



**AN EXAMINATION OF TEACHING STRATEGIES FOR MEDIATING THE  
CONSTRUCTION OF ENVIRONMENTAL CONTENT KNOWLEDGE**

**A case of Grade 11 Life Sciences teaching in two Eastern Cape schools**

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## **ABSTRACT**

In South Africa the new Curriculum Assessment and Policy Statement (CAPS) introduced a more strongly content referenced curriculum which has commitments to active and critical approaches to learning, and to environment and sustainability content. Successful implementation of CAPS requires that teachers attain the requisite knowledge and pedagogical content knowledge for working with environmental and sustainability content.

The study examined teachers' knowledge of environmental content as well as how teachers are mediating learning, through exploring the classroom techniques used by teachers working with environmental content. This was to examine how teachers are through their teaching bridging the gap in the understanding, investigation and application of environmental content in the curriculum.

The study used a number of approaches from the field of environmental education which offer different lenses (or pedagogical sensitizing constructs) for viewing mediation processes as a relational process of knowledge construction. These pedagogical constructs were: knowledge co-construction where perspectives and understandings are shared in the process of social relations (deliberation); relating environmental content knowledge to cultural historical context (situated learning); relating environmental content knowledge to everyday and intergenerational knowledge through hands on experience (proximity experience) and developing an iterative relationship between environmental content knowledge and sustainability practices (practical reasoning).

Practice theory as suggested by Schatzki (2005) and a theory of practice architectures elaborating on Schatzki's practice theory (Kemmis & Heikkinen, 2011) was used as the ontological lens to help in understanding the mediation of environmental content knowledge. Practice theory was used for exploring pedagogical practice in terms of sayings, doings and relatings by teachers, and practice architectures that represent enabling or constraining factors of teachers practice. This research was an interpretive case study drawing on findings from lesson observations, semi structured interviews, stimulated recall interviews and document analysis.

The research found that teachers used different strategies to enhance their environmental content and pedagogical content knowledge to present the mediation. Teachers are supporting situated learning and deliberation in environmental learning. Another finding was that teachers could be enabled to enhance proximity experiences and practical reason in their mediating approaches in environmental learning. The research further showed that teachers could benefit from teacher professional development programmes that explicitly develop pedagogical content knowledge to support critical

deliberation, proximity encounters, situated learning and practical reasoning in order to work with the diverse complex places-based, socio-cultural-historical nature of environmental curriculum content in the context of sustainability practices

Findings also showed that there were constraining factors to mediation of environmental learning. These constraining factors from the research were firstly in material economic arrangements of timetable compliance in CAPS, ability to find internet resources and availability of resources. Secondly, present were constraining factors of socio-political arrangements of CAPS curriculum document prescriptiveness, multiculturalism, learning institution management and governance. Thirdly, cultural discursive arrangements of teacher learner language, knowledge of the language of the field affected mediation. Teachers passion for environmental content topics, the ability of teachers' to improvise resources in mediating environmental content lessons and the ability of teachers' to navigate a stringent CAPS timetable were found in this research to be enabling mediation.

Recommendations from the research are ongoing teacher refresher workshops on the environmental content in the CAPS curriculum, teachers' need more input on strategies to mediate environmental content, teachers' prior knowledge of new knowledge can be used to strengthen teacher professional development processes, teachers' prior knowledge needs to be deepened and reinforced, there is need to develop quality educational resources encompassing a variety of pedagogical sensitizing constructs and support needs to be given for familiarising teachers with teaching materials and their appropriate use. These could help to strengthen mediation of environmental content knowledge in the Grade 11 CAPS Life Sciences and inform South African teacher professional development programmes seeking to understand classroom practices in relation to environmental content.

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## LIST OF ACRONYMS

ABET	Adult Education Based Training
CAPS	Curriculum and Assessment Policy Statements
DHET	Department of Higher Education and Training
DoE	Department of Education
DoBE	Department of Basic Education
ECK	Environmental Content Knowledge
EE	Environmental Education
EFA	Education for All
ESD	Education for Sustainable Development
FET	Further Education and Training
GET	General Education and Training
LoLT	Language of Learning and Teaching
MEA	Millennium Ecosystems Assessment
NCS	National Curriculum Statements
NEEP	National Environmental Education Programme
NEEP- GET	National Environmental Education Programme -General Education and Training
PCK	Pedagogical Content Knowledge
RNCS	Revised National Curriculum Statements
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organization
WWSD	World Summit on Sustainable Development
ZPD	Zone of Proximal Development
DHET	Department of Higher Education and Training

## **LIST OF TERMINOLOGY**

Environmental content - makes reference to the topics focusing on environmental issues as stated in the Grade 11 Life Sciences curriculum.

Environmental Content Knowledge (ECK) - makes reference to teachers' (or learners') knowledge of this environmental content.

Pedagogical Content Knowledge (PCK) - makes reference to the way in which the teacher translates and works with the environmental content for the learners.

## **CHAPTER 1: INTRODUCTION AND CONTEXT**

### **1.1 Introduction**

This chapter introduces the context of the research. The chapter starts by giving the reader the broader context and the rationale of the study. In this first section, there is discussion of the changes in environmental content knowledge (ECK) in the South African curriculum that have occurred between the introduction of the Revised National Curriculum Statement (RNCS) in 2002 and the Curriculum and Assessment Policy Statement in 2012. The section then examines the current environmental content included in the recently introduced Curriculum and Assessment Policy Statement (CAPS). The focus of the study on examining mediating strategies in the CAPS curriculum by Grade 11 Life Sciences teachers is then discussed. The chapter also introduces the research question and its goals. This is followed by an outline of the case studies used in this research. The chapter ends with a brief overview of each chapter in the thesis.

### **1.2 Background and rationale for the study**

The South African curriculum underwent change in 2012 moving from the Revised National Curriculum (RNCS) to the current Curriculum and Assessment Policy Statement (CAPS) (South Africa. Department of Basic Education (DoBE), 2012). The RNCS was produced in 2002 with a clear environmental focus evident in the first principle of the RNCS. This first principle called for the creation of an awareness of the relationship between human rights, a healthy environment, social justice and inclusivity (South Africa. Department of Education (DoE), 2002). This principle was infused throughout the curriculum so that all learning areas provided the opportunity to contribute to learning about a healthy environment (National Environmental Education Programme- General Education and Training (NEEP-GET), 2004). This was to be achieved through the key features and scope of the learning area and learning outcomes which provided the opportunity to develop knowledge, skills and values important for environmentally literate and competent citizens (South Africa. Department of Education (DoE), 2002).

In the revised Curriculum and Assessment Policy (CAPS) more content knowledge on environment and sustainability issues has been included, particularly in the Life Sciences (Lotz-Sisitka & Songqwaru, 2013). The focus on addressing environmental concerns is relevant in the

context of the National Climate Change Response White Paper, which indicates that there is need to equip South African citizens to reorient society towards socio-ecological sustainability such that future generations are better prepared for a rapidly changing planet and a transition to a lower carbon society and economy (DoE, 2011).

According to Lotz-Sisitka (2011) CAPS introduces a more strongly content referenced curriculum which has commitments to active and critical approaches to learning and to environment and sustainability content. This finding emerged from research within the Fundisa for Change programme, a network for teachers supporting environmental learning in the South African curriculum. Findings from a released 2013 *National Diagnostic Matric Exam Report* showed a lack of content understanding in subjects, thus indicating a challenge within the current strongly content referenced curriculum.

Spork (1992) and Fien (1993) note an emphasis in literature on how teaching approaches of teachers can affect the way in which content knowledge is understood by learners. Similarly Lotz-Sisitka and Lupele (2012) note that education is an important factor empowering society to make the transition to a sustainable future, and central to this is the way in which teachers think about learning processes. A recent finding within the South African school context has shown that close examination of classroom practice and the representations of ECK by teachers is a cause for concern, as content and pedagogical approaches are often mismatched (Fundisa for Change programme, 2013). The findings by the Fundisa for Change programme are discussed further in Section 2.5.

This research examines ways in which environmental content is mediated through classroom practice. A focus on mediating classroom practices of teachers can be linked to the South African *Minimum Requirements for Teachers* which specifies the development of “specialized pedagogical content knowledge, which includes knowing how to represent the concepts, methods and rules of a discipline in order to create appropriate learning opportunities for diverse learners” (South Africa. Department of Higher Education and Training (DHET), 2011, p. 11). The Fundisa for Change Programme has teacher professional development as one of its key foci. The programme aims to understand classroom practices in relation to the new environmental content in the curriculum (Fundisa for Change programme, 2013). The Fundisa for Change programme noted that for teachers to be able to deal with environmental content in the curriculum there is

further need for understanding of disciplinary knowledge (which is linked to knowing your subject) and pedagogical knowledge (linked to improving teaching practice). Successful implementation of CAPS requires that teachers attain the requisite knowledge and pedagogical content knowledge (PCK) for integration of environment and sustainability concerns into the South African National Curriculum (Lotz-Sisitka, 2011). Lotz-Sisitka (*ibid*) mentions that teacher education curricula that simply align with the CAPS appear inadequate, as a more critical expansive orientation to knowledge and pedagogical content knowledge is required, if quality is to emerge.

### **1.3 My interest in the research**

Motivation for this study is rooted in the fact that as a Life Sciences educator, I have noted that CAPS does not prescribe particular instructional strategies or methodologies (DoE, 2012). This study is driven by an imperative to explore possible strategies or methodologies in order to inform and strengthen my and my colleague's classroom practices, and to complement our work with the CAPS curriculum document. It is envisaged that findings from this study can be used to inform teacher professional development programmes such as Fundisa for Change research programme of which I am a part. Rickinson and Lundholm (2008) draw our attention to the fact that there is complexity of learning experiences within environmental education and that there is a need for research-based understandings of environmental learning processes. This study set out to do this. By studying how teachers are working with this new curriculum knowledge, findings can improve teacher practice and in turn promote quality education. As suggested by Lotz-Sisitka (2013) any research work that goes into examining teaching processes will add to educational quality.

### **1.4 Framing of the study**

An exploration of mediation helped inform reflection on teaching strategies in this study. Mediating learning makes reference to the way in which stimuli experienced in the environment of learning are transformed by a mediating agent, which is the teacher (Feuerstein, Falik & Rand, 2006). For this research mediation in CAPS was viewed in relation to four pedagogical sensitizing constructs namely; deliberation (concerned with the critical co-construction of knowledge), situated learning (concerned with cultural- historical context), practical reason



(concerned with knowledge and practice) and proximity experience (concerned with hands-on learning). Lotz-Sisitka and O'Donoghue (2006) present these pedagogical sensitizing constructs within an open process learning framework for environmental learning. These pedagogical sensitizing constructs are used in this study as lenses for viewing mediation processes as a relational process of knowledge construction.

Section 2.7 of this study explains how the pedagogical sensitizing constructs described above were elaborated for the purposes of this study. This elaboration is part of the original contribution of this Masters study, as a relational perspective on the above mentioned pedagogical sensitizing constructs. The elaboration was necessary in order to explore the relationship between ECK and teaching practice in teaching and learning processes.

A second important contribution to the framing of the study is the theory of practice and theory of practice architectures. The study draws on Hemmings, Kemmis and Reupert (2013) to describe teaching practice (as bundles of doings, saying and relatings), and the cultural discursive material, economical and social-political architectures from which these practices emerge (see Section 2.6).

## **1.5 Research question and goals**

This research examined teacher mediating strategies with the following research question:

- How do teachers mediate environmental content knowledge in the Grade 11 Life Sciences curriculum?

The following were the goals of this research:

1. To explore teachers' content knowledge and pedagogical content knowledge with respect to environmental content in the Grade 11 Life Sciences.
2. To describe and relate teachers' doings, sayings and relatings to pedagogical sensitizing constructs in environmental learning which emphasize deliberation, situated learning, proximity experience and practical reason in the teaching of Grade 11 Life Sciences.
3. To investigate the practice architectures enabling or constraining the above aspects of practice.

## 1.6 Context of the research

The research participants were two teachers chosen according to their willingness to participate. These teachers were from two coastal schools within the Ndlambe (often referred to as Port Alfred) area of the Makana District. The first teacher (referred to as T1) was a holder of a teaching diploma. She had six months teaching experience of Life Sciences and Natural Sciences. *Human Impact on the Environment* was the topic she taught during the data generation process having earlier completed animal diversity and photosynthesis sections. The second teacher (referred to as T2) had a teaching diploma, Bachelor of Education (Honours) and a Masters degree in Educational Leadership and Management. He had been teaching for eighteen years with experience in Geography and Life Sciences (when it was still referred to as Biology). T2 also taught the section on *Human Impact on the Environment* during the data generation process.

## 1.7 Overview of the study

There are five chapters following this one, all oriented towards responding to the research question as will be highlighted in this overview.

**Chapter 2** is an overview of the literature relevant to the research study. The chapter begins by looking at a brief history of international meetings that played a role in influencing policy-making decisions with regard to Environmental Education (EE) in the South African context. The chapter then moves to highlighting the South African response to those EE imperatives as evident in the schooling curriculum in South Africa. This is followed by a discussion of the mediating of environmental content through the discussion of various pedagogical approaches in EE which are used as pedagogical sensitizing constructs in this research. These are deliberation, situated learning, proximity experience and practical reason. Furthermore there is a discussion of theory of practice and practice architectures which forms the conceptual framework of the study.

**Chapter 3** discusses the qualitative orientation chosen for the study and the data generating techniques selected for use with discussions on the suitability of each. The chapter elaborates on how data was organized, interpreted and analysed through a detailed conceptual and theoretical

framework. The chapter concludes with a discussion of issues of validity of the research findings, the research ethics involved and limitations of the research.

**Chapter 4** presents the findings from the research study. The chapter starts by highlighting the environmental content as outlined in the official Life Sciences CAPS curriculum document. This is followed by a description of how this was interpreted by the two participants in the research. This analysis addressed Goal 1 of the research. The chapter also describes findings from observations, semi-structured and stimulated recall interviews in response to Goals 2 and 3 of the study. Finally the chapter highlights the possible enabling and constraining factors influencing the teachers' practices.

**Chapter 5** focuses on discussions of the research findings as related to the goals and aims of the research stated in Chapter 1. To add depth to the discussion, this chapter in its presentation of analytical statements relates to the literature review as presented in Chapter 2. This chapter captures the essence of the study by reflecting on the research question through the analytical statements.

**Chapter 6** draws all the strands of this research together in a conclusion of the study. This chapter ends with a discussion on recommendations from the research as well as possible recommendations for further research.

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1 Introduction**

This chapter explores how the representation of ECK has changed between the Revised National Curriculum Statement (RNCS) of 2002 and the recently introduced Curriculum and Assessment Policy Statement (CAPS) in 2012. Also mentioned is a brief history of international conferences and summits that influenced policy-making decisions with regard to environmental education in the South African educational context.

The chapter then highlights environmental education as presented in the school curriculum in South Africa. It also details transitions between the RNCS and CAPS curriculum. This is then followed by a discussion of an active learning approach to the teaching and learning of environmental content in the CAPS curriculum. The importance of coherence between content, pedagogical approaches and assessment in CAPS is also discussed.

The chapter further discusses two relevant theories which form the conceptual framework of the study. These are *practice theory* (Schatzki, 2005) and the *theory of practice architectures* (Kemmis and Heikkinen, 2011).

Finally, the chapter details the mediating strategies of deliberation, situated learning, proximity experience and practical reason and the theoretical framing of these in educational and environmental education literature.

### **2.2 Influential environmental education events and policies**

This section highlights international conferences and summits that influenced the inclusion of environmental and sustainability issues in the South African context.

A focus on environmental concerns came about in the 1960s in response to environmental issues emerging at the time, which led to international conferences and summits calling for education that would lead to the protection of the environment (Eames et al, 2006). In many of the international conferences and summits, it was explicit that education was central to the protection of the environment and various environmental issues. The Belgrade Charter of 1972, proved vital in setting out how to implement active involvement in environmental issues through education (United Nations Educational Scientific and Cultural Organization (UNESCO), 1978).

According to Fensham (1979), the Tbilisi Declaration of 1977 expressed two principles. Firstly, it suggested guidelines and secondly, it proposed key characteristics of environmental education that would promote a particular approach to curriculum development. Some of the characteristics proposed in the Tbilisi Declaration of 1977 suggested pedagogical practices necessary to achieve the stated environmental goals.

During the 1992 Earth Summit held in Rio de Janeiro the development of Agenda 21 was another important influence of environmental education in schools. It proposed “Education for Sustainable Development” as a multi-disciplinary approach to school curricula which would acknowledge socio-cultural and environmental approaches to teaching and learning that would enable actively involving students during the planning of the environmental activities, to improve and protect the environment for the future (UNESCO, 1992). The World Summit on Sustainable Development (WSSD) Plan of Implementation of 2002 went further to say that there should be integration of sustainable development concepts, actions and principles in all levels of education to promote education as a key agent for change.

In South Africa, the White Paper on Education and Training (South Africa, 1995) was the catalyst for the inclusion of environmental education in the school curriculum. The White Paper on Education and Training presented an initial framework for the transformation of the education and training system in South Africa. This was done partly through including a focus on environmental issues in education. The focus on addressing environmental concerns is still relevant today considering the context of the National Climate Change Response White Paper, which indicates that there is need to develop socio-ecological sustainability in South Africa in order to prepare for a rapidly changing planet and a transition to a lower carbon society and economy (South Africa, 2011).

According to Lotz-Sisitka and O’Donoghue (2007), the inclusion of environmental education in the school curriculum became a driving force behind highlighting environmental sustainability issues. This was promoted in documents such as the national curriculum statements through highlighting sustainable development concepts, actions and principles. Lotz-Sisitka and O’Donoghue (*ibid*) also mentioned that inclusion of environmental education in school curricula is important as it builds the capacity in learners to act with reference to environmental issues.

This section presented a brief history on the imperative for the inclusion of environmental issues in education as suggested at the various international conferences and summits concerned with the environment and environmental education. It reflected on how policy on the inclusion of environmental issues was introduced in the South African educational context. The next section will detail the educational response to the environmental concerns identified at the conferences and summits through the South African curriculum.

### **2.3 Environmental education in the South African school curriculum**

This section highlights curriculum changes in South Africa and shows the differences in terms of environmental focus.

According to Le Roux (2000) with the changing curriculum and issues which are related to the environment, curriculum documents have increasingly incorporated sections of work that deal with ECK. The RNCS was produced in 2002 with a clear environmental focus evident in the first principle of the RNCS. This first principle called for the creation of an awareness of the relationship between human rights, a healthy environment, social justice and inclusivity (DoE, 2002). Infused throughout the curriculum, this principle provided the opportunity for all learning areas to contribute to learning about a healthy environment (NEEP-GET, 2004). This infusion was evident in the key features and scope of the learning area learning outcomes which called for the development of knowledge, skills and values important for environmentally literate and competent citizens (DoBE, 2012).

Even with the change to the CAPS in 2012, environmental education still forms an integral part of all subjects in the South African national curriculum (Fundisa for Change, 2013). In CAPS the topics enable ECK to be ‘brought out’ in the development of lessons with an environmental and sustainability focus (*ibid*). In CAPS more content knowledge on environment and sustainability issues has been included particularly in Life Sciences (Lotz-Sisitka & Songqwaru, 2013).

The Life Sciences CAPS curriculum (DoE, 2013) is the official document stipulated by the Department of Basic Education (DoBE), which all teachers use as a guide in their teaching of the subject. As an official curriculum document, it is distributed to all school teachers by the DoBE

to ensure uniformity of the subject content to be taught. In South Africa, CAPS training for teachers in Life Sciences commenced in 2011 before its introduction in Grade 10 of the Further Education and Training (FET) phase in 2012. Teachers teaching Life Sciences in Grade 11 underwent training during the year 2012 for the introduction thereof in 2013. Teachers from the training were introduced to the new content knowledge, including an environmental strand as discussed below.

The Life Sciences CAPS document has a series of knowledge strands and one of these is Knowledge Strand 3, which deals with environmental studies. This knowledge strand contains the environment and sustainability content knowledge in Life Sciences. The strand is divided in Grade 10 to cover the biosphere and ecosystems, whilst in Grade 11 and 12 it deals with population ecology as well as the human impact on the environment as a current crisis for human survival. This environmental studies strand was the focus of this study.

Although CAPS is not seen to be prescribing teaching methods, it does offer what can be thought of as a guideline for teachers of the subject expectations. This is done through its subject specific aims which relate to the purpose of learning science (DoE, 2011). The intention of these is to aims help teachers to translate environmental content into meaningful knowledge.

The subject specific aims need to be considered during teaching and learning by teachers as they indicate the expected knowledge, skills and values which ought to be achieved by learners at the end of teaching units in Life Sciences. Furthermore, from the subject specific aims teachers can translate the ECK discussed in Section 4.2.1 into meaningful forms for the learners. In this study teaching and learning activities were analyzed in relation to various skills and values as they were outlined by the subject specific aims.

In the Life Sciences CAPS curriculum (DoBE, 2012) Specific Aim 1 relates to “knowing the subject content thereby enabling learners to make many connections between the ideas and concepts, such that learners can apply their knowledge in new and unfamiliar contexts” (DoBE, 2012, p.14). The curriculum further states that it encourages “active and critical approaches to learning instead of rote learning which does not create opportunities for critiquing of given truths” (DoBE, 2012, p.4). This is an indication that teachers need to provide learning

opportunities with which learners will be able to critically to assess and review the environmental and sustainability content being taught to them.

Specific Aim 2 relates to doing science. The intentions of this aim are geared for supporting learners to plan and carry out investigations as well as solve problems that require some practical ability. It is expected that in the process of doing this, learners acquire a range of skills related to building knowledge and understanding within the context of cognitive domains as expected by Specific Aim 1 (DoBE, 2012, p.15).

It is stated that Specific Aim 3 seeks to enable learners to be aware and understand that school science can be relevant to their lives outside of school and that it is able to enrich their lives. Within this aim, there is emphasis that the knowledge acquired should show that relevance, and also clarify the relationship between the subject and society for example by including indigenous knowledge systems that relate to a specific topic and its application in their daily lives (DoBE, 2012). Furthermore, it is highlighted within this aim that teaching and learning should “ensure that children acquire and apply knowledge and skills in ways that are meaningful to their own lives. In this regard, the curriculum promotes knowledge in local contexts while being sensitive to global imperatives” (DoBE, 2012, p .4).

## **2.4 Teacher professional development**

Fundisa for Change (2013) proposes a framework for teacher professional development. In the teacher professional development framework presented in Figure 2.1, Fundisa for Change highlights the inter relatedness of three aspects of teaching namely content knowledge, teaching practice and assessment practice.





**Figure 2.1: Arrangement and inter-relatedness of knowledge, pedagogy and assessment in teaching (Fundisa for Change, 2013, p.4).**

In this research the term ‘Environmental Content’ makes reference to the topics focusing on environmental issues as stated in the Grade 11 Life Sciences curriculum. The term ‘Environmental Content Knowledge’ (ECK) makes reference to teachers (or learners) knowledge of this environmental content. The term ‘Pedagogical Content Knowledge’ (PCK) makes reference to the way in which the teacher translates and works with the environmental content for the learners. This is in line with Shulman’s (1986) definition of PCK which is understood as the way in which teachers recontextualise curriculum content so that it can be understood by learners (Shulman, 1986).

Findings by Stone (1998) suggest that teachers dealing with environmental content must possess knowledge and skills in the selection, utilization and implementation of environmental education strategies designed to achieve the accepted goals of environmental education. Carl (2009) warned that successful implementation of a curriculum was dependent largely on how well teachers had been informed and prepared for curriculum change. Successful implementation of CAPS requires that teachers attain the necessary subject content knowledge and PCK skills for integration of environment and sustainability concerns into the South African National Curriculum (Lotz-Sisitka, 2011).

In this research the Fundisa for Change teacher professional development framework helped in highlighting the important link between the environmental content in CAPS and the teaching practice used to mediate this content in Grade 11 Life Sciences. In this research, teaching practice (the second circle in Figure 2.1) was equated to the mediation of environmental content as described by the pedagogical sensitizing constructs discussed in Section 2.7.

## **2.5 Environmental content and pedagogical content knowledge.**

Having noted the extent of environmental content in the Grade 11 Life Sciences curriculum, this section draws on literature which shows the challenge of the introduction of new environmental content in the curriculum. Earlier findings have shown that there are problems associated with the quality of the teacher knowledge and that knowledge of new topics and issues still exist (Taylor & Vinjevold, 1999; Lotz-Sisitka & Olivier, 2000; Nelson Mandela Foundation, 2005). The section reports on previous local and international research findings that show how teachers are responding to the inclusion of the new environmental content in the South African school context.

Rickinson and Lundholm (2008) draw attention to the fact that there is complexity of learning experiences within environmental education and that there is a need for research based understandings of environmental learning processes. Lotz-Sisitka and Lupele (2012) note that education is an important factor empowering society to make the transition to a sustainable future, and central to this is the way in which teachers think about learning processes. Elmqvist, Ernston and Sorlin (2008) argue that teachers therefore need to help learners interpret the world through how they teach. A UNESCO study recommended that focus should be turned to the actual experiences rather than reviews of literature, and to data collection based on tightly focused questions that would capture greater detail about learning processes and learning opportunities (Lotz-Sisitka & Lupele, 2012). In the case of this research these concerns were addressed through a close examination of the mediating approaches in CAPS Grade 11 Life Sciences by the participating teachers.

Ballantyne (1992) mentions that a new curriculum brings with it reforms in the practice of teaching and learning, which challenges assumptions about subjects as they are perceived and practiced by educators. Ballantyne (*ibid*) notes that perceptions of teachers used in operating

within a discipline or subject based system will be important in determining the successful translation of a new curriculum approach in the classroom. The Education for All (EFA) Global Monitoring Report (2005) notes that how well pupils are taught, as well as how much they learn, has an impact on how long they stay in school. This highlights the need for teachers to make use of effective and well-strategized teaching and learning.

Findings from a recently released South African National Diagnostic Matric Exam report showed a lack of content understanding in most of the subjects that have a focus on environmental content such as Life Sciences and Geography (Lotz-Sisitka, 2014). Spork (1992) and Fien (1993) both note an emphasis in literature on how teaching approaches of teachers can affect how content (environmental content in the case of this study) is understood by learners, as education is seen as a continuous interpretation of the curriculum by teachers (Stables, 2004). According to Grossman (1995 as cited in Cutter-Mackenzie and Smith 2003) teachers tend to teach well that which they know and are not confident when it comes to teaching content with which they are unfamiliar. Robinson (2015) notes that interactions taking place within the classroom are arguably the biggest factors affecting whether and what children learn, hence the interest in mediating approaches in the Grade 11 CAPS Life Sciences.

Revealed in a case study by Lotz-Sisitka and Mandikonga (2012) was a noted absence of concept progression in areas being mapped out in Geography in South African schools. They found that content was learnt as separate entities built independently into one main concept - that of climate. According to their study this affects the making of coherent links within the environmental topic of climate change. This does not develop learners' minds into understanding that the content they would have learnt is not to be taken as separate units, but rather should link up to form a body of knowledge for the section of work on climate change.

An additional challenge for the development of ECK is the history of the educational system in South Africa. Findings from environmental education research have shown that some South African teachers lack environmental and sustainability content knowledge due to the fact that this content is new (Lotz-Sisitka, 2011; Fundisa for Change, 2013). According to Bertram (2011) teachers need propositional knowledge of a discipline (that is the knowledge of facts and ideas), which should be taught systemically in order for learners to be able to access new content knowledge on their own. This is in line with the South African *Minimum Requirements for*

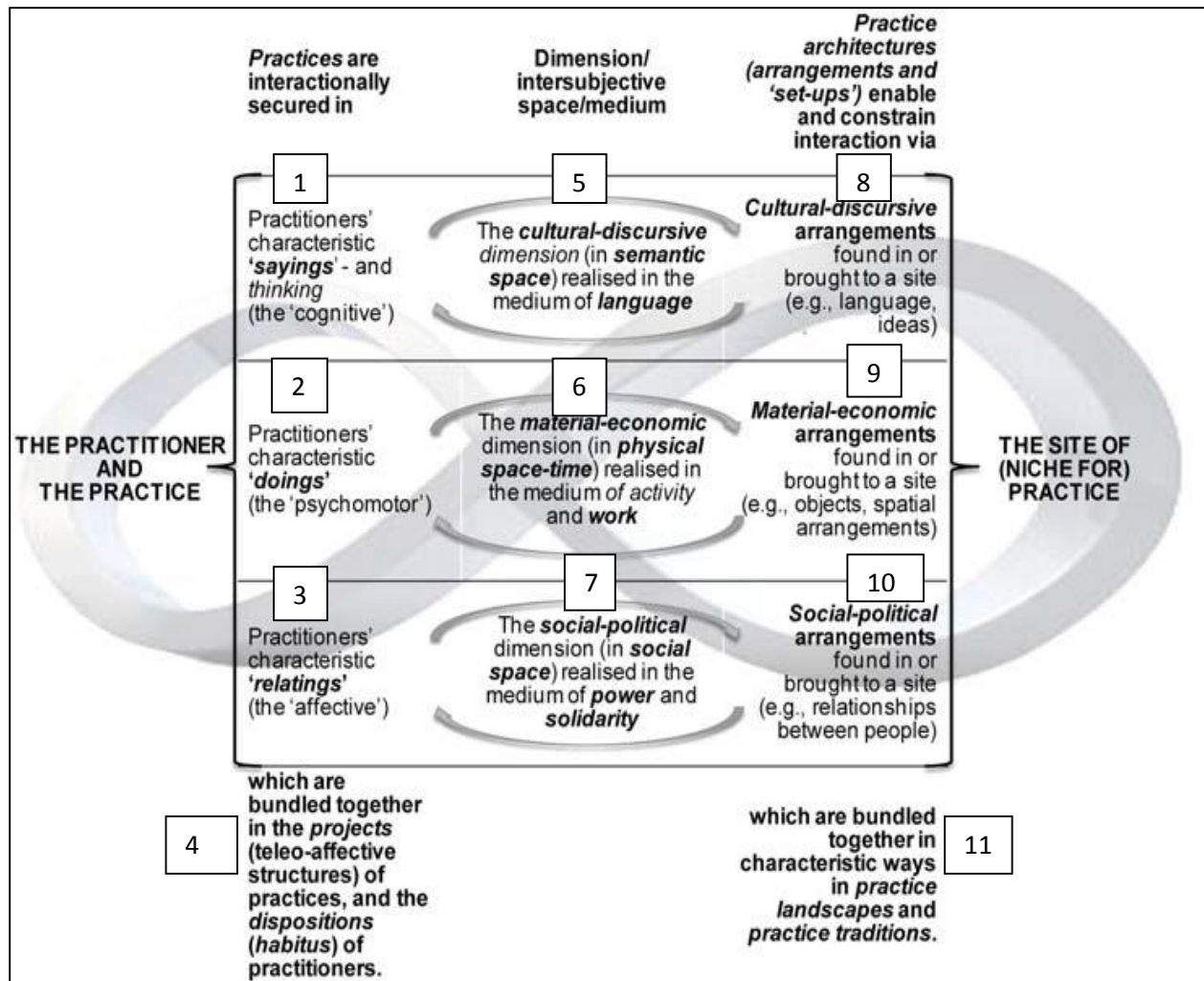
*Teachers* which specifies the development of “specialized pedagogical content knowledge, which includes knowing how to represent the concepts, methods and rules of a discipline in order to create appropriate learning opportunities for diverse learners” (DHET, 2011, p.11).

## **2.6 Practice Theory and Practice Architectures (theoretical framework)**

This section elaborates on two relevant theories which form the conceptual framework of the study. These are *practice theory* as proposed by Schatzki (2005) and the *theory of practice architectures* (Kemmis and Heikkinen, 2011), as underlying structures influencing mediation of environmental content. Figure 2.2 represents the ideas of practice theory and practice architectures as put forward by Schatzki (2005) and Kemmis and Heikkinen (2011) respectively, and as represented in this diagram by Hemmings et.al (2013).

Kemmis and Heikkinen (2011) highlight the fact that practices are always situated in time and space and unfold in ‘site ontologies’. They further note that practices are not merely set in, but always already shaped by, the particular historical conditions that exist in particular localities or sites at a particular moment. This view of practice will be used in this study to emphasize possible conditions that could impact on how environmental content is mediated. According to Schatzki (2005) this calls for an examination of doings, sayings and relatings in a practice elaborated below.

The following diagram (Figure 2.2) represents the ideas of practice theory and practice architectures (Hemmings et.al, 2013) as discussed in this section. It is important to note that the practices and their architectures do not necessarily remain immobile but that they are, in fact, constantly moving and changing from time to time and from place to place (Kemmis & Mutton, 2012).



**Figure 2.2: Theory of practice and practice architectures (adapted from Hemming et al., 2013, pg. 475).**

In practice theory developed by Schatzki (2005), practices consist:

- Firstly of sayings (marked 1 in Figure 2.2) which according to Kemmis (2008) can be described as “arrangements of relevant ideas in characteristic discourses” (cited in Hemmings, Kemmis and Reupert, 2013, p. 474).
- Secondly of doings (marked 2 in Figure 2.2), which are the type of activities and actions in physical space–time (in this case the school).
- Thirdly practices include relatings (marked 3 in Figure 2.2) which according to Kemmis and Groetenboer (2008) are people and objects distributed in characteristic arrangements of relationships in their interactions.

Practice theory stipulates that practices are organized bundles of sayings, doings and relatings which, according to Kemmis (2008) ‘hang together’ in a distinctive project. In practices sayings are interactionably secured in the cultural discursive dimension (marked 5 in Figure 2.2), whilst doings are secured in the material and economic dimension (marked 6 in Figure 2.2), and relatings are secured in socio-political dimension (marked 7 in Figure 2.2). These are bundled together in the projects of (teleo-affective structures) of practices and the dispositions or (habitus) of practitioners (marked 4 in Figure 2.2). Teleo-affective structures in Figure 2.2 refer to the purposes or emotions that cause people to act towards possible ends and goals. According to Schatzki (2006) the teleo-affective structures instill a view of practice as the reason why an organization as it happens is not simply the organization’s functioning, but the habitus of practitioners with general understandings that may be relevant such as the nature of their job.

Kemmis (2008) further mentions that by engaging in and through practice people

- Firstly construct their self-understandings and their understandings of the world.
- Secondly people also understand their modes of activity, skills and capabilities.
- Thirdly, people develop an understanding of their roles and patterns of relating to others.

Emirbayer (1997) goes on to say that a practice goes beyond recognizing the importance of activities or agency of the people who form them. He points out that practice theory focuses as the analytical lens on the nature of associations connecting people and artifacts in interactive ways that give rise to a relational theory of action.

Kemmis and Grootenboer (2008) referred to above describe how forms of action are shaped through previous actions, experiences and the way situations are arranged. These they call practice architectures and mention that these prefigure a practice. The practice architectures are:

- Firstly cultural discursive arrangements responsible for shaping the language used in the practice (marked 8 in Figure 2.2), which is made possible in semantic space (marked 5 in Figure 2.2). In this research the language of learning and teaching (LoLT) as will be discussed in Section 4.4 is one such example, while having the language and content knowledge of a particular discipline is another.

- Secondly material economic arrangements (marked 9 in Figure 2.2), which control the activities during the practice. These include the use and availability of physical and financial resources, and the use and availability of time. These arrangements are made possible in physical space-time (marked 6 in Figure 2.2). In this research, resources such as textbook availability or lack thereof; and scientific apparatus used in mediation are examples.
- Thirdly the social-political arrangement (marked 10 in Figure 2.2), controls relationships among practitioners and other people involved, and even between the people and the environment, and this is made possible in social-political space (marked 7 in Figure 2.2) (Kemmis & Heikkinen, 2011, p. 3). In this study examples of the socio political arrangements include the curriculum and how it controlled and influenced learning, and how power relations between teacher and learner played out during mediation.

The concept of practice architectures enables an understanding of the enabling and constraining factors of the practices themselves. According to Kemmis and Grootenboer (2008) practices are not dependent on the experience, intentions and actions of individuals or groups of people alone, but are also influenced by arrangements, circumstances and conditions beyond the individual educator. In order to be able to change teaching practice, Kemmis (2008) argues a need for changing the practice architectures that construct teachers' action possibilities, their self-understanding and their understandings of the world, and those practice architectures enabling or constraining what these teachers do. In this study, mediation of ECK in the CAPS Grade 11 Life Sciences was examined in terms of how it may be influenced by practice architectures.

Presented in Figure 2.2 as related to practice architectures are practice landscapes and practice traditions (marked 11 in Figure 2.2).

- The practice landscapes interrelate with other practices linking people, technology, spaces and artifacts together through the embedded structures and material arrangements. The practice landscapes frame future action possibilities for individuals and the organizations (Kemmis, 2008).
- Practice traditions reflect on practices that persist and perpetuate in organizations because they are carried forward within what Schatzki (2006) refers to as the practice memory of an organization.

The theory of practice architectures developed from practice theory by Schatzki (2005) and Kemmis and Grootenboer (2008) is an ontological lens that helps in understanding how different environmental education approaches emerge in different contexts.

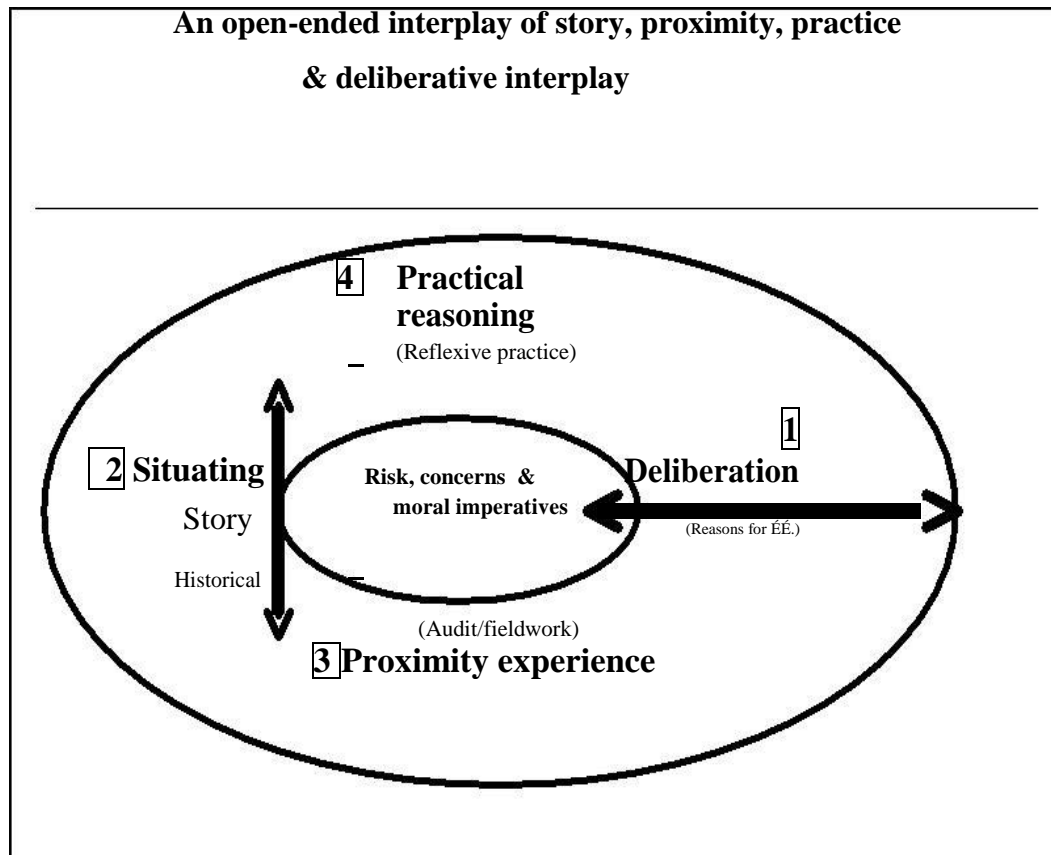
The two theories discussed above were used towards Goals Two and Three of the study as presented in Section 1.5 of this research. Goal Two related the teachers' doings, sayings and relatings to pedagogical sensitizing constructs in environmental learning which emphasize deliberation, situated learning, proximity experience and practical reason in the teaching of Grade 11 Life Sciences. Goal Three investigated those practice architectures enabling or constraining the above aspects of practice.

## **2.7 Mediation of learning**

Mediating learning makes reference to the way in which stimuli experienced in the environment of learning are transformed by a mediating agent that is, the teacher, in the life of a learner (Feurstein, et.al, 2006). Mediation is thus the subtle social interaction between teacher and learner in the enrichment of the student's learning experience (Presseisen & Kozulin, 1992). In this research mediation was equated to the idea of Vygotsky's (1978) concept of the zone of proximal development (ZPD). Vygotsky (*ibid*) describes the ZPD as the gap that exists between what learners can do alone and what they could achieve with the help of a more knowledgeable other (in this case, the teacher). Teachers use different teaching approaches to help learners to bridge their ZPD.

As introduced in Section 1.4, this study will draw on a number of pedagogical sensitizing constructs from the field of environmental education for viewing mediation as a relational process of knowledge construction. These pedagogical sensitizing constructs are deliberation, situated learning, proximity experience and practical reasoning; and are represented in Lotz-Sisitka and O'Donoghue's (2006) open process learning framework for environmental learning. This framework is illustrated in Figure 2.3 below.





**Figure 2.3: Open process framework for environmental education (adapted from O'Donoghue and Lotz-Sisitka, 2006).**

The four pedagogical sensitizing constructs are highlighted below, with emphasis on the role of environmental content in each. This is in an attempt to explore the nexus of teachers' content knowledge and teaching practice (that is the mediation of content) as highlighted by the link between content knowledge and teaching practice in Figure 2.1.

- Deliberation (marked 1 in Figure 2.3) as a process of knowledge co-construction where perspectives and understandings of human environment relations are shared in critical processes of social relations.
- Situating story (marked 2 in Figure 2.3) as a process where environmental content is related to cultural historical context.

- Proximity experience (marked 3 in Figure 2.3) as a situated learning process where environmental content is related to everyday and intergenerational knowledge through hands on experiences.
- Practical reason (marked 4 in Figure 2.3) as a process of knowhow, where there is of an iterative relationship between ECK and sustainability practices.

The following sections 2.7.1 to 2.7.4 will elaborate on the pedagogical sensitizing constructs.

### **2.7.1 Deliberation in mediation processes**

This study elaborates on the open process framework by Lotz-Sisitka and O'Donoghue (2006), by proposing deliberation as a sensitizing construct for giving insight into how environmental content is co-constructed or co-created. Perspectives and understandings are shared in critical processes of social relations with others. Deliberation in learning processes emphasizes participation in various cultural practices and shared learning activities (Paavola, Lipponen & Hakkarainen, 2004). Lotz-Sisitka and O'Donoghue (2006) mention that learning processes which involve deliberation are essential as they enable the weighing up of possibilities.

A focus on deliberation is informed by ideas of social constructivism which argues that an individual cannot be given knowledge, but rather that there is construction of knowledge through social interactions (Armstrong, Henson & Savage, 1997). In participatory processes students need skills in making decisions in a way that is consultative, democratic, collaborative and cooperative (Rutherford, 2004). Hogan, as cited in Lave and Wenger, (2003) also notes that learning occurs through social interactions and increasing participation in a community of practice. Adding to the importance of learning through deliberation it is noted that:

*“Knowledge ... is acquired through interactive and dialogical engagement...”*

(Gawe, Vakalisa & Van Niekerk, 2000, p.162)

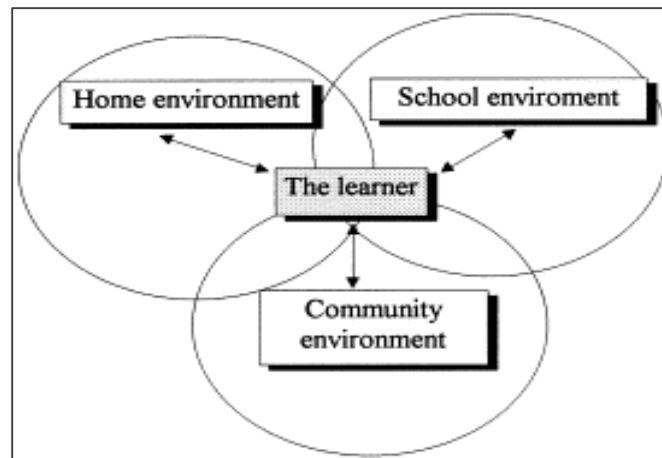
As a mediating approach, deliberation enables engagement of various ideas of environmental content, which can enable teachers to mediate based on the verbally expressed ideas.

### 2.7.2 Situated learning in mediating processes

Makrakis and Kostoulas-Makrakis (2005) found that the national curriculum is usually decontextualised, focusing on knowledge without “real life” meaning to students. However, this is problematic given Ono and Ferreira’s argument that “knowledge is situated and is socially and culturally constructed” (2010, p. 61). Situated learning is used as a pedagogical sensitizing construct for this study as it encourages research into community and place as additional texts for student learning (Stevenson, 2013). Stevenson (*ibid*) has argued that situated learning can improve academic performance through strengthening relevance of issues in context. In further support research by Smith, cited in Lotz- Sisitka and Mandikonza, (in press) said that providing contextually situated forms of epistemological access (access to more complex forms of knowledge offered in schools) via engagement with EE and place-based knowledge improves learner achievement. According to Wals (2007) situated learning has the advantage of moving away from curriculum definitives and knowledge transfer. Instead situated learning leads to awareness reflected in reality. Situated learning emphasizes curriculum content in relation to socio-cultural and historical context (O’Donoghue & Lotz-Sisitka, 2006). According to Lotz-Sisitka and O’Donoghue (2006) through situated learning activities, a rich mix of action centered enquiry and activity can be taken up with tangible benefits and cultural relevance in local community contexts.

Furthermore, Lotz-Sisitka and Zazu (2012) argue that context counts in understanding ESD. Lotz-Sisitka and Zazu (*ibid*) suggest that ESD ought to be supporting communities and learners to develop capabilities and action competence for risk negotiation in their everyday lives. According to O’Donoghue, Lotz-Sisitka, Asafo-Adjei, Kota and Hanisi (2006) the use of situated learning supports learning and can strengthen social relationships across school and community which has the potential to develop as reflective praxis in response to environment and health risks in a local context. Adding support to the idea of linking learning processes to context, Short (2009) mentions that young people need every opportunity to learn in a context relevant to their personal needs and societal issues. Vosniadou (2001) concurs with Short (2009), and also mentions that people learn best when they are able to participate in activities that are perceived to be useful to real life and are culturally relevant. Taylor and Mulhall (2001) in Figure 2.4 below

present a proposed link that supports situated learning whereby they say that learning is improved by bringing in three learning environments, that of the school, home and community.



**Figure 2.4: Links between the three learning environments of school, home and community existing in situated learning (adapted from Taylor and Mulhall, 2001).**

Hayes and Stephens (1990) point out that education must be rooted in a society and a culture which learners comprehend. They warn about previous failures of formal education whereby it is said that formal education usually suffered setbacks as it was out of context with learners lived environment. This is also supported by Taylor and Mulhall in Figure 2.4, who assert that “these three learning environments are often rather weakly linked and the experiences gained in each although individually of great value, are seldom drawn together and integrated in learning process” (2001, pg.138). This separation was found to be detrimental to education as it created two world views for the learner: the school and the world in which they live. The inability to make links to living environments can bring about educational disconnections between theory and environment.

### **2.7.3 Practical reason in mediating processes**

Practical reason as an additional pedagogical sensitizing construct gives insight into teachers’ methods and strategies relating ECK and sustainability practices in the process of what Lotz-Sisitka and O’Donoghue (2006) term ‘reasonable practice’. Mandler (2001) defines practical reason as the general human capacity for resolving, through reflection, the question of what one is to do. In practical reasoning reflection about action itself directly moves people to act, thus developing reflective thinking as ECK is being mediated. This is an idea formulated by Bourdieu

(cited in O'Donoghue and Lotz-Sisitka, 2006) who states that practical reason involves exploring a practice that is reasoned in action. Fien (2000) emphasizes the importance of mediated teaching approaches that influence the lifestyle in which one engages, enabling them to and whether or not it will be beneficial.

Practical reason according to Jickling, Lotz-Sisitka, O'Donoghue and Ogbuigwe (2006), is a process of self-validation allowing students to re-evaluate and re-image their lives. Practical reason supports learners to participate in society as informed and responsible citizens.

#### **2.7.4 Proximity experience in mediating processes**

Proximity experience is used as a fourth pedagogical sensitizing construct in this study as it enables reflection on how environmental content relates contexts of intergenerational and everyday knowledge. O'Donoghue and Lotz-Sisitka (2006) refer to proximity experience as participants' hands-on experiences. According to them, proximity experience allows participants to engage with their surroundings allowing them to make relevant links between their personal experiences, everyday contexts and learning.

Teachers are encouraged to use a broad range of teaching and learning techniques emphasizing practical activities and first hand experiences (Thomas, 2005). Du Toit and Sguazzin (Namibia. Ministry of Education and Culture, (MEC), 1995) mention that one of the best approaches to environmental education would be the use of different learning situations to teach and learn with the emphasis on activities and hands-on experience. Practical demonstrations and fieldwork are amongst some of the methods that fall under teaching and learning approaches of proximity experience. Through hands-on activities learners are expected to be able to observe both the desired and the unexpected results from their actions. The fieldwork and practical aspects can be considered to be vital as it enhances conceptual understanding of the ECK being taught.

According to Edlund (2011) fieldwork is a way of expanding the boundaries of the classroom through involvement of the broader community including school grounds and the nearby environment. Practical work experience according to Fien (1993) provides students with an appreciation of the environment through contact with it, whilst Edlund (2011) also highlights that hands-on experiences are essential to academic engagement as they promote higher order thinking skills. Furthermore Lotz-Sisitka and O'Donoghue (2006) advocate for active learning

methods that allow students to engage with the problems themselves and this is achieved through inclusion of fieldwork and these practical experiments.

Lotz- Sisitka and O'Donoghue (2006) provide examples of possible school lessons in which the pedagogical sensitizing constructs are evident in a section of work with environmental content. The examples they make use of show possible approaches to the mediation of environmental content. Lotz- Sisitka and O'Donoghue (*ibid*) in Figure 2.5 show their example in relation to their open process framework.

<b>EESD Focus</b>	<b>Socio-cultural situating and orientating</b>	<b>Some classroom / curriculum activities</b>	<b>Possible EcoSchool activities</b>	<b>Home and Life Style uptake possibilities</b>
<b>Biodiversity</b>	Stories of plants of cultural significance	Soil biodiversity Brush pack germination Seedling collection Dung seed dispersal	Low cost school nursery for propagating indigenous plants	Community planting of indigenous trees

**Table 2.1: Examples of lessons exploring pedagogical sensitizing constructs within an open process framework for environmental education (O'Donoghue and Lotz-Sisitka, 2006, pg. 7).**

The following is my elaboration on the examples given by Lotz- Sisitka and O'Donoghue (2006) of potential activities for addressing the different aspects of their open process framework (Figure 2.3). The example also highlights the nexus between environmental content and the particular aspects of the open-process framework. Taking the biodiversity topic Lotz-Sisitka and O'Donoghue (*ibid*) suggest starting the topic by narrating of stories of plants with cultural significance such as *cancer bush* or *Hoodia*. Since this is a story with examples from the cultural context of the learners, this is illustrative of **situated learning**. The environmental content in this topic is the relationship between human health, environment and the recognition of indigenous plant and cultural heritage. The topic continues with learners doing a seedling collection or dung seed dispersal activity. This hands-on activity is illustrative of **proximity experience**. Across the situating stories and proximity experiences, learners might be involved in **critical deliberation** comparing traditional and modern plant use, harvesting and propagation methods. Finally

learners plant seedlings in a low-cost school nursery and transfer these seedlings out into the community when strong enough. Such activities would be illustrative of involving learners in **practical reason**, as during these activities they would potentially be trying out ideas and reasoning in order to resolve problems of: loss of traditional knowledge, over-harvesting and possible extinction of medicinal plant species.

## **2.8 Conclusion**

This chapter looked at how EE policy was formulated internationally then locally in South Africa. It also detailed the change in curriculum within the country to the CAPS Grade 11 Life Sciences curriculum which has a more environmental content than the RNCS. Because of such a change in curriculum content, there was need for the examination of teaching strategies teachers are using for mediating environmental content. There was discussion of practice theory as it was used in the research to examine the teacher practices of doings, sayings and relating, as well as the theory of practice architectures which sought to explore enabling and constraining factors in a practice of teachers in the research. There was mention of deliberation, situated learning; proximity experience and practical reason as the pedagogical sensitizing constructs from theoretical framework informing the study, with a consideration of the role of environmental content in each of these constructs.

## **CHAPTER 3: RESEARCH METHODOLOGY**

### **3.1 Introduction**

This chapter discusses the research processes and activities used to generate data for examining how teachers were mediating the construction of environmental content in the Life Sciences Grade 11 curriculum. The chapter begins with a discussion of the naturalist qualitative orientation of the research and elaborates on the suitability of this particular orientation as used in the case studies. The data generation techniques selected for use are also described and discussed regarding their suitability for use. The chapter further elaborates on how data was organized and analyzed through a detailed analytical framework. This chapter concludes with a discussion of issues of validity and trustworthiness of the research findings, issues of ethics, and limitations encountered in the research orientation used.

### **3.2 Research methodology**

In this research various methodological approaches were used to help generate relevant data. The methodological methods used are discussed in Sections 3.2.1 and Section 3.2.2.

#### **3.2.1 Qualitative study**

In examining the diverse ways in which teachers are mediating environmental content, this research used a qualitative naturalist orientation. According to Denzin and Lincoln (2000) qualitative research is a type of scientific study that seeks answers to a question using a systemically predefined set of procedures in order to be able to answer that question. Denzin and Lincoln (*ibid*) furthermore mention that in order to be able to achieve the expectations of a qualitative study, evidence has to be collected in the process. This evidence usually produces findings that are not determined in advance, and the findings may become applicable beyond the immediate boundaries of the study. In this research for example, findings from the study can inform teacher professional development programmes in South Africa such as Fundisa for Change which are supporting teachers to meet the challenge of newly introduced environmental content in the CAPS Life Sciences curriculum.

The study occurred in a real world setting with the researcher not manipulating the phenomenon under study, but with the researcher being open to what emerged as the phenomenon unfolded



naturally (Patton, 2002). This according to Patton (*ibid*) gives the qualitative research a naturalist feel enabling it to be classified as a naturalist qualitative study. According to Ezzy (2002) qualitative researchers study meaning, and the quality of research into meanings cannot be ensured simply by following correct procedures. For this study quality was ensured through engaging with participants in context and in close proximity to enable first hand encounters, in-depth analysis and understanding.

### **3.2.2 Case study**

This research examined the diverse ways which teachers are mediating environmental content. The study examined how teachers work with environmental content in terms of understanding, investigating and applying environmental curriculum content. The research was done in the form of a case study. According to Baxter and Jack (2008) case study research is an empirical inquiry that investigates a phenomenon within its real life context. In this case the phenomenon is how teachers are mediating the construction of ECK in the CAPS Grade 11 Life Sciences. Cohen, Manion and Morrison (2005) say that a case study has the flexibility of allowing the investigation to report events with their relationships as they unfold. This was useful in the study as it enabled the continuous engagement between myself as the researcher and the participants who were involved in the research. Case study methods allow for the handling of operational links that need time to be traced instead of frequencies or incidences (Yin, 2009).

In this case study teachers analyzed their practices as they viewed video recordings of their lessons, thus allowing for teacher reflexive praxis. The importance of reflexivity is highlighted by Lotz-Sisitka and Raven (2002) who state that a case study should involve reflexive analysis of values and interests in social context.

In support of a case study approach Yin (2009) draws our attention to a strength of case studies which is that they provide a unique example of real objects. Case study is a methodology through which understandings can be reached of the experiences of people. In this research that is the experiences by teachers of mediating environmental content.

### **3.3 Research site and participants**

This research made use of the Volunteer Sampling Technique, a non-probability sampling approach where the participants are chosen on their willingness to participate (Cohen, Manion & Morrison, 2007). The research participants were two teachers chosen according to their willingness to be participants. These teachers were from two coastal schools within the Ndlambe (Port Alfred) area of the Makana (Grahamstown) District. Contextual information of the two teachers was gathered at the beginning of each semi structured interview. This was meant to elicit data such as participant qualification, their preferred teaching styles, their experiences as well as their understanding of the environmental curriculum content.

The two teachers took an interest in being participants in the study when approached at a cluster meeting at the start of the 2014 year. Both teachers were teaching Life Sciences in their respective schools. In Section 1.6 each of the educator's academic qualifications and years of teaching experience was discussed.

### **3.4 Data generating process**

For this study data was generated using a variety of methods. De Vos, Strydom, Fouche and Delport (2005, p.135) state that, "a choice of various techniques is advantageous in that the limitation and inadequacy of any of one of the tools is completed by the other, thereby eliciting rich and comprehensive data". Golafshani (2003) adds that the use of multiple methods of data generation allows for both in-depth description and triangulation. The data generation was separated into different stages as the information being sought could not be generated in a single step. These built up collectively to respond to answering the research question.

The data generation techniques in this study included:

- Collection of documents namely the CAPS curriculum statement, to relate to teacher work plans and learners' worksheets.
- Semi structured and stimulated recall interviews.
- Classroom observations.

These different research data generation tools are discussed below.

### **3.4.1 Selection of curriculum documents**

According to Cohen and Manion (2004), documents are original objects that are related directly to the events being investigated. Corbin and Strauss (1990, cited in Bowen 2009) view document analysis as a systematic process involving examination and interpretation of data. Documents were selected to gain insight into the environmental curriculum content which teachers are expected to teach. The Grade 10 -12 Life Sciences Curriculum and Assessment Policy Statement had relevance to this study as it was the formal policy document which guided teachers' curriculum planning. An extract of the section used for analytical purpose is included as Annexure A.

An examination of the work schedule for the unit of work per each educator in the research (Annexure D), as well as worksheets pertaining to the section of work was also done (see Annexure E). The work schedules which the teachers referred to as 'work pace setters' provided already prescribed environmental content in the curriculum to be taught and for how long it was to be taught. One of the teachers provided additional data in the form of notes made on the work schedule and this data illustrated teacher intentionality. The structure of the worksheets given to the learners for the lessons involved in the research was examined.

According to Wigley (2006) selection of documented material allows researchers to look out for educational orientations and methods that will enable meaning to be derived. Having an understanding of the curriculum document teachers used, was important in this research as it showed the environmental content to be mediated. Document selection further enabled comparison with interview and observational data, as well as deepening and extending the richness of data.

### **3.4.2 Semi structured interviews**

In qualitative research there are three common types of interviews used, these being structured, semi structured and unstructured interviews (Chambers, 1994). Koul (1984) defined structured interview as those interviews in which the procedure to be followed is standardized and is determined in advance. Semi structured interviews provide greater flexibility, although a series of questions and procedures to be followed are to be decided upon beforehand.

This research made use of semi structured interviews for each educator. These semi structured interviews were recorded and transcribed (See Annexure B and C). Semi structured interviews elicited data about the teachers practices (that being their sayings, doings and relatings about their mediating practices), as well as the architecture influencing these practices. The semi structured interviews were done to further explore teachers teaching approaches, and how they go about mediating environmental content in the curriculum; with questions specifically designed to elicit information on the pedagogical sensitizing constructs described in Section 2.7. According to Walker (1995) interviews enable people to give explanations for their own behaviour, practices and actions to the interviewer. Thus this validates strategies used by the teacher. There is also the flexibility of the researcher changing and adapting questions based on responses being given. Kvale (1996), as cited in Cohen et.al, (2007) views an interview as a tool that recognizes people as resources of knowledge through exchange of ideas on topics of mutual interest in the conversation. In this research, finding out how teachers mediate environmental content in their everyday classroom practices in the environmental strand in Grade 11 Life Sciences was the subject of the mutual conversation.

### **3.4.3 Lesson observations**

Lesson observations were done through video recordings of three lessons each for the two participant educators. Each of the two participant teachers were willing to teach lessons in the schools they worked in, through the four week duration for the environmental content coverage as set out in the Life Sciences curriculum. This four week content coverage was also the time frame within which the research lesson observations were to be conducted. Lesson observations enabled generation of first hand data and accounts of teacher approaches to mediating environmental content. They also provided evidence of the practice architectures in each one of the schools in the research.

According to Cohen, Manion and Morrison, (2000) observational data gives the researcher the opportunity to collect live information from real situations, enabling a look at what is taking place ‘in situ’ rather than getting second hand information. Patton (2000) further states that observations are essential in that they make it possible for the researcher to identify practices which would not be easy to pick up in an interview.

During lesson observation and video recordings, observation notes were made (See Annexures F and G). Lesson observations allowed the following to be noted:

- What was directly transpiring in the classroom.
- Teaching and learning interactions.
- Physical setting of the classrooms and schools.
- Relations and interactions within the schools and classrooms.
- School and classroom resources used in mediation.

In this study video recordings were done using video recording technology of a cell-phone as well as Iris Connect technology. Iris Connect is a video recording based technology which records a teacher's lesson and uploads to its main Iris Connect server. The teacher can log on to the website and retrieve their saved lesson. Iris works over Wi-Fi which cuts on data charges, making it cost effective for those teachers within Wi-Fi locations. During lesson recordings using Iris Connect a teacher wears a microphone around his or her neck which has a remote motion sensor. This motion sensor then enables the mounted Iris camera to move to where the teacher will be. This enables the capturing of lessons from all angles. The microphone also eliminates background noise for better audibility, which is not always possible with cell-phone footage. In this study Iris Connect technology enabled lessons to be recorded and viewed later to help with data that could have been missed in the observations. It also enabled lesson recall with teachers during stimulated recall interviews.

#### **3.4.4 Stimulated recall interviews**

According to Lyle (2003) stimulated recall is a research method that allows the investigation of cognitive processes through inviting participants to recall and reflect on their concurrent thinking during an event when prompted by a video sequence or some other form of visual recall.

Stimulated recall interview is an interview method which enables retrieving of memories, as well as enabling participants to explain their decision making (Slough, 2001; Mackey & Gass, 2005; Sime, 2006). In stimulated recall recordings taken by researchers as part of their lesson observational recordings are used in the interviewing process and to act as a stimulus to the participants (Moreland & Cowie, 2007). According to Sime (2006) the use of multimedia

sources in recall sessions has the benefit of replaying and reintroducing cues that were present during the task.

Video recorded lessons were used to facilitate stimulated interviews with the teachers. In this study stimulated interviews were conducted to give the participant teachers the chance to reflect on their practice and clarify issues or matters that would have arisen during their lesson proceedings. Stimulated recall enabled me to probe for insight into each of the participant's practice to get more insight and clear understandings or misunderstandings which may have arisen on my part. Discussions with teachers during stimulated interviews were voice recorded which enabled capturing of all details from the interview. The interviews were carried out in English and transcribed (See Annexure H for an example). This added to the "richness" of data collected.

#### **3.4.5 Summary of data generation methods**

An inventory of the data techniques is presented in Table 3.1. Here it is arranged sequentially. Each participant was given a code so as to be easily identified and each data set given a specific label.

**Table 3.1: Inventory of data generated**

<b>Data type</b>	<b>Source</b>	<b>Purpose of data</b>	<b>Data set label (if any used)</b>	<b>Annexure</b>
<b>Curriculum and Assessment Policy Statement Grades 10-12 Life Sciences</b>	Only extracts with environmental content with special attention to the subject specific aims (pg 13- 18)	To compare the three subject specific aims to the teachers understanding of teaching approaches.		A
<b>Semi structured interview</b>	Teacher 1 (T1) and 2 (T2).	Teacher scan evaluate and reflect on ways that they mediate learning of environmental content knowledge	SS1 T1 and SSI T2	B and C
<b>Document: Life Sciences work schedules for the environmental section in Grade 11 Life Sciences</b>	Teacher 1 and 2	Show the expected environmental curriculum content to be taught by both T1 and T2 and teacher intentionality (T2)	WS T1 WS T2	D
<b>Document Worksheets</b>	Teacher 1 and 2 (one per teacher)	Evidence of mediating strategies	Worksheet 1 and worksheet 2	E 1 and T2
<b>Lesson observation teacher 1 and 2 lessons</b>	Teacher 1 (T1) and 2 (T2)	Observe teacher practices and mediating methods	LO1 T1 and T2 LO2 T1 and T2 LO3 T1 and T2 (lessons 1,2 and 3)	F1 – F3 and G1- G3
<b>Stimulated recall interviews</b>	Teacher 1 (T1 ) and 2 (T2)	Teacher reflections on their practices and mediating strategies in lessons observed	SRI 1 T1 and T2 SRI 2 T1 and T2 SRI 1 T1 and T2 (lessons 1,2 and 3)	H1 – H3

Cohen and Manion (1994) warn that with case study researchers data is strong in reality but difficult to organize. This was dealt with by assigning labels as in Table 3.1.

### **3.5 Data Analysis**

According to O’Leary (2004) data analysis is a process of moving from raw data to meaningful understanding of the data. Patton (2000) adds that data interpretation and analysis involves making sense of what people have said, looking for patterns and putting it all together.

There are inductive and abductive approaches for use in analyzing data. In inductive research the researcher develops categories and concepts from the data generated and these are related to the research question. Abductive analysis deals with the researcher re-describing the phenomenon under study to discover connections and relations that would have possibly been not so obvious (Danermark, Ekstrom, Jakonsen & Karlsson, 2002). In most cases with abductive analysis categories are based on the theoretical framework and the data is coded according to these predetermined categories. This research study made use of the abductive approach with the analytical framework presented, with categories that were colour coded to match each block in the analytical framework presented in Table 3.3. In this research the interpreting and recontextualizing of data in order to make meaning of what transpired, was achieved through the analytical framework developed from the theory guiding this research. The analytical framework was constructed making use of the theory of practice Schatzki (2005) and the theory of practice architectures by Kemmis & Heikkinen (2011) and as represented diagrammatically by Hemming et.al (2013) (see Section 2.6) as well as Lotz-Sisitka and O’Donoghue’s open process framework for environmental learning (2006, see Section 2.7).

The teacher practices presented as bundles of doings, sayings and relating were captured in analytical memos 1 and 2 (See Annexure I and J), addressing Goals One and Two of the study. The practice architectures that constrained or enabled practices of the two teachers in the research were captured in analytical memos 3 and 4 (See Annexure K and L), addressing Goals Three of the study. These analytical memos later were used to form the structure for presentation of data in Chapter 4.

An inventory of the analytical memos which formed part of the data analysis techniques is presented in Table 3.2. Once again, each participant was given a code so as to be easily identified and each memo given a specific label.



**Table 3.2: Inventory of analytical memorandums used in the data analysis process**

<b>Educator</b>	<b>Memo</b>	<b>Research goal addressed</b>	<b>Memo (Source / Purpose)</b>	<b>Annexure</b>
<b>Teacher 1 (T1) and</b>	Analytical memo 1(A)	Goal 1	Summary of observation, semi structured interviews and notes of work schedules	Annexure I (A)
<b>Teacher 2 (T2)</b>	Analytical memo 1(B)	Goal 1	Summary of observation, semi structured interviews and notes of work schedules	Annexure I (B)
<b>Teacher 1 (T1 )</b>	Analytical memo 2 doings, sayings and relatings in relation to pedagogical sensitizing constructs	Goal 2	(Source) Summary of observation, semi structured interviews	Annexure J(A)
<b>Teacher 2 (T2)</b>	Analytical memo 2 doings, sayings and relatings in relation to sensitizing constructs	Goal 2	(Source) Summary of observation, semi structured interviews and notes of work schedules	Annexure J (B)
<b>Teacher 1 (T1 )</b>	Analytical memo 3 enabling / constraining factors	Goal 3	(Purpose) Summary enabling constraining factors	Annexure K
<b>Teacher 2 (T2)</b>	Analytical memo 4 enabling /constraining factors	Goal 3	(Purpose) Summary enabling and constraining factors	Annexure L

In the analytical framework, teacher practices (doings, sayings and relatings) were placed in a matrix in relation to the pedagogical sensitizing constructs described in Section 2.7. Column 1 in Table 3.3 is constructed from the viewpoint of a relational approach to knowledge construction as outlined for each of the four theoretical constructs guiding this study (see Section 1.4 and 2.7). Also examined and linked to these pedagogical sensitizing constructs were the practice architectures which enabled or constrained the teachers' sayings, doings and relatings (see the last two rows of the analytical framework Table 3.3) These architectural influences were drawn from the last column of Hemmng et.al's diagram (Figure 2.2- Section 2.6).

**Table 3.3: Analytical framework combining practice theory and an open process framework for environmental learning.**

		<u>Analytical dimensions</u>		
		<b>SAYINGS</b> <i>What does the teacher say to support...</i>	<b>DOINGS</b> <i>What does the teacher do to strengthen....</i>	<b>RELATINGS</b> <i>How do teachers relate to their students</i>
<b>Pedagogical sensitizing constructs (Conceptual framework)</b>	<b>DELIBERATION</b> <i>Perspectives and understandings shared in social relation. It includes methods and strategies supporting critical knowledge co-constructing/co creation</i>	<b>1</b> ...knowledge co construction?	<b>2</b> ....knowledge co construction?	<b>3</b> ..during the process of knowledge construction?
	<b>SITUATED LEARNING</b> <i>Defined as learning where environmental content is related to social cultural historical context</i>	<b>4</b> ...constructing knowledge in cultural historical context?	<b>5</b> ...knowledge construction in cultural historical context?	<b>6</b> ...In terms of their cultural historical context?
	<b>PROXIMITY EXPERIENCE</b> <i>Environmental content is related to everyday and intergenerational knowledge interactions through participants' hands on encounters /experiences</i>	<b>7</b> ...developing scientific knowledge through hands on activities focusing on intergenerational and everyday knowledge?	<b>8</b> ..... scientific knowledge through hands on activities focusing on intergenerational and everyday knowledge?	<b>9</b> .... in context of intergenerational and everyday interactions?
	<b>PRACTICAL REASON</b> <i>An interactive relationship between content knowledge and sustainability practices</i>	<b>10</b> ...strengthening the relationship between content knowledge and sustainability practices	<b>11</b> ...the relationship between content knowledge and sustainability practices?	<b>12</b> ...while supporting an iterative content knowledge / sustainability practices relationship?
		<b>Practice architectures</b>		
		Arrangements and set ups enabling interaction via cultural discursive arrangements	Arrangements and set ups enabling interaction via material economic arrangements	Arrangements and set ups enabling interaction via socio- political arrangements
		Arrangements and set ups constraining interaction via cultural discursive arrangements	Arrangements and set ups constraining interaction via material economic arrangements	Arrangements and set ups constraining interaction via socio- political arrangements

Each block in the matrix has been assigned a number (1-12). These positions in the matrix are described below:

With respect to deliberation there was examination of what the teacher said (1) and did (2) to support critical deliberation, and how the teacher related to their students during the process of critical deliberation(3). A focus on situated learning provided insight into what the teacher said to relate environmental content to socio-cultural and historical context (4), what the teacher did to relate environmental content to socio-cultural and historical context (5), and how the teachers related to their students and to non human set ups during this aspect of the learning process (6). A focus on proximity experience gave insight into what the teacher said while using “hands on” experiences to relate environmental content to intergenerational and everyday knowledge (7), how the teacher used hands on experiences to relate ECK to hands on to relate environmental content to intergenerational and everyday interactions (8), and how teachers related to their students during these interactions (9). Finally a focus on practical reason gave insight into what the teacher said in developing an iterative relationship between environmental content and sustainability practices (10), what the teacher did to mediate the relationship between environmental content and sustainability practices (11), and how teachers related to their students during mediation of these relations (12). The data was presented in Section 4.4 as narratives of the two cases according to the four pedagogical sensitizing constructs elaborated in this analytic framework.

### **3.6 Validity and trustworthiness**

Bassey (1999) notes that validity is the extent to which a research fact or finding is what it is claimed to be through supporting evidence from data in the study. Cohen, Manion & Morrison (2000) make mention that the use of a variety of techniques ensures that there is consistency, validity and trustworthiness in the data collected.

This study enhanced data validity through deepening insight into the observation method. That is video recordings were used to stimulate conversation with participants about videoed lessons. These stimulated recall interviews enabled data verification and deepened the insights from the observation process.

By always having in mind the study’s research goals and the research question, the appropriate data generating techniques were used. This was also done so as to stay focused and have

techniques which would elicit data relevant to the research study. Throughout the study the research goals and question were always referred to. This, according to Maxwell (1992) is important as validity is not always about the methods one uses, but whether the conclusions made from the methods adhere to the purpose and context of the study.

Bassey (1999) recommended an adequate audit trail when writing up the research in order to enhance validity and trustworthiness during the interpretation and reporting stages. Through labelling of each data source and linking to the specific location of text within sources in the analytical memos, raw data of this study is more convincing and accessible to the reader, and easy to trace.

### **3.7 Ethical considerations**

Merriam (2001) notes that, in qualitative studies ethical dilemmas are likely to emerge with regard to the collection of data and dissemination of findings. This is why in this research permission in writing was sought from the relevant headmasters of schools and the education department district offices (according to the Eastern Cape policy on visiting schools) (Annexure M). Observation was done in accordance with the teachers' timetable so as not to affect other lessons during the time of conducting the study. Permission was sought from my school principal (Annexure N) to allow me to conduct research at times where I might have needed to be out of my own classroom during school time. According to Cohen, Manion & Morrison (2005) informed consent is essential when collecting data. The teachers were orientated to the research intentions and requested to participate. On agreement to participate they were asked to sign consent forms (Annexure O). The parents or guardians of the nine learners from the two schools, whose photographs were to be used in the research, gave written consent for the students to be part of the research (Annexure P).

There was assured anonymity through the use of code names throughout the study. Although Cohen et.al (1994) recommended that anonymity is not advisable for case studies, at the request of the participants their identities remained anonymous. Code names were used: example T1 in reference to the first teacher and T2 for the second teacher.

Assurance of safe keeping of recordings was undertaken, and these recordings remain in my possession as the researcher. I informed participants of their right to withdraw from the study any

time should the need arise. The participant teachers were allowed access to the data and will get a copy of the final research findings on request.

### **3.8 Reflections on data generation**

One weakness in data generation for this research was the difficulty at times to transcribe video recordings in environments where background noise was detected. The difference between using a smart phone in the one group of the teacher's lessons and using the sophisticated Iris Connect technology was evident. It was easier to transcribe the lessons recorded using the Iris Connect technology as it eliminated background noises and the teachers had the microphone in close proximity. The other follow up lessons could not be recorded using Iris connect technology as the technology was borrowed from a research centre, and was not available for use during the time period allocated for the second and third set of observations. Instead a smart phone (cell phone) equipped with a camera and video recording function was used to take footage of the lesson, and this unfortunately could not eliminate the background noise and this affected audibility during the transcribing process.

A total of three lessons per each teacher of the allocated 45 minutes were transcribed and this meant that a lot of data had to be handled. The transcribing of the video recordings of lessons and interviews' was a tedious process. It required constant replays of videos so as not to miss vital information but capture as much detail as possible for use in the study. Further difficulties which delayed the transcribing process were encountered where audio had a lot of background disturbances. As the lessons were in English transcribing them did not take much time. This is advantageous especially in research studies such as this one undertaken in an educational context, as it speeds up the process and does away with the time consuming process of translating or the dangers of distorted meaning during translation process. Polkinghorne (2005) says that a primary form of access to people's perceptions and experience is language and rich data are generated when participants use the language they master. Although both participants are second language speakers, this did not affect the research and their language of learning and teaching (LOLT) was in English, which was comprehensible to me, the researcher.

Stimulated recall showed that there is need for a preliminary analysis of observations.

Stimulated recall, if done before preliminary analysis of observation does not provide enough

depth or ideas for critical engagement with the participants. This was evident in this research as follow up on data initially obtained provided further clarity on some issues as well as added depth to data.

The environmental content in the curriculum for Life Sciences is designed and designated to be taught in the third term of the school year. This was problematic as it delayed the research. Careful negotiation with teachers was required. Both teachers were informed ahead of time and were accommodating enough to work in such a way that they were ahead of their schedules. This enabled them to bring the environmental section in their syllabus forward to accommodate the research time frame.

Timetabling in the schools was also difficult as negotiations had to be made with the teachers for times suitable to carry out research. Where timetables clashed with that of the researcher the rescheduling of lessons obviated the problem. In terms of my own teaching and school commitments, thorough planning was also required in order to avoid prejudicing my own learners' educational needs. Fortunately none of these eventualities occurred but a failure to identify potential limitations such as time constraints could jeopardize any similar research studies.

### **3.9 Conclusion**

This chapter discussed the research design and methods used in the generating of data in the research study. The qualitative case study research orientation was discussed including discussing the appropriate nature of case study approaches, which allow for phenomena to be studied in real world settings. An overview of the methodology for data generation and analysis was given in this chapter. The data generation process was organized to answer to the research goals in this study. The data generation methods used were discussed in detail regarding their suitability for use in this study. Documents were selected for analysis, semi structured interviews, and lesson observation, stimulated recall interviews and additional methods were used to generate data for this study. Findings that emerged from the study were analyzed through use of an analytical framework constructed making use of practice theory, theory of practice architectures and an open process framework for environmental learning. The chapter ended with discussions of validity, ethical consideration and trustworthiness of data and reflections on the research process, as well as possible limitations that were encountered during

this study. The research findings obtained from this chapter will be discussed in the following chapter, and the interpretations of these findings from the data will be addressed in Chapter 5.

## **CHAPTER 4: RECONTEXUALISING OF DATA**

### **4.1 Introduction**

This chapter presents the findings from the research as set out in the research goals described in Chapter 1. The chapter starts by discussing educators' knowledge of the environmental content in the official Life Sciences CAPS curriculum (Section 4.2.1). This was in response to Goal One of the study. The chapter also describes findings from the semi-structured and stimulated recall interviews, lesson observation, work schedules and tasks discussed in Chapter 3. These are presented in the form of doings, sayings and relatings making up the two teachers' mediation practices. This addresses Goal Two of the research and is discussed in Chapter 4.3. The chapter concludes by addressing the aims of Goal Three by looking at the various practice architectures (see Section 2.6) as evident in the data generated during the study.

### **4.2 Teachers' Environmental Content Knowledge and Pedagogical Content Knowledge**

This section responds to Goal 1 of the study. The section was analyzed in analytical memo 1 (Annexure I), and it was analyzed in two parts. The first part presented data that influenced the teachers' knowledge of the environmental content. The second part of the analytical memo presented data on the teachers PCK in relation to the subject specific aims in Life Sciences.

#### **4.2.1 Teachers' Environmental Content Knowledge**

Section 2.3 stated that in CAPS new and additional concepts related to environmental content not previously covered in the curriculum, such as 'sustainability' have been introduced (DoBE, 2012). Teachers have different ways of understanding and interpreting this environmental content in the curriculum. The mediation of the curriculum's environmental content through different teaching approaches forms part of the PCK as defined by Shulman (1986, Section 2.5).

The two teachers who participated in the research revealed different interpretations and understanding of the ECK in the Life Sciences curriculum. An insight into the teachers' mediating of environmental content was also prompted by the fact that the CAPS document states the following:

*.....The content framework focuses on ideas, skills and concepts as well as ideas between them, rather than on listing the facts and procedures that need to be learned. It also*



*does not prescribe particular instructional strategies or methodologies. Instead teachers have the freedom to expand concepts and to design and organize learning experiences according to their local circumstances, including the availability of resources...* (DoBE, 2012, p.10)

According to both teachers unfamiliarity with EE and ESD concepts, because of the omission thereof during teacher training, affected their knowing of the new content in Life Sciences CAPS and their pedagogical approaches. This was a view expressed by T1 (SSI T1// 16-18) and this was echoed by the second teacher (T2) (SSI T2// 18).

T1, despite not being trained in ESD, was asked what topics in the Grade 11 curriculum she viewed as environmental. Her response was: “There is a whole module which we are expected to teach so references to human impact on environment highlights what the section is focusing on” (SSI T1 // 39-40).

The second teacher attributed his understanding of environmental content to his years of teaching experience when he said: “I have been teaching for eighteen years and two months to be exact!” (SSI T2// 6). T2 also said that he was able to integrate environmental content from both Geography and Life Sciences. In support of his teaching approach that made use of subject integration, T2 said: “I think that there is some relevant knowledge of the topic on environmental content in Geography which helps in the teaching of the ECK topics in Life Sciences. One sees that there is an overlap in the ideas of the environmental content in the two subjects which I find exciting” (SSI T2// 12-1). He goes on to say that this works to the Geography teacher’s advantage and also complements Life Sciences (SSI T2// 14-16).

T2 showed acknowledgement that EE and ESD concepts were present during his teacher training course, although not specifically being referred to with the same names. He said he had noticed that, the ideas behind what was taught then resembled ESD. This showed how T2 translated his prior experiences, and this prior experience was playing a role in reflecting how T2 understood the current environmental content. T2, when asked if they had studied EE or ESD in their teacher training answered by saying: “Yes, to a certain extent in Geography. Of course, back then it was not explicitly called ESD but looking back now you can see that the principles of EE/ESD were captured within the content we were taught,” (SSI T2// 20-22). Further probing into his understanding of the environmental content was done by finding out what topics he considered to be environmental content related in the Grade 11 curriculum. The reply he gave

was: “Water resource availability, climatology, alien species - quite a varied amount, as well as a focus on the human impact on the environment” (SSI 1 T2// 53). His response showed insight into the ‘human impact on the environment’ topic which is part of the ‘new’ environmental content in the Grade 11 CAPS Life Sciences.

T2, apart from knowing what makes up environmental content in the curriculum, seemed to have an understanding of the need for any teacher to have ECK. He elaborated on this point by saying: “One has to have a full understanding or at least familiarization with the environmental content; in order to fully implement it. You cannot expect one to teach what they can’t relate to or do not know, now can you?” (SSI T2// 88-91).

#### **4.2.2 Teachers’ Pedagogical Content Knowledge**

Goal One of this study was partly an investigation of teachers’ understanding of environmental content in the curriculum. This section looks at how the two teachers’ approaches to learning and assessment address the subject specific aims in Life Sciences. This addresses the second part of Goal One, namely teachers’ PCK. Analytical memo 1 (see Annexure I) presents the subject specific aims in relation to how each educator works with these aims in mediation.

As mentioned in Section 2.3 in the Life Sciences CAPS (DoBE, 2012), Specific Aim 1 relates to “knowing the subject content thereby enabling learners to make many connections between the ideas and concepts, such that learners can apply their knowledge in new and unfamiliar contexts” (DoBE, 2012, p.14). The curriculum further encourages “active and critical approaches to learning instead of rote learning which does not create opportunities for critiquing of given truths” (DoBE, 2012, p.4). This active and critical approach to learning is applicable to Specific Aim 2 and Specific Aim 3. This is an indication that teachers need to provide learning opportunities which will enable learners to critically assess and review the environmental and sustainability content being taught to them.

Evidence in this study indicated that T1 and T2 promoted active and critical approaches to varying degrees. T1 understood that using narrative and discussion type of teaching methods encouraged learners to engage and translate content into useful forms. T1, stated that she did not like passive learners or passive learning (SSI T1// 67-68), and that she initiated discussions so as to encourage learners to question what they were being taught as well as to think critically

through the type of discussions they had (SSI T1// 175). Furthermore, she opted for a discussion type of teaching and learning approach which she noted gave her room to control the lesson and know the level of learners' understanding in relation to the body of environmental content (SSI T1// 59-61).

The second teacher in the study, in promoting active approaches to learning, said that he chooses to use group and report methods through brainstorming and discussion (SSI T2// 71). According to T2, discussions enable learners to think and learn from each other as they shared ideas: "It is active learning instead of the teacher being the source of all information" (SSI T2// 72).

However T2, cautioned that despite encouraging deliberation: "I have to guide them during their discussions so as to not make them lose track of what's to be discussed" (SSI T2// 76-77).

How teachers relate to their students during the process of knowledge construction is important in the process of mediation.

T2 is seen to promote an active approach to learning through the type of assessment activities which T2 incorporates as part of the teaching and learning process. The activities used were based on a lesson on the town's water type and quality. There is for the second teacher also a case study based activity which was linked to the topic on water scarcity and this was tasked to the learners.

The teacher mentioned the importance of encouraging the use of assessment that encourages learners "to think outside the box and push their limits" (SSI T2//179-180). Furthermore, according to T2, the activities that he gives, require and encourage learners to explore the knowledge taught and what they may know before or after being taught the relevant environmental content (SSI T1// 181). This is evidenced by activity on the worksheet the educator gave to the learners on water quality test (Annexure E1), and the water scarcity case study (Annexure E1).

Section 2.7 stipulates that in Life Sciences, Specific Aim 2 relates to doing science. The intentions of this aim are geared towards learners planning and carrying out investigations as well as solving problems that require some practical ability. It is expected that in the process of doing this, learners acquire a range of skills related to building within the context of cognitive domains as expected by Specific Aim 1 (DoBE, 2012, p.15). For this specific aim, T1 indicated

that she realized that some of the areas within the environmental module required hands-on activities (SSI T1 //184).

T2 offered reasons for limitations to a hands-on approach. He noted: “There is the issue of cost to travel to some places that would help the learners understand the topic better ...so it’s that ability to give children the closeness to experiences especially within their context that enables them to have a feel and make sense of this environmental content” (SSI T2// 99 – 107).

Furthermore T2 explained: “I like to use more of the hands-on activities more often but I find that they are limited and only one on water testing has been done. This was not enough to cover all skills and issues as stipulated by the curriculum” (SSI T2// 191-192). This is an area in which he himself hoped to improve. The relevance of such thinking in planning by T2 does not only promote practical skills in the teaching and learning of ECK; but overlaps with the idea of using context to make content relevant to learners. This is as stipulated by Specific Aim 3 of the curriculum as discussed in the next paragraph.

It is stated that Specific Aim 3 (mentioned in Section 2.3) seeks to develop learners’ awareness and understanding that school science can be relevant to their lives outside of school and that it is able to enrich their lives. Within this aim, there is emphasis that the knowledge acquired should show that relevance and also clarify the relationship between the subject and society, for example by including indigenous knowledge systems that relate to a specific topic and its application in their daily lives (DoBE, 2012, p.13). Furthermore, it is highlighted within this aim that teaching and learning should “ensure that children acquire and apply knowledge and skills in ways that are meaningful to their own lives. In this regard, the curriculum promotes knowledge in local contexts while being sensitive to global imperatives” (DoBE, 2012, p .4).

In this study, situated learning (see Section 2.7.2) was linked to Specific Aim 3 where teachers have made use of local context in their approach to mediating construction of environmental content in the CAPS curriculum. A situated approach to learning was evident in T1’s appreciation of teaching the environmental section in the curriculum which she said stemmed from the fact that most of the topics are part of their daily lives (SSI T1 // 43). Because of this, T1 stated that wherever possible she would make reference to local issues and incorporated ideas for example how, in the various cultures within the multicultural set up amongst her students, they purified water. This was observed in her water quality and pollution lessons where she

constantly referred to the salty quality of the town's water and the various ways they would have reduced the salt content when speaking about curriculum content demarcated for that section of work (LO1 T1 //165). She further showed her understanding of the purpose of Aim 3 saying that some issues are relevant in our society as we are directly affected by them. She explained that: "You will see that in my lessons I do refer to... the various issues where applicable in our town" (SS1 T1 // 110-112). This was an indication that T1's own beliefs of using context in mediating environmental content.

In the semi-structured interview T1 acknowledged the fact that she encouraged her learners to engage and reason as they were being taught to apply what was learnt outside the classroom. To do this, she explained that the way she engaged in transferring content to the learners was by soliciting answers from them by taking them through the content usually through asking questions. She also mentioned that she liked to break down the content into small steps which then enabled her to give learners time to reflect what had been said.

T2 mentioned that in the teaching of ECK he made use of examples from learners' backgrounds. "Learner history and their background in most cases, (especially in multicultural set-ups) we tend to ignore, but has an influence on attainment coming from how they would have had the content brought to reality where relevant context examples can be made" (SSI T2// 80-81). He added, "I try and make environmental issues as relevant as possible, especially to those learners of mine who come from disadvantaged backgrounds" (SSI T2// 167-168). He supported this when he said: "I use examples that they encounter in their homes or communities every day such that this makes sense when the issues on environment content knowledge are discussed" (SSI T2// 165-166).

T2 had a strategy in which he would initially acquaint learners with the environmental content before he moved to making reference to local examples (SSI T2// 162-163). Many of the examples he used were relevant, according to him, as the learners encountered them on an everyday basis in their homes. As such, learners would be able to relate to the content (SS1 T2// 165-166). This was seen when he made references to scenarios to which the class could relate. These examples included the effect of low rainfall in a nearby town (LO1 T2// 5-7), the possible effects of global warming which may have caused the devastating floods in the previous year that caused damage in the coastal town where the school is situated (LO1 T2// 15-17) and the red

tide that had been present in the beach water. In his semi-structured interview he mentioned how he planned to remind the learners about the red tide example in the lesson (SS1 T2// 101-107).

### **4.3 Summary of teachers' lessons**

This section presents data from lesson observations, semi structured interviews, stimulated recall interviews and teachers' worksheets. This data helps to illustrate teachers' mediation practices. This is in response to Goal Two of this research considering of mediating practices in terms of doing, sayings and relatings, as defined by theory of Practice discussed in Section 2.6. In this case practices in mediating environmental content were examined. The practices were investigated in relation to the pedagogical sensitizing constructs of deliberation, situated learning; proximity experience and practical reason (see Section 2.7). This was done to understand the mediating of environmental content in the Grade 11 CAPS Life Sciences in the two case studies.

An analysis of the work schedules representing the environmental content taught by both educators was made. The process involved an in-depth examination of the topics and themes selected in the section of work, the proposed type of activities and assessment. This gave insight into the scope and nature of environmental and sustainability content set for the teachers to teach. The two teachers provided their work schedules which were extracts of the official document. These guided them on the content knowledge and duration which the sections of work were to be taught.

#### **4.3.1. Summary of first teacher's three lessons**

Annexure D1 is a copy of the work schedule used by T1 (WS T1) in placing the lesson. The lessons were from the water and availability section of the work schedule.

T1's first lesson was an introduction to the topic of water quality. In this lesson she stated differences between fresh water and sea water, giving the local town's water as an example of one of the two types of water. This was then followed by a discussion on the role of the two water types in the water cycle and how this translates to water availability in South Africa. This led to the further discussion on various water uses in the country and how climate change was affecting the water availability and in turn all the mentioned uses.

The second lesson was a follow up to the previous day's lesson. In the lesson, learners were taught about the function of the Gariep dam. This was linked to water availability in the country as discussed in the previous lesson. Discussions then moved to other sources of water supply such as aquifers. In addition wetlands were also discussed and the significant role which they play in water purification and maintenance of the water table. The lesson ended with discussion on the effect of human activity (such as poor farming practices) on these water sources.

The third lesson was a class test, assessing the previous two lessons' work. Figure 4.1 shows one of the learners working through the test.



**Figure 4.1: Learner answering questions to a water scarcity and availability class test.**

**Summary of second teacher's three lessons.**

#### **4.3.2. Summary of second teacher's three lessons**

Annexure D2 is a copy of the work schedule used by T2 (WS T2) for this section of work. T2 used the work schedule to plan around his lesson and added notes as part of planning of the lessons.

T2's first lesson was an introduction to the human impact on the environment. This made mention of human activities detrimental to the environment such as deforestation, carbon emissions leading to the green house effect, and desertification. The effects of each of the

practices were looked at from a local, national and international scale. The lesson ended with a focus on the various negative effects South African citizens are having on the environment.

Lesson two made use of group work after having introduced the importance of saving water. The group work required reporting back to the class from each group on a specific topic, for example the effect of droughts and leaking water taps. The teacher initially called on learners to answer the various question related to negative impact on the environment. Learners gave various answers to the discussion. This was then followed by the learners gathering in groups and discussing the subject topic which the teacher had tasked (Figure 4.2). After being given ten minutes for group discussions the teacher then called on the learners to report back to their classmates.



**Figure 4.2: A group of teacher two's learners engaged in a group discussion and deliberating on an environmental topic.**

As the groups did not complete their presentations in the second lesson, the third day was a continuation of the class presentations. When groups had completed their presentations, the teacher then summarized most of what had been presented by the various groups. He then gave the learners a case study written task on the effect of drought in an African village, which was based on what they had learnt in one of the topics discussed.



#### 4.4 Mediating processes Teacher practices

This section presents the data which addresses Goal Two of mediating environmental content. The section will firstly discuss mediation by T1 (case 1) and secondly by T2 (case 2) in the order of deliberation, situated learning, proximity experience and practical reason (see Section 2.7 and Table 3.3 for the essence of these four analytic categories). It is important to note that there was a lot of overlap found between the four sensitizing constructs, thus making it sometimes difficult to place them in one particular ‘box’. For example one needs critical thinking (central to ‘deliberation’) in order to develop practical reason. Also proximity (hands on) experience supports practical reason if one trials and thinks about ideas for resolving environmental problems. Similarly situated learning can be supported by proximity experience. However, it was still deemed useful for analytic purposes to construct the following narratives by thinking about these four constructs.

##### 4.4.1. Case study 1

In explaining how she encouraged **deliberation** in her teaching practice. T1 argued that: “The discussion type approach enables various ideas to be brought out in the open which can build to one body of knowledge for a topic. So in a way they can learn amongst and from each other and in turn bring concepts they did not know before but make them understand the content better” (SSI T1 // 59-61). T1’s chosen method of interaction was through a narrative and discussion type of approach, with both approaches allowing engagement between teacher and learner that promoted learners’ development of critical thinking (SRI T1// 26-28).

In her first lesson T1 encouraged deliberation in her engagement with the learners when she said: “Now we will be looking at the water availability. Is water equally available? Let us discuss this idea”. When probed in the stimulated recall interview on what her intentions had been at this point of the lesson, the teacher’s response was that she needed the learners to engage more critically through discussion on the issue at the start of the lesson so that they realized the various ideas each brought (SRI T1// 8-14). They could then, according to T1, bring these ideas on water availability which they have mentioned in their discussions. She added that she tried to guide the learners’ ideas during the process of knowledge co-construction so that the learners did not lose track of discussions. T2 also believed that her encouragement of learners’ ideas during

the process of knowledge co-construction was an encouraging approach to mediating (SSI T1 // 61).

In the stimulated recall interview T1 noted how she was expected to have a relationship with the learners that would be conducive for deliberation as a mediating approach. This she noted was one of the reasons that drew her back to making use of it more in the lessons. She felt, however, that the little engagement and learner participation during activities and lessons showed their lack of enthusiasm for deliberation in the lesson. According to T1 lack of enthusiasm was when she used relatively short debates to initiate discussions and only a relatively small group of learners would participate in the discussion willingly without being called to answer (SSI T1 // 101-103).

T1 showed an inclination towards using situated learning in the mediating of environmental content. From the semi-structured interview T1 indicated the importance of highlighting context in mediating process. This was evident in her statement: “Some issues are relevant in our society as the learners are directly affected, so as a result when you teach the topic you make reference to some of these local issues” (SSI T1// 110-112). She added that when she teaches and plans her work around a topic involving ECK, learners have to learn, take in the content and have to be able to relate it to their day to day living (SRI T1// 16-18). “As well as inclusion of locally relevant environmental issues, these learners have taken what’s expected in the syllabus and linked it to their everyday lives as evidenced by them now taking note of some of the environmental issues in their communities after being discussed in class,” (SSI T1 // 116-118). She further pointed out that she “did gather information of our environment to include in the lessons. This means the topic is a bit more ‘real’ to learning such as the water quality issue in the town” (SSI T1 // 165). She added: “This town has had water issues such as its quality and pollution being talked about a lot so it would only be good to bring learners to that reality that this happens in their context and perhaps they can then learn from this” (SSI T1 // 138-140).

T1 further highlighted her use of content in enriching learning when she explained: “A lot of examples are actually a lot from what happens in our direct environment where learners live; such as garbage and water pollution. Even the issue of abalone poaching and alien plants around their homes” (SSI T1// 167-169).

In T1's classroom practice, **situated learning** was also evident. In the first observed lesson she drew the learners' attention to the idea of context in mentioning the town's high salt content levels in the water (LO1 T1 // 10). She made a comparison of water resources at a local and national scale, to enable learners to see the relevance of both local and national issues. This is supported thus: "The resources of South Africa are actually in short supply. And if the economy grows as they expect and the population grows as they expect, the demand for water will not be sustainable" (LO1 T1 // 32-34). Awareness of impact to the environment was continued when T1 said: "In this case most of the water is actually polluted by humans by industrial influence, domestic and commercial usage, by mine drainage and so that is quite bad and we should look into how to fix that" (LO1 T1 // 39-41). When she mentioned this, most learners began commenting, appearing to concur what had been said by the educator.

She did not limit examples to the local area but also included other parts of the South African context by mentioning issues affecting the country and how they would filter down to the local area. She also made mention of other concepts such as that of global warming:

"No one knows exactly what the effect climate change will have on the water availability but the expectations is that the rainfall will start to vary so the parts of land in South Africa that are dry will become dryer and the parts that are wet will become wetter but there are certain parts that are dry and can become wet. Scientist predict that certain parts will become wetter. The eastern parts of SA especially in KwaZulu-Natal which is already a wet area, floods may occur as a result" (LO1 T1 // 60-64).

In her stimulated recall interview she argued that the relevance of making learners link the effects of climate change to the local context was to make them think again how changed weather patterns and the floods that affected the town in the previous year had possibly come about. Thus she wanted to encourage learners to think how their actions have contributed to climate change. T1 also recalled the lessons that took place in the school grounds (Figure 4.3), which would also form part of proximity experience as discussed in Chapter 2.7.4, but also using the local context. She refreshed their memories by saying to the learners, "Remember when we went to a recently cleared area of the school and looked at all the possible effects the cutting down of trees may have had on the process of photosynthesis and the environment?" (LO1 T1// 149-151). This is presented in Figure 4.3 below.



**Figure 4.3: An outdoor lesson of teacher one showing learners the effects of deforestation in an area around the school fields.**

Part of the role in mediation of environmental content is how teachers relate to learners. T1 carried out her lesson using examples relevant to content and learner context (SRI T1// 18-23). The inclusion to using context was noted when she argued that relating local issues has made the interaction better and the learners seemed to enjoy it” (SSI T1 // 112-113).

T1 also encouraged **proximity experience** in her teaching. She believed that proximity experience could be enhanced through the use of audio-visual material and that this did not necessarily mean experiments had to actually be carried out physically. She explained that she used internet based video resources containing relevant material on environmental issues (SSI T1 // 90-93). She further went on to support her use of audio-visual material through arguing that “Whenever I use internet based materials I find it easier for the learners to relate and also to answer their questions. I get a feeling that it’s learning together in a way, as we both watch the material and learn” (SSI T1 // 92-95). The teacher did not restrict her mediation through proximity experience to the use of audio-visual material. She indicated that planned expeditions to the local river to test the water quality was one of the methods she planned on using to enhance the understanding of environmental content. The expedition would also help develop other relevant scientific skills, as backed up by this statement: “Yes I do - I plan on doing a water

quality expedition on the River Kowie and this would also develop their scientific skills” (SSI T1// 92-95).

Despite her plan to conduct a field trip to test for water quality, she made use of audio-visual material in the observed lesson. The Life Sciences curriculum includes a section where water quality tests and knowing the effects of pollution of water are required. Here she used audio-visual material which enabled learners to show relevance and make the link between what they had learnt earlier in a section on micro-organisms to the water quality section they were currently engaged in. She showed the learners a video of polluted water and its effect on a community in another province which she said helped learners experience a similar issue of water pollution in another town through this video, which they could relate to Port Alfred. To quote the educator: “ This town (Port Alfred) has had water issues being talked about a lot so it would only be good to bring learners to that reality that this happens in their context and perhaps they can then learn from this”. Being unable to visit the river to enhance proximity experience was not a problem according to T1 (SSI T1 // 94). She went on to say, “For me making such a connection (between abstract and day to day) was vital as it showed that the learners within their environment were able to make links to people’s day to day practices and their practices’ effect on the environment.

An example of **practical reason** was displayed when T1 says: “What happens when it is warmer is that the water evaporates faster than normal from the sea, from dams and rivers so it makes the available water to us less and the salt in the water would become more because the concentration would become higher. So that means less water for agriculture, animal use, industrial use and domestic use.” (LO1 T1 // 56-58).

The teacher acknowledged the importance of encouraging practical reason in mediation processes by mentioning that she “initiated quite a few discussions *to promote critical thinking such as through the type of questions I asked*” (SSI T1// 175). This is illustrated by her elaboration in the stimulated recall interview as follows: “I tried to include examples of things that the learners and their parents do that directly interfere with the environment, such as cutting down trees, dumping rubbish in undesignated grounds and how they dispose waste. The re-use of water particularly turned out to be quite a hot debated topic” (SRI T1// 25-26). An example thereof was evident in one of her lessons where she asked her learners: “First question is, “What an aquifer is? Name two poor farming practices that effect water supply”. According to T1,

having knowledge of the aquifer and being asked about farming practices would enable the learner to think through what had been taught, and link it to practical scenarios such as those included in the questions on the farming practice (SRI T1 // 28).

T1 said that the learners had come up with some brilliant answers, which showed that they were engaging well with the content of the topic, something that was pleasing to her (SSI T1 // 103-104). The teacher made mention of an example, by saying: “They mentioned that people, especially in the informal settlements, live off the fish that they catch in the river. If you keep water in a reservoir there is not enough water in the stream and it will affect the fish. If there is a flood it will affect them as they may not be able to catch fish, this will force them to move elsewhere, where they can make a living. And you will always find people living next to water supply” (LO T1 // 106-110).

#### **4.4.2. Case study 2**

T2 supports **deliberative** processes through group and report methods to enhance teaching (SS1 T2// 64). T2 appeared to favour deliberation in his mediating approaches, as can be seen in this comment:

“Group and report methods promote learners to discuss ideas thereby learning from each other. It’s active learning instead of me the teacher being the source of all information. The verbal interaction and engagement, it can allow me to see if they understand what I have taught to the part of the content they will be looking at and promote critical thinking”(SSI T2// 71-77).

T2 ensures that learners do not lose track of the topic under discussion as well as not leaving all the construction of knowledge only between learners, by moving from group to group. T2 however, cautioned that despite encouraging deliberation: “ I have to guide them during their discussions so as to not make them lose track of what’s to be discussed” (SSI T2// 76-77). How teachers relate to their students during the process of knowledge construction is important in the process of mediation. The relevance of his involvement during student discussion was elaborated in the stimulated recall interview with T2 stating that this strengthened learning relationships between himself as the teacher and the learners (SRI T2// 6-7).

In the classrooms, the teacher included group discussion among learners. Furthermore, he tasked the learners with presenting their findings first and then proceeding to discuss the findings from each group as a class from the presented topic of human impact on the environment. At this point of group discussion in the lesson, learners were absorbed in dialogue whilst the teacher moved from group to group listening to and giving guidance on the groups' discussions (LO1 T2// 40-49). Groups presented their work and T2 issued an invitation to the groups to criticize or add relevant information they deemed necessary to the presentations. Learners were then seen taking this opportunity and engaging further by asking questions and probing into what their fellow learners had presented (LO1 T2// 50-61).

The teacher also encouraged deliberation with the learners in the way he raised questions. For example with questions such as: "Would you agree with me that water is a very important source and that we have to look after water in order for our next generation and animals to survive? Now we are going to start to engage in this particular lesson. We want to look at the availability of water now. How available is water in South Africa? Do all people have access to water?" (LO3 T2// 23-27). This was a point in the lesson when the learners responded to, critiqued and complimented each other's ideas. T2 argued the value of deliberation and engaging with learners through presenting scenarios by stating that otherwise, "...normally you would teach and they just sit and the learners don't participate much or never ask that many questions" (SSI T2// 117-118).

In addition, he said the use of group work promoted learner involvement. In facilitating the group learning he acknowledged that working together encouraged group dynamics. When probed further in the stimulated recall interview about this he highlighted the multicultural set up in the school as being the reason for this and as such, group work is the teaching method that needed learners to learn to work with each other and to learn from each other (SRI T2// 18-22). According to T2 the use of discussions and debates are ways of ensuring that all parties build a learning network among each other.

With T2, the lessons observed showed that deliberations were controlled in a manner that ensured that the teacher did not get side-tracked in the process. This could be a challenge in the use of deliberation as a mediating approach, but T2 demonstrated awareness of this through his comment that: "Most of my students know how I get carried away when I'm busy teaching any

topic therefore I would say that they rather chose to join me on this journey, sharing and discussing ideas. This helped me also not to wander off the topic” (SSI T2// 121-123).

In the observed lessons of T2, the use of **situated learning** was brought out not only in the examples which he referred to in the lessons but also in the homework task he gave his learners. The homework task dealt with the issue of climate change on the African continent following on earlier examples of this along the coast (LO1 T2// 15-17) as well as on possible diseases affecting our South African context (LO1 T2// 63-67). Given such topics, a case study example was one way T2 felt there would be an enhanced engagement with environmental content by learners as he once again made reference to making issues relevant to learners’ backgrounds (SSI T2// 166-168). T2 said he hoped that using context-based examples to which the learners could relate, would lead to self-awareness of the surroundings. This is evident in his explanation that:

...“You are what your surrounding is like. Hence what you do in the community around your house reflects on you especially where environmental issues are concerned. If you have an illegal dump outside your house, it is calling for all sorts of diseases and I make such links possible to learners”... (SSI T2// 185-188).

A previous visit to the local beach area and river to study water pollution due to presence of red tide was one of the references made by T2 to enhance **proximity experience** (see Figure 4.4). He acknowledged the need for learners to have hands on experience of learning. His beach and river visit encounter did this as he noted that: “We went to visit the beach and river and it made sense now when we spoke of water pollution and water quality as some of the effects of that red tide could be linked by the learners to this section. So it is that ability to give learners the closeness to experiences especially within their context that enables them to have a feel and make sense of this environmental content” (SSI T2// 103-104). This beach and river learning expedition enabled learners to observe and test the water quality after the red tide was referred to in the lesson as an example (SSI T2// 101-107) (Figure 4. 4).





**Figure 4.4: Previous outdoor river expedition by teacher two’s learners to test for water quality affected by a red tide.**

In showing the importance of **practical reason** in mediating processes, T2 mentioned that: “The verbal interaction and engagement where I probe deep into learner answers can allow me to see if, the learners understand what I have taught in the part of the environmental content they will be looking at and through this, critical thinking is promoted” (SSI T2// 74-75). His choice of approach was informed from his own experiences where he said if learners were not probed via verbal interaction or in written task they became passive (SRI T2// 29-31). To support this he said:

“Learners just sit and don’t think through their answers or what the teacher would have asked. There is no considered thinking on their part, but this time I kept digging deeper into their responses asking why, how and then. The level at which they answered as well as the sort of questions asked, they showed deep thought and engagement with the content” (SSI T2// 116-117)

In a stimulated recall interview when asked on his manner of question such as in continuously asking learners why and how to their responses, T2 said that helped learners think through each step of their response. He noted that this manner of bringing concepts across through constant reference to how and why evoked deeper reflective thought in the learners (SRI T2// 30-33).

This is evidence in a lesson when he says:

“The suggestion: environmental issue in terms of chopping down trees is deforestation, you’ve mentioned the greenhouse effect, and there is another impact: desertification? What is it? What does it mean? How does it happen? Why does it happen? Since we are talking about chopping down forests, how does this link with desertification?” (LO1 T2// 3-5).

A second example is when he probed further a response from the learner: “The factories release heat which gets trapped within the ozone layer. What is this referring to exactly and tell the class why is it bad? What is the reason behind this happening? Tell the class more. With each part of the question learners’ facial expressions seemed to suggest their own internal thinking (LO1 T1 // 22-25). T2 created critical thinking in his lesson as observed in the third lesson observed, whereby his method of mediation involved presenting a question to learners and leaving them to reflect on what had been discussed before they reported back in the form of a debate (SRI T2// 33-36).

#### **4.5 Practice architectures as enabling and constraining factors**

This section presents data illustrating the enabling and constraining factors described as practice architectures that shaped the teachers’ practices in the two case studies. According to Kemmis and Grootenboer (2008) (see Section 2.6) practice architectures refer to those practices which are shaped not solely by intentional action and practice knowledge of participants but also by circumstances and conditions ‘external’ to them by pre-existing cultural discursive (concerned with language of teaching and learning or the language of environmental field) , material economic (concerned with resources teaching and learning) and social-political arrangements (concerned with policy guiding teaching and learning as well as organizational rules and regulations teaching and learning institutions). These arrangements shape the content and conduct of a practice that is the distinctive sayings, doings and relatings that occur in a particular kind of practice. These are discussed below in the order of firstly the material economical arrangements, secondly cultural discursive arrangements and thirdly social political arrangements.

#### 4.5.1. Case study 1

**Table 4.1: Summary of practice architectures enabling and constraining Teacher 1 (T1)’s practice in Case Study 1 in the research.**

Enabling factors	Constraining factors
<ul style="list-style-type: none"><li>• Some prior experience in high school</li><li>• Ability to supplement information by adding on to CAPS</li><li>• Other relevant qualification experiences</li><li>• Well structured content demarcation in curriculum guideline</li><li>• Conducive environment</li><li>• Passion to teach environmental content section</li></ul>	<ul style="list-style-type: none"><li>• No prior exposure to environmental content during teacher training coupled with lack of CAPS training and limited familiarity of environmental content in CAPS</li><li>• Lack of confidence in teaching environmental content</li><li>• Stringent curriculum document</li><li>• Limited support from “district office”</li><li>• Language of instruction in relation to both teacher and learners’ home languages</li><li>• Limited experience as still settling in the field</li></ul>

#### *Material-economic arrangements*

In a stimulated recall interview T1 mentioned that, despite her limited teaching experience; additional searching for information helped her mediate the environmental content through finding additional supportive material to deepen understanding of content. T1 used a lecture-style teaching approach (SRI T1 // 38-42). This was seen when she mentioned that:

“Like I said I try and find extra information on the internet about the topic and that has helped me a lot especially with teaching using videos to help them understand. Whenever I use

internet based materials I find it easier for the learners to relate and also to answer their questions” (SS1 T1// 90-92).

The availability of resources was thus used to supplement prescribed material, which enhanced T1’s ability to play her role in mediation.

Limited exposure and training to teach environmental content in CAPS impacted on mediation. T1 highlighted that she responded to an environmental content familiarity as much as possible by preparing and sourcing information from elsewhere (SS1 T1// 77-78

T1 felt that additional support from her “district office” and follow up content workshops would be one way of helping her find approaches to enhancing mediation of ECK in the Grade 11 Life Sciences (SRI T1 // 40-42). “There is lack of follow-ups or ongoing support from our education “district office” (SSI T1// 135 – 137).

### ***Cultural-discursive arrangements***

T1 stated that despite the fact that she was still a beginner teacher in the field she was familiar with some of the content knowledge and that this, to a certain extent, enabled her to mediate. However, she also felt that this was not enough to allow for deeper engagement during her lessons, “I would have loved some help with the section on endemic plants, their role, threats to them and what role citizens can play in their preservation” (SS1 T1 // 124 -125). She then went on to say: “Although I am enjoying teaching the subject topic very much, I do not have that very broad knowledge of environmental issues. So as a result, the learners ask certain questions about the topic or argue certain points and I am unsure about the answer” (SS1 T1 // 73 – 75).

One of the constraining factors was that of language. T1 and her learners are non English speakers and English is their second language. Most of the available learning and teaching materials were in English, limiting both T1 and her learners (SS1 T1 // 20 -23). This meant that she found it difficult to articulate the content in such a way that learners could easily understand, and this hampered mediation.

### *Socio political arrangements*

T1 noted that the curriculum being prescriptive of what was to be taught helped her in controlling what she would teach and how she would mediate. According to her, the CAPS document (DoBE, 2012) “directly influences the delivery of certain topics in schools. It gives strict guidelines as to the topics to be discussed” (SS1 T1// 129-130). This then offered teachers like herself with limited teaching experience some guidance (SS1 T1 // 12- 13).

In addition, the subject specific aim calling for the use of active [participatory] learning is something T1 found difficult to use arguing that controlling the learning taking place between all groups could be rather time consuming, and required careful handling in terms of the activities taking place in the group. She highlighted this by saying: “Well, I make use of minimum group work as I find it difficult to control the class or judge just how much of the actual learning is happening as I’m not with all the groups at the same time” (SS1 T1 // 173).

T1 showed that despite the challenges of the CAPS curriculum, an understanding that the teacher’s enthusiasm played a role in mediation. This is seen when the teacher remarked that: “Yes, I do like the topics because they are a part of our daily lives. Through teaching others about the environmental issues, we can have a cleaner and safer environment. I am actually honoured to be part of teaching learners who preserve and protect our environment” (SS1 T1 // 43-45).

#### **4.5.2. Case study 2:**

The following table below summaries the enabling and constraining factors for second educator.

**Table 4.2: Summary of practice architectures enabling and constraining factors of Teacher 2 (T2)’s practice in Case Study 2 in the research.**

<b>Enabling factor</b>	<b>Constraining factor</b>
<ul style="list-style-type: none"><li>• Years of teaching experience</li><li>• Type of qualifications</li><li>• Subject integration</li><li>• Language of teacher</li><li>• Passion for topic</li></ul>	<ul style="list-style-type: none"><li>• Learners’ language</li><li>• Limited familiarity with ECK</li><li>• Timetable constraints</li><li>• Learner history / background</li><li>• Governance (management) type</li></ul>

### ***Material-economic arrangements***

Despite his years of experience in teaching, T2 acknowledged the presence of some unfamiliar content in the CAPS textbooks given for use to schools by DoBE which slightly influenced his pedagogical approaches. This was compounded by the fact that he did not receive CAPS training for the grade due to planning logistics on the part of the DoE in his district. Despite this, he gave credit to his teaching of Geography and Adult Based Education and Training (ABET) Life Sciences as experiences that have made him familiar with environmental content and be able to use worksheets from ABET and Geography, thus enabling him to teach Life Sciences (SSI T2// 12-16; 31-34). Even after the introduction of CAPS, T2 notes as mentioned to him by the DoE district officials that a lack of photocopying machines to copy teaching and learning material and a lack of cars to travel to schools, were amongst the reasons for not having mop-up training seminars to enhance teacher readiness for CAPS (SSI T2// 143) and this, in turn meant inadequate preparation to fully understand the environmental content in CAPS.

The lack of adequate resources was a contributing factor hindering the teacher's full potential to mediate. The curriculum has ECK that can be mediated through the use of outdoor experiences and field trips. However, this was not always possible to carry out due to resource constraints and it was thus not always possible to take learners on excursions. To support this teacher said: "There is also the issue of availability of resources, with not much extra teaching materials, transport to take learners for field trips and teachers or textbooks that sort of thing, it then becomes difficult to fully and enjoyably make the learners excited about such topics" (SSI T2// 81-85). This was further highlighted by T2 saying:

*... "I also think there are too few or no excursions or fieldtrips which would otherwise bring a real feel to the learners and enable them to carry out observations and experiments in the environment. It is part of their skills development as well which the syllabus requires them to attain but is currently being limited" ... (SSI T2// 154-157).*

### ***Cultural discursive arrangements***

T2 noted that Geography and Life Sciences overlapped which T2 said he found to be exciting. This was also to the Geography teachers' advantage mainly as they can complement the work of their Life sciences teachers (SSI T2// 12-16). Furthermore, T2 was able to teach environmental

content by bringing in part of the environmental content he learnt in his teacher training, although he noted that at that time it was not explicitly called EE or sustainability. However, he did recognize areas of familiarity with regards to some of the environmental content with which he engaged with the current knowledge (SSI T2// 20-22).

Language served as both an enabling and a constraining factor in the teacher's mediating role. Being in a multicultural environment and a dual-medium (English / Afrikaans) school, the teacher used both languages as a medium of instruction. Being fluent in both languages, T2 was easily able to code switch making the ECK better understood (SSI T2// 26-28). However, it also served as a constraining factor as it required learners to have the ability to read and understand both languages where case studies were used. The teacher highlighted language as a barrier when he said: "A subject has to incorporate other relevant skills so comprehension and ability to read through the case studies are essential" (SSI T2// 68-69).

Despite "borrowing" environmental content from his own school years and another subject T2 did not feel entirely confident with environmental content in CAPS. He said: "I have limited knowledge in some content areas" (SSI T2// 131- 137) and furthermore, that a lack of knowing the content knowledge that is needed to teach this topic is detrimental. T2 made mention that one has to have a full understanding or at least familiarization with the environmental content, otherwise you will not fully be able to implement it or develop ways to help intervene" (SSI T2// 88-90).

### ***Social political arrangements***

T2 mediated environmental content in a manner that made experiences enjoyable for the learners (SRI T2// 41-42), because as he said: "I enjoy learning together with the learners, especially on such challenging topics" (SSI T2// 110). T2 draws on the importance of knowing and understanding environmental content when he states that, "It teaches us all: teachers, learners and parents about preserving our environment and natural resources. It also teaches us about our attitude towards our own environment on which we depend so much. The topics are very much a part of our daily lives. I am actually always excited to be teaching learners how to preserve and protect our environment" (SSI T2// 56-60). This was observed in his lessons where the learners were enthusiastic about taking part in the activities given to them and about which he even said

he was pleased by the manner in which they responded (SSI T2// 114-118). This was an enabling factor.

The CAPS was noted as a constraining factor to mediation. T2 noted that because the CAPS curriculum was so prescriptive, it limited expansion of teaching and learning if the teacher did not consider such expanded learning opportunities. When, during the stimulated recall interview, prompted to explain, the teacher said: “The CAPS document directly influences the delivery as it gives work coverage meaning. Most teachers won’t think outside the box. So the CAPS document is too stringent” (SSI T2// 138-142). T2 highlighted the downside to the lack of this expanded learning approach as he said it disengaged learners from being in the real “feel” and experience needed for mediation leading to better engagement with environmental content. To this he said his use of local relevant examples of the learner context and culturally relevant examples, helped in mediation.

The social and governing structures within the schools were also cited as factors constraining how the teacher mediates. His planning of lessons and adherence to some of the expectations of the curriculum such as field trips depended of approval of these trips by schools and the district office (SSI T2// 144-147).

In a multicultural school set-up, T2 felt that his mediating strategies were affected by the learners’ different backgrounds. The use of context was one way that could be used more to develop deeper engagement with the environmental content as most issues were prevalent in the communities learners found themselves (SSI T2// 56-60).

T2 reckoned that he was one of the better placed teachers who had some understanding and engagement with the environmental content. To support this, he said: “Move around these schools and you will see teachers struggle to comprehend this unit’s content or plan activities other than those in the textbook they will be using” (SSI T2// 92-94). He suggested that more could be done to familiarize teachers with the content (SRI T2// 42-47).



## **4.6 Conclusion**

This chapter presented the data generated from the lessons observed, the responses in the semi-structured interviews, stimulated recall interviews, document analysis and the learner activities from the two educators. The presentation of teachers' understanding of environmental content as their representation of this environmental content was discussed. Narratives drawn from analytical memos were constructed from the data summarized from the various data generating techniques. The data was presented as teacher practices included doings, sayings and relatings in relation to the sensitizing construct of deliberation, situated learning, proximity experience and practical reason. Through this it was possible to understand how teachers were mediating learning. The chapter further on went to present the practice architectures enabling or constraining each one of the two educators' practices. The data findings presented in this chapter are discussed in the form of analytical statements in Chapter 5.

## CHAPTER 5: DISCUSSION OF DATA FINDINGS

### 5.1 Introduction

This chapter captures the essence of the study by reflecting on the research question, and discusses the results through the use of analytical statements. The analytical statements are related to the goals and aims of the research stated in Chapter 1. According to Bassey (1999), analytical statements are relevant in research studies as they are meaningful statements that are generated to give clear answers to the research question. The analytical statements point to evidence presented in Chapter 4 which was structured in the form of a narrative for each of the two case studies. The analytical statements are also discussed in relation to some of the key ideas and concepts as highlighted in Chapter 2.

### 5.2 Summary of analytical statements

With reference to each respective goal of the research study, an accompanying analytical statement is listed below and then elaborated in the following pages.

Goal 1: To explore teachers' content knowledge and pedagogical content knowledge with respect to environmental content in the Grade 11 Life Sciences.

- **Analytical statement 1:** Teachers use different strategies to enhance their environmental content and pedagogical content knowledge.

Goal 2: To relate teachers' doings, sayings and relatings to pedagogical sensitizing constructs in environmental learning which emphasize participation, situated learning, proximity experience and practical reason.

- **Analytical statement 2:** Teachers are supporting situated learning in environmental learning.
- **Analytical statement 3:** Teachers are supporting deliberation in environmental learning.
- **Analytical statement 4:** Teachers could be enabled to enhance proximity experiences in their mediating approaches in environmental learning.
- **Analytical statement 5:** Teachers could be enabled to enhance practical reason in environmental learning.

Goal 3: To investigate the practice architectures that enables or constrains the above aspects of practice.

- **Analytical statement 6:** Material economic arrangements of timetable compliance in CAPS, ability to find internet resources and availability of resources can constrain mediation.
- **Analytical statement 7:** Socio-political arrangements of CAPS curriculum document prescriptiveness, multiculturalism and learning institution management and governance can constrain mediation.
- **Analytical statement 8:** Cultural discursive arrangements of teacher-learner language, knowledge of the language of the field can constrain mediation.
- **Analytical statement 9:** Teachers' passion for environmental content topic and improvising resources to navigate CAPS timetable are enabling mediation.

### **5.3 Analytical statement 1: Teachers use different strategies to enhance their environmental content and pedagogical content knowledge.**

According to Lotz-Sisitka (2011 - Section 2.3) and as was discussed in Chapter 2, the new CAPS curriculum (DoBE, 2012) introduced a more strongly content-referenced curriculum with commitment to active and critical approaches to learning, and to environmental and sustainability content. Furthermore with this introduction of new environmental content comes the challenge of how teachers interpret this new environmental content and how they are able to teach this environmental content to learners. Findings from an earlier study done in South Africa showed a poor understanding amongst teachers of sustainable development, with the teachers having little capacity for the integration of issues into teaching and learning (Lotz-Sisitka, 2011 - Sections 2.3 & 2.4). In addition evidence from research by Lotz-Sisitka (2011) shows that there is the intersection between curriculum content knowledge and how it is taught, hence the interest in this research.

In this research the teachers understanding of the environmental content in the curriculum was reflected through their planning of mediating approaches of the environmental content in the Grade 11 Life Sciences. It was evident from the responses given by the teachers involved in the study that content gaps still existed as both teachers said they felt that they needed help to

strengthen their understanding of environmental content in the new curriculum (see Section 4.2.1 and 4.2.2). Lotz-Sisitka (2011 – Section 2.3) points out that a range of knowledge which includes new environmental content is accompanied with the challenge of teachers being limited by content with which teachers are familiar, and content on problems and issues raising awareness, failing to develop deeper conceptual depth and understanding of ESD. This point as highlighted in the findings by Lotz-Sisitka (2011) seemed to be supported by T1 highlighting one of the areas of concern for her, is the issue of not having in-depth knowledge on environmental content (see Section 4.2.2).

Further evidence was presented in this study whereby T1 was asked to mention the topics which would be considered as part of environmental content in the Life Sciences curriculum and in general, this resulted in her making mention of most topics but little mention of the subtopics in the curriculum, despite the section encompassing a wide variety of topics (see Section 4.2.3). The subtopics within this environmental content topic form part of the strand being taught and as such should form part of mediation processes. This raises concern to the further existence of environmental content gaps in the Grade 11 Life Sciences. Furthermore the statements made by the teachers in the case studies show that problems associated with the quality of the teacher knowledge, and that of new topics and issues still exist (Taylor & Vinjevold, 1999; Lotz-Sisitka & Olivier, 2000; Nelson Mandela Foundation, 2005 – Section 2.5).

T1 expressed concern regarding her limited knowledge of environmental issues, stating how at times she was unsure of the responses to give her learners (Section 4.2.3). The teachers' limited knowledge of environmental issues limited engagement with her learners. When teaching new content such as environmental content in Life Sciences, one needs not only to understand the environmental content (teacher ECK) but needs also to be confident in its delivery (PCK). This can be referred to Section 1.2 which focused on mediating classroom practices of teachers as they can be linked to the *Minimum Requirements for Teacher Educators*. The requirements specifies the development of “specialized pedagogical content knowledge, which includes knowing how to represent the concepts, methods and rules of a discipline in order to create appropriate learning opportunities for diverse learners” (South Africa Department of Higher Education and Training, 2011, p11). In addition these requirements suggest that the successful implementation of CAPS requires that teachers attain the requisite knowledge and PCK skills for

integration of environment and sustainability concerns into the South African National Curriculum (Lotz-Sisitka, 2011). According to Grossman (1995 as cited in Cutter-Mackenzie and Smith 2003- Section 2.5) teachers tend to teach well that which they know and are not confident when it comes to teaching content with which they are unfamiliar. The sections T1 and T2 were confident in teaching also showed partly in their manner of mediating strategies such as the use of situated learning and deliberation as methods of mediating, as well as in their responses and the enthusiasm they displayed in their lessons while teaching certain sections of the work. This was an indication of the possibility of teachers not realizing that they actually knew more than they assumed in relation to environmental content, which enabled them to mediate.

The two teacher participants in the research also felt that a large proportion of the blame for gaps in their ECK rested on a failure to spend sufficient time in CAPS training. This was a point of concern for both the teachers and researcher as not being familiar with environmental content does impact on the manner in which methods of mediation are selected. Carl (2009 – Section 2.4) warned that successful implementation of a curriculum was dependent largely on how well teachers had been informed and prepared for curriculum change.

Both teachers mentioned that their engagement and ability to teach the environmental content in the current curriculum mostly relied on their prior experience. They said they engaged with the subject content based on what they learnt during their school years (T1 and T2), and more so in their teacher training years, especially in the case of T2 who had eighteen years teaching experience (see Section 4.4). Despite CAPS teacher training having been planned by the DoE at district levels, both teachers in the case study felt the training provided was inadequate and they needed further on-going training.

During the CAPS training sessions T1 and T2 felt that the preparedness and familiarity with the environmental content of the subject education specialist (subject advisors) was minimal or in some instances lacking, a concern both voiced during semi-structured interviews and stimulated interview. One of the reasons mentioned by both T1 and T2 for this was that these subject advisors were also trained before 1994 during a period where the type of environmental content included in the old curriculum was far less than in the new curriculum, and concepts such as ESD were not yet popularized (see Section 4.2.1). Therefore there was the concern that most of

the foundational knowledge that the subject advisors possessed also depended on prior experiences, and that at times was not always adequate to enhance teachers' familiarization to the new environmental content (see Section 4.4). As highlighted in a study by Lotz-Sisitka and Schudel (2007), prior knowledge and experience of the teacher has a profound influence on the depth of engagement in the issues concerned. Similar concerns were presented in findings by Lotz-Sisitka (2011), where she said that teachers were mostly exposed to poor quality teacher training as was confirmed in a number of national studies she had examined. The consequence of this was that teachers would then lack a solid foundation and would struggle to cope with new content such as that of environmental content.

Some familiarity with environmental content enabled the teachers in the case studies to develop confidence in engaging with the ECK in the curriculum and thereby enabling them to teach in such a way that helped mediate learning. This was mentioned by both teachers in the semi structured interviews (see Section 4.2.1 and 4.2.2). Despite being able to teach environmental content based on prior experiences and training, careful examination of new curriculum regarding prior knowledge and experiences should be noted. Of concern in teaching of new content is the issue of normalization whereby old methods and knowledge are infused into the new content even at times when they don't match. As found in the research teachers relied on their prior years at school and teacher training experiences to teach the new environmental content in the CAPS curriculum. Teachers take their own prior knowledge and training experiences and teach the current new environmental content in the same manner. Changes have been made to the environmental content in the curriculum and these changes need to be teachers knowledgeable of their existence and application in teaching and learning. Possible failure to recognize the changes in new environmental content in the curriculum could hinder and limit appropriate mediating methods needed to be able to match to the current trends as advocated for in both the EE and ESD sectors.

#### **5.4 Analytical statement 2: Teachers are supporting situated learning in environmental learning**

Findings by Lotz-Sisitka and Schudel (2007) show that there is a deepening of a learners' knowledge and experience by using local community issues for teaching and learning. They said the use of local community fostered deeper engagements and high quality investigations of local

issues. According to O'Donoghue, Lotz-Sisitka, Asafo-Adjei, Kota and Hanisi (2006-Section 2.7.2) the use of situated learning is also then supported, whereby learning can strengthen social relationships across school and community and has the potential to develop as reflective praxis in response to environment and health risks in a local context. This was a sentiment echoed by the teachers in the research as they made mention of their belief in the use of local context to help in mediating. T1 understood the relevance of contextual learning to learners' everyday life and this was also displayed in her observed lessons (see Section 4.4). Following suit is T2 who uses many examples in the local context which learners were observed being able to link to. T2 was explicit in the interview of his constant reference to practical examples that were in his context (see Section 4.4).

### **5.5 Analytical statement 3: Teachers are supporting deliberation in environmental learning**

Deliberation is said to be a method that maximizes critical dialogue amongst participants and this can possibly be done through texts, as in the case of T2's lessons (Rosenberg, O'Donoghue & Olvitt, 2008- Section 2.7.3). The aim of deliberative dialogue is for learners to express their own views and values and then come up with new, improved and perhaps jointly-held understanding of matters, an understanding which none of the participants may have held before (Rosenberg, O'Donoghue & Olvitt, 2008). As presented and previously discussed in Section 4.4 T2 encouraged deliberation by giving the learners a section of work they had to discuss before presenting their take on the issue to the rest of the class. T2 also stated that he made use of deliberation as it promoted social construction of knowledge and helped learners to learn from each other. There was control of discussion and mediating by T2 as he moved from one group to another and interacted with each (see Section 4.4).

Similar sentiments on the use of deliberation in mediating were expressed by T1. T1 made use of deliberation initiating deliberating talk with her learners during some of the lessons observed. The issue of time management and classroom control as a constraining factor according to T1 made her inclined to limit the amount of deliberation she engaged in with learners during her lessons. This was in contrast to T2 who set aside entire lessons to allowing deliberative engagement to be used to mediate learning.

#### **5.6 Analytical statement 4: Teachers in the research could be enabled to enhance proximity experiences in their mediating approaches in environmental learning.**

The teacher participants mentioned their intention in supporting proximity experience through their mediation activities. However, in most cases, they also then went on to mention reasons that constrained the use of proximity experience namely limited resources, infrastructure and working space. As a mediating approach proximity experience was discussed in Section 2.7.4 whereby Lotz-Sisitka and O'Donoghue (2006) noted that it allowed participants to engage with their surroundings, enabling them to make relevant links between their personal experiences and everyday context and learning. In the research teachers T1 and T2 showed the use of audio visual material as an alternative to venturing outside the classroom for proximity experience for learners (e.g. water quality testing).

#### **5.7 Analytical statement 5: Teachers could be enabled to enhance practical reason in environmental learning.**

The teachers in the research in their mediation made use of ways that encouraged practical reason. As a mediating approach proximity experience was discussed in Section 2.7.3 as allowing participants to resolve, through reflection, the question of what one is to do (Mandler, 2001- Section 2.7.3). T1 and T2 encouraged practical reason through how they asked questions to learners which enabled learners to think through environmental content, as well as critique their practices whilst coming up with possible solutions to what would have arisen in the discussion and reflection processes (see Section 4.4).

#### **5.8. Analytical statement 6: Material economic arrangements of timetable compliance in CAPS, ability to find internet resources and availability of resources can constrain mediation.**

The theory of practice architectures makes mention of material and economic arrangements found in or brought to a site as enabling or constraining interaction in a practice (see Section 2.6). This lends itself to the idea of resources playing a role in the practice of an educator. The CAPS curriculum has examples of possible resources which teachers can use when they teach the environmental content section as well as the other sections of the curriculum. For the



environmental content section these are noted in the work schedules guiding the two educators in the research (see Section 4.2) These include textbooks, DVDs, suitable experimental equipment, water test kits, excursions and the internet, to name but a few. Many of the items on the list are suggested guidelines which teachers can plan to use in their preparation of lessons. However, in the study the teacher participants mentioned a lack of many of these resources, with the internet being easily accessible and of most use to the participants (see Section 4.4). The other resources such as the high cost of taking learners on excursions and field trips, and as such in most cases these were not included in the planning of lessons. They did, however, agree that excursions such as in school grounds were easily planned but those requiring travel were not usually considered (see Section 4.5).

T2 observed that the curriculum suggested the use of field work, hence his intentions in saying that he would plan a lesson to include field work and practical activity. T2 mentioned that he planned doing further context based field work in his lesson on water testing and water scarcity but he found having replacing the field work idea with a case study as he attributed constraining factors such as transport availability and timetable to hindering field work being used to mediate (see Section 4.4). T1 made mention of her intentions to use a river expedition to develop scientific skills and well as using context to make environmental content more real to her learners (see Section 4.4). However, this did not happen in the lessons observed for this research due to a lack of apparatus.

CAPS curriculum stipulates that teaching time for Life Sciences should amount to four hours a week (DoBE, 2012). The teachers in the case study during the semi structured interviews in Section 4.2 both attributed the limitation in the time allocated in their timetables as one of the contributing factors constraining their ability to employ mediating strategies such as the use of practical work or field trips to enhance proximity experience (see Section 4.4). If timetables were compliant to the teaching and learning hours required in CAPS, it would create more opportunities for teachers to plan strategies that could help mediate learning. The issue of timetable compliance or lack thereof in this case, is further compounded by the fact that the environmental module is set to be taught in term four. This then further limits the time available to the teachers for which to plan and mediate in the environmental content, particularly considering that in the year-end, DoE externally set examinations start some three weeks after

the commencement of the fourth term, hence having to have negotiated with the teachers in the research to bring forward this environmental content topic (see Section 3.8).

Both T1 and T2 in their semi structured interview note as another possible downside to the teachers not being allocated the appropriate time to the teaching of Life Sciences is that it limits them in so far as sourcing additional help from colleagues who may have deeper ECK than them. As highlighted by T1 in her semi structured interview (Annexure B) timetable logistic issues hamper in the assistance of mediating (see Section 4.5). She gave an example of where the Geography teacher could have been approached to help with a section of work T1 struggled with in the environmental section of Life Sciences. However it was not possible as taking the Geography teacher from his own subject during that time deprived him of teaching time in his own subject which suffered the same problem in terms of time allocation (see Section 4.5).

#### **5.9. Analytical statement 7: Socio-political arrangements of CAPS curriculum document prescriptiveness, multiculturalism and learning institution management and governance can constrain mediation.**

Kemmis and Heikken (2011-Section 2.6) state that practice architectures influence practices, amongst them educational policy and administration, which is concerned, for example, with issues such as the curriculum in use. The CAPS curriculum was cited as a constraining factor by the teachers in the research being prescriptive stipulating quite clearly in which term environmental content in Grade 11 Life Sciences must be taught. T1 and T2 also mentioned the prescriptive curriculum as being one that can limit a teacher if they do not consider expanding beyond what is prescribed. Also observed was how the CAPS adapted extracts of work schedules were being taken as “lesson plans” by the educators. T2 showed a slight move from this prescriptive work schedule with jotted down notes of this section of work. T2 was also able to expand beyond the curriculum prescription due to his ability to integrate Life Sciences with the Geography subject environmental content and experience. Evidence of this is seen when he mentioned a programme that was helping teacher to expand beyond what CAPS has stipulated (see Section 4.4).

T1 is still relatively new in the field of teaching, and she also expressed concern that the CAPS curriculum was restrictive in its prescription of what was to be taught and when it was to be taught. This she warned was not limiting in mediation if she thought to expand beyond the

confinements of what was stipulated (see Section 4.4). Once again this was observed in the reliance of the work schedule with extracts of the curriculum environmental content as the “lesson plan” (Section 4.2). This is a feature of CAPS against which Lotz-Sisitka (2011) cautioned when addressing the requirements of a successful implementation of CAPS, stating that a curriculum that aligns itself with CAPS appears to be inadequate. According to her a more critical expansive orientation to knowledge and PCK is required if quality in education is to be achieved. It was then assumed in this research that the teacher participants recognized that if they adhered to only what was prescribed in the CAPS curriculum it would constrain their methods of mediating. By expanding beyond curriculum prescription the expansive orientation as mentioned by Lotz-Sisitka (2011) enabled embracing variable mediating approaches would be achieved.

**5.10. Analytical statement 8: Cultural discursive arrangements of teacher learner language, knowledge of the language of the field can constrain mediation.**

Schatzki (2012- Section 2.6) referred to practice theory which stipulates that practices are organized bundles of sayings and doings, indicating that a practice is associated with distinctive language. Most of our schooling environments are multicultural and multilingual, one of the issues that then need to be addressed is that of the role that the ability of both teachers and learners to read and write in their home language as well as additional language, or lack thereof, plays in mediation of environmental content.

Interaction between the learner and teacher is necessary so that the learner is able to receive feedback and the teacher will guide the ideas of the student which will allow them to develop schemes in their mind and as such they are be able to make use of the knowledge they constructed. In this educational theory, knowledge is constructed in the mind of the learner (Bodner, 1985). For this interaction to occur there has to have been concrete language development and both parties have to be fluent in the language of learning and teaching (LOLT).

Language was cited as a barrier to mediation of environmental content (see Section 4.5). The educators expressed the supply of learning materials in one medium of learning and instruction, that of English in a dual medium Afrikaans English school. Both educators being English second language speakers raised concern about language being a barrier. The educators noted

that at times it was difficult to articulate the content in such a way that learners could easily understand, and this hampered mediation.

### **5.11 Analytical statement 9: Teachers' passion, multiculturalism ability to improvise in resource sourcing enabled the mediation of environmental learning.**

The educators' passion for the environmental content section was another enabling factor to mediation in this research (see Section 4.2.3). Both educators noted how they enjoyed teaching this section of work, with the section being well embedded within learners' and the teachers' lives, such that they taught it to make it relevant. The passion enabled the teachers in the research also to improvise mediating strategies such as using internet resources instead of actual field work (see Section 4.3) whereby they were aware of the containing factors which would limit their ability to go with the learners on expeditions.

In the research participants' acknowledgement of their schools' multicultural setup enabled mediation of environmental content (see Section 4.2.3). According to research by Graddol (2000), South Africa is constantly evolving in terms of its cultural and linguistic relationships, and the dynamics in the classroom have shifted dramatically since the introduction of integration and multicultural classroom. The ability for teachers in the research to recognize their learner dynamics and make use of mediation strategies, for example in situated learning whereby examples of local and cultural relevance were used to enable mediation.

### **5.12 Conclusion**

The analytical statements drawn up in this section are from findings of mediating strategies of environmental content in the research. The research also showed that teachers were making use of mediating strategies such as situated learning, deliberation, proximity experience and practical reason as guided by the subject specific aims, although the use of these strategies could be refined in their use. Also emerging in this section were enabling and constraining factors such as resource availability, school timetable subject allocation and teacher knowledge playing a role in the teachers mediating strategies in this research. These findings presented in this chapter provide useful insight in how mediation is taking place in the Grade 11 Life Sciences in CAPS. In the following Chapter 6, some recommendations from findings are made which can be used to improve the quality of mediation in the curriculum.

## **CHAPTER 6: CONCLUSION AND RECOMMENDATIONS**

### **6.1 Introduction**

This chapter presents a summary of the study as well as its main findings in relation to the research question. This study was done to gain insight into the role of mediation in the wake of the introduction of new ECK in CAPS Life Sciences curriculum. Recommendations from the findings of the two schools used in the study would feed into teacher professional development programmes, and further research to the role of mediation of ECK in the curriculum.

### **6.2 Summary of the research**

The research was aimed at seeking an understanding of the mediating strategies by teachers in the new CAPS Grade 11 Life Sciences curriculum in the construction of ECK. The interest in the study stemmed from attempts to improve my own practice, as well as being able to contribute to other teacher professional development programmes, which would help teachers cope with introduction of new content such as environmental content in CAPS.

An interest in the study came about as a result of the inclusion of new environmental content with the introduction of the new CAPS curriculum. Furthermore how teachers are mediating environmental content in the Life Sciences subject is crucial as this section is taught only in one grade, Grade 11 but is externally examined in both Grades 11 and 12. It was therefore imperative to understand how teachers such as those in the case study were helping mediate so as to bridge the ZPD in the understanding of environmental content which would allow learners to apply it over the two years that it is examinable, as well as beyond the school curriculum. Findings and reflections from this study can inform future developmental programmes to help teachers in Life Sciences with mediating strategies for the construction of environmental content.

The study investigated how two Grade 11 Life Sciences teachers were working with environment and sustainability content in the CAPS curriculum and was done through a qualitative data generating method. Two willing teachers in the coastal cluster of the Ndlambe district were used due to their close proximity to my place of work and their willingness to participate in the research study.

The study was an interpretive case study which drew on a range of environmental education as well as literature on mediating. Key semi structured interviews as well as stimulated recall interviews were conducted with the two teachers involved in the study. Video recordings of the interviews were recorded and transcribed as part of data collection and evidence. Lesson observation was also used as part of the data generation with each of the three lessons per teacher transcribed. The data collected from the semi structured and stimulated recall interviews and lesson observations were analyzed using analytical memos, and from this analysis of a number of issues emerged. The triangulation of data sources allowed for the detection of consistencies and contradictions that was emerging from the data. These issues in relation to the research question on mediating strategies were compared against the data to establish its authenticity. The findings as they were generated from the data were discussed using analytical statements. Throughout this process good research ethics were upheld through obtaining consent to carry out research and the right to access of the data by the teachers who had willingly participated in the study.

### **6.3 Summary of research findings**

The following are summaries of the findings that emerged from the study:

- Teachers use different strategies to enhance their environmental content and pedagogical content knowledge in CAPS Grade 11 Life Sciences.

As mentioned and explained in the analytical statements presented in Chapter 5 it is clear that the teachers in the study still have gaps in their own ECK. They feel strongly that they were not fully acquainted with the new environmental content. They attributed this to a lack of CAPS training as they either had to attend training for the other subjects they teach at the same time Life Sciences had its training or that they were still in training themselves and as such missed out on the other subject CAPS training workshops. Additional reasons noted included that the facilitators of the CAPS workshops merely worked through CAPS requirements such as tasks to be done, and did not go through the actual new environmental and sustainability content integrated in the Grade 11 Life Sciences curriculum. A lack of ongoing or follow up CAPS training with in-depth engagement with environmental content was also not done, a reason teachers also mentioned as affecting possible mediating strategies. Despite this the teachers in the study showed that they were able to navigate through some of the ECK in the curriculum

based on their prior knowledge, as well as knowledge from other subjects such as Geography. This allowed for the section of work to be taught although CAPS training was still needed for the Life Sciences subject.

- Teachers are supporting situated learning and deliberation in environmental learning.
- Teachers could be enabled to enhance making use of proximity experiences and practical reason in environmental learning.

Part of the study was looking at how pedagogical sensitizing constructs in the field of environmental education explained in Chapter 2 were showing as mediating strategies. These pedagogical sensitizing constructs were linked to the subject specific aims in the Life Sciences curriculum. It was observed that teachers in the research were making use of the sensitizing constructs, and their ability to reflect as mediating strategy was as a result of the mentioned subject specific aims which guided them. However, it was felt by both teachers that the in-depth and expanded use of sensitizing approaches as mediating strategies could be improved. Although some of these approaches were seen as being used in the study it was felt that if the teachers had an in-depth familiarity with these methods in environmental education, their mediation levels and strategies would be enhanced. What was reflected from this research showed that teachers were able to approach environmental content in the curriculum by deliberating, which was followed by environmental content lessons being able to be situated in a context. However, the environmental content being brought through proximity experience and allowing the experiences gathered through this mediated learning to be reflected upon in practical reason, could be enabled.

- Material discursive arrangements, cultural discursive arrangements and socio- political arrangements can constrain mediation, whilst enabling factors enhance mediation.

The study also revealed that there were enabling and constraining factors which affected the role of the teachers in mediating or how mediation was to be done. The issue of school timetable not allocating the specified time per week for the subject was identified as one of the factors hindering mediation. The prescriptive curriculum, should the teacher not expand beyond what is assigned, limited how mediation would happen as one would be confined to what was stipulated. Lack of resources such as funds to go on excursions which would mediate in teaching and

learning of environmental content, was also cited as a reason which hampered mediation. However, passion for the environmental content section of work, the ability to improvise in resource use to enhance mediation of environmental content enabled teachers to mediate the environmental learning.

#### **6.4 Recommendations**

This section draws on the analytical statements and discussions in Chapter 5 to make possible recommendations to improving ways in which teachers can mediate in the teaching and learning of environmental content in the new CAPS curriculum. The release of 2014 Matric results saw the teacher union leaders as well as education experts and researchers in South Africa such as Nic Spaull (2015) noting that many of the teachers did not have the required content knowledge and teaching skills required to teach the new curriculum. He attributed this to the low quality of in-service teacher training in the post-apartheid period. Both the teacher unions as well as Spaull (2015) agreed that retraining of teachers was essential because of the curriculum changes. Bruce and Calhoun (2010) suggest that in this century teachers need to have more subject content knowledge and also know how to teach it. According to them the coaching of teachers on how then to deal with this subject content knowledge in terms of teaching and assisting in how teachers can understand it, can be the avenue for modernizing the curriculum.

Lotz-Sisitka (2011) avers that subject knowledge and teaching methods need to be updated as teaching occurs in a world that is predominantly complex, uncertain and dynamic. Summers, Kruger and Child (2003) concur, emphasizing that the maintenance of good teaching should include ensuring that teachers regularly update their curriculum content knowledge (ECK in this case), their teaching methods and their assessment strategies. This is definitely applicable in the South African context as this country's curriculum is constantly changing, and more so with the increased EE and ESD content.

Kemmis (2005- Section 2.6) argues a need to changing practice architectures that constrict teacher action possibilities. It has already been stated on a national scale that there is a need to improve South African teachers' knowledge and PCK (capacity to teach) of environmental and sustainable development content, values and skills (see Section 2.3 & 2.4). The environmental content in the Life Sciences CAPS curriculum is new knowledge with which teachers in South



Africa have not always engaged. The following recommendations are made to help teachers engage in and work with the environmental and sustainability content in Life Sciences. Findings in this study can be used to feed into teacher training programs in South Africa for the Life Sciences subject.

#### **6.4.1 Teachers' need more input on strategies to mediate environmental content**

The findings from the research suggest that despite CAPS having been introduced three years ago, teachers are still finding it difficult to practice teaching and learning using methods that reflect mediation taking place through such approaches as those discussed in this study.

Teachers can possibly be helped with strategies that help mediate in environmental content through being made more aware of the various active learning pedagogies available which help in the mediation. Examples of the active learning pedagogies to mediate in environmental content include those such as the pedagogical sensitizing constructs as discussed in this research study. This can be done through the arrangement of ongoing teacher training workshops which would allow teachers to learn how to engage with the environmental content on an ongoing basis. Training workshops maybe structured in ways that can foster deeper engagement and understanding of the environmental content by the teachers so that they are made aware of the need to explore other mediating strategies, rather than those which merely go through curriculum requirements.

#### **6.4.2. Teachers' prior knowledge of new knowledge can be used to strengthen teacher professional development processes**

Part of the findings in this study showed that teachers in the study successfully relied on prior knowledge to deal with some of the environmental content in the Life Sciences. Their prior knowledge can be utilized at cluster meetings to help colleagues who may struggle with the environmental content. The prior knowledge and expertise that the teachers bring can be utilized in group training such that the onus in training does not become the sole responsibility of the subject advisor, but that they rather learn from each other.

### **6.4.3. Teachers' prior knowledge needs to be deepened and reinforced**

Despite effective use of prior knowledge by teachers in these cases, there were still incidences where deepening knowledge could have enhanced learning processes further. Ongoing teacher education to deal with environmental content was a key priority for the second half of the UN Decade on Education for Sustainable Development (UNESCO, 2009). Teachers are able to do their work properly if they are well prepared, thus keeping up to date with change and renewing their knowledge. Ongoing content and pedagogical training workshops would serve the necessary purpose.

### **6.4.4 Quality educational resources encompassing a variety of pedagogical sensitizing constructs need to be developed**

The development of teaching and learning materials for environmental content should ensure that teachers have guided mediating materials developed with good insight into what is needed to help in the mediation of environmental content. Such packages of teaching and learning materials would not only ensure uniformity but also help teachers who perhaps struggle with ways in which to mediate learning.

The resource material should be developed after taking the issues of constraining factors as previously mentioned. Materials could include activities that require hands-on investigations within school grounds, and that can be referenced within the indigenous knowledge systems familiar in most areas in the country. Including community elders and traditional healers who are knowledgeable on medicinal plants, during lesson planning by teachers, or by the district office at content training workshops can help in mediation of environmental content. This would enhance the proximity experience and situated learning approaches. Activities that initiate debates could also be developed thus strengthening mediation through engagement and promoting critical thinking (practical reason) in learners as they deliberate on a range of topics included in said worksheets or resource material.

The CAPS curriculum needs to be expanded and not only limited to what is highlighted therein with the developed materials allowing room to go beyond the confines of what is currently stated in the CAPS Life Sciences environmental content section. Developing materials that can be used

to help mediate this section would therefore ensure that good quality teaching resources are available.

#### **6.4.5. Support needs to be given for familiarising teachers with teaching materials and their appropriate use**

The materials mentioned above would have to go hand-in-hand with training workshops to ensure that teachers are equipped to implement the use of the resources in their classrooms. Teacher professional development programmes can then not only have access to good quality resources but develop teachers' skills, competency and capacities to deal with the new environmental content in the curriculum. There is a need to look at many of the resources suggested in the curriculum being made available if this will mean expansive approaches in mediating environmental content can take place in the Grade 11 Life Sciences curriculum.

#### **6.5 Possible further research recommendations**

- The study scope can be expanded by increasing the sample size of participants, instead of the number used in this research.
- The number of lessons used in the study can be expanded but should deal with the same section of work on ECK in the Grade 11 Life Sciences curriculum. A fair spread of lessons might give a bigger frame for representation on how the module is being mediated.
- The study area can be broadened for better comparison. It could possibly be expanded to other areas within the province or make sample study comparisons with other provinces. This would perhaps give a better comparison and representation of how mediation is taking place across a fair representation of schools in South Africa.
- Sample groups of teachers could be selected and worked with over a period of time. The results of these groups could be used for developmental purposes to feed back into cluster groups / teacher learning communities and thus improve developmental programs. Constant monitoring by teacher professional programs could also be included.

#### **6.6 Conclusion to the study**

This study was important in helping the researcher gain insight into the possible ways in which environmental content is being mediated in the Grade 11 Life Sciences CAPS curriculum. This

enabled possible suggestions to be made to help improve on the teacher practices in the classroom to develop better and deeper understanding of sustainability and environmental content in the curriculum. Findings could feed into future teacher professional development programs.

It can be concluded that there is mediation taking place within the schools used in the case study. The participating teachers showed use of some mediating approaches such as situated learning and deliberation with others such as proximity experience approach and practical reason needing to be enhanced in their enabling of environmental learning. The research also showed that despite the ECK being new in the curriculum there were enabling factors that helped the teacher participants cope with the scope and demands of this new environmental content. These included prior experience, subject integration between Life Sciences and Geography and the teachers' passion for the type of sustainability and environmental content as indicated in the Life Sciences curriculum. The research further showed that teachers could benefit from teacher professional development programmes that explicitly develop PCK to support critical deliberation, proximity encounters, situated learning and practical reasoning in order to work with the diverse complex places-based, socio-cultural-historical nature of environmental curriculum content in the context of sustainability practices.

At the same time it was also evident that there were constraining factors hampering the mediation role played by the educators. These ranged from lack of familiarity with the environmental content, not enough experience in years of teaching, the lack of CAPS training, limited support from “district office” and lack of adequate resources for use in some of the approaches to mediation such as field trips and the like. Despite some intervention taking place, mediation can be improved through development of teaching resources which encompass various approaches such as situated learning, proximity experience, practical reason and deliberation. These four pedagogical approaches which were of interest in the study form part participatory approaches as advocated by environmental education. This is supported by Lotz-Sisitka and O'Donoghue as cited in Reid, Jensen, Nikel and Simovska (2008), where they found that participatory education is a central feature and a terrain of ambivalence within the developing landscape of environmental education in South Africa.

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## ANNEXURES:

### ANNEXURE A: Life Sciences CAPS Policy statement (extracts of subject specific aims and prescribed environmental content knowledge used in the research study)

#### WHAT DO THE THREE AIMS MEAN AND HOW DO THEY RELATE TO ASSESSMENT?

##### 2.5.1 Specific Aim 1: Knowing Life Sciences

(Life Sciences concepts, processes, phenomena, mechanisms, principles, theories, laws, models, etcetera).

Specific Aim 1 involves knowing, understanding, and making many connections between the ideas and concepts. Making such connections makes it possible for learners to apply their knowledge in new and unfamiliar contexts. The process of acquiring a deep understanding of science is about more than just knowing a lot of facts. The scope of knowledge that learners should acquire includes knowledge of the process skills related to carrying out investigations.

The following cognitive (thinking) skills comprise the **range** of skills that all learners should develop by working through the curriculum in a school year. These skills indicate what should be assessed at **the appropriate grade level** in a variety of different kinds of assessments. Note that teachers must ensure that, by the end of the year, skills have been assessed for each learner.

##### 2.5.1.1 Acquire Knowledge

In the process of acquiring knowledge learners must:

- **access** information from a variety of sources (teachers, parents, etc.);
- **select** key ideas;
- **recall** facts; and
- **describe** concepts, processes, phenomena, mechanisms, for Life Sciences.

## Assessment

In order to assess these competences (or cognitive skill assessments that they set: state, name, label, list, de **knowledge** of the subject is being assessed.

### 2.5.1.2 Understand and Make Connections Between Ideas and Concepts to Make Meaning of Life Sciences

In the process of making meaning and achieving understanding learners must:

- **build a conceptual framework** of science ideas;
- **organise** or **reorganise** knowledge to derive new meaning;
- **write** summaries;
- **develop** flow charts, diagrams and mind maps; and
- **recognise** patterns and trends.

## Assessment

In order to assess these competencies (cognitive skill assessments they set: explain, compare, rearrange, give reason, make a generalisation, interpret information or that indicate that learners' understanding of the subject

### 2.5.1.3 Apply Knowledge on Life Sciences in New and Unfamiliar Contexts

**Learners must be able to:**

- **use** information in a new way; and
- **apply** knowledge to new and unfamiliar contexts.

## Assessment

In order to assess these competencies (cognitive skill assessments that they set: demonstrate, interpret, as any other appropriate verbs that assess a learner's able to apply knowledge in a context

or situation for knowledge in a new way.

#### 2.5.1.4 Analyze, Evaluate and Synthesize Scientific Knowledge

In the process of learning science, learners must be able

- **analyse** information/data;
- **recognise** relationships between existing knowledge and new ideas;
- **critically** evaluate scientific information;
- **identify** assumptions; and
- **categorise** information.

## LIFE SCIENCES GRADES 10-12

### ASSESSMENT POLICY STATEMENT (CAPS)

#### Assessment

In order to assess these competencies (cognitive skill assessments that they set: appraise, argue, judge, select, evaluate, criticise (an argument or assumption) differentiate, di analysis, evaluation and synthesis are being assessed.

#### 2.5.2 Specific Aim 2: Investigating Science Phenomena in Life

Learners must be able to plan and carry out investigations as well as solve problems that require some practical ability. This ability is underpinned by an attitude of care and living things in it work.

The following range of skills relates to **doing** practical work in Life Sciences. All seven skills will not apply to every activity equally. The skills are aligned to what learners would be doing in the normal course of carrying out an Investigation. Teachers must select those skills that are by the end of the Grade 10 year, all **grade seven-appropriate** skills level.



**Note:** While **doing** practical investigations involves a specific ran of science can, and should, be assessed within Aim 1

Learners must be able to:

### **2.5.2.1 Follow Instructions**

This is essential, especially in the lower grades and unfamiliar equipment and to do so independently without giving them a clear set of instructions to follow. The amount of assistance required would indicate the level of performance in this regard. Adherence to safety rules should be part of this.

### **2.5.2.2 Handle Equipment or Apparatus**

This should include having knowledge of the apparatus, for. The learner should be able to use different kinds applies to any equipment used for many different kinds o same skills as would be required for handling standard laboratory equipment. The emphasis is on **using** equipment appropriately and safely (and not on only memorising the names of apparatus).

### **2.5.2.3 Make Observations**

A variety of observations are possible and observations

- drawings;
- descriptions;
- grouping of materials or examples based on observable
- measurements;
- comparing materials before and after treatment;

- observing results of an experimental investigation way; and counting.

#### 2.5.2.4 Record Information or Data

This should include recording observations or information graphs, etc. The skill of ‘recording’ is transferable a

#### 2.5.2.5 Measure

Learners should know **what** to measure, **how** to measure it and have a sense of the degree of accuracy that is required. A variety of things could be measured include mass and numbers (counting). Measuring is a way of quantifying observations and in this process learners should learn to make estimations.

#### 2.5.2.6 Interpret

Learners should be able to convert information from one converting a table into an appropriate graph.

Learners should be able to perform **appropriate** simple calculations, to analyse a and graphs, apply knowledge of theory to practical sit limitations of experimental procedures as well as make deductions based on evidence.

#### 2.5.2.7 Design/Plan Investigations or Experiments

Not all investigations are based on the ‘classic’ investigation could involve observing soil profiles or

Designing an investigation is a different process to planning an investigation. In the design process options need to

be considered in terms of the hypothesis and variables

Skills include:

- identifying a problem;
- hypothesising;
- selecting apparatus or equipment and/or materials;
- identifying variables;
- suggesting ways of controlling variables;

- planning an experiment;
- suggesting ways of recording results; and
- understanding the need for replication or verification

In Grades 10, 11 and 12, learners must be able to plan

## LIFE SCIENCES GRADES 10-12

**Note:** Skills 2.5.2.1-2.5.2.6 (following instructions, hand measuring and interpreting information) are all require investigation. By separating seven different kinds of practical work that is appropriate for a particular grad

This approach makes it easier to assess learners in a range of different circumstances and it enables a teacher to judge a learner's **do** science. The ability skills are based to on what learners will be doing actions during the normal course of doing practical work. However, there are some apply and not every skill can be assessed in every practical task.

### 2.5.3

#### **Specific Aim 3: Appreciation and Understanding the History, Importance and Applications of Life Sciences in Society**

The third aim of Life Sciences is to enable learners to understand that school science can be relevant to their lives outside of the school and that it enriches their lives.

Learners must be exposed to the history of science and indigenous knowledge systems from other times and other cultures. Scientific knowledge and understanding have been who persevered with their quest for knowledge. Our present understanding of science will change and improve as modern scientists make new discoveries.

The skills that can be developed in the process of achieving are the same cognitive skills Aim 1 as the ones identified.

Since the knowledge that will be acquired in respect of content provides the context for learning about various aspects of science in society. Science should therefore be taught in an integrated way in order to both enhance the subject and to clarify the relationship

between the subject and society i.e. indigenous knowledge systems that relate and the applications of science in everyday life.

### **2.5.3.1 Understanding the History and Relevance of Some**

The subject content provides the context for learning able society. These aspects, the history and relevance of content that are related to a particular discovery or a particular scientist.

### **2.5.3.2 The Relationship Between Indigenous knowledge and Life Sciences**

All knowledge stems from views on how the world works. One of the differences between modern science (and technology) and traditional, indigenous knowledge systems

Learners should understand the different cultural contexts in which indigenous knowledge systems were developed.

The examples of indigenous knowledge that are selected African cultural groups. They should also link directly

### **2.5.3.3 The Value and Application of Life Sciences Knowledge in the Industry in Respect of Career Opportunities and in Everyday Life**

Knowledge of Life Sciences is applied in and relevant to the subject content that learners are dealing with at a socio-biology and animal behaviour, plant pathology, game

of biodiversity, palaeontology, palaeoanthropology, biotechnology, genetic engineering, and many others. Moreover, it is not necessary to discuss or teach these

### **Skills**

Whilst the kind of knowledge is different for Specific A in order for learners to understand the history, relevant skills that must be developed and assessed for Specific

Learners must be able to:

- **access** information;
  - **select** key ideas;
  - **recall** information;
  - **describe** knowledge of natural sciences;
  - **build a conceptual framework**;
  - **organise** or **reorganise** knowledge;
  - **write** summaries;
  - **develop** flow charts and mind maps;
  - **recognise** patterns and trends;
  - **apply** knowledge in new contexts;
  - **use** knowledge in a new way;
  - **analyse** information/data;
  - **critically evaluate** scientific information ;
  - **recognise** relationships between existing;  
knowledge and new ideas;
  - **identify** assumptions; and
  - **categorise** information.
- 
- Specific Aim 1.1
- Specific Aim 1.2
- Specific Aim 1.3
- Specific Aim 1.4

The three aims are aligned with the three learning outcomes with which teachers are familiar. Within each of these aims, specific skills or competences have been identify separately, nor is it possible to report **well-designed** on **assessments** individual must show **evidence** that, by the end of the year,at all **grade-appropriate** of the **level** skill. There must be a clear link between the aims and the out assessment will provide the links between the specific

#### 2.5.4 Developing Language Skills: Reading and Writing



Teachers of Life Sciences should be aware that they are also engaged in teaching language across the curriculum. This is particularly important for learners for whom the Language of Learning and Teaching (LoLT) is not their home language. It is important to provide learners with opportunities to develop and improve their language skills in the context of learning Life Sciences. It will therefore be to write reports, paragraphs and short essays as part of assessments **for** learning.

## **ANNEXURE B: Semi structured interview teacher 1 transcript**

**Teacher profile:** semi structured Interview

**ANNEXURE B**

**Date:** 6 June 2014

**Time:** 8.00am

**Name (optional)**

**Name of school (optional)**

5 **CC How long have you been teaching?**

6 T1 I have only been teaching for about one and half months , I am still new to the game of  
7 teaching

8 **CC What qualifications do you hold?**

9 T1 ND Biomedical Technology pending PGCE through UNISA  
10

11 **CC What qualifications do you hold relevant to the subject?**

12 T1 Biomedical Technology pending PGCE through UNISA but this gives ,es some relevant  
13 knowledge of the topic on environmental content knowledge and of cause my own prior  
14 experiences in school of the topic do help in teaching the topic area.

15

16 **CC Did you study ee/ sustainable development in your teacher training?**

17 T1 No none at all , that's because it was through correspondence and has general topics

18 **CC What is the language of instruction in your class?**

19 T1 Mainly English although at times im forced to code switch into Afrikaans for some  
20 learners. But generally the school is a dual medium school and we have that flexibility of  
21 teaching in both languages. Also majority of the learners in my class are not Afrikaans

22 speaking so English becomes the more better of the two languages for instruction.

23

24

25 **CC How long have you been teaching Life Sciences (Biology)?**

26 T1 Not long really would say about a month, remember im still starting in the teaching field

27 **CC Did you receive any CAPS training? And when?**

28 T1 No since im not yet actively involved in the field I did not , and also came after the courses  
29 had been done. To my knowledge this year 2014 there has not been any scheduled mop up  
30 workshops.

31

32 **CC If you received CAPS training of what relevance was it to you in terms of sections**  
33 **which deal with environmental topics in Grade 11?**

34 T1 No none

35

36 **CC Which topics do you consider to be environmental content related in the Grade 11**  
37 **curriculum?**

38 T1 Well there is a whole module which we are expected to teach so reference to human  
39 impact on the environment highlights what the section is focusing on.

40

41 **CC Do you like these topics? Why or Why not?**

42 T1 Yes I do like the topics because they are a part of our daily lives. Through teaching others  
43 about the environmental issues we can have a cleaner and safer environment. I am actually  
44 honoured to be part of teaching learners how preserve and protect our environment.

45

46



47  
48

49 **CC For the topics that are of environmental content based on your answer from the**  
50 **previous question , what teaching methods (approaches) do you use? And WHY**

51 T1 I like to use the narrative and discussion type of teaching methods.

52 Narrative because it gives knowledge from me and enables me to see how they feel as  
53 they learn from me. Although I am careful not to overuse it as they can become bored  
54 hence why I introduce the discussion type of teaching and learning.

55

56 With discussion type approach I also find that through verbal interaction and  
57 engagement, it can allow me to see if they understand what I have taught to the part of  
58 the content they will be looking at. In addition I feel discussion type approach enables  
59 various ideas to be brought out in the open which can build to one body of knowledge for  
60 a topic. So in a way they can learn amongst and from each other. I do though take  
61 caution in that I have to guide them during their discussions so as to not make them lose  
62 track of whats to be discussed.

63

64

65 **CC What factors do you think influence your choice of methods selection?**

66 T1 think its mainly based on the type of teacher that I am. I do not like passive learning or  
67 learners hence my choice of methods approach. Also the type of learners one has from  
68 year to year also may play a role

69

**CC What**  
70 **challenges are you facing (if any) in teaching of these environmental content sections in the**  
71 **curriculum?**

72 T1 Although I am enjoying teaching the subject topic very much, I do not have that very  
73 broad knowledge of environmental issues. So as a result the learners ask questions about  
74 the topic or argue certain points and then I am unsure about the answer. This is a

problem as at times I'm left feeling that the amount of knowledge learners have acquired from the section is inadequate and may impact on later sections. I am in as much as possible trying to thoroughly prepare and source information from elsewhere.

**CC .....Have you perhaps tried asking other colleagues with experience in the subject to help you with the section?**

T1 Well that has turned out to be a bit of a logistical issue as they have other classes during the time I would want them to come and help. Also asking them to come teach the section would mean swapping classes and me sitting in their class which won't help much as i would like to sit in the lesson and learn from them as well.

**CC: Are you comfortable teaching the environmental content section on the curriculum? Why or why not?**

T1 :Yes despite my not being CAPS trained and all I am slightly comfortable teaching this topic. As I mentioned previously there are some sections that I struggle with but I doubt if it makes such a huge impact although I suppose I should judge. Like I said I try and find extra information on the internet about the topic and that has helped me a lot especially with teaching using videos to help them understand. When ever I use internet based materials I find its easier for the learners to relate also to answer their questions. I get a feeling that its learning together in way as we both watch the material and learn step by step. Most times we pause the video and discuss what will be transpiring. It's a form of active learning I guess a move away from the old all teacher does all the work that we used to have in my days.

**CC How do you think you students have responded to the environmental section on the syllabus?**

T1 I think they have responded very well judging from the way they participate during lessons and activities. They show enthusiasm and there is engagement and debate over some of the ideas that they bring about when they ask or answer questions. They have

103 come up with some brilliant answers which show that they are engaging well with the  
104 content of the topic, something that's pleasing. Their test results also showed that they  
105 averagely performed better in this section.  
106

107 I also felt that it seemed as if they had a good knowledge of the topic which gave them a  
108 good basis for the lesson. I think well environmental studies is a bit of common  
109 knowledge too as some issues are relevant in our society as they are directly affected so  
110 as a result when you teach the topic you make reference to some of these local issues.  
111 You will see that in my lessons I do like the various issues where applicable in our town.  
112 This I see has also made the interaction better and they seemed to enjoy it.  
113

114 **C C How do you think the students have related this section to your ways of teaching?**

115 T1 Considering my choice of teaching methods narrative and discussion, as well as inclusion  
116 of locally relevant environmental issues, these learners have taken what's expected in the  
117 syllabus and linked it to their everyday lives. And through discussion they have had the  
118 opportunity to each bring their ideas to the topic. This I think gave them plenty of  
119 opportunity to relate to the topic.  
120

121 **CC If you had to get assistance which topic that you think is environmental content**  
122 **related do you think you would need help with?**

123 T1 I would have loved some help with the section on evasive plans and explaining the best  
124 ways to destroy them that's eco friendly of cause perhaps touching on natural predators  
125

126 **CC What f actors do you think are influencing the delivery of environmental topics in**  
127 **the curriculum? (eg CAPS compliance)?**

128 T1 The CAPS document directly influences the delivery of certain topics in schools. It gives  
129 strict guidelines at the topics to be discussed. The teacher also influences any extra topics

130 to be looked at depending on their passion for the topic. So perhaps if the CAPS  
131 document was not too stringent it would help. A teacher who won't look outside the  
132 confinement of CAPS guideline will surely limit their learner's attainment I think. Take  
133 for example the water pollution issue a lesson can be developed from that.

134 CC **So do you have any lesson planned to do this, I'm taking it it's not prescribed in the**  
135 **guideline?**

136 T1 Oh yes I do I plan of doing a water quality expedition on the river Kowie and this would  
137 also develop their scientific skills. This town has had water issues being talked about a lot  
138 so it would only be good to bring learners to that reality that this happens in their context  
139 and perhaps they can then learn from this. But again I'm taking the extra initiative outside  
140 the guidelines.

141

142 CC **As an teacher do you think you are doing enough to promote environmentally**  
143 **related issues in the curriculum? Elaborate.**

144 T1 Yes I tried to relate this topic to our direct environment as we went through the  
145 environmental studies section. Also as we did topics not directly linked to this section I  
146 always tried to educate them about the effects that we as humans have on the  
147 environment. Take for example when we covered the section on photosynthesis and food  
148 chains , we went to a recently cleared area of the school and looked at all the possible  
149 effects the cutting down of trees may have had to the process of photosynthesis and the  
150 environment as well. Many realized how food being eaten by some animals had been  
151 lost. For me making such a connection was vital as it showed that the learners within  
152 their environment were able to make links to people's practices and the effect on the  
153 environment.

154

155

156

157

158

159

160

161 CC . In your teaching of the section with environmental content, how do you make use of

162 CC **The local context**

163 T1 I did gather information of our environment to include in the lessons. This makes the  
164 . topic more “real” e.g the water quality issue in port Alfred

165 CC **Relatings to everyday life of learners**

166 T1 Here I used a lot of examples a lot from what happens in our direct environment where  
167 learners live such as garbage and water pollution. Even the issue of abalone poaching  
168 and aliens plants around their homes

169 CC **Learners’ prior knowledge of the section**

170 T1 Tested on the water cycle and water quality what they knew before the lesson

171 CC **Learner involvement through group work**

172 T1 Well minimum I find it difficult to control the class

173 CC **Activities that promote critical thinking skills**

174 T1 I initiated quite a few discussion

175 CC **Activities which make learners to be socially critical of practices in the school and**  
176 **community that are environmentally related**

177 T1 I tried to include examples of things that the learners and their parents do that directly  
178 interfere with the environment, such as cutting down trees dumping rubbish in  
179 undesigned grounds, how they dispose off waste. The reuse of water and this turned  
180 out to be quite a hot debated topic.

181    CC    **Activities which make learners relate to content through engagement (hands on)**  
182           **experiences?**

183    T1    Well not quite like I said not now but previously went to the river to do water quality test

184 **ANNEXURE C: Semi structured interview teacher 2 transcript**

185

1 **Teacher profile: semi structured Interview**

2 **Date: 20 MAY 2014**

**Time: 10.25AM**

3 **Name (optional) .....K.P.....(T2)**

**Name of school (optional)**

4

5 **CC How long have you been teaching?**

6 T2 I have been teaching for 18 years and 2 months to be exact

7

8 **CC What qualifications do you hold?**

9 T2 HDE (NIG) , Bed (Hons), Med (Education Management)

10

11 **CC What qualifications do you hold relevant to the subject?**

12 T2 Think more Geography 1. It has some relevant knowledge of the topic on environmental  
13 content which do help in teaching the topic area. One sees that there is an overlap in the  
14 ideas of the environmental content in Life Sciences and Geography which I find is exciting  
15 works to geography teachers' advantage mainly as they can complement their life sciences  
16 teachers.

17

18 **CC Did you study ee/ sustainable development in your teacher training?**

19 T2 Yes to a certain extend in Geography training. Of cause back then it was not explicitly  
20 called ESD but looking back now you can see that the principles of EE/ESD were captured  
21 within the content taught

22

23

24 **CC What is the language of instruction in your class?**

25 T2 Mainly English although I do teach in both English and Afrikaans for some learners. But  
26 generally the school is a dual medium. English becomes the better of the two languages for  
27 instruction as we have a multicultural class.

28

29 **CC How long have you been teaching Life Sciences (Biology)?**

30 T2 Not long 6 months mainly with the ABET groups who still have their set syllabus which  
31 follows similar content to what CAPS has. I mean well... the subjects we do teach have  
32 to be at par with each other. I have now come to teach the subject at the moment  
33 stepping in for a colleague.

34 **CC Did you receive any CAPS training? And when?**

35 T2 yes once again for geography mainly and quick glance at Life Sciences CAPS document  
36 but not a proper formal LS training session. I tell you that CAPS everyone trained at the  
37 same time it was not staggered so even if I wanted to attend both sessions I had to with my  
38 options and see which one of the two subject demanded my attention. Sadly which I think  
39 would have added value to most teachers and being in the EC with the teacher instability in  
40 allocation at schools, would have been a mop up workshop. But to my knowledge this year  
41 2014 there has not been any scheduled mop up workshops.

42

43 **CC If you received CAPS training of what relevance was it to you in terms of sections**  
44 **which deal with environmental topics in Grade 11?**

45 T2 very much so , it was relevant because there was a number of topics overlapping between  
46 geography and life sciences, especially with reference to basic terminology and  
47 processes. The ideas in general serve the same function making learners to be aware of  
48 their surroundings.

49



50 CC **Which topics do you consider to be environmental content related in the Grade 11**  
51 **curriculum?**

52 T2 water resource availability, climatology, alien species quite a varied amount. Well there  
53 is a whole module focusing on human impact on the

54 CC **Do you like these topics? Why or Why not?**

55 T2 Yes because it teaches us all both teachers learners and parents about preserving our  
56 environment and natural resources. It also teaches us about our attitude towards our own  
57 environment on which we depend so much. The topics are very much a part of our daily  
58 lives. I am actually always excited to be part of teaching learners how preserve and protect  
59 our environment.

60

61 CC **For the topics that are of environmental content based on your answer from the**  
62 **previous question, what teaching methods (approaches) do you use? And WHY**

63 T2 case study method, group and report method as well as visual aids which enhance  
64 teaching

65 With case study approaches I feel they allow for issues to be context based, make  
66 relevance to learners as they can see what is happening elsewhere can be linked to them.  
67 Apart from that I think it improves literacy skills too. A subject has to incorporate other  
68 relevant skills so comprehension and ability to read through the case studies are essential.

69

70 Group and report methods promote learners to brainstorm and discuss ideas thereby  
71 learning from each other. It's active learning instead of me the teacher being the source  
72 of all information. The verbal interaction and engagement, it can allow me to see if they  
73 understand what I have taught to the part of the content they will be looking at and  
74 promote critical thinking. It is slightly tricky as there is the challenge of ensuring that the  
75 ideas presented are. I do though take caution in that I have to guide them during their  
76 discussions so as to not make them lose track of what's to be discussed.

77

78    **CC    What factors do you think influence your choice of methods selection?**

79    T2    well I would say the learner history their background which in most cases especially in  
80           multicultural set ups we tend to ignore but has an influence of attainment. There is also  
81           the issue of availability of resources, with not much extra teaching materials, transport to  
82           take learners for field trips and teachers or textbook that sort of thing, then it becomes  
83           difficult to fully and enjoyably make the learners excited about such topics. However I  
84           improvise and make the lesson enjoyable.

85    **CC    What challenges are you facing (if any) in teaching of these environmental content**  
86           **sections in the curriculum?**

87    T2    lack of knowing the content knowledge that is needed to teach this topic. One has to  
88           have a full understanding or at least familiarization with the environmental content  
89           otherwise you will not fully be able to implement it. You can't expect one to teach what  
90           they can't relate to or they don't know now can you? That's just plain silly to  
91           expect..... But I tell you move around these schools some of them and you will see  
92           teachers struggle to comprehend this units content or plan activities other than those in  
93           the textbook they will be using.

94    T2 There is also the issue of a lack of general environmental insight into topics related to  
95           environmental issues on the part of the learners

96    **CC    What do you mean by this can you elaborate?**

97    T2    well the learner doesn't have a basic sense of issues and lacks understanding e.g where we  
98           are they lack knowledge on coastal environment. There is also the issue of cost to travel to  
99           some of the places that would help them understand the topic better, imagine learners who  
100           are not coming to the coast to see some of the effects eg of coral reefs we had the red tide  
101           as an environmental issues at the beginning of the year and at that time the topic was on  
102           phylum s fungi and all and we went to visit the beach but it also made sense now when we  
103           spoke of water pollution and water quality that some of the effect s of that red tide could  
104           be linked by the learners to this section. So it's that ability to give kids the closeness to

105 experiences especially within their context that enables them to have a feel and make sense  
106 of this environmental content..

107 **CC: Are you comfortable teaching the environmental content section on the curriculum?**

108 **Why or why not?**

109 **T2:** Yes, because I enjoy learning together with the learners, especially on such challenging  
110 topics

111 **CC How do you think you students have responded to the environmental section on the**  
112 **syllabus?**

113 T2 I think they have responded very well to my surprise! Most of lesson was interesting and  
114 could clearly see that as the lessons developed that they developed a new look at  
115 environmental content because normally you would teach and they just sit and don't  
116 participate much or ask that many questions but the level and sort of questions asked this  
117 time around showed engagement with the content, which is exciting for the teacher.

118

119 **CC How do you think the students have related this section to your ways of teaching?**

120 T2 Most of my students know how I get carried away when I am busy teaching any topic  
121 therefore I would say that they rather chose to join me on this journey sharing and discussing  
122 ideas. This helped me also not to wonder off the topic.

123

124 **CC If you had to get assistance which topic that you think is environmental content**  
125 **related do you think you would need help with?**

126 T2 environmental impact studies and how it is done to enable developers to go ahead in  
127 developing vulnerable areas for human inhabitancy. Such as what are the criteria to be  
128 used this helps them understand the issue of environmental impact assessment as I have  
129 made reference to it to the quarry earmarked to go up but I can see both I and them  
130 are not well knowledgeable on the subject.

131

132 **CC** **What factors do you think are influencing the delivery of environmental topics in**  
 133 **the curriculum? (eg CAPS compliance)?**

134 T2 Lack of sufficient subject advisors and curriculum planners who make sensible or more  
 135 concrete follow-ups or support. Like I said earlier some of them appear unfamiliar with  
 136 the content. So how can they guide us when they themselves have content gaps?

137 The CAPS document directly influences the delivery as it gives work coverage meaning  
 138 most teachers won't think outside the box. I have heard someone mention at a training  
 139 presentation presented at Rhodes University about CAPS ++ teachers meaning thinking  
 140 beyond the prescribed CAPS guidelines but the question is come on how many of them  
 141 will? So the CAPS document is too stringent.

142 There is also not enough teacher training and seminars on environmental content.

143 Then there is the issue of arrogant heads who only focus on management and not staff  
 144 development of meeting some of the staff requirements. By this I mean where field trips  
 145 are required to reinforce the knowledge of issues and they say it takes away teaching time  
 146 yet it would be beneficial.

147

148 **CC** **As a teacher do you think you are doing enough to promote environmentally**  
 149 **related issues in the curriculum? Elaborate.**

150 T2 Not by a long shot!!!!

151 **CC** **Why? Elaborate please**

152 T2 I feel I am not involved enough in vocational teaching and learning of environmental  
 153 education locally and elsewhere! I also think there are few too or none excursions or  
 154 fieldtrips which would otherwise bring a real feel to the learners and enable them to carry  
 155 out observations and experiments in the environment its part of their skills development  
 156 as well which the syllabus requires them to attain but is currently being limited. I should

157 also cross teach with other subjects geography, social sciences and life science go hand in  
158 hand.

159 **CC In your teaching of the section with environmental content, how do you make use of**

160 **CC The local context**

161 T2 I allow for reading of the content first, then clarity of difficult terminology and will then  
162 . help implement it by making reference to our local examples

163 **CC Relatings to everyday life of learners**

164 T2 I use examples that they encounter in their homes or communities every day such that  
165 this makes sense when the issues on environment are being discussed and taught. I try  
166 and make these issues as relevant as possible especially to those learners of mine who  
167 come from disadvantaged backgrounds by means of my own heritage.

168 **CC Learners prior knowledge of the section**

169 T2 I have a policy of always checking what came in earlier grades and revising this earlier  
170 knowledge mainly through pre test at the start of topics. Also by verbal engagement I  
171 can assess the level of knowledge from how they respond and engage with questions on  
172 the environment with which I will ask

173 **CC Learner involvement through group work**

174 T2 I try and make use of this more often. I facilitate group learning myself whilst  
175 encouraging group ethics and dynamics. Reporting is important to me and it helps them  
176 learn from each other.

177 **CC Activities that promote critical thinking skills**

178 T2 all the time as I believe learners learn best through assessment of activities that are  
179 central to encouraging them to think outside the box and push their limits. Their  
180 activities which I give out require them to explore their knowledge taught and what they  
181 may know before or research.

182     **CC     Activities which make learners to be socially critical of practices in the school and**  
183     **community that are environmentally related**

184     T2     I encourage self awareness of surrounding as self image. You are what your surrounding  
185             is like hence what you do in the community around your house reflects on you especially  
186             where environmental issues are concerned. If you have an illegal dump outside your  
187             house its calling for all sorts of diseases and I make such links possible to learners.

188     **CC     Activities which make learners relate to content through engagement (hands on)**  
189     **experiences?**

190     T2     I would like to use these more often but I find there are limited only one which was on  
191             water testing and it's not enough to cover all skills and issues as well. So definitely this is  
192             an area I could always look at improving.

**ANNEXURE D: Work Schedule “Lesson plans” 1 /2/3 for teacher 1 (Teacher T1 and T2Lesson plans)**

**EASTERN CAPE PRESCRIBED LIFE SCIENCES PACESETTER LESSON PLANS**

<b>Planned Date* (Week ending)</b>	<b>Reference page in Caps Document</b>	<b>Strand</b>	<b>Topic</b>	<b>Content</b>	<b>No. of teaching hours</b>
<b>26/09</b>	<b>51</b>	<b>ENVIRONMENTAL STUDIES</b>	Human impact on the Environment: Current Crises for Human Survival: Problems to be Solved within the Next Generation	<p>Causes and consequences of the following (relate to the conditions and circumstances in SA)</p> <ul style="list-style-type: none"> <li>• The atmosphere and climate change <ul style="list-style-type: none"> <li>- Carbon dioxide emissions,</li> <li>- Carbon footprint</li> <li>- Deforestation</li> <li>- Greenhouse effect &amp; global warming</li> <li>- Desertification,</li> <li>- Drought &amp; floods</li> <li>- Methane emissions</li> </ul> </li> <li>• Ozone depletion</li> </ul>	16 hours (4 weeks)

Planned Date* (Week ending)	Reference page in Caps Document	Strand	Topic	Content	No. of teaching hours	Completion Date	Programme of Assessment (Formal tasks)	
							Task and number required per term	
17/10	51	ENVIRONMENTAL STUDIES	Human impact on the Environment: Current Crises for Human Survival: Problems to be Solved within the Next Generation	<ul style="list-style-type: none"> <li>• Water</li> <li>• Availability</li> </ul> <ul style="list-style-type: none"> <li>- Construction of dams</li> <li>- Destruction of wetlands</li> <li>- Poor farming Practices</li> <li>- Droughts and floods</li> <li>- Exotic plantations &amp; depletion of water table</li> <li>- Boreholes and effects of aquifers</li> <li>- Wastage,</li> <li>- Cost of water</li> </ul>	28hours ( 7 weeks)		1 RESEARCH PROJECT/ ASSIGNMENT = 100 MARKS	TOPIC: <hr/> FORMALLY RECORDED CLASS TEST (70 min = 70 MARKS)

\* These table detail the content to be taught (as set out in the official Life Sciences CAPS document), when it should be taught and the suggested type of activities to be set for the section of work.



Planned Date* (Week ending)	Reference page in Caps Document	Strand	Topic	Content	No. of teaching hours	Completion Date	Programme of Assessment (Formal tasks)	
							Task and number required per term	
24/10 31/10	52	ENVIRONMENTAL STUDIES	Human impact on the Environment: Current Crises for Human Survival: Problems to be Solved within the Next Generation	<ul style="list-style-type: none"> <li>Food Security (<i>link with population ecology dynamics</i>) <ul style="list-style-type: none"> <li>Human exponential growth</li> <li>Droughts and floods (climate change)</li> <li>Poor farming practices, monoculture, pest control, loss of topsoil, need for fertilisers</li> <li>Alien plants &amp; reduction of agricultural land</li> <li>The loss of wild varieties, impact on gene pools</li> <li>Genetically engineered foods</li> <li>Wastage</li> </ul> </li> </ul>	28hours ( 7 weeks)		1 RESEARCH PROJECT/ ASSIGNMENT = 100 MARKS TOPIC: _____	FORMALLY RECORDED CLASS TEST (70 min = 70 MARKS)
07/11				<ul style="list-style-type: none"> <li>Loss of Biodiversity (6<sup>th</sup> extinction) <ul style="list-style-type: none"> <li>Habitat destruction, farming methods e.g. over grazing, monocultures, golf estates, mining, urbanisation, deforestation, loss of wetlands and grasslands etc.</li> <li>Poaching e.g. rhino horn, ivory, bush meat</li> <li>Alien plant invasion: control using chemical, biological and mechanical methods</li> </ul> </li> <li>Indigenous knowledge systems &amp; the sustainable use of environment e.g. <ul style="list-style-type: none"> <li>Rooibos, fynbos, devils claw, <i>Hypoxis</i>, <i>Hoodia</i></li> </ul> </li> </ul>				

## Work Schedule "lesson plan" for teacher 2 (T2)

### TERM FOUR

Planned Date (Week ending)	Reference page in Caps Document	Strand	Topic	Content	No. of teaching hours	Completion Date	Programme of Assessment (Formal tasks)
17/10	51	ENVIRONMENTAL STUDIES	Human impact on the Environment: Current Crises for Human Survival: Problems to be Solved within the Next Generation	<p><i>important strand</i></p> <p><i>Talk about water as an important strand</i></p> <ul style="list-style-type: none"> <li>Water</li> <li>Availability → <i>What are the implications of water?</i></li> <li>Construction of dams</li> <li>Destruction of wetlands</li> <li>Poor farming Practices</li> <li>Droughts and floods</li> <li>Exotic plantations &amp; depletion of water table</li> <li>Boreholes and effects of aquifers</li> <li>Wastage</li> <li>Cost of water</li> </ul> <p><i>Questions</i></p> <p>① <i>Poster → present in class</i></p> <p><i>* Compile a list of the impacts of</i></p> <ul style="list-style-type: none"> <li>Poor farming Practices</li> <li>Droughts and floods</li> <li>Wastage</li> </ul> <p>② <i>Debate → participate in class</i></p> <p><i>Construction of dams is it</i></p> <ul style="list-style-type: none"> <li>Destruction of wetlands vs Development</li> <li>Cost of water → should water costs rise or brought down?</li> </ul>	28 hours (7 weeks)		<p>1 RESEARCH PROJECT ASSIGNMENT = 100 MARKS</p> <p>TOPIC: <i>Case Study on page 28</i> <i>(Spot on Geography) questions on p 30-31</i></p> <p>FORMALLY RECORDED CLASS TEST (70 min = 70 MARKS)</p>

Planned Date (Week ending)	Reference page in Caps Document	Strand	Topic	Content	No. of teaching hours	Completion Date	Programme of Assessment (Formal tasks)
26/09	51	ENVIRONMENTAL STUDIES	Human impact on the Environment: Current Crises for Human Survival: Problems to be Solved within the Next Generation	<p>Causes and consequences of the following (relate to the conditions and circumstances in SA)</p> <p><i>What is the link between the atmosphere and climate change?</i></p> <ul style="list-style-type: none"> <li>Carbon dioxide emissions</li> <li>Carbon footprint</li> <li>Deforestation</li> <li>Greenhouse effect &amp; global warming</li> <li>Desertification</li> <li>Drought &amp; floods</li> <li>Methane emissions</li> <li>Ozone depletion</li> </ul> <p><i>Group discussion</i></p>	18 hours (4 weeks)		<p>1 FORMAL RECORDED PRACTICAL (30)</p> <p>TOPIC: <i>Case Study p 25</i> <i>Case Study on page 25</i></p> <p>FORMALLY RECORDED CLASS TEST (70 min = 70 MARKS)</p>
26/09 03/10				TESTS			
TERM THREE HOLIDAY: 04 OCTOBER TO 12 OCTOBER 2014							


## ANNEXURE E: Evidence of mediating strategy – structure of worksheet student Teacher 1

4/ENVIRONMENTAL STUDIES

INVESTIGATE IT NOW

# Waterborne threats

Water reaching our homes through the water distribution network has been tested and chemically treated to purify it and to kill all germs and harmful agents. This is what we pay water accounts for. Although it falls from the clouds at no cost, it costs money to ensure that it is safe when it reaches our homes.



*Fig. 4.2 A woman collecting water from a stream*

### ACTIVITY 4.2

Study the photograph and use it to answer the questions below.


- 1 Why is this woman collecting water in a bucket?
- 2 Assuming that the bucket can hold 20 litres of water and that there are 8 people in the woman's household, how much water is available today to each person?
- 3 How will they use this water?
- 4 How much water does your family use in one day? What for?
- 5 When she has filled the bucket, the woman will carry it home. She will do so at least once a day. What will be the long-term effect of this on her health?
- 6 How can this woman ensure that her family does not contract a disease like cholera from this water?

### ACTIVITY 4.3

The first sign of cholera is a watery, runny stomach. The stomach loses a lot of water very quickly. The sufferer has serious cramps in the legs and arms, and is very weak. As the body dries out, the skin becomes cold and wrinkled. Unless treated quickly, death may occur due to the loss of water and salts from the body.

Find out –

- what cholera is
- where it comes from
- how it is spread from person to person
- how we can stop the spread of cholera
- what the important first treatment for cholera is.



*Cholera looks like this through a microscope*



Water reaching our homes through the water distribution network has been tested and chemically treated to purify it and to kill all germs and harmful agents. This is what we pay water accounts for. Although it falls from the clouds at no cost, it costs money to ensure that it is safe when it reaches our homes.

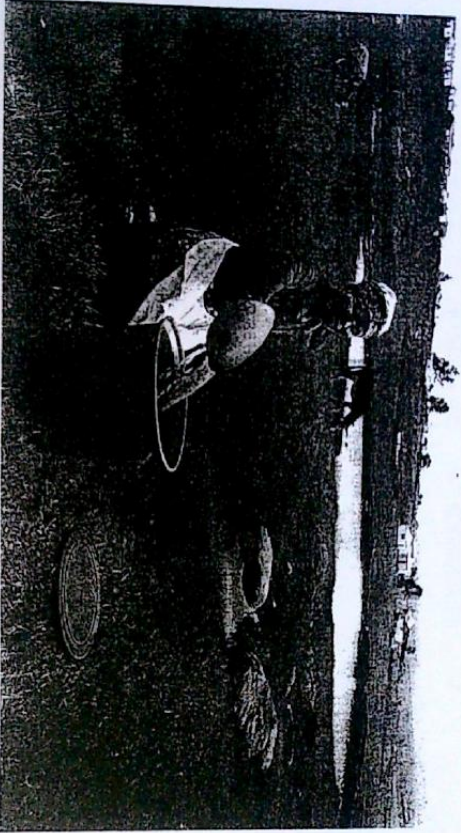


Fig. 4.2.2 A woman collecting water from a stream

Study the photograph and use it to answer the questions below.

- 1 Why is this woman collecting water in a bucket?
- 2 Assuming that the bucket can hold 20 litres of water and that there are 8 people in the woman's household, how much water is available today to each person?
- 3 How will they use this water?
- 4 How much water does your family use in one day? What for?
- 5 When she has filled the bucket, the woman will carry it home. She will do so at least once a day. What will be the long-term effect of this on her health?
- 6 How can this woman ensure that her family does not contract a disease like cholera from this water?

The first sign of cholera is a watery, runny stomach. The stomach loses a lot of water very quickly. The sufferer has serious cramps in the legs and arms, and is very weak. As the body dries out, the skin becomes cold and wrinkled. Unless treated quickly, death may occur due to the loss of water and salts from the body.

- Find out –
  - what cholera is
  - where it comes from
  - how it is spread from person to person
  - how we can stop the spread of cholera
  - what the important first treatment for cholera is.



*Cholera looks like this through a microscope*

1. She is collecting water to take back to her home. ✓
2.  $20 - 8 = 12$  L.
3. Drinking, bathing, hygiene purposes. ✓
4. Over boil of water a day. <sup>1000 L</sup>  
for cooking, bathing, hygiene purposes and drinking. ✓
5. If can affect her body means she will not be able to walk. She will then not be able to fetch water etc. <sup>spoon, dehydrated, cholera, severe pain.</sup>  
~~This~~ This will affect her health attributes.
6. She can boil the water to ensure the bacteria that causes cholera dies. ✓ <sup>filter.</sup>

## Activity 4.3

Vibrio cholerae - It is a sickness that causes severe diarrhea. ✓

Where does it come from - It comes from a bacteria Vibrio cholera when water or food contaminated by faeces is swallowed. <sup>2</sup> aquatic animals, free living.

How does it spread - When someone does not wash their hands and touches food it can infect other people. ✓



How can we stop the spread of cholera.  
Health education, clean water and proper sanitation as well as importance of washing hands before handling food. ✓

Treatment for cholera - drinking a solution of re-hydration salts or antibiotics. ✓

### Activity 3.6.10

#### Water Quality:

1. domestic purposes (washing, cooking, cleaning, bathing)  
industrial purposes (mining)  
agriculture (irrigation) ✓

2. Eutrophication → The process by which nutrients, especially nitrogen and phosphorus, become highly concentrated in a body of water, leading to increased growth of organisms such as algae. ✓  
*consequence: oxygen depletion, loss of biodiversity, toxic substances*

3. The mining we may be exposed to rocks containing Pyrite. This causes a chemical reaction takes place with the sulfur-bearing minerals, turning the water to an acid = ✓  
This is called acid mine drainage. ✓  
*acid contains heavy metals*

4. thermal pollution → refers to an increase in the temperature of rivers, streams, lakes and ground water as a result of the release of extremely hot water by industries.

*decreases oxygen levels in the water.*  
*Eutrophication has not water encouraging algal bloom.*  
Directly → reducing the oxygen supply in the water since heating water drives the oxygen out of it. ✓  
*Algae, heavy metals.*

Indirectly → Reducing the oxygen supply since higher temperatures encourages algal bloom that uses up oxygen. ✓

5. They form almost a continuous mat on the surface of the water.
  - × Light is no longer able to reach the lower levels of water
  - × Photosynthesis is stopped.
  - × Plants die and decompose.
  - × The population of decomposers increase using oxygen
  - × Animal life die to a lack of oxygen.

They clog the canals.  
They spend thousands to clear water bodies.  
Sports cannot take place.

to the type of dissolved salts and gases (substances)  
Chemical quantity → it refers to the amount of water (mole) ✓  
Physical quantity → it refers to the characteristics, hot, cold etc. (temp) ✓  
Biological quantity → the amount of water a organism needs for survival ✓  
Aesthetic → water quantity, taste, colour, appearance

## Annexure E: Evidence of mediating strategy – worksheet student teacher 2 (case study and context based activity) (T2)

### Experts say that climate change is fuelling malaria in Kenya 2008

"We are now finding malaria in places that we did not expect to find it, particularly the highland regions that used to be too cool for malaria," said Dorothy Memezi, deputy director of the Malaria Division in Kenya's Ministry of Health.

Malaria has occurred on Kenya's humid coast and swampy lowland regions for many generations, but it has only rarely reached villages on the slopes of Mount Kenya. In recent decades, however, scientists have noted an increase in epidemics in the region.

Many medical and environmental experts claim that the spike in malaria is due to climate change, in the form of warmer temperatures and variations in rainfall patterns.

Malaria is an infectious disease caused by parasites in the blood system. Symptoms include fever and severe joint pain. Changes in temperature can affect the development and

survival of malaria parasites and the mosquitoes that carry them. Rainfall also influences the availability of mosquito habitats and the size of mosquito populations.

"The best climate conditions for malaria are a long rainy season that is warm and wet, followed by a dry season that is not too hot, followed by a hot and wet short rainy season," according to Shem Wandiga, a professor of chemistry at the University of Nairobi who has studied the relationship between climate and malaria.

While environmental and public health experts express alarm over the effects of climate change on malaria's spread, there are other possible causes of the increase in malaria in Kenya. Rising malaria rates could also be the result of increased drug resistance in malaria parasites and the infrequent use of pesticides in mosquito breeding grounds.

(Source: Adapted from: [http://news.nationalgeographic.com/news/2008/01/080109-malaria-warming\\_2.html](http://news.nationalgeographic.com/news/2008/01/080109-malaria-warming_2.html))

#### Activity 6.1 Malaria and climate change

30 minutes

Experts say that climate change is fuelling malaria in Kenya. Read the case study and then answer the questions below.

1. What is the main cause of the increase in malaria?
2. Name two other causes of the increase in malaria in Africa.
3. What is the link between the increased cases of malaria and climate change?
4. You work for the World Health Organisation, and they have asked you to design a proposal on how to solve this problem. Suggest temporary solutions that can be adopted as well as long term solutions.

Large developing countries like India, China and Brazil are not required to meet the specific targets for reduced emissions. This is for now – and might change. Two major countries opposed to the Kyoto Protocol are Australia and the United States of America. The reason for their opposition is concern that their industrial growth will be hampered.

#### Activity 5.1 Global warming and the Greenhouse Effect

30 minutes

1. Name two greenhouse gases.
2. a) What is a greenhouse?  
b) Why is the comparison between a greenhouse and the atmosphere effective?
3. Explain, with the use of a well-labelled diagram, how the Greenhouse Effect increases the temperature of the planet.
4. Imagine that the world's ice caps thaw (melt). This would increase the sea level. Describe some of the consequences this will have on coastal areas around the world.
5. How would the melting of the world's ice caps affect the following:  
a) the global energy balance  
b) the hydrological cycle?
6. List four ways in which humans can try to decrease the effects of global warming.
7. Many plants and animals do not adapt as quickly as humans adapt to large-scale environmental changes. How would this affect the supply of food and the occurrence of drought in South Africa?

#### Activity 5.2 Factors influencing temperature

30 minutes

1. Explain why areas at the equator receive more sun energy than areas nearer to the poles.
2. Draw a sketch map of South Africa. On this map, fill in and label the following:  
a) the cold Benguela Current  
b) the warm Mozambique Current.
3. Refer to the information in the Notes box on page 19. Explain why the climate in Durban and Port Nolloth is different.
4. Explain why the climate of Johannesburg would differ from the climate of Maputo. Refer to the following factors when answering this question:  
a) distance from the coast  
b) moisture in the air  
c) height above sea level.

**ANNEXURE F: Transcribed Lesson observations 1/2/3teacher 1 A,B,C (LS1 T1 )**

1 12 May T1                      **LESSON 1**(LO1 T1 )                      **ANNEXURE F1**

2 To the atmosphere or it can stay on the earth's surface when it reaches the surface two  
3 things can happen to it, it can actually go into the ground, it can be absorbed by the  
4 surface and become ground water or it can stay on the surface and the water can go to  
5 dams and rivers and travels down to the ocean again and that is the water cycle.

6 Now we will be looking at the water vapour availability, when I say water vapour  
7 availability it means the amount of fresh water that is available for humans and for the  
8 eco system. What is fresh water? Fresh water is water that has low levels of dissolved  
9 salt. Looking at that Port Alfred has high levels of salt in the water. Looking on the  
10 internet looking into high salt levels in water and brak water that we have and I couldn't  
11 really find lots of information but I asked a civil engineer and he said it is mainly  
12 because of the types of rock that we find that have high levels of salt, which is the most  
13 important point to remember. What percentage of the earth is covered by water? 70%  
14 and of that 70% only 3% is fresh water that's available for use or consumption by  
15 industries or the eco-system the rest is caught into glaciers and ice sheets that are  
16 found in the south pole.

17 There are two main sources of water the one is wetlands and rivers and the other form  
18 of water supply is ground water. Do you know how ground water is kept in the soil? Its  
19 kept in equafers which is loose soil and rock which is actually poorest to water so it can  
20 keep the water in little small channels and basically what happens with ground water is  
21 that they bore holes into it and then it can demise from the rock and the sand and make  
22 it available for consumption. Most ground water is also often salty, most of it. The water  
23 in that rock actually contains the salt.

24 Surface water, like we said in the water cycle these rivers actually come from rain water  
25 so that is the water that stays on top and the ground water is the water that infiltrates  
26 into the ground and soil. You can think about this when we have floods, normally, say  
27 for instance we have rain for a week the first water that actually gets absorbed into the



soil and then what that soil has enough as is saturated and it cannot take in any more water so it runs through to the rivers and the dams flood and it all goes to the sea.

The resources of South Africa are actually of short supply. And if the economy grows as they expect and the population grows as they expect the demand for water will not be sustainable. If there is no water it will be very difficult to live as we need it to cook to clean and to survive, basically we need water for everything. So they say the economy and population is going to deplete the water and if we don't have enough water then economic growth cannot happen and so what is going to happen is that poverty cannot be fixed or eliminated which is a big problem. South Africa can't grow and we are all going to suffer. And this case most of the water is actually polluted by humans by industrial influence, domestic and commercial usage by mine drainage and so that is quite bad and we should look into how to fix that. Because it is a problem and we are all actually contributing to it. 77% of South Africa's water comes from rivers, lakes and dams. 9% is from ground water and 14% is free usable water.

That is basically an introduction to the water quality and availability. There are certain factors that affect the water availability there are 9 of them and we will be looking at all of them

#### 1. Difference in temperatures.

In global warming the main factor is the increase in temperatures. In a nutshell global warming is the pollution and gasses going into the atmosphere and it cannot escape so it makes the earth warmer the temperature goes higher because of the gasses and the gasses come from fossil fuels and from deforestation. What happens when it is warmer is that the water evaporates faster than normal from the sea from dams and rivers so it makes the available water to us less and the salt in the water would become more because the concentration would become higher. So that means less water for agriculture, animal use, industrial use and domestic use.

#### 2. Droughts and floods

No one knows exactly what the effect of the climate change will have on the water availability but the expectation is that the rainfall will start to vary so the parts of



land in South Africa that are dry will become dryer and the parts that are wet will become wetter but there are certain parts that are dry and can become wet. Certain parts where they say will become wetter is the eastern parts of SA especially the KwaZulu-Natal which is already wet there and it may cause a flood. What happens where there is a flood is the surface soil which is the rich soil will actually be washed away and when there is floods it actually causes the soil to not be able to support crops so that part of the country will not be able to plan crops like they use to and it will affect humans and animals because the houses, roads and soil will all be washed away, kids wouldn't be able to go to school etc. There are certain parts that will be dryer like the Interior and Western parts of the country like the Western Cape produces a large quantity of apples which we export which supports the economy but needs water to grow. They say that by 2070 the water supply to the Western Cape will decrease by 60% not only do they grow apples they do all sorts of fruits, grapes for wine, which is also a big export.

### 3. Construction of Dams

There are 4 main purposes of dams.

- a. Supply water for households, commercial and industrial use – water is stored in reservoirs within the rains season and the water is used by animals, humans, farmers, industry so normally when it rains they fill it up and use it when they need it. Not only do they use the water for human consumption. The animals need the water too. You cannot only keep water for human consumption.
- b. Supply water for irrigation (the supply of water for plants) – normally in a region there is enough water if it rains frequently to farm and to plant crops but when the water supply is low or it doesn't rain at all they release that water for them to use.
- c. Control flooding - as the levels of the rivers increase the dam can catch some water to help prevent flooding. So the river and the animal life within it won't be affected. Not only floods, they can help with droughts, if it is a

river it will continue to run away but the dam is able to contain the water for a while so it can supply water when there is a drought.

- d. Store water to generate hydro electricity power - we have a short supply of power supply and we have to approach new ways of getting electricity.

The water supply in the ground should be higher than the power station because the water will fall down on the turbines and will generate electricity. The biggest dam in South Africa is the Gariep dam. Which generate electricity therefore it is a very important dam to us.

Damns have disadvantages too:

People and their lively hoods are affected - because of floods and people that live next to the rivers can be flooded and animals can die from drowning. They also mention that people especially in the informal settlements live off the fish that they catch in the river if you keep water in a reservoir there is not enough water in the stream and it will affect the fish. If there is a flood it will affect them as they may not be able to catch fish which will force them to move elsewhere where they can make a living which means they mostly need to learn a new skill so definitely effect lots of people. And you will always find people living next to water supply.

Now we will look at the eco systems and the natural habitats of the downstream river parts - they say that when dams build the rich soft soil is kept in the dam which is normally close with the water down the river so it will definably affect the crops. When this floods the effects of the marine life even in normal eco systems it effects plants and it washes the plants away and effect the fish and marine life to a different place. So that is dams for us. We have about 500 government built dams in South Africa and it hold about half of the annual rainfall.

4.

2 Other two factors that we did not mention is wastage and cost of water availability. Number two  
3 is a short description of how the increase in temperatures affects water availability. What causes  
4 the fast evaporation? The increase in temperature. The water that's available is less for  
5 agriculture and industrially consumption. Number three the four main purposes of dams is flood  
6 control, supply water for commercial and industrial use, strong water for hydro electric power  
7 and irrigation so that's the four answers. The two disadvantages of dams the effect on people and  
8 their lively hoods and the eco system and natural habitat. Number five is exchange apparatus in  
9 South Africa is the GARIEP. What is its main purposes, the Gariep dam? Its hydroelectric  
10 power, to supply water. So that is that.

11 First question is what is an aquifer? It is the underground layer of sand or rock with mini spaces  
12 of crack filled with water. Surface water is precipitation slowly passes through the outer layers of  
13 the soil and through the layer of removable rock and it becomes saturated. Basically a layer of  
14 loose sand and rock with spaces that can be filled with water. Name two poor farming practices  
15 that affect water supply, ploughing downhill and although they use much water for irrigation that  
16 is not exactly a poor farming practice. Another is wastage of irrigation by not covering the  
17 channels, the channels are not covered so the evaporation will take place and the water will get  
18 lost through the ground because it is not proofed. And that is how the irrigation affects the water  
19 supply. Number four, what is a wetland? An area of wet soil is one way of describing it. An area  
20 in which the soil is wet long enough for the oxygenated air that's normally found between the  
21 soil particle s to be replaced by water. Which is a source of oxygen and the water becomes water  
22 logged.

23    **ANNEXURE F3: Transcribed Lesson observation 3 teacher 1 A,B,C (LS1 T1 )**

17 MARCH T1

**LESSON 2 (LO3 T2)**

**ANNEXURE F3**

24

25    The third lesson was a test lesson based on lessons one and two.

## ANNEXURE G: Transcribed Lesson observations 1/2/3 teacher 2 , A,B, C (LS2 T2)

1 MR P 1 AM LESSON 1 (LO1 T2)

### ANNEXURE G1

2 Today we are going to look at the human impact and what it has on the environment. The  
3 environment in terms of chopping down trees are deforestation you've mentioned greenhouse  
4 effect there is another impact which is desertification, what is it? What does it mean? Since we  
5 talking about chopping down forests now does it link with desertification? So in areas where we  
6 have less rainfall, and why would we have less rainfall in some areas? What causes it where  
7 usually we have more rain, what causes it? Climate change, meaning what? In certain areas  
8 perhaps we have less water to be evaporated so there is less rain in the area or maybe it is too hot  
9 therefore there is not enough water or humidity to form clouds and to have rainfall. So thats a  
10 problem so if we now have hotter temperatures we will have less rainfall therefore these places  
11 will be subjected to desertification. Roots won't find water and then the plants die and it will  
12 become dead. What about chopping down the trees? How long does it take a tree to grow and  
13 plant another? Those ears that have now been chopped down are now also exposed to  
14 desertification unless they receive more rain. Another one would be that would be linked to that  
15 is droughts and floods, we've spoken about flooding of the coastal areas when it comes to global  
16 warming or melting of the ice caps and we have the raising of the sea level but also what about  
17 areas that receive more rainfall that usually. That means that you are going to have a lot of water  
18 in the area that does not receive that much water so you will have climate change and that will  
19 have flooding in those areas. What is the result of that? More rain than usual, there would be no  
20 pollution which means we will have dry soil moved by these running forceful water. We will  
21 have a problem with agricultural perhaps you won't have land to plant on. And then there is  
22 another one that contributes quite a lot to global warming and that is methane emissions, what is  
23 meant by that? It is a gas coming from cows and their dug which releases methane into the  
24 atmosphere. In America they are trying to cut down on meat because the more cows and ox you  
25 going to keep the more reproductions and the more you are going to damage the atmosphere in  
26 terms of methane being released. They want to make it law for a no meat Thursday and if all  
27 people don't eat meat on a Thursday that means we are going to cut down on the amount we  
28 have produce. So maybe South Africa we should think about doing this.

29 Now we are going to have a group discussing amongst ourselves, I will give you 5 minutes and  
30 I'm going to take out 3 other these particular things that impact the environment so I'm going to  
31 ask someone to write down, then someone that is going to control the discussion and be the MC  
32 of the group. And then I need the last person who will present and discuss the findings on how  
33 humans impact on the environment. I want you to write down the causes and the consequences  
34 of the following impacts, what is the link between the atmosphere and the climate change and the  
35 following and then I'm going to give you three of those. One, carbon dioxide, two, greenhouse  
36 effect and global warming and three, drought and floods. You will discuss the link in climate  
37 change and those three points.

38 Students discussing: What is the link between the methane emissions and the atmosphere and  
39 climate change? If the atmosphere changes then the climate must also change because if the  
40 atmosphere gets warm then the climate must also get warm. It speeds up the greenhouse gasses.  
41 If the earth gets warmer because of global warming then there will be more droughts and floods.  
42 Dry places will get dryer and wet places will get wetter. If there is a coastal area you will get  
43 more rain but if it is a dry place more desertification will occur. The evaporation will take place  
44 and therefore more rain but if there is less evaporation there will be less rain. If the ozone layer is  
45 depleted then how will it be depleted and how would that contribute to global warming. How  
46 would this impact the environment? Would the animals become less, there will be more heat so  
47 the animals will have to adapt.

48 Presentation: SO as a class we had the topic what is the link between at atmosphere and climate  
49 change firstly the link between the atmosphere and carbon demotions if there is more carbon that  
50 is released in the atmosphere this will lead to the depletion of the atmosphere and it will heat the  
51 atmosphere therefore helping global warming. The release of greenhouse gasses. If we have an  
52 earth that is warming this means that the plants and animals aren't use to that certain  
53 environment which means some plants won't be able to survive and some animals won't be able  
54 to adapt which is a negative thing. If more sun is giving into the ocean this effects the  
55 oxygenation process which means plant will only get so much oxygen because the sea water  
56 would be much hotter. If the atmosphere gets warmer we get more droughts and there will be  
57 more desertification going on because there is not much rain and there is hotter temperatures and

58 coastal areas will have more rain because there will be more evaporation taking place and that  
59 will result in floods.

60 It seems like you have covered the topic and you have an understanding of the impact of you as a  
61 human can have on hot environment, the natural impact. What I am sending you home with is  
62 going to be a case study that will be based on the impact of climate change End the change in  
63 Africa. On page 5 of your book there is a case study about experts say that climate change is  
64 fuelling Kenya in 2008 I want you to read the case study and answer the questions on what they  
65 say.

66 Why is malaria going to be problem if the temperature changes? Because it is a disease that kills  
67 lots of people in Africa and if we have a malaria outbreak it can be devastation to the population  
68 of Africa. Within South Africa where do you think there will be regions of malaria? Where  
69 specifically in South Africa? Durban, Kruger national park, Limpopo. But specifically Durban  
70 because of the humidity. What causes the temperature to be very humid in Durban, the warm sea  
71 current flows past Durban.

2 Today we are going to look at the human impact and what it has on the environment. The  
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28 have produce. So maybe South Africa we should think about doing this.

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54 to adapt which is a negative thing. If more sun is giving into the ocean this effects the  
55 oxygenation process which means plant will only get so much oxygen because the sea water  
56 would be much hotter. If the atmosphere gets warmer we get more droughts and there will be  
57 more desertification going on because there is not much rain and there is hotter temperatures and  
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69 specifically in South Africa? Durban, Kruger national park, Limpopo. But specifically Durban  
70 because of the humidity. What causes the temperature to be very humid in Durban, the warm sea  
71 current flows past Durban.

2 Humans VS the environment and the survival of the environment.

3 We want people to be actively involved in this lesson. Let's think of the impact, the human  
4 impact on our environment. There have been talks about how we interact on the environment and  
5 how we negatively impact on the environment. We do many many things and today I want to  
6 talk about one or two of these things that we impact onto the environment negatively. About  
7 water and the source or as a resource, what can you tell me about water? What is water?

8 **Pupil:** a liquid that is important for us to survive.

9 Our bodies need water to survive. Do you think anyone can survive without water? Now if we  
10 can't do without water, we certainly need to look after water. How do we get water?

11 **Pupil:** Rain

12 How does the rain process the water? Using evaporation, condensation, precipitation, run off to  
13 the sea and rivers. Okay and so the circle starts again and through that water cycle we get out  
14 rain water. Okay no many of us do not know that fresh water is a scarcity these days we don't  
15 have a lot of fresh water due to many other things that happen. What would be one that that  
16 would make us have a scarcity of water?

17 Pupil: pollution, people throwing things into the dams

18 When we pollute our rivers our water sources it makes tem undrinkable meaning we cannot  
19 drink them because we are going to get sick from water born diseases. But besides polluting  
20 rivers by ourselves how can it also be polluted? In other words when we have floods it is mixed  
21 with fresh water, all the dirt and bursting of pipes and then we pollute the water in that way and  
22 then its undrinkable. Would you agreed with me that water is a very important source and that  
23 we have to look after water in order for our next generation to survive and or animals. Now we  
24 are going to start to engage in this particular lesson. We want to look at the availability of water  
25 now. How available is water in SA? Do all people have access to water?

26

1 **Class: No.**

2 Why would you say no?

3 **Pupil:** some rural places only have one dam which may be a far distance from where they live so  
4 that have to travel far just to get some fresh water.

5 So people some of us have got water within our houses, running water, just open the tap and  
6 water comes out. But in rural areas people have to walk long distances to get water not from a  
7 tap but from a dam or river. Drinking with the animals which are where they can get sick. SO  
8 water is not a available to us all in the same way some of us struggle to have water available at  
9 our deposable immediately so those people have to basically budget in terms of how much water  
10 they need to use within a day so because the water is so far away they have to use it sparingly,  
11 for washing dishes, washing themselves, washing clothing etc. So it is true that water is not  
12 available to everyone. Now that brings us to the following the impact that we have or what  
13 impact do you think that the following things or actions have one the availability of water? Now  
14 what I want you to do, I'm going to split the class in half. And I need you to work together in a  
15 very conducive manner where everyone contributes and I'm going to ask someone to write down  
16 what you discuss. So after the discussion we are going to debate. As for now I want you to  
17 quickly focus on the following two things that impact the availability of water as such. First  
18 group will be poorer farming practices and wastage meaning the waste of water. How do those  
19 particular actions affect water availability and a negative impact on the environment? And on  
20 this side you guys will look at droughts and floods and then you will look at the construction of  
21 dams. I am going to supply you with two posters where you are going to write these down. You  
22 will have 5 minutes to discuss this.

23 **GROUP PRESENTATIONS START**

24 Pupil: Wastage of water for that topic we have building, leaking taps, broken pipes and water  
25 pollution but the main one is leaking taps. Building, when construction workers are building they  
26 have to mix their concrete with water and sometimes they overdo it which is another of way  
27 wasting water.

1 **Mr P:** is there a way that we can perhaps measure that? She's saying that the water needs to be  
2 measured as to say this is the amount of water that will go with this many bags of concrete.

3 **Pupil:** Leaking taps that is a problem that most towns have because when you close the tap if its  
4 leaking then a lot of water is being lost, enough to fill a whole bucket but if it is not leaking you  
5 could have saved that water for something else.

6 **Mr P:** Why do people just see taps leaking and do nothing about it? A lot of water is wasted  
7 because people just leave taps open or half open or there is something wrong with the tap.

8 **Pupil:** broken pipes is to blame on the municipality because they should be looking after the  
9 water and make sure that everything is running properly. People living above ground wont be  
10 able to see if their tap is leaking or not.

11 **Mr P:** Is that entirely true?

12 **Class:** No.

13 **Mr P:** Why not? The ground will show a wet mark or patch of land if the pipes are leaking. And  
14 perhaps that is our duty to inform the municipality.

15 **Pupil:** Water Pollution, and example in a rural area they have a river where everyone goes to  
16 wash which makes the water dirty therefore they cannot drink it. Put signs up saying no washing  
17 your clothing or have only a bucket to take home to use to wash to prevent the pollution.

18 **Mr P:** why can't the government then even in the rural areas or towards getting pipes to the  
19 people's houses?

20 **Pupil:** in some places they are trying to do so but the government is very slow.

21 **Mr P:** Next group please.

22 **Pupil 2:** Morning class, constant flats means no fresh water. Tunamies can pollute our water by  
23 washing over land by carrying dirt and other substances into our land, rivers etc therefore making  
24 it not usable. Droughts effect rural areas because the people who use that water becomes fished  
25 quicker because of the hot heat and there is no rain and then no water.

1 **Mr P:** Are rural areas the only areas that are affected by droughts? No, urban areas are effected  
2 to. How does that affect urban areas? The main availability of water if it's too dry and we don't  
3 have water it affects a lot of things. What if we have a big international soccer match and we  
4 don't have water it would be a disaster.

5 **Pupil 2:** dam walls should be built higher to help reduce the loss of water because higher walls  
6 would be able to contain more water and the water won't spill over, this does depend on where the  
7 dam is built. Acid rains pollute our dams.

8 **Mr P:** How does acid rain form there?

9 **Pupil:** from pollution like from exhaust fumes from cars and it goes into the air and it stays in  
10 the clouds and then once it starts to rain, it rains from the clouds which then forms acid rain.

11 **Mr P:** when we have these gasses released into the atmosphere some of them are used as  
12 condensation nuclei which is going to take place on these small particles which is part of what the  
13 raindrop forms that is what we called acid rain.

14 **Pupil 2:** Construction of dams, well dams can be built in rural areas for fresh water so that they  
15 are not drinking from dirty rivers where animals also use. Government should provide taps and  
16 running water to rural areas that don't have dams so that they can have clean fresh water easily  
17 accessible water. During droughts there's no availability of water so we must be extra careful  
18 not to waste water.

19 **Mr P:** In times of drought there is no availability of water so we must be EXTRA careful not to  
20 waste water. So if we see a leaking tap we must make sure to close it or report it to the local  
21 authorities. Let's use these next five minutes to just obey two quick issues here. I want you to  
22 quickly debate the following two issues. Remember now, in South Africa we need people that  
23 are living in informal settlements need houses with running water and taps available. We've got  
24 hundred and thousands of shacks and informal settlements around other Africa. The availability of  
25 land is also a problem. Where can they build houses for these people. And it becomes more and  
26 more of a problem when it comes to the destruction of certain areas that we need to actually  
27 preserve for our own good. The scenario would be destruction of wetlands VS development.  
28 How important is it to preserve wetlands VS development of building of houses and new

1 developments and job creation. Let's talk about that quickly. Unfortunately this debate will have  
2 to take a bit further. I want you to think about that. The development VS preserving. The second  
3 of is the cost of water should everybody pay for water should the cost be higher or should we all  
4 have free water to drink as it is a natural resource. What about people that are poor, they cannot  
5 pay for water. So does that mean those people must just die out? We are having a problem of the  
6 scarcity of water and this is a problem. These are two things to think about.

# 1 ANNEXURE F: Extract of evidence of lesson observations notes teacher 1 and 2

Cluster 1

Lesson observations

	State / explain how its surfacing	extend of use, and effect it has made for that lesson / section	Enabling factors Resources?????other factors	Limiting factors
Enable learners to co create knowledge (deliberation)	initiating topic discussion Brief moments allowing learners to talk through issue given Discussion happening a lot.	Could be made more use of partially starts then stops. - at times didn't push it enough as could have when opportunity presented	- space - learners familiar with each other.	time lessons needed to allow debate and theory had to be fitted in learners to coming to own to participate.
Made learning be linked to social cultural and historical settings (situated learning)	Edenham examples learners seemed familiar with.	Most used (overstated) although quite relevant in all parts of lesson content & resources used.	Practical real issues learners could see.	not being able to do visit time table constraints
What is making learners experience hands on encounters as well as incorporate their prior everyday knowledge linking to environmental content in curriculum (proximity experience)	Recap of experimental lesson of the river - video showing events	limited: made mention of many activities water test pac	Resource of lab equipment. resources to river	Class size central limited materials time

## Annexure F2

TF

How is learning leading to (or showing that it is leading to) an interactive relationship between content knowledge and sustainability practices (practical reason)	Discussion making some probing to be done type of test questions Global issue, in-depth thinking	Depend depending on what part of lesson topic teacher was focusing on Detail appears as much regularly used		learner responses attitude, perceived doubtful opinion, not educator "forces" answers. Time lesson lesson time limited educator expects giving answers to as to move on.
What are existing interactions and classroom environmental set ups like?	Some interaction Start environmental more controlled.	Difficult to quite tell as more work / discussion asking a bit of probing improved: learners interested but not vividly	space - best set up room to manoeuvre	time and questions that where at times challenging, with more of experience could perhaps be integrated.

possible area of expansion for in case.

Worked well with relatively new experience.

- What support can be given to spreading educators.
- What can SES do in terms of support.

Review?



## **ANNEXURE H**

### **ANNEXURE H 1: Stimulated recall interviews teacher 1**

**STIMULATED RECALL INTERVIEW (SRI T1 )**

**LESSONS 1/2/3**

**If I look at the first lesson as well as the second lesson take for example where you are talking about the town water quality you seem to initially bring in an approach from learners that requires them to engage with one another but then at the same time you appear not to pursue it further. Why was this so. Lets look at this scene in the lesson**

T1 : OH THIS! I expect to have a relationship with the learners that would be conducive for deliberation. However one of the reasons that drew me back to making use of it more in the lessons was the level of response to this approach. Not everyone was willing to engage with each other or participate. There was as you can see little engagement. The learner participation during activities and lessons showed their lack of enthusiasm, hence I felt my choice of mediating approach that of deliberation in the lesson wasn't as making progress as I had envisaged.

**And why the many examples of local issues?**

When I teach and plan my work I do it around a topic involving environmental content knowledge relatable, learners have to learn, take in the content and have to be able to relate it to their day to day living. You will also see that even with the outdoor activity which I carried out with deforestation it was an example that is within the school context and with which learners see and know about every day. And as you see here where we are standing by this bush that's being cleared for the hockey field, they see it happening everyday and they can see it happening even when they go back into their neighborhoods. Learning in and through situations as I make it even look at me when I give this lesson and I look at the learners as all of it is making sense.

**I see in the manner you probe why do you ask questions in the manner that you do.**

1 Well im a believer in stretching their minds promoting and encouraging critical thinking hence I  
2 do that. Furthermore I make use of discussive and narrative methods as you can see in this lesson  
3 over here... yes pause to this part just listening to how we make use of this discussion indicates  
4 how I want to promote this critical thinking in learners.

5 **Do you think you have been well prepared for teaching this section of work being relatively**  
6 **knew in the filed.**

7 I don't think so. The CAPS training I missed and the follow up session I wasn't quite sure as  
8 some areas even the person who conducted the training session at times left out sections they felt  
9 they could not help the teachers to understand. So I supposed we in the same boat of relying on  
10 same information from before to navigate this new content material.

11 **But don't you think that is dangerous and detrimental to education because some conept**  
12 **such as water scarcity, climate change and sustainability were not there before and have**  
13 **now been introduced in the curriculum.**

14 Yes I understand what you are saying but I have to make do with what I can and have at that  
15 moment hence relying on my prior education years. However I am refining these and some  
16 concepts as time goes by , hoping as well that there is more workshops introduced to help those  
17 of us who joined the sector later adapt to this environmental; section as well as other sections of  
18 work in CAPS too.

**ANNEXURE H 1: Stimulated recall interviews teacher 2**

**STIMULATED RECALL INTERVIEW TEACHER 2 (T2)**

Lessons 1/2/3

**During this second lesson you do a lot of moving around from group to group why is that so?**

Well clearly there needs to be control of what learners are doing and also moving from group to group I think strengthens learning relationships between myself as the teacher and the learners.

**I also see that you liked to use the term WE instead of I in your lessons, care to explain why?**

Well clearly this lessons was an interactive lesson and one were by the environmental issues on climate were debated and deliberate by the learners with my involvement as well. We managed to resolve the issues in the lesson discussed and presentations involved us to work together so I believed that It was appropriate in promoting relations that there is mention of the term WE rather than for me to say I. its good for learning relations , more of a healthy environment in school which I know once learners feel at ease they look forward to coming to the class.

**You seem to have a certain level of excitement in your lesson where learners were discussing that's the second lesson and I observed your interaction with them and thinking through the examples your were giving to them. What is your motivation behind this enthusiasm**

My dear, in this multicultural set up in the school group work is the teaching method that needed learners to learn to work with each other and to learn from each other. The use of discussions and debates are ways of ensuring that all parties build a learning network between each other. Making use of deliberation method also promoted the understanding of characters of each learner which helped in how in the process of mediation through deliberation.

**Why do you also in this lesson keep probing? You keep asking questions to the learners even where I thought listening to your lesson that the answer was given, but I saw how you keep digging deeper into their answer. Is it effective? Actually why do that.**

The learners if not probed further will be passive they won't bother to stretch their minds, way of thinking or even think outside the box. So all I do is encourage them to exert their thinking otherwise believe you me they won't want to think further. Another thing also is that as they are constantly being asked each response they give enables them to reflect on what it is they are saying and you saw me do that a lot in the first and second lessons. The debate enabled them to think through critically each groups findings and the questions they were raising were relevant if you look at the first lesson especially they were being socially critical of the many environmental; issues presented.

**On the whole where you happy with the way your lessons happened?**

Yes im actually enjoying this and you can see how im enthusiastic about these lessons and believe you me that's how I teach each day its not even window dressing nah not at all! My only concern however as you heard me point out in our earlier interview was that the subject advisor who took us of CAPS training had very minimal knowledge of the new content on environment that is in there. ESD was a foreign term it seemed although climate change issues one of them seemed to be knowledgeable. They must do more training themselves just like the teachers they will stand with.

## **ANNEXURE I (A)**

### **ANALYTICAL MEMO 1**

**Exploring teachers content knowledge and pedagogical knowledge with respect to environmental content in Grade 11 Life Sciences**

#### **Teacher 1**

<b>T1</b>		<b>Comment</b>	<b>Source</b>
<b>Content Knowledge</b>	<b>Training and experience</b>	Not trained in ESD  CAPS training not received  6 months teaching experience	Section 4.5
	<b>Content in different subjects</b>	Teacher does not subject integrate between Natural Science and Life Sciences but does not.	Section 4.2.2
	<b>Relevant topics</b>	The whole module on human impact on the environment.	SSI T1// 39-40
<b>Pedagogical Content Knowledge</b>	<b>Specific aim 1</b> (knowing the subject content )	T1 uses narrative and discussion type mediation approach	SSI T1// 67-68 SSI T1// 175
	<b>Specific aim 2</b> (Doing science-planning and carrying out investigations that require some practical ability)	Recognition of hands on activities	SSI T1// 184
	<b>Specific aim 3</b> (knowledge acquired should show that relevance and also clarify the relationship between the subject and society)	T1 gives learners experiences within their context so as to enable them to make relevance of ECK outside the classroom to their daily lives  T1 uses examples locally and culturally relevant in mediating ECK	SSI T2 // 99-107  SSI T2// 43  SSI T2// 110-112 Lo1

1 Annexure I (2) : Teacher 2 Analytical memo 2:

<b>T2</b>		<b>Comment</b>	<b>Source</b>
<b>Content Knowledge</b>	<b>Training and experience</b>	Eighteen years and two months teaching experience  Teacher training familiarized T2 with concepts  CAPS training undergone but not all training days were attended	SSI T2// 6  SSI T2// 20-22
	<b>Content in different subjects</b>	Integration of Geography and Life Sciences	SSI T2//12-13
	<b>Relevant topics</b>	Water resource availability, climatology, alien species - quite a varied amount, as well as a focus on the human impact on the environment	SSI 1 T2// 53
<b>Pedagogical Content Knowledge</b>	<b>Specific aim 1</b> (Knowing the subject content )	T2 uses group and report methods for discussion and brainstorming  Type of assessment activities used - all the time learners learn best through assessment activities central to encouraging them to think outside the box	SSI T2// 71  SSI T2// 179-180
	<b>Specific aim 2</b> (Doing science- planning and carrying out investigations that require some practical ability)	Likes to make use of hands on activities and experiences which promote practical and scientific skills	SSI T2// 191-192
	<b>Specific aim 3</b> (knowledge acquired should show that relevance and also clarify the relationship between the subject and society)	T2 made use of examples learners encounter in their local context	SSI T2// 80-81 SSI T2// 162-168 LS1 T2// 5-7 LS1 T2// 15-17

## ANNEXURE J

### 1 ANNEXURE J: Analytical memorandum 4 Practices teacher 1

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Doings	Sayings	Relatings
Now we will be looking at the water vapour availability(although limited) LS 1 T1 // 7	I like to use the narrative and discussion type of teaching methods SSI T1 // 52 SSI T1 // 57 – 59	I do though take caution in that I have to guide them during their discussions so as to not make them lose track of what's to be discussed. SSI T1 // 61
Looking at that Port Alfred has high levels of salt in the water. LS1 T1 // 10	With discussion type approach I also find that <u>through verbal interaction and engagement</u> , it can allow me to see if they understand what I have taught to the part of the content they will be looking at SSI T1 //59– 61	I think they have responded very well judging from the way they participate during lessons and activities. They show enthusiasm and there is engagement and debate over some of the ideas that they bring about when they ask or answer questions SSI T1 // 101 – 103
The resources of South Africa are actually of short supply. And if the economy grows as they expect and the population grows as they expect the demand for water will not be sustainable. LS1 T1 //32-34	In addition I feel discussion type approach <u>enables various ideas to be brought out in the open which can build to one body of knowledge for a topic</u> . So in a way they can learn amongst and from each other.	I do like the various issues where applicable in our town. This I see has also <u>made the interaction better and they seemed to enjoy it</u> . LS1 T1 112-113
And in this case most of the water is actually polluted by humans by industrial influence, domestic and commercial usage by mine drainage and so that is quite bad and we should look into how to fix that LS1 T1 // 39-41	And through discussion they have had the opportunity to each bring their ideas to the topic. This I think gave them plenty of opportunity to relate to the topic.	Yes I tried to relate this topic to our direct environment as we went through the environmental studies section. Also as we did topics not directly linked to this section I always tried to educate them about the effects that we as humans have on the environment LS1 T1 //145-148
No one knows exactly what the effect of the	some issues are relevant in our society as they are	Many realized how food being eaten by some animals had been

<p>climate change will have of the water availability but the expectations is that the rain fall will start to vary <u>so the parts of land in South Africa that are dry will become dryer and the parts that are wet will become</u> wetter but there are certain parts that are dry and can become wet. Certain parts where they say will become wetter is the <u>eastern parts of SA especially the KwaZulu-Natal which</u> is already wet there and it may cause a flood LS1 T1 // 60-64</p> <p>There are certain parts that will be dryer like the Interior and Western parts of the country like the Western Cape produces a large quantity of apples which we export which supports the economy but needs water to grow. LS1 T1 //69-72</p> <p>They say that by 2070 the water supply to the Western Cape will decrease by 60% not only do they grow apples they do all sorts of fruits, grapes for wine, which is also a big export LS1 T1 // 72-75</p>	<p>directly affected so as a result when you teach the topic you make reference to some of these local issues. You will see that in my lessons I do like the various issues where applicable in our town LS1 T1 // 110-112</p> <p>as well as inclusion of locally relevant environmental issues , these learners have taken what's expected in the syllabus and linked it to their everyday lives LS1 T1 // 116-118</p> <p>This town has had water issues being talked about a lot so it would only be good to bring learners to that reality that this happens in their context and perhaps they can then learn from this LS1 T1 // 138-140</p> <p>I did gather information of our environment to include in the lessons. This means the topic more "real" e.g the <u>water quality issue in port Alfred</u> LS1 T1 //165</p> <p>Here I used a lot of examples a lot from what happens in our direct environment where learners live such as garbage and water pollution. Even the issue of abalone</p>	<p>lost. <u>For me making such a connection was vital as it showed that the learners within their environment were able to make links to people's practices and the effect on the environment.</u> LS1 T1 151-154</p> <p>Whenever I use internet based materials I find it easier for the learners to relate also to answer their questions. I get <u>a feeling that its learning together in way as we both watch the material</u> and learn LS T1 //94</p> <p>This town has had water issues being talked about a lot so it would only be good to bring learners to that reality that this happens in their context and perhaps they can then learn from this LS T1 // 138-140</p> <p>For me making such a connection was vital as it showed that the learners within their environment were able to make links to people's practices and the effect on the environment LS T1 // 152-154</p> <p>Narrative because it gives knowledge from me and enables me to see how they feel as they learn from me. Although I am careful not to overuse it as they can become bored hence why I introduce the discussion type of teaching and learning SSI T1 // 53-55</p>
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<p>We have about 500 government built dams in South Africa and it holds about half of the annual rainfall LS1 T1 //119-120</p> <p>we went to a recently cleared area of the school and looked at all the possible effects the cutting down of trees may have had to the process of photosynthesis and the environment as well LS T1 //149-151</p> <p>Well not quite like I said not now <u>but previously went to the river to do an activity on algae and water quality</u></p> <p>Most times we pause the video and discuss what will be transpiring. It's a form of active learning I guess a move away from the old all teacher does all the work SSI T1 //95//96</p> <p>I initiated quite a few discussions (<i>to promote critical thinking such as through type of questions I asked</i>) SSI T1 // 175 I tried to include examples of things that the learners and their parents do that</p>	<p>poaching and alien plants around their homes LS1 T1 //167-169</p> <p>Like I said I try and find extra information on the internet about the topic and that has helped me a lot especially with <u>teaching using videos to help them understand</u> LS T1 // 90-93</p> <p>Whenever I use internet based materials I find it easier for the learners to relate also to answer their questions. I get a feeling that its learning together in way as we both watch the material and learn LS T1 // 92-95</p> <p>yes I do I plan of doing a water quality expedition on the river Kowie and this would also develop their scientific skills LS T1 // 137-138</p> <p>Do you know how ground water is kept in the soil? LS1 T1 // 19</p> <p>The resources of South Africa are actually of short supply. And if the economy grows as they expect and the</p>	<p>In addition I feel discussion type approach enables various ideas to be brought out in the open which can build to one body of knowledge for a topic. So in a way they can learn amongst and from each other. I do though take caution in that I have to guide them during their discussions so as to not make them lose track of what's to be discussed SS1 T1 // 59-63</p> <p>They show enthusiasm and there is engagement and debate over some of the ideas that they bring about when they ask or answer questions SS1 T1 // 102//103</p> <p>They have come up with some brilliant answers which show that they are engaging well with the content of the topic, something that's pleasing. SS1 T1 // 103//104</p> <p>They also mention that people especially in the informal settlements live off the fish that they catch in the river if you keep water in a reservoir there is not enough water in the stream and it will affect the fish. If there is a flood it will affect them as they may not be able to catch fish which will force them to move elsewhere where they can make a living which means they mostly need to learn a new skill so definitely effect lots of people. And you will always find</p>
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<p>directly interfere with the environment , such as cutting down trees dumping rubbish in undesignated grounds, how they dispose off waste. The reuse of water and this turned out to be quite a hot debated topic. SSI T1 // 178-181</p> <p>First question is what is an aquifer? Name two poor farming practices that affect water supply... LS2 T1 // 11-22</p>	<p>population grows as they expect the demand for water will not be sustainable LS1 T1 // 32-34</p> <p>.</p> <p>What happens when it is warmer is that the water evaporates faster than normal from the sea from dams and rivers so it makes the available water to us less and the salt in the water would become more because the concentration would become higher. So then that means less water for agriculture, animal use, industrial use and domestic use LS T1 // 56-58</p>	<p>people living next to water supply LS1 T1 // 106-110</p>
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ANNEXURE J: Analytical memorandum 2 practices teacher 2

ANNEXURE J

<u>DOINGS</u>	<u>SAYINGS</u>	<u>RELATINGS</u>
Since we are talking about chopping down forests LS1 T2// 4	I use ...group and report methods as well as visual aids to enhance teaching SSI 2// 64	Student dialogue (group discussion) LS2 T2
We have spoken about flooding of the coastal areas when it comes to global warming LS1 T2// 15	Group and report methods promote learners to brainstorm and discuss ideas thereby learning from each other. It's active learning instead of me the teacher being the source of all information. The verbal interaction and engagement, it can allow me to see if they understand what I have taught to the part of the content they will be looking at and promote critical thinking. SSI 2	If there is anything you need to add as groups don't hesitate to add.....teacher walks around from group to group interacting with the learners' during this time LS2 T2
Now we are going to have a group discussion amongst ourselves, I will give you 5minutes. LS1 T2// 30		Group presentations
.... so I'm going to ask someone to write down, then someone that is going to control the discussion and be the MC of the group. And then I need the last person who will present and discuss the findings on how humans impact on the environment. LS2 T2// 29-37	I do though take caution in that I have to guide them during their discussions so as to not make them lose track of what's to be discussed SSI T2// 166	Now that we have spoken We spoke about LS 2 T2
Student dialogue (group discussion) LS2 T2// 40-49	this makes sense when the issues on environment are being discussed and taught SSI T2	I do though take caution in that I have to guide them during their discussions so as to not make them lose track of what's to be discussed. SSI 2// 76/77
Group presentations LS2 T1 // 50-61		

<p>Now we've spoken in previous lessons about human impact on the environment and there are specific lessons that were have touch and this is doing to be familiar to you LS2</p> <p>But when we talk about climate change we talk about the impact that humans have on the environment and leads to climate change LS2</p> <p><u><b>we spoke</b></u> specifically about the release of these gasses into the atmosphere and the Ultra Violet rays from the sun into the earth and the warming up of the atmosphere LS2</p> <p>. One of them is carbon dioxide emissions and <u><b>we spoke</b></u> about factories releasing dangerous gasses into the atmosphere and then there is the carbon footprint LS2</p> <p>Would you agree with me that water is a very important source and that we have to look after water in order for our next generation to survive and or animals. Now we are going to start to engage in</p>	<p>The ideas in general serve the same function making learners to be aware of their surroundings. (<i>THE RELEVANCE OF CAPS TRAINING</i>) SSI T2// 48//49</p> <p>e had the red tide as an environmental issues at the beginning of the year and that time the topic was on phylum s fungi and all and we went to visit the beach but it also made sense now when we spoke of water pollution and water quality that some of the effect s of that red tide could be linked by the learners to this section. so its that ability to give kids the closeness to experiences <u><b>especially within their context</b></u> that enables then to have a feel and make sense of this environmental content SSI T2// 101-107</p> <p>I allow for reading of the content first , then clarity of difficult terminology and will then</p>	<p>I think they have responded very well to my surprise! Most of lesson was interesting and could clearly see that as the lessons developed that they developed a new look at environmental content SSI T2// 114-116</p> <p>Most of my students know how I get carried away when im busy teaching any topic therefore I would say that they rather chose to join me on this journey sharing and <b>discussing</b> ideas. This helped me also not to wonder off the topic. SSI T2// 121-123</p> <p><b>Learner involvement through group work :</b> I facilitate group learning myself whilst encouraging group ethics and dynamics SSI T2//175-176</p> <p>I try and make these issues as relevant as possible especially to those learners of mine who come from disadvantaged backgrounds by means of my own heritage</p>
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<p>this particular lesson. We want to look at the availability of water now. How available is water in SA? Do all people have access to water? <b><u>Class: No.</u></b> Why would you say no? LS3 T2/</p> <p>because normally you would teach and they just sit and don't participate much or ask that many questions SSI T2// 117-118</p> <p>And I'm going to ask someone to write down what you discuss. So after the discussion we are going to debate LS3 T2// 40//41</p> <p>So in areas where we have less rainfall such as say ... Bathurst or Limpopo, and why would we have less rainfall in some areas? What causes it where usually we have more rain, what causes it? LS1 T2// 5-7</p> <p>Another one would be that would be linked to that is droughts and floods; we've spoken about <b><u>flooding of the coastal areas</u></b> when it comes to global</p>	<p>help implement it by making reference to our local examples SSI T2//162//163</p> <p>I use examples that they encounter in their homes or communities every day such that this makes sense when the issues on environment are being discussed and taught SSI T2// 165-166</p> <p>With case study approaches I feel they allow for issues to be context based, make relevance to learners as they can see what is happening elsewhere can be linked to them. SSI T2// 66</p> <p>Why do people just see taps leaking and do nothing about it? A lot of water is wasted because people just leave taps open or half open or there is something wrong with the tap LS3 T2//57//58</p>	<p>SSI T2// 166-168</p> <p>I encourage self awareness of surrounding as self image. You are what your surrounding is like hence what you do in the community around your house reflects on you especially where environmental issues are concerned. If you have an illegal dump outside your house its calling for all sorts of diseases and I make such links possible to learners. SSI T2// 185-188</p> <p>Are rural areas the only areas that are affected by droughts? No, urban areas are effected to. How does that affect urban areas? The main availability of water if it's too dry and we don't have water it affects a lot of things. What if we have a</p>
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<p>warming or melting of the ice caps and we have the raising of the sea level but also what about areas that receive more rainfall that usually LS1 T2//15-17</p> <p>What I am sending you home with is going to be a case study that will be based on the impact of climate change End the change in Africa. On page 5 of your book there is a case study about experts say that climate change is fuelling Kenya in 2008 I want you to read the case study and answer the questions on what they say LS3 T2</p> <p>Why is malaria going to be problem if the temperature changes? Because it is a disease that kills lots of people in Africa and if we have a malaria outbreak it can be devastation to the population of Africa. Within south Africa where do you think there will be regions of malaria? Where specifically in South Africa? Durban, Kruger national park, Limpopo. But specifically Durban because of the humidity. What causes the temperature to be very humid in</p>	<p>we went to visit the beach but it also made <u>sense</u> now when we spoke of water pollution and water quality that some of the effect s of that red tide could be linked by the learners to this section. so its that ability to <u>give kids the closeness to experiences especially within their context that enables then to have a feel and make sense of this environmental content..</u> SSI T2//103-104</p> <p>The verbal interaction and engagement, it can allow me to see if they understand what I have taught to the part of the content <u>they will be looking at and promote critical thinking</u> SSI T2// 74//75</p> <p>they just sit and dont participate much or ask that many questions but the level and sort of questions asked this time around showed engagement with content SSI T2// 116-117</p> <p>What would be one that that would make us have a scarcity of water? LS3 T2// 15//16</p> <p>Let's talk about that quickly. Unfortunately this debate will have to take a bit further. I <b><u>want you to think about that.</u></b> The</p>	<p>big international soccer match and we don't have water it would be a disaster. LS3 T2//77-80</p> <p>Remember now, in South Africa we need people that are living in informal settlements need houses with running water and taps available. We've got hundred and thousands of shacks and informal settles around other Africa. The availability of land is also a problem. Where can they build houses for these people. And it becomes more and more of a problem when it comes to the destruction of certain areas that we need to actually preserve for our own good. The scenario would be destruction of wetlands VS development. How import is it to preserve wetlands VS development of building of houses and new developments and job creation. LS3 T2// 98-109 (also applied to practical reason relatings)</p> <p>However I improvise and make the lesson enjoyable SSI T2//84//85</p>
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<p>Durban, the warm sea current flows past Durban. LS1 T2// 63-67</p> <p>So we will touch on these things that you may already know. In the beginning of the year we are doing for example the atmosphere and all the processes within the atmosphere that makes the atmosphere the impacts on us living within the atmosphere on the planet earth. <u>The content that we want to look at today is for example, causes and consequences of things that would relate to the conditions and the circumstances within South Africa LS2 T2// 6-11</u></p> <p>The next thing is deforestation which is the cutting down of forest for the use of the wood and you have seen this on the way to grahams town for new residential area and by farm land in Bathurst LS2 T2//30//31</p> <p>I have made reference to it to the quarry earmarked to go up but I can see both I and them are not well knowledgeable on the subject SSI T2// 130//131</p>	<p>development VS preserving LS3 T2// 105-106</p>	<p>I encourage self awareness of surrounding as self image. You are what your surrounding is like hence what you do in the community around your house reflects on you</p> <p>SSI T2//185//186</p> <p>Only one which was on water testing and it's not enough to cover all skills and issues as well.</p> <p>SSI T2// 191//192</p> <p>It seems like you have covered the topic and you have an understanding of the impact of you as a human can have on ht environment, the natural impact LS2 T2//</p> <p>Also by verbal engagement I can assess the level of knowledge from how they respond and engage with questions on the environment with which I will ask SSI T2// 171-173</p> <p>I believe learners learn best through assessment of activities that are central to encouraging them to think outside the</p>
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<p>We want to look at the availability of water now. How available is water in SA? Do all people have access to water? LS3 T2//24//25</p> <p>I'm going to take out 3 other these particular things that impact the environment so I'm going to ask someone to write down, then someone that is going to control the discussion and be the MC of the group LS1 T2// 32</p> <p>We can recycle like what we do with those bins at pick n pay centre LS2 T2// 33//34</p> <p>The environment in terms of chopping down trees are deforestation you've mentioned green house effect there is another impact which is desertification, what is it? What does it mean? Since we talking about chopping down forests now does it link with desertification? LS1 T2// 3-5</p> <p>So in areas where we have less rainfall such as say ... Bathurst or Limpopo, and why would we have less rainfall in some areas? What causes it where usually we have more rain, what causes</p>		<p>box and push their limits. Their activities which I give out require them to explore their knowledge taught and what they may know before or research. SSI T2//179-182</p> <p>We are having a problem of the scarcity of water and this is a problem. These are two things to think about. LS3 T2// 109//110</p>
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<p>it? Climate change, meaning what? LS1 T2//5-7</p> <p>So that's a problem so if we now have hotter temperatures we will have less rainfall ? Therefore these places will be subjected to desertification. Roots won't find water and then the plants die and it will become dead LS1 T2//10</p> <p>What about chopping down the trees? How long does it take a tree to grow and plant another? Those TREES that have now been chopped down are now also exposed to desertification unless they receive more rain LS1 T2// 12-14</p> <p>..... That means that you are going to have a lot of water in the area that does not receive that much water so you will have climate change and that will have flooding in those areas. <u>What is the result of that?</u> More rain than usual, there would be no pollution which means we will have dry soil moved by these running forceful water LS1 T2// 18-21</p> <p>And then there is another one that contributes quite a lot to global warming and that is methane emissions, what is meant by that? LS1 T2// 22-23</p>		
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<p>In America they are trying to cut down on meat because the more cows and ox you going to keep the more reproductions and the more you are going to damage the atmosphere in terms of methane being released. They want to make it law for a no meat Thursday and if all people don't eat meat on a Thursday that means we are going to cut down on the amount we have produce LS1 T2//25-29</p> <p>The factories release heat which gets trapped within the ozone layer. What is this referred to? The green house effect which means that the heated gasses are getting trapped which causes climate change in terms of melting of the ice caps. This causes the sea level to rise and why can't they rise, why is it bad? LS1 T2//22-25</p> <p>Do you think we can do without wood? Is it necessary of use to chop down trees for wood? We can recycle like those bins outside pick and pay centre. The rate in which we are chopping down trees makes us concerned about deforestation. LS1 T2// 31-33</p>		
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**ANNEXURE K: Analytical memorandum 3**
**practice architectures teacher 1**
**PRACTICE ARCHITECTURES teacher 1**
**ANNEXURE K**

	ENABLING FACTORS		CONSTRAINING FACTORS	
DOINGS	<p>My own prior experiences in school of the topic do help in teaching the topic area.</p> <p>Language (dual medium)</p> <p>Like I said I try and find extra information on the internet about the topic and that has helped me a lot especially with teaching using videos to help them understand. Whenever I use internet based materials I find it easier for the learners to relate also to answer their questions.</p>	<p>SS1 T1 // 13 // 14</p> <p>SS1 T1 // 20 - 23</p> <p>SS1 T1 // 90-92</p>	<p>No none at all , that's because it was through correspondence and has general topics</p> <p>Language</p> <p>I would have loved some help with the section on evasive plans and explaining the best ways to destroy them that's eco friendly of cause perhaps touching on natural predators</p> <p>So perhaps if the CAPS document was not too stringent it would help. A teacher who wont look outside the confinements of the CAPS guideline will</p>	<p>SS1 T1 // 18</p> <p>SS1 T1 // 20 -23</p> <p>SS1 T1 // 124 // 125</p> <p>SS1 T1 // 131- 134</p>

			<p>surely limit their learners attainment I think</p> <p>Lack of sufficient subject advisors and curriculum planners who make sensible or more concrete follow-ups or support.</p> <p>Well I make use of minimum group work as I find it difficult to control the class or judge just how much of the actual learning is happening as I'm not with all the groups at the same time <i>(use of group work)</i></p>	<p>SSI T2// 135 – 137</p> <p>SS1 T1 // 173</p>
SAYINGS	Biomedical Technology pending PGCE through UNISA but this gives ,some relevant knowledge of the topic on environmental content knowledge and	SS1 T1 // 12 // 13	Although I am enjoying teaching the subject topic very much, I do not have that very broad knowledge of environmental issues. So as a result the learners ask questions about the topic or	SS1 T1 // 73 – 75

	The CAPS document directly influences the delivery of certain topics in schools. It gives strict guidelines at the topics to be discussed.	SS1 T1 // 129 // 130	argue certain points and then I am unsure about the answer.	
RELATIN GS	<p>Yes I do like the topics because they are a part of our daily lives. Through teaching others about the environmental issues we can have a cleaner and safer environment. I am actually honoured to be part of teaching learners how preserve and protect our environment.</p> <p>I am in as much as possible trying to thoroughly prepare and source information from elsewhere</p> <p>Yes despite my not being CAPS trained and all I am slightly comfortable teaching this topic</p>	<p>SS1 T1 // 43-45</p> <p>SS1 T1 // 77-78</p> <p>SS1 T1 // 88 // 89</p>	<p>I have only been teaching for about one and half months , I am still new to the game of teaching</p> <p>Lack of CAPS training</p>	<p>SS1 T1 //6</p> <p>SS1 T1 // 29 – 35</p>

	The teacher also influences any extra topics to be looked at depending on their passion for the topic.	SS1 T1 // 130 //131		
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# ANNEXURE L: Analytical memorandum 4

# practice architectures teacher 2

## PRACTICE ARCHITECTURES

## ANNEXURE L

### TEACHER 2 :

	ENABLING FACTOR		CONSTRAINING FACTOR	
<b>DOINGS</b>	<p>I have been teaching for 18 years and 2 months to be exact(<i>experience</i>)</p> <p>Think more Geography 1. It has some relevant knowledge of the topic on environmental content which do help in teaching the topic area. One sees that there is an overlap in the ideas of the environmental content in Life Sciences and Geography which I find is exciting works to geography teachers' advantage mainly as they can complement their life sciences teachers. (<i>QUALIFICATIONS</i>)</p>	<p>SSI T2// 6</p> <p>SSI T2// 12 -16</p>	<p>Lack of CAPS training</p> <p>There is also the issue of availability of resources, with not much extra teaching materials, transport to take learners for field trips and teachers or textbook that sort of thing, then it becomes difficult to fully and enjoyably make the learners excited about such topics.</p> <p>The CAPS document directly influences the delivery as it gives work coverage meaning most teachers won't think outside the box. So the CAPS document is too stringent.</p> <p>There is also not enough teacher training and seminars on environmental content.</p>	<p>SSSI T2//</p> <p>SSI T2// 81-85</p> <p>SSI T2// 138 – 142</p>

			<p>I also think there are few too or none excursions or fieldtrips which would otherwise bring a real feel to the learners and enable them to carry out observations and experiments in the environment its part of their skills development as well which the syllabus requires them to attain but is currently being limited</p>	<p>SSI T2// 143</p> <p>SSI T2// 154 – 157</p>
SAYINGS	Language	SSI T2// 26– 28	<p>Language</p> <p>A subject has to incorporate other relevant skills so comprehension and ability to read through the case studies are essential.</p> <p>Lack of knowing the content knowledge that is needed to teach this topic. One has to have a full understanding or at least familiarization with the environmental content otherwise you will not fully be able to implement it.</p> <p>Move around these schools some of them and you will see teachers struggle to comprehend this units content or plan</p>	<p>SSI T2// 26 – 28</p> <p>SSI T2// 68 //69</p> <p>SSI T2// 88- 90</p>



			activities other than those in the textbook they will be using.	SSI T2// 92 – 94
			Limited knowledge in some content areas	SSI T2// 127 – 131 // 136 //137
RELATIN GS	<p>Liking the topics Yes because it teaches us all both teachers learners and parents about preserving our environment and natural resources. It also teaches us about our attitude towards our own environment on which we depend so much. The topics are very much a part of our daily lives. <u>I am actually always excited to be part of teaching</u> learners how preserve and protect our environment.</p> <p>Yes, because I enjoy learning together with the learners, especially on such challenging topics(<i>ENJOYING TEACHING THE TOPIC</i>)</p>	<p>SSI T2// 56 – 60</p> <p>SSI T2// 110</p>	<p>Learner history their background which in most cases especially in multicultural set ups we tend to ignore but has an influence of attainment.</p> <p>Then there is the issue of arrogant heads who only focus on management and not staff development of meeting some of the staff requirements</p>	<p>SSI T2// 80 //81</p> <p>SSI T2// 144 – 147</p>

## **ANNEXURE M: Application to carry out research in two schools**

### **SCHOOL ACCESS APPLICATION**

Port Alfred

6170

[chitsigac@gmail.com](mailto:chitsigac@gmail.com)

7 April 2014

The Headmaster  
School X  
PORT ALFRED  
6170

Dear Sir

#### **RE: REQUEST FOR PERMISSION TO CONDUCT SMALL SCALE SURVEY**

As part of my MEd (Hons) course at Rhodes University, I will be carrying out my coursework this year. My interest in the research is in observing how mediation of the Grade 11 CAPS Life Sciences is happening in our classrooms. In order to conduct this research, I should, therefore would like to use your schools Grade 11 Life Sciences classes for my research.

Conducting the research will require interview with the teacher and an observation of three lessons where the environmental content in the curriculum is being taught.

Please note that this research does not in any way attempt to evaluate individual teacher or learners or the school itself. Information gathered from the learners will be presented in such a way that the school, teachers and the learners themselves shall maintained under strict anonymity. Participation is not compulsory however would be appreciated in the value of helping education. The teachers do have the right at any time to withdraw from the project.

Should you have any queries regarding either this research please feel free to contact me on the supplied contact details.

I should be pleased if you would grant permission for me to conduct this survey and await your favourable response.

Yours faithfully

Christina Chitsiga

**ANNEXURE N: Own school consent for research conduct in own school time**

PO Box 67  
Port Alfred  
6170  
[chitsigac@gmail.com](mailto:chitsigac@gmail.com)

7 April 2014

The Headmaster  
X HIGH SCHOOL  
PORT ALFRED  
6170

Dear Sir

**RE: STUDY PLANS IN YEAR 2014**

For school planning purposes for the year 2014, I would like to inform you that I will be completing the second part of my M.Ed course in 2014. The course requires my coursework part of the thesis to be conducted. My thesis will require classroom observation in the two local schools being used in my research. This may require me to attend these lessons during school time. May I be granted permission to attend to the research lessons in the other schools. I will try as much as possible to not have timetable clashes such that my own classes are affected.

Yours faithfully

Christina Chitsiga

## **ANNEXURE O: Teacher consent to take part in research teacher 1**

### **Acknowledgement of willing participant in research**

I .....**MS**..... (Initials) being made reference to as teacher ...**1**.... do hereby acknowledge my willingness to being a participant in the research being conducted by Miss C. Chitsiga for her studies. I do hereby give permission that only under exceptional circumstances may my identity be revealed, after consultation with me. I also am giving her permission to observe and record my lessons. All relevant data from this project of Miss Chitsiga I have been assured will be safe guarded and will not in any way be a judgment of my character , my work or my ability to carry out my work.

## **Annexure O2: Teacher consent to take part in research teacher 2**

### **Acknowledgement of willing participant in research**

I .....**KP**..... (Initials) being made reference to as teacher ...**2**.... do hereby acknowledge my willingness to being a participant in the research being conducted by Miss C. Chitsiga for her studies. I do hereby give permission that only under exceptional circumstances may my identity be revealed, after consultation with me. I also am giving her permission to observe and record my lessons. All relevant data from this project of Miss Chitsiga I have been assured will be safe guarded and will not in any way be a judgment of my character , my work or my ability to carry out my work.

**ANNEXURE P: PARENT CONSENT LETTER**

P.O BOX 67

PORT ALFRED

6170

12 April 2014

Dear Parents

**CONSENT FOR PARTICIPATION IN RESEARCH**

I am currently doing my Masters research at Rhodes University. The research focuses on the mediation of environmental content knowledge in Grade 11 Life Sciences at your child's school. I am kindly seeking permission to take photographs during the research. These photographs may form part of my data presentation, and as such would need your approval as the parent/ guardian allowing me to use them if need arises. There will be no publication of your child's name. If you do agree to allow your child to be a participant in this research and have photographs made use of, please sign below the tear off slip. The research will be open to you parents to view for those photographs which will or may be used.

Thanking you in advance for your assistance

Yours Sincerely

Miss C. Chitsiga