE SCIENCE | | |
| THEME AND TOPIC: ECOLOGY : Global warming | | |
| TEACHING AIDS AND RESOURCES TO BE USED: Text books and EXCELLENT BOOK | | |
| LEARNING OBJECTIVES WITH THE LESSON: Learners will: | | |
| Understand how some gases create a greenhouse effect causing global warming. | | |
| BASIC COMPETENCIES (Refer to Syllabus): Learners should be able to: | | |
| Identify CO_2 , methane, CFCs and nitrous oxide as gases causing global warming. List and describe activities that release the gases that | | |
| PRESENTATION OF THE LESSON: | | |
| 1. Monitoring of homework done: Causing global warming into the atmosphere! | | |
| 2. An appropriate short introduction: A short explanation of what global warming is should be made. | | |
| 3. Presentation of subject content and learning tasks: The gases that causing global warming are such as methane, carbon dioxide, CFCs and nitrogen oxide. Burning of fossil fuels, decomposition of organic materials & deforestation release huge amount of Write summary of main point. these gases into the atmosphere. | | |
| 4. Consolidation The emphasise should be put on the competencies that | | |
| ASSESSMENT / HOMEWORK / TASK / EXERCISES need to be mastered. | | |
| Homework: Global warming | | |
| The destruction of Namibia woodlands may lead to global warming. Suggest the role of trees in the prevention of global warming. | | |
| OPPORTUNITIES TO DEVELOP LEARNERS' ENGLISH READING AND WRITING SKILLS IN THE SUBJECT: | | |
| Reading activities Individual learners will be asked to read sentence by sentence | | |
| Writing activities: and they would take notes of explanation during the present | | |

Lesson 4 (LO4)

| LESSON PREPARATION | | LO4 |
|--|-----------|------------------|
| TEACHER: [REDACTED] | GRADE: 10 | DATE: 24.06.2014 |
| SUBJECT: LIFE SCIENCE | | |
| THEME AND TOPIC: The body's immune system & STDs | | |
| TEACHING AIDS AND RESOURCES TO BE USED: The prescribed textbook | | |
| LEARNING OBJECTIVES WITH THE LESSON: Learners will: | | |
| understand the transmission, symptoms, effects, treatments and ways of preventing the transmission of typhoid. | | |
| BASIC COMPETENCIES (Refer to Syllabus): Learners should be able to: | | |
| describe the transmission, symptoms, effects, treatments and suggest ways how to prevent the transmission of typhoid. | | |
| PRESENTATION OF THE LESSON: | | |
| 1. Monitoring of homework done: | | |
| 2. An appropriate short introduction: Asks questions from the previous topic (HIV/Aids). The teacher will let learners to describe the abbreviation of STDs and asks them to mention the 3 common STDs in Namibia. | | |
| 3. Presentation of subject content and learning tasks: writes different diseases on the chalkboard and asks learners to identify diseases which are STDs. - The focus of the lesson should be on the cause, transmission and the symptoms that develop into 3 stages. The effects and the treatment of typhoid would be discussed, and the ways of preventing typhoid. - Write summary of main points on the chalkboard. | | |
| 4. Consolidation Cause, transmission, effects, treatments, prevention should be mastered. | | |
| 5. ASSESSMENT / HOMEWORK / TASK / EXERCISES | | |
| Homework Learners would collect information from the parents how a typhoid infected person should be traditionally identified. | | |
| OPPORTUNITIES TO DEVELOP LEARNERS' ENGLISH READING AND WRITING SKILLS IN THE SUBJECT: | | |
| Reading activities: Opportunities to read sentences should be given and | | |
| Writing activities: they will take notes of the main points of the explanation | | |

Lesson 5 (LO5)

LESSON PREPARATION LO5

| | | |
|--|-----------|----------------|
| TEACHER: XXXXXXXXXX | GRADE: 10 | DATE: 02.07.14 |
| SUBJECT: Life Science | | |
| THEME AND TOPIC: Diversity of Organisms : Six Kingdoms | | |
| TEACHING AIDS AND RESOURCES TO BE USED: Plants Specimens, Learners text book, handouts | | |
| LEARNING OBJECTIVES WITH THE LESSON: Learners will: Realize that organisms are divided into six kingdoms and know diagnostic features of each group. | | |
| BASIC COMPETENCIES (Refer to Syllabus): Learners should be able to: Describe the diagnostic features of a monocotyledon and a dicotyledon as found in their local environment | | |
| PRESENTATION OF THE LESSON: | | |
| 1. Monitoring of homework done: Teacher will ask learners if they are done with the collection of diagrams | | |
| 2. An appropriate short introduction: Teacher will ask learners to describe the Plantae Kingdom. | | |

| Teacher Activities | Learners Activities |
|--|--|
| <ul style="list-style-type: none"> • Explain more on the two phylum of plantae kingdom and ask learners to identify plants in our environment that belong to class monocotyledon and dicotyledon. | <ul style="list-style-type: none"> • Expected to know the major phylum of the plantae kingdom and their diagnostic features. |
| <ul style="list-style-type: none"> • Teacher will ask ^{learners} to observe the specimen plants and describe their diagnostic features. | <ul style="list-style-type: none"> • Expected to study their plants and view their answers based on the diagnostic features of monocotyledon and dicotyledon. |
| <ul style="list-style-type: none"> • Write a Summary of main points on the chalkboard | <ul style="list-style-type: none"> • Copy the Summary in their note books. |

Assessment Activities: (Make sure to plan the criteria for assessment). Learners will be assigned to observe fruit trees in the Orchard and outline weather. They are monocotyledon or dicotyledon plants. Collect diagrams of Monocotyledon and dicotyledon plants & study their differences and similarities.

Reflection:

Lesson 6 (LO6)

LESSON PREPARATION LO6

TEACHER: [REDACTED] GRADE: 10 DATE: 02.07.14

SUBJECT: Life science

THEME AND TOPIC: Ecology: Global Warming

TEACHING AIDS AND RESOURCES TO BE USED: Learners text books • Polyester products
Handout • Spray can

LEARNING OBJECTIVES WITH THE LESSON: Learners will:

Understand how some gases create a greenhouse effect causing global warming.

BASIC COMPETENCIES (Refer to Syllabus): Learners should be able to:

Identify carbon dioxide, methane, CFCs and nitrous oxide as gases causing global warming and describe the activities that releases CO₂, methane, CFCs, and nitrous oxide into the atmosphere.

PRESENTATION OF THE LESSON:

1. Monitoring of homework done: None

2. An appropriate short introduction: Teacher will ask learners to define the term greenhouse effects as a review of the previous lesson. Let learners be in groups and come up with different greenhouse gases they know and present their answers.

Teaching and Learning Activities

| Teacher Activities | Learners Activities |
|--|---|
| • Ask learners to mention greenhouse gases and define the term global warming. | • Expected to mention gases such as CO ₂ , methane, CFC etc. and define global warming. |
| • Explain more on how those gases causing global warming and engage learners into discussion about the activities releasing them into the atmosphere. | • Expected to know the gases causing global warming and describe the activities releasing CO ₂ , methane, CFCs and nitrous oxide into the atmosphere. |
| • Show learners some of the products such as spray cans, polystyrene products that release CFCs into the atmosphere and refer them to the local environment to observe activities such as deforestation, combustion into the atmosphere. | • Expected to observe the local environment and to identify activities such as deforestation, burning of fossil fuel etc. that release gases into the atmosphere. |
| • Write Summary of main points | • Copy the Summary. |

Assessment Activities: (Make sure to plan the criteria for assessment) Learners will be assigned to do a research on global warming, bring articles and push stories on global warming. Learners will also make posters with information on awareness to reduce gases causing global warming.

Reflection:

Appendix 8: Example of textbook practical investigation

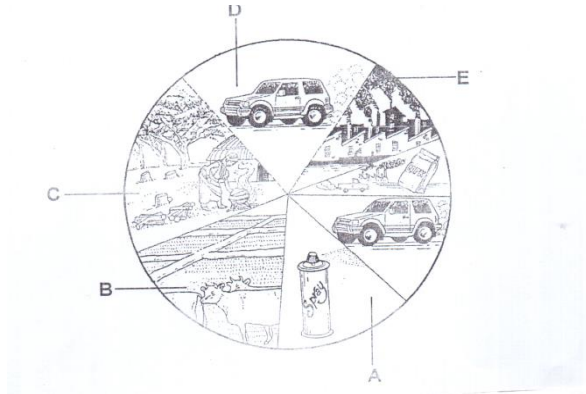
INVESTIGATION ON THE IMPACT OF GLOBAL WARMING

1. Make an appointment and visit the local environment officer from the Ministry of environment or from the local authority (Department of Community Environment)
2. Ask the environment officer to address your class on environmental pollution especially air pollution and global warming
3. Take notes from the presentation by the local environment officer
4. Collect charts and other information about pollution and global warming
5. Report on the impact of global warming on the ecosystem from collected information

(Source: Chikarango, 2007: 158).

Appendix 9: Extract from section B Examination paper

Use the pie chart showing examples of activities and items that contribute to the production and release of greenhouse gases.



(a) (i) Name the process by which heat from the sun is trapped within the earth's atmosphere

----- [1]

(ii) Identify the activity/item in the pie chart that releases CFC's.

----- [1]

(iii) State what gas is released by activity B.

----- [1]

(iv) Name the gas that is released by activities C, D and E.

----- [1]

(v) Suggest two ways how global warming will affect life in Namibia.

1-----

2-----

----- [2]

[Total: 6]

Appendix 10: Sample of teachers' timetable

Time Table for T1

| Time | Period | Monday | Tuesday | Wednesday | Thursday | Friday |
|-------------|--------|----------|------------|------------|----------|----------|
| 08:00-08:40 | 1 | L.SC 9B | L.SC 8B | L.Skill 5B | L.SC 8A | L.SC 9B |
| 08:40-09:20 | 2 | L.SC 10 | L.SC 10 | - | - | L.SC 8B |
| 09:20-10:00 | 3 | L.SC 9A | L.SC 9A | - | P.E | Elem 5A |
| 10:00-10:40 | 4 | L.SC 8B | BIS 6A | Elem 5A | L.SC 9A | - |
| 10:40-11:20 | 5 | BIS 7A | L.Skill 8B | BIS 7B | L.SC 10 | L.SC 8A |
| 11:20-11:50 | | B | R | E | A | K |
| 11:50-12:30 | 6 | - | BIS 7C | L.SC 8B | - | RME 6B |
| 12:30-13:10 | 7 | Elem 5A | L.Skill 5A | L.SC 9B | L.SC 9B | L.SC 9A |
| 13:10-13:50 | 8 | - | L.SC 8A | L.SC 8A | Art 5A | L.SC 10 |
| 13:50-14:30 | 9 | - | | | | |

Time Table for T2

| | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|----------|----------|-----------|----------|----------|
| 1 | | L. SC 8A | L. SC 9A | L. SC 10 | L. SC 8A |
| 2 | L. SC 9C | L. SC 8A | L. SC 9A | L. SC 9C | L. SC 8B |
| 3 | L.SC 9B | L. SC 8B | L. SC 9B | BIS 7C | |
| 4 | L. SC 9A | L. SC 8B | L. SC 9B | BIS 7A | L. SC 8C |
| | B | R | E | A | K |
| 5 | Rel 7A | L. SC 8C | L. SC 9C | | L. SC 10 |
| 6 | Rel 9C | L. SC 8C | L. SC 9C | L. SC 8C | L. SC 9A |
| 7 | L.SC 10 | | | | |
| | B | R | E | A | B |
| 8 | Rel 9B | L. SC 10 | | L. SC 8A | |
| 9 | REL 9A | BIS 7B | | L. SC 8B | L.SC 9B |

Time Table for T3

| Time | Period | Monday | Tuesday | Wednesday | Thursday | Friday |
|-------------|--------|----------|----------|-----------|----------|----------|
| 08:00-08:40 | 1 | Phy | Enter | Maths | Ndo | Art |
| 08:40-09:20 | 2 | Enter | Phy | P.E | Maths | Eng |
| 09:20-10:00 | 3 | Eng | Hist | Ndo | Eng | Hist |
| 10:00-10:40 | 4 | Maths | Maths | L.Skill | Hist | Maths |
| 10:40-11:20 | 5 | L.SC | Eng | L.SC | Geo | PHY |
| 11:20-11:50 | | B | R | E | A | K |
| 11:50-12:30 | 6 | Bis | L.SC | Phy | Agric | Ndo |
| 12:30-13:10 | 7 | Ndo | Agric | Enter | Enter | R.M.E |
| 13:10-13:50 | 8 | Geo | Geo | Eng | L.SC | Agric |
| 13:50-14:30 | 9 | Agric | | | | |

Appendix 11: Questions done in the class

██████████ COMBINED SCHOOL

LIFE SCIENCE Grade 10

Global warming

1. a) What is global warming
b) List any four likely effects of global warming to Namibia
c) State one way in which Namibians can prepare themselves to face changes that might be brought by global warming
2. a) Which one of the listed gas is not a greenhouse gas?
Carbon dioxide, Sulphur dioxide, Nitrogen oxide, Methane.
b) What is the ozone layer supposed to reduce?
ultra-dangerous gases, CFCs, ultra-violet rays, greenhouse gases.
c) Name the type of rays from the sun that cause skin cancer when the ozone layer is destroyed
d) Name the chemicals that damage the ozone layer.
e) Describe the ozone layer.
f) State the importance of ozone layer.
g) State three ways people can help to reduce damage to the ozone layer.
3. a) State two ways by which most carbon dioxide enters the atmosphere of a large city.
b) State any two ways of reducing the amount of carbon dioxide pollution.
c) State the term used to describe the effect of increased levels of carbon dioxide to local temperatures in the atmosphere.
d) Name two other air pollutants which have the same effect as carbon dioxide.
4. a) State ways in which CFC can be released.
b) Describe how CFCs deplete the ozone layer.
c) Apart from CFCs list any two gases that cause global warming.