

**Review of environmental learning in field centres practicing  
outcomes based education. A KwaZulu-Natal case study.**

**by:**

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## **Preface**

This work is presented in two components. Component A is a literature review which explores the National Curriculum and contextualises environmental education in South Africa. Component B is a paper written in the format of the Southern African Journal of Environmental Education.

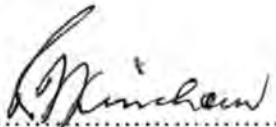
## **Declaration**

The work described in this dissertation was carried out in the Centre for Environment and Development, University of KwaZulu-Natal, Pietermaritzburg, from July 2004 to December 2004, under the supervision of Professor Rob Fincham and Dr. Jim Taylor.

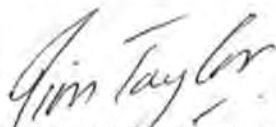
This study represents original work by the author and has not otherwise been submitted in any other form for any degree or diploma to any other University. Where use has been made of the work of others, it is duly acknowledged in the text.



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### **Abbreviations**

ANC	African National Congress
C2005	Curriculum 2005 or the National Curriculum Statement
CFC	Consultative Forum on Curriculum
DoE	Department of Education
DWAF	Department of Water Affairs and Forestry
EEASA	Environmental Education Association of Southern Africa
FET	Further Education and Training (Grades R-9)
GET	General Education and Training (Grades 10-12)
IEEP	International Environmental Education Programme
IUCN	International Union for the Conservation of Nature and Natural Resources
NCS	National Curriculum Statement
NEMA	National Environmental Management Act
OBE	Outcomes Based Education
RDP	Reconstruction and Development Plan
RNCS	Revised National Curriculum Statement
TEWG	Teachers Education Working Group
WESSA	Wildlife and Environment Society of Southern Africa
WSSD	World Summit on Sustainable Development



## Component A

### **Review of environmental learning in field centres practicing outcomes based education. A KwaZulu-Natal case study**

This component sets out the theoretical context of the study and includes the problem statement, aims and objectives, literature review and methodology for undertaking the fieldwork.

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## Section 1

Environmental concerns, in all their complexity, are reaching crisis proportions. They have, therefore, been brought to the forefront of international debate. This is largely due to global environmental deterioration as a result of human activities. Consequently, concepts such as sustainable development have been formulated and principles aimed at assisting in achieving the 'goal of sustainable development' have been devised.

Sustainable development is a concept which has had its validity hotly contested. It is a goal towards which humankind has strived towards and a means to conserve our natural resources and national heritage. Environmental education processes are considered by many to be a key response to the environmental crisis (Lotz-Sisitka 2004) and a means to achieve sustainable development.

Environmental education has changed markedly in recent years, as a better understanding of concepts and approaches is developed. Throughout the literature, the importance of environmental education, has been highlighted by many agreements and conventions, both at a national and international level.

On a national level, the importance of 'environment' and 'environmental education' have been emphasised through the development of the Revised National Curriculum Statement (RNCS) General Education and Training (GET) and the National Curriculum Statement (NCS) Further Education and Training (FET) bands. Furthermore, there has been a move over the years, to encourage excursions as an extra-curricula activity, during which learners visit environmental education centres.



Field based environmental education centres provide learners with a useful setting in which meaningful, active environmental learning can occur. It is up to learning facilitators to manage and develop these centres into entities which are able to support the goal of sustainable development.

The environment and environmental education processes have been emphasised as a means by which to encourage a more environmentally responsible and sustainable society. It is, therefore, important to develop a better understanding of which environmental education processes are appropriate, and how best they may achieve their fullest potential within the new curriculum. Most importantly, there is a need to investigate the potential that environmental education facilities have to promote an ethic of lifelong learning and environmentally responsible behaviour.

## **Background to the study**

### **1.1 Problem Statement**

The current state of environmental education and education in general is in flux. Emphasis is being placed on the environment and environmental education within the RNCS- GET and NCS- FET bands. Within the field of environmental education there has been a definite shift in orientation towards 'education for sustainability' (Lotz-Sistika 2004) from the more traditional 'education for conservation' orientation. With these thoughts in mind, one considers how aspects of the lifelong environmental learning process can be better integrated into school curricula.

There is potential within environmental education centres to facilitate the achievement of outcomes and assessment standards prescribed by the RNCS- GET and NCS- FET bands. By linking events at environmental education centres and the RNCS- GET and NCS- FET band requirements, the possibility exists to better develop learners capacity to become more environmentally literate. Thereby the

potential exists for citizens to become more environmentally active. Currently, visits to environmental education centres may be seen as isolated events. Although these events may have an impact on the learners themselves, on the whole they may not necessarily facilitate the achievement of the required curricular outcomes. It follows that the maximum potential growth of learners may not, by current methods, be sufficiently encouraged.

## **1.2 Aim and Objectives**

The aim of the study to identify the outcomes and assessment standards prescribed by the natural sciences learning area of the RNCS- GET and the subject of geography within the NCS- FET, and to investigate how nature based environmental education centres deliver against these. In order to narrow the focus, only water related studies were included.

The objectives of the research are to:

- Undertake a review of the literature in order to contextualise education and environmental education, within a climate of increasing environmental concern.
- Identify the outcomes and assessment standards prescribed by the natural sciences learning area of the RNCS- GET.
- Identify the outcomes and assessment standards prescribed by the subject of geography within the NCS- FET.
- Investigate how these outcomes and assessment standards are achieved, through the methods and materials used, at environmental education centres.
- Suggest possible areas where environmental education practitioners can improve their service delivery, in terms of outcomes based education.

## Section 2

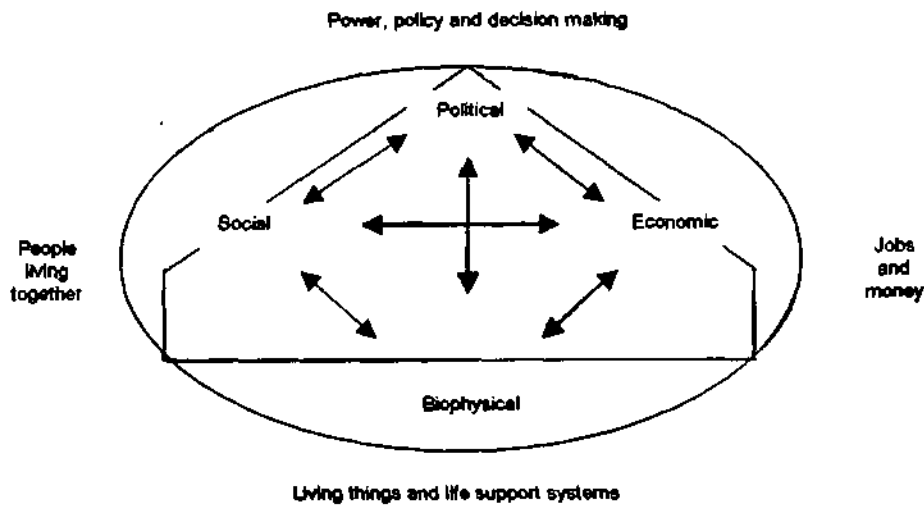
The key reasoning behind engaging in environmental education activities, is to facilitate the process by which we aim to produce more environmentally literate citizens. This in turn supports the aim of working towards achieving the goal of sustainable development.

In order to be effective through environmental education, an understanding of concepts such as 'environment' needs to be developed. In addition, because environmental education supports the goal of sustainable development, the need exists to develop an understanding of what is meant by 'sustainable development' as well. In order to interrogate the above two concepts, the current environmental situation must be documented. Within this study, the importance of water conservation is highlighted, as this is one of South Africa's most pressing environmental concerns.

### **2.1. Environment, the Environmental Crisis and Sustainable Development**

#### **2.1.1 Environment**

In years past, when one referred to the environment, the common perception was that one was referring to the natural environment (Fuggle and Rabie 1999). This concept has since been broadened out to include built environments, social environments and cultural environments. *'Environment is defined widely as the aggregate of surrounding objects, conditions and influences that affect the life and habits of man or any other organism or collection of organisms'* (O'Keefe, Uys and Bruton 1999:312). Furthermore, the components of our environment are not isolated, but interact with each other forming an integrated whole, which can be illustrated through a framework model (Figure 2.1).



**Figure 2.1**

### **The Concept of Environment (National Environmental Education Project 2001)**

Each element within this model, is dependant on another, it is therefore vital that the environment be seen as a whole, and not as individual components within the whole. What affects one component, effects the whole. The environment and how we live in it, effects all those organisms within it. Including human beings.

The Constitution of South Africa (Act 108 of 1996) makes the following statement about the environment:

***Everyone has the right***

- a. to an environment that is not harmful to their health or well-being; and***
- b. to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that***
  - i. prevent pollution and ecological degradation;***
  - ii. promote conservation; and***

- iii. *secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*

(Constitutional Assembly 1996)

In order to conserve the environment, or to ensure that everyone has access to a healthy environment, we need a greater understanding of the concept. In addition to this, we need to understand that the environment consists of different factors, which are connected and interlinked, each affecting the other.

### **2.1.2 Environmental Crisis**

When we consider the environmental crisis, we must bear in mind the definition of environment, as discussed previously. In doing so, the complexity of the issue being addressed, and the interconnectedness of the issue and related factors is apparent. People are becoming more aware of their impact on the environment and issues are reaching a point of crisis (Le Roux 2000). The consumptive life-style of people contributes to the environmental crisis (Weaver, Le Roux and Pretorius 1999, Le Roux 2000).

Through an understanding of what the environmental crisis is, and the depth to which problems run, a better understanding of how to remedy them may be achieved. Life style and attitude towards the environment are major contributing factors with regards to the environmental crisis (Weaver, Le Roux and Pretorius 1999, Le Roux 2000). It is for this reason that concepts such as sustainable development were conceived. Environmental education, and highlighting environmental issues within the curriculum is a positive response to the environmental crisis, and one which may contribute to the success of altering people's life styles and attitudes towards the environment.



### 2.1.3 Sustainable Development

The concept of sustainable development was first introduced by the World Commission on Environment and Development (Bruntland Commission), as a response to the environmental crisis. The Commission produced *Our Common Future*, in 1987 (Weaver, Le Roux and Pretorius 1999). The report makes the following statement regarding sustainable development:

*'Humanity has the ability to make development sustainable - to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs. The concept of sustainable development does imply limits - not absolute limits, but limitations imposed by the present state of technology and social organisation on environmental resources and the ability of the biosphere to absorb the effects of human activities.'*

(Bruntland Commission 1987:87)

In 1991, the document *'Caring for the Earth: A Strategy for Sustainable Development'* was produced. The document is: *'intended to re-state current thinking about conservation and development in a way that will inform and encourage those who believe that people and nature are worth caring about and that their futures are intertwined. It is also intended to persuade people at all levels that they can do something, or help cause something to be done, that will lead to better care for the Earth (IUCN/UNEP/WWF 1991:1).'*

Most strategies and ideologies around sustainable development are defined entirely around one species: *Homo sapiens*, and promote continued and even expanded economic prosperity (Meffe, Ronald Carroll and Contributors 1997). While alternative definitions are available, global conservation strategies have thus far tended to sideline them, favouring anthropocentric models. The question here is: 'can we make qualitative changes within our society without making quantitative changes (Meffe *et. al.* 1997)?' Can we 'develop' without increasing industrialisation or population size? Can anthropocentric models work, if we do not truly recognise the importance of ecosystem systems?

Sustainable development has received criticism from various environmental quarters, some calling the term a *'thundering oxymoron'* and *'a giant exercise in self deception'* (Meffe et. al. 1997: 639). Sustainability is possible, however, one must realise that it is a goal and not a clear end point. According to Meffe et. al. (1997: 641) three things need to be changed in order for us to attain this goal:

1. *'The values systems that lie at the core of the human fabric and drive our collective behaviours need to change drastically.*
2. *The growth orientated economic systems that drive human existence must be replaced by steady-state economic systems that accept natural limits to our artificial economies*
3. *Human population growth must slow, stop and eventually reverse, toward this goal, sustainable development projects must contain internal incentives to limit population growth.'*

The raising of questions of sustainability is, nonetheless, very helpful in education processes rather than seeing sustainable development as an end in itself. Sustainability is the ultimate goal towards which we are working, a goal in which the negative effects of industry and population growth are at an appropriate level. According to the State of the Environment Report - South Africa:1999 (Weaver, Le Roux and Pretorius 1999:5) *' in order to achieve sustainability, and to avoid ecological collapse, the following strategies must be implemented:*

- *Adoption of more globally focused values (i.e. environmental and social values on a global scale);*
- *Reflection of these values in political decision making, supported by improved data and understanding;*
- *Implementation of social and environmental best practices globally;*
- *Promotion of innovations in technology and approaches in technology and approaches to sustainable growth; and*

- *Application of the "Precautionary Principle" (i.e. planning for the worst case scenario in the face of inconclusive evidence of the impacts)*

South Africa has responded to environmental deterioration by developing legislation which aims at combating this, namely National Environmental Management Act (NEMA) (Act 107 of 1998). The Act, has the following sustainable development principles entrenched in it, and requires that:

- *'the disturbance of ecosystems and loss of biological diversity is avoided, or, where it cannot be altogether avoided, is minimised and remedied;*
- *the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;*
- *pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;*
- *waste is (to be) avoided, minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner;*
- *the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.'*

In conclusion, although it seems as though mankind is on a 'crash course of self-destruction', the various global initiatives are encouraging, although they may not be without shortcomings. The future is still hopeful, it is however only when people start to realise that sustainable development requires individual involvement, and that a change in ideals is necessary on all levels, will we reach a sustainable society. Key to achieving this is effective environmental education.

#### 2.1.4 Concern for Water Resources in South Africa

Freshwater has been used by humans since time immemorial. However, with improved living standards and increased technology and sophistication, humans have become more and more dependant on water, for agriculture, industry, recreation and electricity (Maitland and Morgan 1997). This is more often done at the expense of the watercourse from which the water originates. Water, in South Africa is a scarce commodity, and is a resource which requires careful and strict protection, if we are to utilise this resource in a sustainable manner. This is becoming more and more challenging with increasing population numbers, and escalating demand for water. Over the years this sad fact is becoming increasingly evident, with droughts and water shortages occurring more frequently than before (Davis and Day 1998).

Rivers are perhaps one of the single most modified habitat types as a result of mankind's activity. Over history, there has been a continuous increase in the variety of ways and intensity with which mankind has modified the physical, chemical and biological nature of running waters (Allen 1995). There has, however been some positive steps taken within South Africa, in order to conserve our water resources:

- *'Department of Water Affairs and Forestry (DWAF) bringing piped water and even sanitation to many rural and informal settlements;*
- *Water Conservation project (Working for Water), including the clearing of alien plants from catchment areas, an emphasis on water demand management, and education of the public;*
- *wetlands designated as new Ramsar sites;*
- *cities like Cape Town introduce sliding tariffs for water;*
- *DWAF, without being forced by legislation, introducing wide-ranging integrated environmental management techniques for all new developments (this has since changed with the passing of NEMA);*
- *the development of a fundamentally different water law (refers to the National Water Act, No 36 of 1998).'*

(Adapted from Davis and Day 1998)

Wetlands have been identified as vital life support systems, both at an international and national level. They are also regarded as being amongst the most threatened habitats globally (Mitsch and Gosselink 1988). Furthermore, they have been identified by the World Conservation Strategy as *'the third most important life support system on the planet'* (Cowan 1995). The 'RAMSAR Convention on Wetlands of International Importance Especially as Waterfowl Habitat', held in 1971, also highlighted the importance of wetland conservation on an international scale (Guthrie 1996).

The current status of wetlands in South Africa is dire. South Africa is a water poor country. In addition, it is estimated that, at current population trends, in combination with current water consumption rates, South Africans will run out of clean, potable water somewhere between the years 2020 and 2040 (Davies and Day 1998). Essential to avoiding this eventuality is twofold: reduce current water consumption and protect water sources. Protection of our water sources can only occur through sound management of water courses and wetlands (Davies and Day 1998). This in turn can only be realised through the improvement of environmental literacy, and developing responsible management practices.

It is currently estimated that over 50% of South Africa's wetlands have either been lost or destroyed by human development (Kotze, Breen and Quinn 1995, Weaver *et al.* 1999). Furthermore, only 0.8% of highland, and 0.6% of midland wetlands are under protection (Goodman 2004). Failure to conserve wetlands in South Africa may result in lower agricultural productivity, less pure and reliable water supplies, increased flooding downstream, and increasing threatened plant and animal resources (Cowan 1995). It is therefore imperative that we protect and where possible, rehabilitate wetlands, to protect South Africa's water resources.

U



The State of the Environment Report: South Africa :1999 (Weaver et. al. 1999) lists the following impacts of environmental change as a result of demand for water resources:

- *Reduced flow in rivers, damming of rivers, inter basin transfers.*
- *Sedimentation of estuaries, reduced flooding frequency, and reduced water quality in estuaries.*
- *Many rivers have become seasonal (e.g. Limpopo, Levuvhu, Letaba).*
- *Flood plains have become less productive (e.g. Pongola)*
- *Extensive surface and ground water pollution.*
- *Loss of aquatic biodiversity (24 plant species, 25 fish species, 6 amphibian species, 2 reptile species, 24 bird species and 2 mammal species are now endangered)*

With a growing understanding of rivers and wetlands and the effects humans have on these systems, concern for the sustainability of catchment management is growing. Most positive in the move towards sustainable management of South African water resources, is the passing of NEMA. It is imperative that society recognises the importance of river systems and attempt to conserve what little water remains. One way in which this may be achieved is through the development of environmental awareness and environmental literacy.

## **2.2. The National Curriculum**

Environment and environmental education have been highlighted within the new National Curriculum, as mentioned previously. By developing a better understanding of the RNCS- GET, and NSC- FET and how concepts like environment and environmental education may be integrated into it, greater potential exists for the development of environmentally literate citizens.

### **2.2.1 A Background to the Development of the NCS and RNCS**

Under the Apartheid system of governance, education in South Africa was divided and unequal. Formerly, there were nineteen educational departments, divided by race, geography and ideology (Department of Education 2002). The way in which material was covered, and the material presented by this former educational system primed learners to fulfil specific, predetermined functions in wider society, which they were expected to occupy (African National Congress 1994; DoE 2002).

The Constitution of South Africa (Act 108 of 1996) makes the following statement regarding education:

*(1) Everyone has the right*

- a. to a basic education, including adult basic education; and*
- b. to further education, which the state, through reasonable measures, must make progressively available and accessible.*

*(2) Everyone has the right to receive education in the official language or languages of their choice in public educational institutions where that education is reasonably practicable. In order to ensure the effective access to, and implementation of, this right, the state must consider all reasonable educational alternatives, including single medium institutions, taking into account*

- a. equity;*
- b. practicability; and*
- c. the need to redress the results of past racially discriminatory laws and practices.*

*(3) Everyone has the right to establish and maintain, at their own expense, independent educational institutions that*

- a. *do not discriminate on the basis of race;*
- b. *are registered with the state; and*
- c. *maintain standards that are not inferior to standards at comparable public educational institutions.*

(Constitutional Assembly 1996)

Following the 1994 elections in South Africa, curriculum restructuring was put in motion. The aim of this was to develop a curriculum, which was centralised to a national level, in which a single National Education Department would govern education and the formulation of syllabi. The curriculum was also aimed at reflecting the principles of the constitution. This process was done, for the first time in South Africa, in a participatory and representative manner (DoE 2002).

Three sets of legislation informed the development of the *Lifelong Learning through a National Curriculum Framework* document (1996), which was the first prominent curriculum statement of the 'New' South Africa (DoE 2002). These three sets of legislation included the White Paper on Education and Training (1995), the South African Qualifications Act (No 58 of 1995) and the National Education Policy Act (No 27 of 1996).

The White Paper on Education and Training (1995) set to convert the original aims-and-objectives, teacher centred approach to an outcomes-based, learner centred education approach (DoE 2002). This new approach to education allows for enhanced personal development of learners.

The Statement of the National Curriculum for grades R-9 or C2005 was published in 1997, in terms of Government Notice 1445. The vision of this curriculum statement was to produce 'a *prosperous, truly united, democratic and internationally competitive*

*country with literate, creative and critical citizens leading productive, self fulfilled lives in a country free of violence, discrimination and prejudice' (Bengu 1997:2). Later, in 1998, C2005 was implemented in schools. Following its implementation, C2005 was reviewed by the Ministerial Review Committee in terms of the 'structure and design of the curriculum, teacher orientation, training and development, learning support materials, provincial support to teachers in schools and implementation time frames' (DoE 2002).*

The Committee found that C2005 was too bulky and confusing. The committee therefore recommended that the curriculum required amendment, in order to make it more understandable and user-friendly, through the production of the RNCS (DoE 2002). The Council of Education Ministers accepted these recommendations in June 2000, and in July 2000, the Cabinet resolved that:

*'The development of a National Curriculum Statement must deal in clear and simple language with what the curriculum requirements are at various levels and phases, must begin immediately. Such a Statement must also address the concerns around curriculum overload and must give a clear description of the kind of learner in terms of knowledge, skills, values and attitudes- that is expected at the end of the General Education and Training Band.'*

(DoE 2002)

The Draft RNCS – general education and training (GET) grades R-9 was subsequently produced and released for public comment on 30 July 2001, and revised following public comment over 2001/2002. The RNCS should be seen as a *'streamlining and strengthening of Curriculum 2005'* (DoE 2002), which aims to maintain the principles of C2005, and further dedicates itself to OBE. The National Curriculum for the further education and training (FET) band (grades 10-12) was published in 2003. This is the band of education which links the formative GET with the tertiary or higher education and training band (Department of Education 2003a).

The Draft RNCS was met with dispute from various organisations. Most notably from Christian groups, namely the Pestalozzi Trust (a Christian organisation for home schooling), the Frontline Fellowship (a Christian organisation for evangelising Africa), the African Christian Democratic Party as well as the New National Party. The claim from these groups, was that the new curriculum disregarded their rights to freedom of religion (Chidester, 2004:94). Most of the debate centred around the fact that evolution was to be taught in schools. In addition, there was concern that 'secular humanism' principles informed the development of the curriculum. Furthermore, were the issues of the learners being taught an 'interfaith religion', sexuality, and the introduction of 'pagan beliefs' and cultural practises, as well as Africanist values (Chisholm 2003).

Implementation of the RNCS grades R-9 began in 2004, in the Foundation Phase (grades R-3). All other phases are to continue with the implementation of C2005, with an eye on the RNCS. Implementation of the RNCS will be phased into the other education phases in subsequent years (Table 2.1).

**Table 2.1**

**RNCS Implementation schedule (Learn undated)**

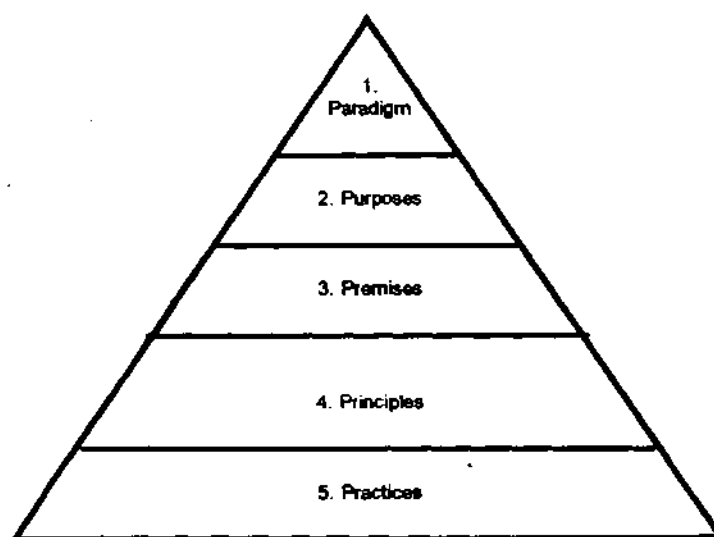
2004	Foundation Phase (Grades R-3) will all use the RNCS
2005	Intermediate Phase (Grades 4-6) will all use the RNCS
2006	Grade 7 will use the RNCS and Grade 10 will use the NCS*
2007	Grade 8 will use the RNCS and Grade 11 will use the NCS
2008	Grade 9 will use the RNCS and Grade 12 will use the NCS

(\*NCS: National Curriculum Statement, or Curriculum 2005)



### 2.2.2 The Theory of Outcomes-Based Education

The most predominant model of outcomes-based education (OBE) was developed by William Spady, in 1988 (Kramer 1999). The major components of his model are illustrated in Figure 2.2, and discussed in more depth here.



**Figure 2.2**

Spady's OBE Pyramid (Cited in Kramer 1999:22)

#### 2.2.2.1 The OBE Paradigm/ Orientation

Paradigms, in general represent how we consider and respond to the world. Within an educational orientation, this involves how educators educate and how society responds to this. The OBE orientation differs from others in that it focuses more on the *'what and whether learners learn'* as opposed to the former *'when and how'* (Spady, cited in Kramer 1999). Spady (cited in Kramer 1999:23) gives an overview of the significance of this shift in orientation:

- ✱ *'Learning is defined by outcomes rather than by the school calendar. We need to ask whether learners have achieved outcomes rather than assume that the exam proves what has been learned.'*

- *We know that people learn and show their learning in different ways and at different paces. We should therefore create expanded opportunities rather than try to make everyone succeed in exactly the same way and time.*
- *We need to assess and evaluate learning by checking whether learners can apply useful knowledge and skills. Tests based on recall alone are inadequate for modern life. Learners must prove their achievement by clearly showing that they can choose and use skills, knowledge and values.*
- *Reality is complex and integrated. The traditional curriculum divides experience into separate packages of subjects or disciplines. Learning should be as integrated as we can make it in order to prepare learners for reality.*
- *Teaching must be seen as helping learners achieve success, not just to cover the syllabus;*
- *Demonstration of achievement does not need to require learners to show everything they have learned. Spady speaks of "culminating" as opposed to "cumulative" achievement;*
- *Learning is not a competitive activity, where learners race to be the winner of a kind of race. Norm referenced education, which compares all learners to each other, makes us look at success in the wrong way. We need to allow each learner to measure themselves against what needs to be learned rather than what their peers have achieved. This would allow us to work in teams and help each other rather than protect ourselves against other people's success.'*

#### 2.2.2.2 The Purpose of OBE

According to Spady (cited in Kramer 1999:24), OBE has two fundamental purposes, these are:

1. *to ensure that all learners are equipped with the knowledge, skills and values that they will need for success in the various roles they will fill in their lives*

*outside the classroom. By being clear about what these are and by setting these as outcomes to be achieved through learning, we can properly plan how best to help learners.*

- 2. to create a school environment, in terms of the structure and functioning of schools, that assists and encourages learners to achieve those outcomes.*

#### **2.2.2.3      Premise of OBE**

Spady (cited in Kramer 1999:24), describes the underlying assumptions of OBE as:

- 1. All learners can succeed if allowed to learn in ways and at the pace that is natural and preferred by them as individuals. We know for certain that individuals are different and learn differently. We must therefore assume that we cannot achieve success by forcing the same method and pace on all learners.*
- 2. Successful learning promotes more successful learning.*
- 3. The way that we manage schools will have an impact on the level of success achieved by learners. Effective well-managed and operated schools will facilitate successful learning. Poorly operated, resourced and managed schools are likely to retard successful learning.*

#### **2.2.2.4      The Principles of OBE**

The principles of OBE described by Spady, relate to those of the RNCS, although they are not written in the same format. The principles described by Spady, and related by Kramer (1999:24) include the following:

#### 2.2.2.4a Clarity of Focus

These are the basic outcomes, on which a curriculum is based. In South Africa, within the RNCS the basic outcomes are the critical cross field outcomes. These outcomes need to be clear and written in such a way as to be easily interpretable to educators. In other words *'outcomes must be worded in a clear, measurable and observable language'* (Kramer 1999:24). The critical cross field outcomes are further broken down within the RNCS. This is in order to ensure a clarity of focus, by defining learning outcomes and assessment standards (Department of Education 2002).

#### 2.2.2.4b Designing Down Deliver Up

Within OBE, we identify with an outcome as an 'end result', and work backwards from there. In other words, *'planning for OBE happens by asking what needs to be achieved before attempting to achieve the final outcome, and then asking what learners need to achieve before that and so on...'* (Kramer 1999:24). This is helpful in that learners learn at different paces and in different ways. In addition to this, individually, a learner's beginning point, or prior knowledge may greatly vary, through OBE, this may be built upon.

#### 2.2.2.4c Expand Opportunities

Again, owing to the fact that learners learn at different paces, and in different ways, this principle aims to ensure that educators facilitate the establishment of a learning environment where all the learners:

1. *have an equal opportunity to learn in the way that is best for them and*
2. *show their evidence of learning in a way that is best for them.*

(Kramer 1999:24)

In other words, the differing learning styles are complimented through the effective implementation of OBE, in that learners can achieve outcomes through their individual learning style, as opposed to a learning style which is not suited to them as individuals (Kramer 1999).

The expanded opportunities principle is determined by the following dimensions:

- Time
- Methods and modalities
- Operational principles
- Performance standards
- Curriculum access and structure

(Spady, cited in Kramer 1999)

#### 2.2.2.4d High Expectations

*'Learning should always be challenging, relevant, useful but not trivial'* (Kramer 1999:30). OBE theory states that, given the opportunity, all learners can achieve. By removing the disabling factors such as resource availability, time constraints, previous political regimes and so forth, the highest expectations may be reached (Kramer 1999).

#### 2.2.2.5 The Practices of OBE

The following practices of OBE are described by Spady (cited in Kramer 1999:31):

- *Define outcomes*
- *Design the curriculum*
- *Deliver instruction*
- *Document results*
- *Determine advancement*



### **2.2.3 Positive and Negative Features of OBE**

The implementation of a system such as OBE has both positive and negative points. Young (1997:7, cited in Govender 1999:22) outlines the positive features of OBE as:

- *'The need for being clear about aims and objectives is stressed, thus leading to greater accountability.*
- *Recognition and accreditation of prior experiential learning and the accreditation of prior learning.*
- *Outcomes based system is flexible. It is made up of relatively small units of attainment defined in terms of credits. This allows qualifications to be achieved through credit accumulation and transfer over a number of different periods of time.*
- *Outcomes based system is transparent: outcomes make clear at the beginning of a programme what students have to achieve and provides accurate information about what a student knows to potential employers.'*

On the flip side, OBE does not come without limitations. Young (1996, cited in Govender 1999:23) describes the following points:

- *'By shifting control from teachers to learners, outcomes based systems can make students vulnerable if, as is likely, they lack the "cultural capital" to make the best choices and to use the resources available.*
- *The flexibility of creating learning programmes, as well as greater employer involvement both through defining outcomes and choosing outcomes that they think they need in their employees, may reduce the opportunities for learners to have access to a broader curriculum.*
- *Σ Outcomes based systems tend to shift the educational debate from shortages of resources to the use of given resources, thus weakening pressure for the government to improve provision.'*

In addition to this, Jansen (1997, cited in Govender 1999), states that C2005 *'is based on flawed assumptions about what happens in schools, how classrooms are organised and what kinds of teachers exist within the system.'* Furthermore, (cited by Jansen 1997, cited by Govender 1999:23) emphasis has been made, that *'the claims that transformational OBE is collaborative, flexible, trans-disciplinary, outcomes - based, open system, empowered-orientated approach to learning assume that highly qualified teachers exist to make sense of such a challenge to existing practice.'* In other words, it is all good and well, and the intentions of OBE are noble. However, the implementation of such a system, requires a teacher base of qualified practitioners, with adequate resources. This is not necessarily the case in many schools, particularly those situated within formally 'disadvantaged' communities.

#### **2.2.4 Learning Styles**

As discussed before, individual learners have different learning styles, and this is related back to how people think. OBE aims at utilising these different learning styles, in order to enable learners to achieve, in a way which is best suited to their individual learning style. The learning styles are defined and described in Table 2.2.

**Table 2.2**

The different learning styles and characteristics (Kramer 1999:14)

Learning Style	Learning Characteristics
Verbal/ Linguistic	Thinks in words. Likes reading, writing, listening and speaking. Does well with books, dialogues, debates.
Logical/ Mathematical	Likes reasoning. Likes to organise and interpret data. Does well at maths and science problem solving.
Spatial	Thinks in images. Likes drawing and observing. Does well at mind-mapping, puzzles and graphics.
Musical/ Rhythmic	Thinks rhythmically and in tunes. Likes music and dance. Often taps and hums.
Body/ Kinaesthetic	Thinks through sensations. Like sport, drama, movement, physical activity.
Interpersonal	Thinks best with others. Likes co-operative and group activities. Good at interactive, people centred activities.
Intrapersonal	Thinks best alone. Like individual self-placed and managed activities. Reflective and quiet.

For the most part, learners do not exclusively fit into one of these categories, but rather, into a number of these learning styles. By learning how to cater to the group of individuals learning styles, the educator can best enable learners to achieve required outcomes (Kramer 1999).

### **2.2.5 An Overview of the RNCS and OBE**

The RNCS is *'aimed at stimulating the minds of young people so that they are able to participate fully in economic and social life. It is intended to ensure that all learners are able to develop and achieve to their maximum ability and are equipped for lifelong learning'* (DoE 2002:12). The RNCS is a reflection of the principles of the Constitution and C2005 was created with these underlying values in mind (DoE 2002). The underlying principles of the RNCS- GET and NCS- FET, within the

curriculum vary somewhat to each other, in accordance to learners level of development (DoE 2002, DoE 2003a) (Appendix 1).

OBE , as discussed previously, is a framework for education which centres around the achievement of clearly defined outcomes, as opposed to the more traditional teacher based input of syllabus content (DoE undated). It places more emphasis on participatory, learner based and activity based education (DoE 2002). The RNCS lays out specific criteria, and a learner's progress is then measured against these criteria. The concept of pass or fail is thereby transformed to a concept of credit or try again, enabling learners to work towards specified criteria, with an eye on areas which they specifically need to improve upon (DoE undated).

The RNCS Grades R-9 and the NCS Grades 10-12 (General) are based on four components, namely the critical and developmental outcomes; the various learning areas or subjects; the learning outcomes and the assessment standards for each grade (DoE 2002, DoE 2003a).

#### **2.2.5.1.      *Critical Cross-field and Developmental Outcomes***

Critical cross-field outcomes provide the foundation of the curriculum, and learners effectively have to demonstrate that they have achieved these outcomes in order to show competence within the various fields (Kramer 1999). Various sets of outcomes are required in addition to these to prove competence within specific fields. Critical cross-field outcomes 'express the intended results of education and training in a broad sense' (DoE undated). They are not linked to any specific learning context, they are rather a working set of interrelated, cross-curricular principles which guide and inform the formulation of learning outcomes (DoE undated).

**The Critical Cross-Field Outcomes are as follows:**

- *Identify and solve problems and make decisions using critical and creative thinking.*
- *Work effectively with others and as a member of a team, group, organization and community.*
- *Organize and manage oneself and one's activities responsibly and effectively.*
- *Collect, analyse and critically evaluate information.*
- *Communicate effectively using visual, symbolic and/or language skills in various modes.*
- *Use science and technology effectively and critically showing responsibility towards the environment and health of others.*
- *Demonstrate an understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation.*

**(DoE 2002:11)**

In addition to these critical cross-field outcomes, which form the foundation of the RNCS Grades R-9 and NCS Grades 10-12, are additional outcomes. Although these additional outcomes are not critical, they are, however, fundamental to achieving the critical outcomes. These outcomes facilitate the achievement of maximum potential development in learners on a personal level, as well as the social and economic progress of greater society (DoE undated). These are called enabling outcomes.

**The developmental or enabling outcomes require that learners are able to:**

- *Reflect on and experience a variety of strategies to learn more effectively.*
- *Participate as responsible citizens in the life of local, national and global communities.*
- *Be culturally and aesthetically sensitive across a range of social contexts.*

- *Explore education and career opportunities.*
- *Develop entrepreneurial opportunities.*

(DoE 2002:11)

These enabling outcomes, along with the critical outcomes listed before, form the basis of the RNCS Grades R-9 and NCS Grades 10-12. From this foundation, the building blocks of education can be located. The RNCS is divided into inter-related learning areas. Each learning area, has a set of learning outcomes which are related to that learning area.

#### **2.2.5.2 Learning Areas**

##### ***Learning areas in the GET***

Within the RNCS Grades R-9, there are a total of eight, learning areas. These Learning areas are defined as: *'a field of knowledge, skills and values which has unique features as well as connections with other fields of knowledge and Learning Areas'* (DoE 2002:9) The RNCS Grades R-9 identifies the following learning areas;

- Languages
- Mathematics
- Natural sciences
- Technology
- Social sciences
- Arts and culture
- Life orientation
- Economic and management sciences

(DoE 2002:9)

### ***Learning Areas in the FET***

Within the previous education system a total of 124 subjects were offered within the Senior Certificate. Subjects were knowledge based and not considered multidisciplinary (DoE 2003a). This approach has changed with the new curriculum, and subject parameters allow for overlap. This allows for an integration of knowledge and skills development.

Within the New National Curriculum Statement Grades 10-12 (General) subjects are defined by learning outcomes. These subjects are grouped into learning fields (Table 2.3).

**Table 2.3**

**Subjects in the National Curriculum Statement Grades 10-12 (General) (DoE 2003a:12)**

<b>Learning Field</b>	<b>Subjects</b>
Languages (Fundamental)	<ul style="list-style-type: none"><li>• All Home Languages</li><li>• First Additional Languages</li></ul>
Arts and Culture	<ul style="list-style-type: none"><li>• Dance Studies</li><li>• Design</li><li>• Dramatic Arts</li><li>• Music</li><li>• Visual Arts</li></ul>
Human and Social Studies and Languages	<ul style="list-style-type: none"><li>• Geography</li><li>• History</li><li>• Life Orientation</li><li>• Languages (That are not taken in the Fundamental Component)</li></ul>
Physical, Mathematical, Computer, Life and	<ul style="list-style-type: none"><li>• Agricultural Sciences</li></ul>

Agricultural Sciences	<ul style="list-style-type: none"> <li>• Computer Applications Technology</li> <li>• Life Sciences</li> <li>• Mathematical Literacy</li> <li>• Mathematics</li> <li>• Physical Sciences</li> </ul>
Business, Commerce, Management and Service Studies	<ul style="list-style-type: none"> <li>• Accounting</li> <li>• Business Studies</li> <li>• Consumer Studies</li> <li>• Economics</li> <li>• Hospitality Studies</li> <li>• Tourism</li> </ul>
Manufacturing, Engineering and Technology	<ul style="list-style-type: none"> <li>• Electrical Technology</li> <li>• Engineering Graphics and Design</li> <li>• Mechanical Technology</li> </ul>

### 2.2.5.3 Learning Outcomes

Learning outcomes are more narrowly defined outcomes than the critical cross-field outcomes and are 'context linked' (DoE undated). Learning outcomes are formulated within the context of each learning area. These learning outcomes form the basis on which competence is demonstrated and assessed at the various levels, namely the foundation phase (grade R-3), the intermediate phase (grade 4-6) and the senior phase (grade 6-9) (DoE undated). One of the major differences between C2005 and the RNCS is that the RNCS has 3 or 4 learning outcomes per learning area (Appendix 2) whilst C2005 had a total of 66 specific learning outcomes (Shuter and Shooter undated). Therefore, the RNCS is more streamlined, making it more flexible, allowing *'space and time to experiment, draw on new and local resources, conduct fieldwork and engage in a range of educational activities that will supplement the minimum core to be learnt'* (Chisholm 2002:1). Within each learning area, throughout grades R-9, the outcomes remain the same., The



difference, over the grades, is the core knowledge and concepts, as well as the depth of knowledge and understanding required (DoE 2002) (Appendix 3).

#### **2.2.5.4 Assessment**

Within the RNCS- GET and NCS- FET curriculum's, each learning area or subject includes assessment standards or criteria. It is against these assessment standards which performance is measured. These predetermined criteria need to be met by learners in order to prove that the required outcomes have been achieved. These assessment standards vary from grade to grade and between learning areas (Appendix 4) (DoE 2002, DoE 2003a).

#### **2.2.6 Environment as an Interdisciplinary, integral part of the RNCS**

In addition to the Constitution, the RNCS also places emphasis on the importance of the environment, with one of the underlying principles of the RNCS being: social justice, a healthy environment, human rights and inclusivity (Appendix 1). The curriculum inspires learners to consider the interconnectedness between social justice, a healthy environment, human rights and exclusivity (National Environmental Education Project for general Education and Training 2003).

The concept of a healthy environment is further highlighted by the critical cross-field outcomes of the RNCS, namely that learners need to:

*'Use science and technology effectively and critically showing responsibility towards the environment and health of others.'*

(DoE 2002)

Environment as shown in figure 2.1, is a concept which has an integrated construct, including all aspects of the world in which we live. The RNCS has made an attempt to reflect this concept of interrelatedness in the way in which learners are exposed to learning. Environment, and the world in which they live, is mirrored by the interrelatedness of the learning areas, and in the fact that environmental issues are seen as fundamental to all learning areas (DoE 2002 and NEEP-GET 2003). It is by doing so that NEEP aims to facilitate the *'coordination of environmental education activities in schools'* (Department of Education 2003). Within society at large there is a need for *'active and critical public participation in addressing environmental issues, and a broad but also quite in depth understanding of environmental issues, of the way they relate to our everyday lives, and of possible solutions for tackling them'* (Department of Education 2003:7). This necessitates that each learning area contribute to the development of an *'environmentally literate and responsible population'* (DoE 2003:7). The degree to which environment is emphasised can be seen when examining the core concepts and knowledge required from each learning area. Within the natural sciences learning area, throughout the phases, the importance of environment, conservation and ecosystem functioning is emphasised, as well as the interconnectedness of the environment (Appendix 3).

### **2.2.7 Environmental Learning in the Natural Sciences Learning Area- GET**

As stated previously, the raising of environmental awareness, through highlighting the importance of the environment and environmental concerns is trans-disciplinary within the RNCS. In particular, this is highlighted within the natural sciences learning area of the curriculum (DoE 2003). The core concepts and knowledge (Appendix 3) of this learning area further contribute to environmental learning. They fall under the following categories:

- ***Life and living:*** focusing on life processes and healthy living, on understanding balance and change in environments, and on the importance of biodiversity,

- **Energy and change:** explores how energy is transferred in physical and biological systems, and thus helps learners to further understand aspects of the earth's life support systems, and human impact.
- **Planet earth and beyond:** takes learners *inter alia* into the atmosphere, where they explore the impact of technological processes in environmental issues such as global warming... implications for a healthy environment.
- **Matter and materials:** ...understanding of matter and materials is necessary to understand recycling.

(DoE 2003:12)

Within the natural sciences learning area, the DoE (2003:7) 'aims to promote scientific literacy through:

- The development and use of science process skills in a variety of settings
- The development and application of scientific knowledge and understanding, and
- Appreciation of the relationships between science, society and the environment, and associated responsibilities.'

The Learning outcomes for the natural sciences learning area- GET are as follows (DoE 2002):

### **Learning Outcome 1**

**Scientific investigations:** The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

### **Learning Outcome 2**

**Constructing science knowledge:** *The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.*

### **Learning Outcome 3**

**Science, society and the environment:** *The learner will know and be able to demonstrate an understanding of the relationships between science and technology, society and the environment.*

These outcomes enable learners to be critical of environmental issues, in using scientific methodology, whilst understanding that not all questions may be answered through science alone. Social, spiritual and ethical considerations play a part as well. However, through science and technology, learners develop a better understanding of the world and the environment, and how to utilise it in a responsible manner (DoE 2003).

#### **2.2.8 Environmental Learning in Geography- FET**

In addition to environment and environmental issues being highlighted within the natural sciences learning area of the RNCS- GET, these issues are carried over into the subject of geography within the NCS-FET. Within the subject 'geography' in the FET the DoE (2003a:38) aims to:

- *Develop tools and skills to research, interpret, analyze and make judgments based on the information gathered, thereby contributing to geographical literacy. These tools are central to the distinctive approach of geography in order to understand physical and human patterns and processes on Earth. Informed decisions, important to the well being of society and the environment, are based on a range of geographical skills. All these decisions involve the ability to acquire, arrange and use*

*geographical information and to think systematically and critically about social and environmental issues and challenges.*

- Develop knowledge and critical understanding of the challenging nature and interrelatedness of human existence and the environment over space and time. This creates a frame of reference for asking and answering geographical questions, identifying and solving problems, and evaluating the consequences of alternative solutions and possible actions. Geography is in the unique position of drawing together aspects of natural sciences, humanities and indigenous knowledge systems in order to contribute to the understanding of spatial distribution, human-environment interactions, and sustainable development.*
- Prepare learners to become informed, critical and responsible citizens who can make sound judgments and take appropriate action that will contribute to equitable and sustainable development of human society and the physical environment. Geography prepares learners to become responsible and competent decision makers and agents, living and working in a complex world. It encourages them to challenge and address social and environmental injustices. Learners will be guided to develop attitudes and values that will encourage them to take appropriate action, where possible, to address social and environmental problems and injustices.*

There is a strong emphasis within this subject on environmental concerns and sustainability. This comes through in the development of learners towards becoming more critical and responsible citizens. This is further reflected in the learning outcomes and assessment standards (Appendix 4) of this subject.

The learning outcomes within the subject of geography of the FET band are as follows (DoE 2003a: 38):

### **Learning Outcome 1:**

**Geographical Skills and Techniques (Practical competence):** *The learner is able to demonstrate a range of geographical skills and techniques.*

### **Learning Outcome 2:**

**Knowledge and Understanding (Foundational competence):** *The learner is able to demonstrate knowledge and understanding of processes and spatial patterns dealing with interactions between humans, and between humans and the environment in space and time.*

### **Learning Outcome 3:**

**Application (Reflexive competence):** *The learner is able to apply geographical skills and knowledge to environmental issues and challenges, recognize values and attitudes, and demonstrate the ability to recommend solutions and strategies.*

These outcomes encourage the development of learners to become more environmentally literate, and to enable them to make informed decisions regarding the sustainable use of natural resources.

## **2.3 Environmental Education**

### **2.3.1 The Importance of Environmental Education**

Education is a key to developing a sustainable society. By educating people they are empowered to be actively supportive of sustainable development (Freeman 2000, cited in Freeman and Mginguizana 2002). It follows that educating people about

their environment is fundamental in empowering people to coexist with that environment. Environmental education is a tool to '*collaboratively develop capabilities to deal with and encourage change in local contexts*' (Janse van Rensburg 1995:165, cited in Lotz-Sistika 2002). In other words, by educating people about their environment in a responsible manner, not only are people empowered, but are theoretically motivated and equipped to deal with and initiate the changes that are in congruence with the concept of sustainable development. This and other definitions of environmental education are discussed in this document, as well as approaches to environmental education.

Various commissions and documents regarding conservation of natural resources and sustainable development throughout recent years are significant here. Many of which highlight the importance of environmental education. These include documents such as Agenda 21, the Bruntland Commission and the World Summit on Sustainable Development (Box 1).

## **Box 1 – International Statements Regarding Environmental Education**

Agenda 21 states that:

*'Education is critical.... for promoting sustainable development and improving the capacity of people to address environmental and developmental issues... for achieving environmental and ethical awareness, skills and behaviour consistent with sustainable development and for effective public participation in decision making.'*

(Fien 1996:2.27-2.28)

In addition to this, the Bruntland Commission (1987) states that:

*'Environmental education should be included in and should run throughout the other disciplines of formal education curriculum at all levels- to foster a sense of responsibility for the state of the environment and to teach students how to monitor, protect and improve it.... Adult education, on-the-job training, television, and other less formal methods must be used to reach out to as wide a group of individuals as possible, as environmental issues and knowledge systems now change rapidly in the space of a lifetime.'*

The World Summit on Sustainable Development's (WSSD) Implementation Plan highlights the importance of environmental education to the promotion of sustainable development, calling on governments to:

- *'Integrate sustainable development into education systems at all levels to promote education as a key agent of change.*
- *Incorporate education for sustainable development into global plans for promoting 'Education for All' and the Millennium Development Goals, and*
- *Provide all members of society with a wide range of lifelong learning opportunities in education for sustainable development.'*

(Tilbury 2003:111, cited in Lotz-Sisitka 2004:119)

Within the South African context, environmental education is highlighted through various documents and acts, including the likes of the White Paper on Education and Training of 1995, the RDP, NEMA and the Constitution (Box 2).



## Box 2 – National Statements Regarding Environmental Education

White Paper on Education and Training of 1995 (Departments of Education and Labour 1995:18) supports that:

*'Environmental education, involving an interdisciplinary, integrated and active approach to learning, must be a vital element of all levels and programmes of the education and training system, in order to create environmentally literate and active citizens and ensure that all South Africans, present and future, enjoy a decent quality of life through the sustainable use of resources.'*

South Africa's Reconstruction and Development Programme (RDP) document of 1994, supports the '*...development of programmes which:*

*... rekindle our people's love for the land, and to increase environmental consciousness among our youth, to co-ordinate environmental education policy at all levels, and to empower communities to act on environmental issues and to promote an environmental ethic...*

(RDP 1994, cited in LeRoux 2000:45)

Environmental education is further highlighted within the NEMA, through principle 4h of National Environmental Management, which states:

*'Community well-being and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means.'*

The South African Constitution '*signalled a national commitment to environmental action*' (Badul and Jacobs 2004:32), stating that people have a right to a healthy environment. This requires that people be '*environmentally literate*'. Badul and Jacobs (2004:32) define '*environmental literacy*' as being able to:

- *Interpret environments.*
- *Recognise environmental issues.*
- *Justify a personal understanding, and valuation of a decent quality of life.*
- *Identify how environmental issues and risks impact on quality of life.*
- *Find relevant information about environmental issues.*
- *Critically assess and evaluate such information.*
- *Analyse environmental issues, their causes, complexity and interconnectedness, from a number of perspectives, with a depth and range relevant to different age groups.*

Statements made both nationally and internationally (Box 1 and 2), emphasis the importance of environmental education, both in and outside of formal education. Environmental education is, therefore, vital to the achievement of sustainable development (Babatope-Obasa 2002). The question remains, however, as to the orientation and methodology through which to best support environmental education processes.

It is through environmental education processes that we aim to address questions of sustainability and reduce detrimental impacts on our environment. Without knowledge and capacity, this is an unattainable goal. Environmental education processes can play an important role in developing environmental literacy and consequently the awareness of what it means to 'have a right to a healthy environment.' South Africa has developed a National Curriculum which places the environment at the forefront of its principles, by emphasising *'the relationships between human rights, social justice, inclusively and a healthy environment'* (Lotz-Sisitka and Olivier 2004:156).

In short, environmental education processes are essential in that they enable human development, facilitating the protection of environments for the provision of sustainable livelihoods and in guaranteeing a safe environment in which to live (Lotz-Sisitka 2004). Within a democratic South Africa, it is important for citizens to be empowered to participate and make decisions which affect their everyday life. Environmental education processes support a system of education which enables people to do this and *'education for sustainable development aims at attaining a sustainable society... showing the attributes of sustainable living'* (Mandikonga 2004:173).

### **2.3.2 Towards a Better Understanding of Environmental Education**

The concept of environmental education is one which has evolved over recent years. This has happened, as people have developed a better understanding of the environmental crisis and how best to respond to it, as well as a better understanding of environmental learning processes (Kiln 2000). Previous regimes were seen as imposing solutions to the environmental crisis, through environmental education (Taylor and Paxton 1994). An approach of 'education for conservation' was taken, with the emphasis being placed on *'preservation of the biophysical aspects of the environment on isolation, both geographical and academic, from the human context'* (IUCN 1999:4). Environmental education has, since then, developed more into a *'process of community based problem solving'* (Kiln 2000) and to that of education for sustainable living (IUCN 1999).

One of the earliest definitions of environmental education was developed at a workshop on 'Environmental Education in the School Curriculum' held in Nevada, USA, by the International Union for the Conservation of Nature and Natural Resources (IUCN), in 1970. This definition was accepted by many international organisations (Palmer and Neal 1994) (Box 3).

### Box 3 - Various definitions of Environmental Education

International Union for the Conservation of Nature and Natural Resources (IUCN), in 1970.

*'Environmental education is the process of recognising values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among man, his culture and his biophysical surroundings. Environmental education also entails practice in decision-making and self formulation of a code of behaviour about issues concerning environmental quality.'*

(IUCN 1970, cited in Palmer and Neal 1994:12)

Education for sustainability: an agenda for action. National forum on partnerships supporting education about the environment. San Francisco 1994, cited in IUCN (1999:5). Defines environmental education as:

*'... a lifelong learning process that leads to an informed and involved citizenry having the creative problem-solving skills, scientific and social literacy, and commitment to engage in responsible individual and cooperative action. These actions will help ensure an environmentally sound and economically prosperous future'*

Further to this definition, the South African Environmental Education Policy Initiative (1995, cited in IUCN 1999:6) defines environmental education as:

*'... Environmental education seeks to develop the necessary knowledge, understanding, values, skills and commitment to allow people to be proactive in securing a healthy and properly functioning environment that is sustainable (it will still be good for our children). This is as true for people's local environments as it is for regional and global environments.'*

Yet another definition of environmental education, as discussed by Wigley (2001) is:

*'Environmental education is a process of developing productive learning and teaching situations that allow teachers and learners to engage with environmental issues affecting them, and explore responses that lead to informed and responsible living.'*

Education for sustainable living as defined by the IUCN Commission on Education and Communication (1993, cited in Fien 1993) as a process which:

*'develops human capacity and creativity to participate in determining the future, encourage technological progress as well as fostering the cultural conditions favouring social and economic change to improve the quality of life and more equitable economic growth while living within the carrying capacity of supporting ecosystems to maintain life indefinitely.'*

Following the Nevada meeting, the International Environmental Education Programme (IEEP) was established at an international workshop for environmental education convened in Belgrade, in 1975. The end result of this workshop was the production of 'The Belgrade Charter - a Global Framework for Environmental Education'. This was the *'first intergovernmental statement on environmental education'* (Palmer and Neal 1994:13), and its objectives are summarised by Palmer and Neal (1994:13) as:

1. *'To foster clear awareness of and concern about economic, social, political and ecological interdependence in urban and rural areas.'*
2. *To provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment.*
3. *To create new patterns of behaviour of individuals, groups and society as a whole towards the environment.'*

(UNESCO 1975, cited in Palmer and Neal 1994:13)

Subsequent to 'The Belgrade Charter', the first intergovernmental conference on environmental education was assembled in Tbilisi, USSR in 1977. The following recommendations, which continue to inform environmental education internationally, were developed:

*'Environmental education should:*

- *Consider the environment in its totality - natural and built, technological and social (economic, political, cultural-historical, moral, aesthetic);*
- *Be a continuous lifelong process, beginning at the pre-school level and continuing through all formal and non-formal stages;*
- *Be interdisciplinary in its approach, drawing on the specific content of each discipline in making possible a holistic and balanced perspective;*

- *Examine major environmental issues from local, national, regional and international point of view so that students receive insights into environmental conditions in other geographical areas;*
- *Focus on current and potential environmental situations which take into account the historical perspective;*
- *Promote the value and necessity of local, national and international cooperation in the prevention and solution of environmental problems;*
- *Explicitly consider environmental aspects in plans for development and growth;*
- *Enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences;*
- *Related environmental sensitivity, knowledge, problem-solving skills and values clarification to every age, but with special emphasis on environmental sensitivity to the learners own community in early years;*
- *Help learners discover the symptoms and real causes of environmental problems;*
- *Emphasize the complexity of environmental problems and thus the need to develop critical thinking and problem solving skills;*
- *Utilize diverse learning environments and a broad array of educational approaches to teaching/ learning about and from the environment with due stress on practical activities and first hand experience.'*

(UNESCO-UNEP, cited in EECI 2000:46)

Later, in 1980, the World Conservation Strategy (IUCN 1980) highlighted environmental education by stating:

*'Ultimately the behaviour of entire societies toward the biosphere must be transformed if the achievement of conservation objectives is to be assured... the long term task of environmental education (is) to foster or reinforce attitudes and behaviour, compatible with a new ethic.'*

Environmental education in South Africa, around the 1970's, was focused largely on education about soil conservation, and was termed 'conservation education'. This *'concentrated on conservation as the wise use of (mainly) natural resources and basic ecology and seldom concerned itself with the political, social or even built environment'* (Irwin 1991:7). This 'environmental education' in the context of nature conservation emerged as a result of problems associated with environmental degradation (Gcilitshana 2002).

The 1980's, in South Africa, at the height of apartheid, saw the development of the concept of 'outdoor education', which overlapped to a certain extent with 'conservation education'. Irwin (1991:7), makes this statement regarding the era:

*'Some conservative educationists in South Africa were alarmed by the socio-political connotations of environmental education and saw a possibility of sanitising the idea by conflating it with outdoor education which was perceived to be free of such notions - other than those which were acceptably patriotic.'*

The Environmental Education Association of Southern Africa (EEASA) was formulated in 1982, at the first international conference on environmental education held in South Africa. Since then, EEASA has played an important role in southern Africa, in developing and coordinating environmental education efforts (Irwin 1991).

Within South Africa, the concept of environmental education; emphasises a more holistic concept of environment, as discussed in section 2.1. Environmental education processes, now, no longer focus solely on the biophysical environment but encompass social, economic and political aspects as well (IUCN 1999).

Stark (2002:61) discusses the importance of action competence through environmental education and makes the following statement:

*'Environmental education, in its broadest meaning, is concerned with empowerment and with developing a sense of responsible ownership. It is about improving the capacity for all people to address environmental and developmental issues in their own and the global context. It is also about touching our beliefs and attitudes in a way that makes us able to make a sustainable living- with a perspective on the life of future generations. Beliefs and attitudes must be based on sound information and be associated with appropriate action. Action competency therefore, is used to refer to skills, knowledge and personal values and capacities, which enable learners to respond appropriately to environmental issues in the local and global context.'*

The current approach to environmental education in South Africa is one of 'education for sustainable development', as stated previously. This approach, guides the majority of environmental education programmes in South Africa, promoting ecological sustainability and social justice (Badul and Jacobs 2004). Table 2.4 provides us with an overall picture of the current status of environmental education in South Africa, as it relates to the WSSD Implementation Plan. Important links have been made within this table. This is vital, as it provides environmental education practitioners with a scope in which to place environmental education.

**Table 2.4:** Current status of environmental education in southern Africa (compared to Tilbury's 2003 suggestions on how environmental education should be re-orientated, based on the WSSD Plan of Implementation) (Cited in Lotz-Sisitka 2004:201).

WSSD Implementation Plan: Implications for environmental education (adapted from Tilbury 2003:112)	Current 'status' of environmental education in southern Africa (2004).
Make stronger links between environment	Environmental education processes have been focused on



and sustainable development.	environment and development issues for a long time, and have recently considered 'sustainability' as a key theme, particularly in the context of sustainable livelihoods.
Address the core sustainable development themes of globalisation, trade, poverty alleviation, consumerism as well as biodiversity, water, health, sanitation and climate change.	Issues such as poverty, equity, trade, biodiversity, health, sanitation, water, and food security have been key issues addressed by environmental education praxis include a focus on urbanisation, trade, consumerism and climate change, particularly in urban contexts.
Integrate the 'three pillars' of sustainable development in environmental education.	Ecology and economics have been related concepts in southern African social contexts of poverty and development, except in 'pure' conservation education, where the emphasis has been on 'telling about' or 'interpreting' nature to others.
Understand the socio-political root causes underpinning threats to the environment.	Environmental education processes in southern Africa have critically considered socio-political 'root-causes', such as the impact of structural adjustment programmes, World Bank policies, land ownership patterns under colonial and apartheid governments etc. on the environment.
Be inclusive in focus and incorporate women's and indigenous rights in learning processes.	Processes of mobilising indigenous knowledge in environmental education have been pioneered in southern Africa and many programmes address gender-related issues.
Expand educational programmes to reach out to governmental agencies and the private sector.	New arenas of practice in southern African environmental education include education and training in industry contexts, and local government.
Practice education which questions our thinking and assumptions, as well as our practice.	Socially critical and reflexive approaches to environmental education have gained currency in the region over the past 10 years.
Educate for the future and consider scenarios available to us.	Environmental education in southern Africa has been contextually and historically situated, to provide the scope for contextually relevant actions, and to create a framework for consideration of futures perspectives. Futures education has not been practiced in terms of the 'hyper-real'.
Educate for participation in decision-making processes and not just for awareness raising about issues.	Participation has been a strong focus of environmental education processes in southern Africa. Participatory methodologies have been explored and researched which cover professional development deliberations; participatory approaches to materials development; and participatory learning interactions.
Develop partnerships with non-educators to assist with the mainstreaming of environmental education and sustainability across a number of socio-political levels.	Partnerships (mainly across environmental education organisations) have been a strong feature of environmental education praxis and only recently have environmental education practitioners begun to explore partnerships with a range of non-educators (e.g. local government officials, industry managers etc.).

Through this, one is able to examine current environmental education practices, and realise that southern Africa is able to place itself within an international context of environmental education. Throughout the years definitions have changed, however ideas remain debateable as to which definition is preferable. An attempt was made within this research, to draw a picture of this varying landscape of shifting priorities, and to give an illustration of how ideology has shifted over the years in South Africa. South Africa, can be seen as aligning itself with developments of the rest of the world, with the onset of democracy, and with greater emphasis being placed on education for sustainability. While the inclusion of social, political and economic issues to the previously biophysically 'biased' environmental education, is a positive step, one must however bear in mind that the ultimate goal of environmental education is to increase environmental literacy, for the conservation of the natural environment on order to sustain human life. Therefore, emphasis should still remain on the biophysical, with the acknowledgement of other factors as influencing factors.

### **2.3.3 Active Environmental Learning**

The greatest potential exists, for meaningful environmental learning to occur, when learning happens in, for and about the environment (Le Roux 2000). These three aspects are vital in developing a system of learning, in which learners are able make meaning, and thereby personalise their concept of the environment and environmental issues, in turn enabling them to make better environmental management and lifestyle choices (Figure 2.3).

The orientation of education 'about' the environment, is in order to *'emphasis knowledge about natural systems and processes and the ecological, economic and political factors that influence decisions about how people use the environment'* (Fien

1993a:231). While an approach of education 'through' the environment, uses learners *'experiences in the environment as a medium for education'*.

Fien (1993a:232) makes the following statement:

*'Education through the environment may also foster environmental concern if students become captivated by the importance and fragility of ecosystems and the beauty of landscapes, or immersed in the values conflict over an environmental issue.'*

In addition to this Fien (1993a:233) describes here, the ideology of education 'for' the environment, which aims to:

*'engage students in the exploration and resolution of environmental issues in order to foster the values of the new environmental paradigm and to promote lifestyles that are compatible with the sustainable and equitable use of resources'*.

This enables learners to interpret and understand, people–environment relationships and therefore capacitate them to act in an appropriate manner. Furthermore, Fien (1993a:233) states that many environmental educators argue:

*'... it is only when the overt intention of a programme is education for the environment that effective environmental education is actually taking place. Education about and through the environment are valuable only in so far as they are used to provide skills and knowledge to support the transformative intentions of education for the environment.'*

There are various orientations and approaches to environmental education. Each of these shaping orientations have their place within the broader context of environmental education. When and where they are utilised will, however, depend largely on circumstances relating to the present educational situation. For example, as is illustrated by figure 2.3, the younger the learner, the more emphasis will be placed on vocational/ neo-classical orientations. As people get older, their store of

knowledge increases, and therefore there is less reliance on introduction to information (Figure 2.3). As opposed to when someone is young and relies on what information is given to them, in order to encounter, or consider the world. In addition, the older the learner, the less difference there is between teacher and learner, and a more socially critical orientation to environmental education becomes prevalent.

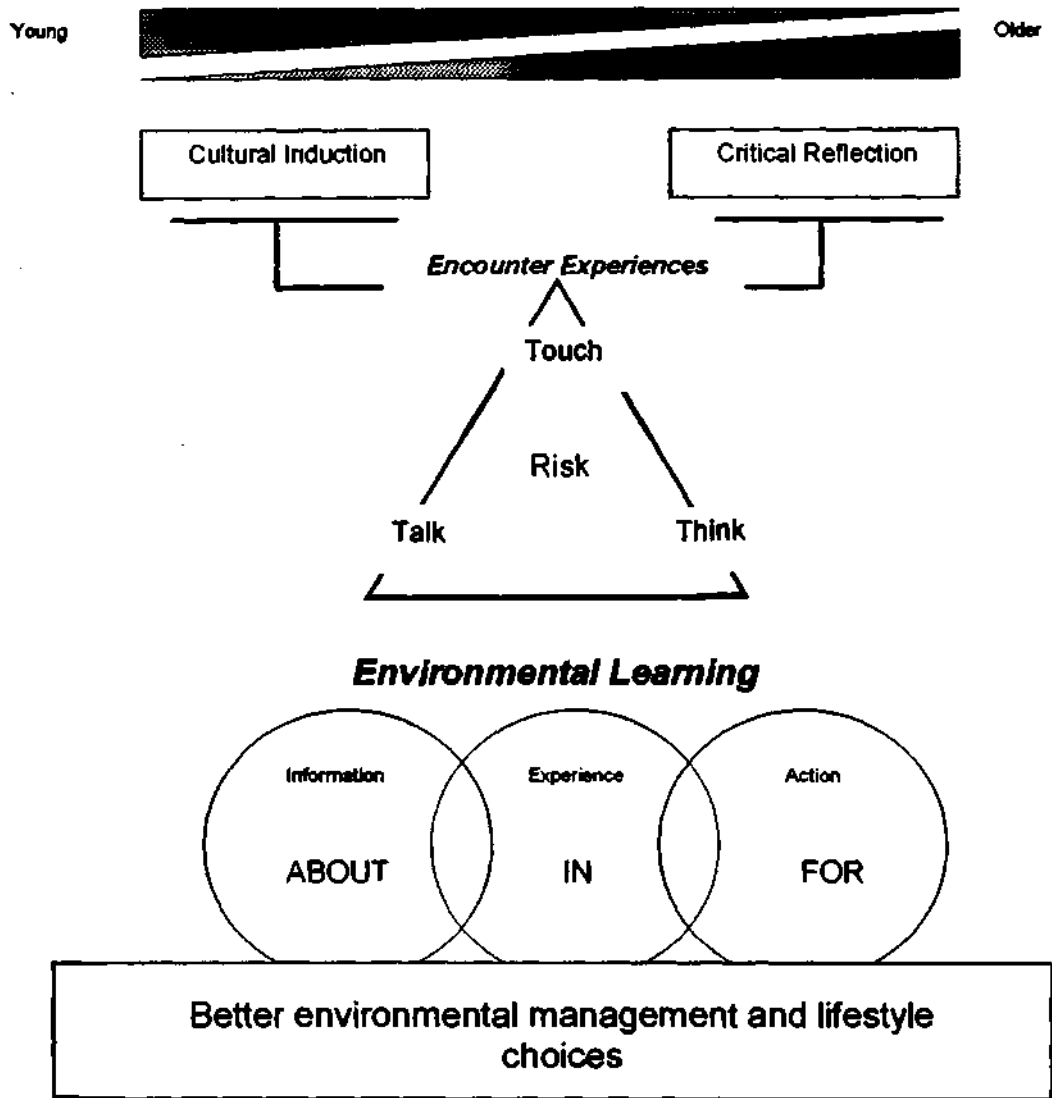


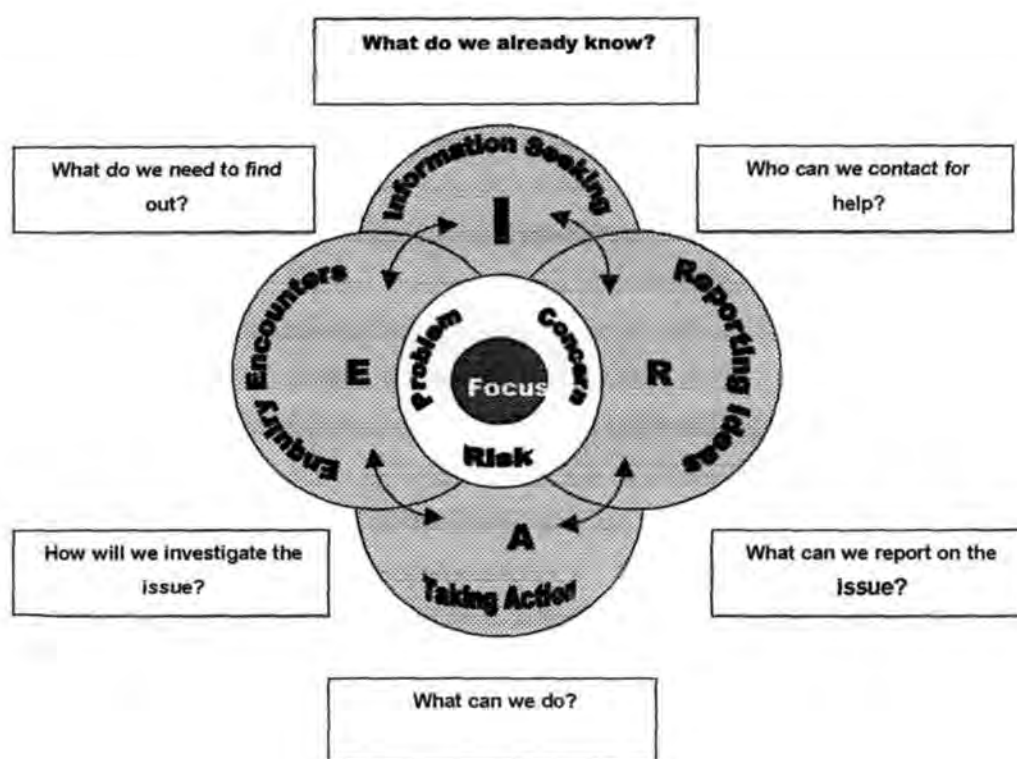
Figure 2.3

The process of Environmental Learning (NEEP 2001)

Environmental education is a lifelong process, as is education in general. Active environmental learning happens when learners are allowed to learn in a way which is holistic and which caters to their individual experiences. In a situation, in which learners are able to draw on each others experience and knowledge, more active learning takes place.

This is further supported by Irwin (1995:168, cited in Lotz 1999):

*'Environmental problems are not problems of our surroundings but - in their origins and through their consequences – are thoroughly social problems, problems of people, their history, their living conditions, their relation to the world and reality, their social, cultural and living conditions... at the end of the twentieth century nature is society and society is also nature.'*



**Figure 2.4**

Active Learning Framework, with steering questions, to be used as a lens to assess learning processes, within this study (NEEP 2001).

Irwin's statement relates to figure 2.4, which is an active framework, supporting the 'in', 'about' and 'for' the environment, environmental learning model. The active learning model will be used in this research, as a lens from which to assess learning processes at environmental education centres.

It follows from Figure 2.4, that potential lies within this scope to approach environmental education, in an issue; or environmental 'problem' solving manner. Environmental learning is cross-curricular, and is as integrated as the concept of 'environment' itself. An example of this cross-curricular nature of environmental learning is taken from Environmental Education Curriculum Initiative (EECI) (2000:8):

*'To resolve issues associated with water pollution for example, learners will need to engage in the following activities and draw on the following knowledge and skills:*

- *Investigation of the water quality: science outcomes and technology skills.*
- *Investigation of the causes of water quality problems: social and historical knowledge and skills.*
- *Interpretation of the test results and social investigation: science, geographical, historical and social knowledge and skills.*
- *Reporting of the causes of the issues: language and communication skills.*
- *Finding solutions based on investigations: technology, science and social skills.*
- *Application and evaluation of solutions: language, science and social knowledge and skills.'*

Figure 2.4 is an open process model which enables learners to make connections between related issues and concepts and creates an atmosphere in which

competence may be developed, consequently allowing for meaningful environmental learning (NEEP 2001).

#### **2.3.4 The Role of Environmental Education Centres in a Climate of OBE**

Emphasis has been placed on the importance of environmental education, within the RNCS. In addition, the importance of fieldwork is highlighted within the curriculum (DoE 2002). By their very nature, environmental education centres provide an ideal opportunity in which, active and meaningful environmental learning can occur. Furthermore, field based environmental education centres provide education for learners, which is theoretically outcomes based, with emphasis being placed on experience and personal observation. While a distinction can be drawn between field studies and environmental education, environmental education centres have the potential to play a role within both of these fields. An example of which is the Research Project courses which are being run at Umgeni Valley, as part of the geography portfolio of evidence, required for the assessment of outcomes.

There have been efforts, within environmental education centres to align themselves with the principles, objectives and outcomes prescribed by the RNCS. Current methodologies utilized within environmental education centres needs to be viewed within the context of the RNCS. Activities and learning, which occur at these centres needs to compliment the curriculum, in order to be relevant within a changing climate of national education. Activities at environmental education centres can no longer be considered as 'isolated' incidents, but rather as part of a far greater and integrated life-long environmental education process.

## Section 3

### 3. The Study Sites

The study sites included in this study, are both situated near Pietermaritzburg. Both of these environmental education centres are well situated for studying water related issues. One of the centres being situated on a rehabilitated wetland and the other on a river which has had many human impacts on it. Both these facilities are centres of environmental education excellence, committed to promoting environmental literacy, whilst attempting to become more 'outcomes' orientated.

#### 3.1 Entabeni Education Centre

The Entabeni Education Centre is situated in the KwaZulu-Natal Midlands, and is positioned within the Hlatikulu Vlei, which is on the upper reaches of the Nsonga River Catchment (Begg 1989). The Entabeni Education Centre can be found just below Giant's Castle, in the Central Region of the uKathlamba Drakensberg Mountains.

The land on which the centre is situated, is owned by Mondi Forests, and still has pine (*Pinus patula*) trees planted on the slopes above the wetland. The wetland was identified by Begg (1989) as a wetland of provincial priority, and consequently, Mondi Forests consulted the Natal Parks Board for advice on how best to conserve the wetland. As a result, the South African Crane Foundation was asked to adopt the



area and establish a wetland sanctuary for endangered crane species (Thompson, Shaw, McCann, Burden, Wojtulewics and Wilkins 1997).

The Entabeni Education Centre is a privately run company, who's main function is environmental education and outdoor adventure training. The education centre was formally run by the Wildlife and Environment Society of South Africa (WESSA), under the name 'Drakensberg Wetland Project'. At this time, it was managed in collaboration with the South African Crane Foundation. The Crane foundation, however, mainly conducted activities on the Hlatikulu Crane and Wetland Sanctuary. These activities related to the conservation of cranes, wetland rehabilitation and the care and breeding of captive cranes; as well as rehabilitation of wild cranes. While WESSA's activities included crane and wetland conservation, their activities were more broad in scope. The 'Drakensberg Wetland Project' has subsequently been taken over by 'Entabeni Communications' and renamed the 'Entabeni Education Centre'.

Shortly afterwards, in 2001, the South African Crane Foundation moved premises to Nottingham Road, leaving the management of the wetland and the captive cranes in the hands of the Entabeni Education Centre. While the area is still managed in collaboration with the Crane Foundation, the Entabeni Education Centre now manages the cranes and the wetland (pers. comm. Nic Shaw, Oct 2004).

The Hlatikulu Vlei, on which the Entabeni Education Centre is situated, is an interesting case in point. The area was declared by Begg (1989) as a wetland of provincial importance, and seen as vitally important in the conservation of crane species. A section of the wetland was formally under mielie plantation, and that section of the wetland was drained for this purpose. Since then, the mielies have been removed, and those responsible for the management of the area are in the process of rehabilitating the wetland. It is an important illustration for learners who visit the centre, to realise that ecosystems are fragile and not easy to fix, they require a lot of resources and time (years) to return to their former state.

The Entabeni Education Centre has the facilities to accommodate approximately 100 school learners in dormitory style accommodation. The Centre runs a diverse array of courses, suited to the needs and expectations of their visitors. The Centre's website (Shaw 2004) makes the following statement regarding expectations:

*'Entabeni does not have a fixed "package" programme. Learning opportunities are designed around specific needs and requests. This negotiation allows us to maximise the rich learning resources of the human and natural communities and ecosystems available in the Drakensberg.'*

*'... our goal for each and every course, (is) to provide an enjoyable, rich adventurous and life changing experience in nature...'*

The following information was adapted from *Thompson et.al. (1997)*

#### **3.1.1 Purpose of the area**

- The sanctuary will act as a base from which education and extension programmes on the conservation of cranes and their habitats will be mounted.
- The captive crane pens are to be maintained for the purpose of rehabilitating injured wild cranes, and for the breeding of critically endangered crane species.
- The rehabilitating wetland encourages indigenous fauna and flora to return to the sanctuary.

#### **3.1.2 Significance of the area**

- The Hlatikulu Vlei was identified by Begg (1987), as a priority for rehabilitation after extensive damage by years of unsound agricultural practice.
- The Sanctuary is located within the stronghold of the Wattled Crane population, the most endangered of South Africa's three crane species, in KwaZulu-Natal Midlands.

- The Sanctuary falls within the proposed buffer zone area to the Maloti-Drakensberg Transfrontier Park, and borders the uKahlamba Drakensberg Park.
- The Vlei provides vital water production for communities downstream of the wetland.

### 3.1.3 Vision for the area

*"To establish a centre which will provide a sanctuary for cranes and at which education, extension and research on wetland and grassland restoration and management will be carried out. In addition, to develop a captive breeding centre to augment depleted crane populations in the wild."*

*(Thompson et. al. 1997:2)*

### 3.1.4 Aims

- To restore and maintain the biological integrity and functions of the grassland and wetland components of the Sanctuary.
- To provide recreational and education facilities within the Sanctuary.
- To maintain captive cranes as part of an ongoing breeding facility, at which visitors will be able to learn more about cranes and their conservation.

## 3.2 Umgeni Valley Nature Reserve

The Umgeni Valley project is owned and managed by the Wildlife and Environment Society of South Africa (WESSA), and is located 1 km outside the town of Howick in the KwaZulu Natal Midlands. The reserve is situated alongside the Umgeni River. The vegetation within the reserve consists mainly of grasslands and savannah, which supports a variety of savannah animals (Beyer and Duggan 1997).

The Umgeni River, which runs through the Umgeni Valley Nature Reserve is also an interesting case, as most people living in the area obtain their drinking water from

Midmar Dam, which is just up stream of the Umgeni Valley Nature Reserve, and which is fed by the Umgeni River. Learners are given the opportunity to investigate the river, from which their water originates, making the studies on this river more relevant to them.

The reserve specialises in environmental education, and is also home to the Southern African Democratic Countries - Regional Environmental Education Programme (SADC-REEP). The reserve has about 15000 to 20000 visitors a year, many of which are school learners (Beyer and Duggan 1997), attending specialised environmental education programmes. Facilities on the reserve include both dormitory style facilities with a resource centre, as well as 'rustic' bush-camp style accommodation.

The WESSA Website (WESSA undated) makes the following statement:

*'All courses offered at Umgeni Valley have several underlying outcomes:*

- *sharpening senses and stimulating an awareness of the environment and its problems*
- *investigating ecological and geographical concepts through a learner-centred practical approach to learning*
- *satisfying curriculum needs through environmental investigation and the completion of student projects after the course*
- *developing problem solving skills, on an individual level and through group work*
- *providing an opportunity for solitude and reflection as a means of clarifying and reconsidering values and attitudes*
- *reinforcing a long term positive attitude to the environment through enjoyable experiences*
- *encouraging continued involvement in the resolution of environmental and social issues.'*

### **3.2.1 WESSA Policy on Environmental Education**

*'For conservation to succeed in the long term the Society believes that people need to increase their environmental awareness and become skilled in minimising their impact on the environment.*

*To achieve this the Society employs 60 environmental educationists country wide and runs the Umgeni Valley, Treasure Beach, Umbogavango, Twinstreams, and Gold Fields EE Centres. WESSA is also a partner to the Share Net environmental education resource network.*

### **3.2.2 WESSA's Guiding Principles**

*WESSA has adopted the following guiding principles for effective environmental education:*

*WESSA believes that environmental education should:*

- 1. Consider the environment in its totality- natural and built, technological and social (economic, political and cultural-historical, moral and aesthetic)*
- 2. Be a continuous lifelong process, beginning at the pre-school level and continuing through to adulthood and parenthood.*
- 3. Be interdisciplinary in its approach, drawing on the best aspects of each discipline to create a holistic and balanced perspective.*
- 4. Examine major environmental issues from local, national, regional and international points of view so that people receive insights into environmental conditions in other parts of the world.*
- 5. Focus on current and future environmental problem situations, but also taking into account the historical perspective.*

6. *Promote local, national and international cooperation in preventing and solving environmental problems.*
7. *Inform laymen and planners about the need to consider environmental aspects in plans for developments and growth.*
8. *Allow students to have a role in planning their learning experiences and have the opportunity to make decisions, and accept the consequences.*
9. *Relate environmental sensitivity, knowledge, problem-solving skills to every age. During a student's early years, there should be special emphasis on environmental sensitivity within the home environment.*
10. *Help students to recognise and understand the symptoms and real causes of environmental problems.*
11. *Emphasise the complexity of environmental thinking and problem-solving skills.*
12. *Use different learning environments and a broad array of teaching tools with stress on practical activities and first hand experience'*

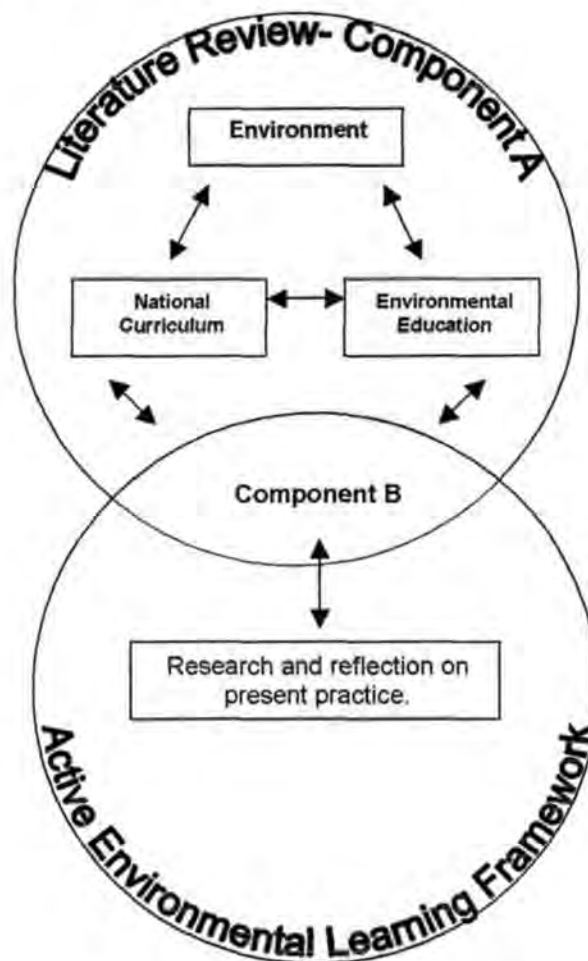
(WESSA undated)

## Section 4

In order to conduct the study, various concepts and ideas feed into each other and a specific process needs to be followed. This section gives an outline of that process and discusses the methodology followed.

### 4.1 Conceptual Framework

The study involves the integration of various concepts, and field observations which feed into each other on Component B. This is represented diagrammatically in figure 4.1.



**Figure 4.1**  
Conceptual Framework for the study

## **4.2 Overview of the Methodology**

### **4.2.1 Literature Review**

An extensive literature review was conducted, in order to investigate how environmental education and education in general, has evolved in recent years, within a climate of increasing concern for the environment.

Neumann (1999:446) outlines the following goals of a literature review.

1. *'To demonstrate a familiarity with a body of knowledge and establish credibility.'*
2. *To show the path of prior research and how a current project is linked to it.*
3. *To integrate and summarise what is known in an area.*
4. *To learn from others and stimulate new ideas.'*

The literature review attempted to achieve these goals, in order to contextualise environmental education in South Africa.

The literature review took the form of both a historical and contextual review. It was historical in the sense that it aimed to *'trace the development of an idea or shows how a particular issue or theory has evolved over time... to show how we got to where we are today'* (Neumann 1999:447). Further to this, the review was a context review which *'introduces the rest of a research report and establishes the significance and relevance of a research question'* (Neumann 1999:447). The key benefits and shortfalls of outcomes-based education (OBE) were also highlighted through this review.



An initial identification of the learning outcomes and assessment standards, prescribed by the RNCS- GET and NSC- FET, was conducted, specifically looking at the natural sciences learning area and geography respectively, with a focus on water related issues. This was a desktop exercise and aimed at generating an understanding of the focus of the RNCS- GET and NCS- FET bands. The 'Active Learning Framework' (National Environmental Education Project 2001) was considered in depth, within the literature review, for use during field observations. Following the review of the literature and curriculum documents, attention was given to data gathering in the field.

#### **4.2.2 Assessment of Two Environmental Education Centres**

Two environmental education centres were selected for the purpose of observations., Namely, the Wildlife and Environment Society of South Africa's Umgeni Valley Project, situated near Howick, KwaZulu-Natal; and Entabeni Education Centre, situated in the foothills of the central Drakensberg region of KwaZulu-Natal.

These two centres were selected, owing to efforts taken by these centres, to become more 'outcomes-based' in their methodology. The researcher is also familiar with both of these centres, having visited them on numerous occasions and having volunteered and worked at these centres. Due to time constraints, only two centres are included in the study. The study must, therefore be considered a preliminary review of a number of selected activities at these two centres and not an attempt to extrapolate trends in the environmental education centres in South Africa in general. Furthermore, the study was not aimed at comparing these two centres, but rather aimed at drawing a picture of methodologies used at both centres and the RNCS outcomes to which they relate, within water-based studies. Water studies, specifically, were selected as a result of the importance and relevance of water conservation in South Africa today. In addition, both centres are actively involved in such studies.

The courses which are included in the study, at both centres, were selected specifically based on the inclusion of water studies within the programmes. Consequently, courses are included in the study as a result of availability. All of the schools involved in the study are private schools, this is as a result of availability and not due to any selection prerequisite. Therefore, as a result of this availability and time constraint, the following courses are included for observation (Table 3.1), in order to complete this study:

Table 3.1: Schedule of courses included in the study for observation

School	Grade	Date	Centre
Creston College	8	15 September 2004	Umgeni Valley
St Andrew/ St Catharine's	11	20-22 September 2004	Umgeni Valley
Luvenhoff Academy	11	8-11 October 2004	Umgeni Valley
St Dunstons	11	12-15 October 2004	Umgeni Valley
Sacred Heart	7	20 October 2004	Entabeni Education Centre
St Charles College	6	27 October 2004	Entabeni Education Centre
St Monica's	6	2 November 2004	Entabeni Education Centre

Each environmental education centre was treated as a separate case study. In the case of each course, the study will *'strive to portray what it is like to be in a particular situation to catch a close up of reality... it is important for events to speak for themselves rather than to be largely interpreted, evaluated and judged by the researcher'* (Cohen, Manion and Morrison 2001:182).

#### 4.2.3 Non- Participant Observation

Observations were conducted in a non-participant fashion. This method of observation is generally not used in natural settings, owing to the fact that the researcher's presence becomes obvious to participants. This may, in turn effect their behaviour, and the behaviour of the education staff (Cohen, Manion and Morrison

2001). In this case, however, this was unavoidable, owing to the fact that the participants are school learners, and the researcher is not. Therefore, the researcher's presence was obvious none-the-less. In addition, the researcher may have been considered an 'expert' by the participants, and participating in the activity may have inadvertently influenced the 'norm', thereby biasing observations. It is for this reason, that the researcher aimed to be a complete observer, detached from participation.

Observation of courses was selected as the main methodology, as observations *'enable the researcher to gather data on:*

- *The physical setting (e.g. the physical environment and its organisation).*
- *The human setting (e.g. the organisation of people, the characteristics and make up of the groups or individuals being observed, for instance gender and class).*
- *The interactional setting (e.g. the interactions that are taking place, formal, informal, planned, unplanned, verbal, non-verbal etc.).*
- *The programme setting (e.g. the resources and their organisation, pedagogic styles, curricula and their organisation).*

(Morrison 1993, cited in Cohen, Manion and Morrison 2001:305)

Observations will be conducted in a semi-structured manner. In other words, there will be an *'agenda of issues that will be highlighted but not strictly pre-determined'* (Cohen, Manion and Morrison 2001:305). The 'Active Learning Framework' (NEEP 2001) was selected as a lens, to explore the learning process, during these water study activities, and as a means to ask questions and mobilise understanding. Course observed of grades within the GET will be reflected back against the RNCS-GET guidelines and outcomes and assessment standards, focusing specifically on the natural sciences learning area, with an eye on the other learning areas. While the grade 11 course observed will be reflected against NSC-FET geography learning outcomes and assessment standards. The aim of which will be to investigate the

level of interaction between activities at these environmental education centres and the RNCS- GET and NCS- FET respectively.

Materials used during water studies at the two centres will be investigated, as a means to assess methodology. The conclusion of the study will then be to identify what possible outcomes may be aimed at by environmental education centres with regards to water studies, and to highlight the challenges faced by centres in implementing outcomes-based education. Responses may then be developed to assist the centres in aligning themselves with the RNCS GET and NSC- FET.

#### **4.2.4 Limitations to and Observations About the Study**

The primary factor limiting the study was course availability. In addition, the National Curriculum is in a state of change, with the RNCS only being implemented this year for the foundation phase (grades R-3) of the general education band (grades R-9). Furthermore, the RNCS has only been completed up to grade 9. The RNCS will be phased into other education phases over the next few years. At this stage, the National Curriculum Statement or Curriculum 2005 (C2005), is to be implemented in the further education band as of 2006, and until such time as the RNCS is published for this education band (Learn undated). Due to the availability of some grade 11 courses at Umgeni Valley, these courses are included in the study and reflected against the NCS- FET geography outcomes and assessment standards.

In addition to problems with the current state of the curriculum, the researcher was not able to observe courses in their entirety, from beginning to end. Therefore, on some courses there are gaps in the data; for example on the St Andrews/ St Catharine's course, learners did some work at night and the researcher was unable to observe at that time.

There was a concern that the environmental education staff would behave differently in the presence of a researcher. For the most part, this was avoided where possible, by observing staff whom the researcher had known previously, or at least had met before. It was also made clear to the staff that I was observing them to look at potential outcomes achievement, and not assessing their performance. In addition, many of the education staff, particularly at the Entabeni Education Centre consider me a peer rather than a researcher. Due to the setting of the courses and the presence of the learner's school teachers, the researcher believes that, for the most part, education staff were not particularly influenced by her presence.

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## **Appendix 1**

### **The Principles of the Revised National Curriculum Statement (GET) General Education and Training (Grades R-9)**

(Department of Education 2002)

The Revised National Curriculum Statement Grades R-9 (Schools) builds on the vision and values of the Constitution and Curriculum 2005. These principles include:

#### **Social Justice, a Healthy Environment, Human Rights and Inclusivity**

The curriculum can play a vital role in creating awareness of the relationship between human rights, a healthy environment, social justice and inclusivity. In some countries this is done through subjects such as civics. The Revised National Curriculum Statement has tried to ensure that all Learning Area Statements reflect the principles of social justice, respect for the environment and human rights as defined in the Constitution. In particular, the curriculum attempts to be sensitive to issues of poverty, inequality, race, gender, age, disability, and such challenges as HIV/AIDS.

The Revised National Curriculum Statement adopts an inclusive approach by specifying minimum requirements for all learners. The special educational, social, emotional and physical needs of learners will be addressed in the design and development of appropriate Learning Programmes.

## **Outcomes-based Education**

Outcomes-based education considers the process of learning as important as the content. Both the process and the content of education are emphasised by spelling out the outcomes to be achieved at the end of the process. In the Revised National Curriculum Statement learning outcomes and assessment standards were designed down from the critical and developmental outcomes.

The critical and developmental outcomes are a list of outcomes that are derived from the Constitution and are contained in the South African Qualifications Act (1995). They describe the kind of citizen the education and training system should aim to create. The critical outcomes envisage learners who will be able to:

- Identify and solve problems and make decisions using critical and creative thinking.
- Work effectively with others and as a member of a team, group, organization and community.
- Organize and manage oneself and one's activities responsibly and effectively.
- Collect, analyse and critically evaluate information.
- Communicate effectively using visual, symbolic and/or language skills in various modes.
- Use science and technology effectively and critically showing responsibility towards the environment and health of others.
- Demonstrate an understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation.

**The developmental outcomes envisage learners who are also able to:**

- **Reflect on and experience a variety of strategies to learn more effectively.**
- **Participate as responsible citizens in the life of local, national and global communities.**
- **Be culturally and aesthetically sensitive across a range of social contexts.**
- **Explore education and career opportunities.**
- **Develop entrepreneurial opportunities.**

**The Revised National Curriculum Statement attempts to embody and uphold a democratic vision of the society and the citizens that should emerge from our school system.**

**By means of the Learning Area Statements, the Revised National Curriculum Statement identifies the goals, expectations and outcomes to be achieved through related learning outcomes and assessment standards. The learning outcomes for each Learning Area are provided later in this document (Appendix 3). The assessment standards are in the actual Learning Area Statements that are published as Addenda to the document (not included in this document).**

**The outcomes and assessment standards emphasis participatory, learner centred and activity-based education. They leave considerable room for creativity and innovation on the part of teachers in interpreting what and how to teach.**

**The South African version of outcomes-based education is aimed at stimulating the minds of young people so that they are able to participate fully in economic and**



social life. It is intended to ensure that all learners are able to develop and achieve to their maximum ability and are equipped for lifelong learning.

### **A high level of skills and knowledge for all**

The Revised National Curriculum Statement aims at the development of a high level of knowledge and skills for all. It sets and holds up high expectations of what South African learners can achieve. Social justice requires that those sections of the population previously disempowered by the lack of knowledge and skills should now be empowered. The Revised National Curriculum Statement aims to provide for a stronger base from which to enable the development of a high level of skills and knowledge by all. It does so by specifying the combination of minimum knowledge and skills to be achieved by learners in each grade and setting high, achievable standards in all the Learning Areas.

### **Clarity and Accessibility**

The Revised National Curriculum Statement aims at clarity and accessibility both in its design and language. Two design features - learning outcomes and assessment standards - clearly define for all learners the goals and outcomes necessary to proceed to each successive level of the system. In addition, the Revised National Curriculum Statement will be available in all official languages and Braille.

### **Progression and Integration**

The principle of integrated learning is integral to outcomes-based education. Integration ensures that learners experience the Learning Areas as linked and related. It supports and expands their opportunities to attain skills, acquire knowledge and develop attitudes and values encompassed across the curriculum.

It is important that the curriculum sets out progressively more complex, deeper and broader expectations of learners. Conceptual progression is a term used to describe this feature of a curriculum. In the Revised National Curriculum Statement, the assessment standards in each Learning Area Statement provide the conceptual progression in each Learning Area from grade to grade.

At the same time, learners should not deal with assessment standards in isolation. Links must be made within and across learning outcomes and Learning Areas. The achievement of an optimal relationship between integration across learning areas and conceptual progression from grade to grade are central to this curriculum.

The ongoing development of teachers, school management teams and departmental support personnel is an important facet of this goal.

# **The Principles of the National Curriculum Statement (FET)**

## **Further Education and Training (grades 10-12)**

(Department of Education 2003a)

### **Social Transformation**

The Constitution of the Republic of South Africa forms the basis for social transformation in our post-apartheid society. The imperative to transform South African society by making use of various transformative tools stems from a need to address the legacy of apartheid in all areas of human activity and in education in particular. Social transformation in education is aimed at ensuring that the educational imbalances of the past are redressed, and that equal educational opportunities are provided for all sections of our population. If social transformation is to be achieved, all South Africans have to be educationally affirmed through the recognition of their potential and the removal of artificial barriers to the attainment of qualifications.

### **Outcomes-Based Education**

Outcomes-based education (OBE) forms the foundation for the curriculum in South Africa. It strives to enable all learners to reach their maximum learning potential by setting the Learning Outcomes to be achieved by the end of the education process. OBE encourages a learner-centred and activity-based approach to education. The National Curriculum Statement builds its Learning Outcomes for Grades 10-12 on the Critical and Developmental Outcomes that were inspired by the Constitution and developed through a democratic process. The Critical Outcomes require learners to be able to:

- Identify and solve problems and make decisions using critical and creative thinking;
- Work effectively with others as members of a team, group, organisation and community;

- Organise and manage themselves and their activities responsibly and effectively;
- Collect, analyse, organise and critically evaluate information;
- Communicate effectively using visual, symbolic and/or language skills in various modes;
- Use science and technology effectively and critically showing responsibility towards the environment and the health of others; and
- Demonstrate an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation.

The Developmental Outcomes require learners to be able to:

- Reflect on and explore a variety of strategies to learn more effectively;
- Participate as responsible citizens in the life of local, national and global communities;
- Be culturally and aesthetically sensitive across a range of social contexts;
- Explore education and career opportunities; and
- Develop entrepreneurial opportunities.

### **High Knowledge and High Skills**

The National Curriculum Statement Grades 10-12 (General) aims to develop a high level of knowledge and skills in learners. It sets up high expectations of what all South African learners can achieve. Social justice requires the empowerment of those sections of the population previously disempowered by the lack of knowledge and skills. National Curriculum Statement specifies the minimum standards of knowledge and skills to be achieved at each grade and sets high, achievable standards in all subjects.

### **Integration and Applied Competence**

Integration is achieved within and across subject and fields of learning. The integration of knowledge and skills across all subjects and terrains of practice is crucial for achieving applied competence as defined in the National Qualifications Framework. Applied competence aims at integrating three discreet competencies- namely, practical, foundational and reflective competencies. In adopting integration and applied competence, the National Curriculum Statement Grades 10-12 (General) seeks to promote an integrated learning of theory, practice and reflection.

### **Progression**

Progression refers to the process of developing more advanced and complex knowledge and skills. The Subject Statements show progression from one grade to another. Each Learning Outcome is followed by an explicit statement of what level of performance is expected for an outcome. Assessment Standards are arranged in a format that shows an increased level of expected performance per grade. The content and context of each grade will also show progression from simple to complex.

### **Articulation and Portability**

Articulation refers to the relationship between qualifications in different National Qualifications Framework levels or bands in ways that promote access from one qualification to another. This is especially important for qualifications falling within the same learning pathway. Given that the Further Education and Training band is nested between the General Education and Training band and the Higher Education and Training bands, it is vital that the Further Education and Training Certificate (General) articulates with the General Education and Training Certificate and with qualifications in similar learning pathways of Higher Education. In order to achieve this articulation, the development of each Subject Statement included a close scrutiny of the exit level expectations in the General Education and Training Learning

Areas, and of the learning assumed to be in place at the entrance levels of cognate disciplines in Higher Education.

Portability refers to the extent to which parts of a qualification (subjects or unit standards) are transferable to another qualification in a different learning pathway of the same National Qualifications Framework band. For purposes of enhancing the portability of subjects obtained in Grades 10-12, various mechanisms have been explored, for example, regarding a subject as a 20-credit unit standard. Subjects contained in the National Curriculum Statement Grades 10-12 (General) compare with appropriate unit standards registered on the National Qualifications Framework.

### **Human Rights, Inclusivity, Environmental and Social Justice**

The National Curriculum Statement Grades 10-12 (General) seeks to promote human rights, social justice and environmental justice. All newly-developed Subject Statements are infused with the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa. In particular, the National Curriculum Statement Grades 10-12 (General) is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors.

The National Curriculum Statement Grades 10-12 (General) adopts an inclusive approach by specifying minimum requirements for all learners. It acknowledges that all learners should be able to develop to their full potential provided they receive the necessary support. The intellectual, social, emotional, spiritual and physical needs of learners will be addressed through the design and development of appropriate Learning Programmes and through the use of appropriate assessment instruments.

### **Valuing Indigenous Knowledge Systems**

In the 1960's, the theory of multi-intelligences forced educationists to recognise that there were many ways of processing information to make sense of the world, and that, if one were to define intelligence anew, one would have to take these different approaches into account. Up until then the Western world had only valued logical, mathematical and specific linguistic abilities, and rated people as 'intelligent' only if they were adept in these ways. Now people recognise the wide diversity of knowledge systems through which people make sense of and attach meaning to the world in which they live. Indigenous knowledge systems in the South African context refer to a body of knowledge embedded in African philosophical thinking and social practices that have evolved over thousands of years. The National Curriculum Statement Grades 10-12 (General) has infused indigenous knowledge systems into the Subject Statements. It acknowledges the rich history and heritage of this country as important contributors to nurturing the values contained in the Constitution. As many different perspectives as possible have been included to assist problem solving in all fields.

### **Credibility, Quality and Efficiency**

The National Curriculum Statement Grades 10-12 (General) aims to achieve credibility through pursuing a transformational agenda and through providing an education that is comparable in quality, breadth and depth to those of other countries. Quality assurance is to be regulated by the requirements of the South African Qualifications Authority Act (Act 58 of 1995), the Education and Training Quality Assurance Regulations, and the General and Further Education and Training Quality Assurance Act (Act 58 of 2001).

## Appendix 2

### Learning Areas: Definitions and Outcomes (RNCS- GET)

(Department of Education 2002)

#### Languages

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##### Definition

The Languages Learning Area Statement includes: All eleven official languages: Sepedi, Sesotho, Setswana, siSwati, Tshivenda, Xitsonga, Afrikaans, English, isiNdebele, isiXhosa and isiZulu. Languages approved by the Pan South African Language Board (PANSALB) and the South African Certification Authority (SAFCERT) such as Braille and South African Sign Language.

In a multilingual country like South Africa it is important that learners reach high levels of proficiency in at least two languages, and that they are able to communicate in other languages.

The Languages Learning Area Statement follows an additive on incremental approach to multilingualism: All learners learn their home language and at least one additional official language. Learners become competent in their additional language, while their home language is maintained and developed.

The Languages Learning Area Statement covers all official languages as:

Home languages

First additional languages

Second additional languages

Learners' home language should be used for learning and teaching wherever possible. This is particularly important in the Foundation Phase where children learn to read and write. When learners have to make a transition from their home language to an additional language for learning and teaching, careful planning is necessary.

#### Outcomes

**Listening:** The learner is able to listen for information and enjoyment, and respond appropriately and critically in a wide range of situations.

**Speaking:** The learner is able to communicate confidently and effectively in a spoken language in a wide range of situations.



**Reading and Viewing:** The learner is able to read and view for information and enjoyment, and respond critically to the aesthetic, cultural and emotional values in texts.

**Writing:** The learner is able to write different kinds of factual and imaginative texts for a wide range of purposes.

**Thinking and Reasoning:** The learner is able to use language to think and reason, and access, process and use information for learning.

**Language Structure and Use:** The learner knows and is able to use the sounds, words and grammar of a language to create and interpret texts.

Listening and speaking; reading and viewing; thinking and reasoning; and the knowledge of sounds, words and grammar, although presented as separate outcomes, should be integrated in teaching and assessment.

## **Mathematics**

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### **Definition**

Mathematics is a human activity that involves observing, representing and investigating patterns and quantitative relationships in physical and social phenomena and between mathematical objects themselves. Through this process new mathematical ideas and insights are generated.

Mathematics uses its own specialized language that involves symbols and notations for describing numerical, geometric and graphical relations. Mathematical concepts build on one another, thereby creating a coherent structure.

Mathematics is a product of investigation by different cultures; it is a purposeful activity in the context of social, political and economic goals and constraints. It is not value-free or culturally-neutral.

### **Outcomes**

**Numbers, Operations and Relationships:** The learner is able to recognize, describe and represent numbers and their relationships and can count, estimate, calculate and check with competence and confidence in solving problems.

**Patterns, Functions and Algebra:** The learner is able to recognize, describe and represent patterns and relationships, and solves problems using algebraic language skills.

**Space and Shape:** The learner is able to describe and represent characteristics and relationships between 2-D shapes and 3-D objects in a variety of orientations and positions.

**Measurement:** The learner is able to use appropriate measuring units, instruments and formulae in a variety of contexts.

**Data Handling:** The learner is able to collect, summarise, display and critically analyse in order to draw conclusions and make predictions, and to interpret and determine chance variation.

## **Natural Sciences**

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### **Definition**

What is today known as 'Science' has its roots in African, Arabic, Asian, American and European cultures. It has been shaped by the search to understand the natural world through observation, codifying and testing ideas, and has evolved to become part of the cultural heritage of all nations. It is usually 'characterised by the possibility of making precise statements which are susceptible of some sort of check or proof' (McGraw-Hill Concise Encyclopaedia of Science and Technology, 2<sup>nd</sup> Edition, p. 1647).

The Natural Sciences Learning Area Statement envisages a teaching and learning milieu that recognises that the people of South Africa have a variety of learning styles as well as culturally influenced perspectives. The Natural Sciences Learning Area starts from the premise that all learners should have access to a meaningful science education. Meaningful education has to be learner-centred. It has to help learners to understand not only scientific knowledge and how it is produced but also the environmental and global issues. The Natural Sciences Learning Area aims to provide a foundation on which learners can build throughout life.

The Natural Sciences Learning Area Statement promotes scientific literacy. It does this by focusing on:

- The development and use of specific process skills in a variety of setting.
- The development and application of scientific knowledge and understanding.
- Appreciation of the relationships and responsibilities between Science, society and the environment.

### **Outcomes**

**Scientific Investigation:** Learners act confidently on their curiosity about natural phenomena; they investigate relationships and solve problems in Science, Technology and environmental contexts.

**Constructing Science Knowledge:** Learners know, interpret and apply scientific, technological and environmental knowledge.

**Science, Society and the Environment:** Learners are able to demonstrate an understanding of the relationships between Science and Technology, society and the environment.

## Social Sciences

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### Definition

The Social Sciences study relationships between people, and between people and the environment.

These relationships vary over time and space. They are also influenced by social, political, economic and environmental contexts, and by people's values, attitudes and beliefs.

The concepts, skills and processes of History and Geography form key elements of the Social Sciences Learning Area Statement. Environmental education and human rights education are integral to both History and Geography.

The Social Sciences Learning Area Statement is concerned with what learners learn and how learners learn, and how learners construct knowledge. The Learning Area Statement encourages learners to ask and find answers to questions about society and the environment in which they live.

**This Learning Area Statement aims at contributing to the development of informed, critical and responsible citizens who are able to participate constructively in a culturally diverse and changing society. It also equips learners to contribute to the development of a just and democratic society.**

### Outcomes

#### *History*

**Historical Enquiry:** The learner is able to use enquiry skills to investigate the past and present.

**Historical Knowledge and Understanding:** The learner is able to demonstrate historical knowledge and understanding.

**Historical Interpretation:** The learner is able to interpret aspects of history.

#### *Geography*

**Geographical Enquiry:** The learner is able to use enquiry skills to investigate geographical and environmental concepts and processes.

**Geographical Knowledge and Understanding:** The learner is able to demonstrate geographical and environmental knowledge and understanding.

**Exploring Issues:** The learner is able to make informed decisions about social and environmental issues and problems.

## Arts and Culture

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### Definition

The Arts and Culture Learning Area Statement covers a broad spectrum of South African arts and culture practices. Arts and Culture are an integral part of life, embracing the spiritual, material, intellectual and emotional aspects of human endeavour within society.

Culture expresses itself through the arts and ways of living, behaviour patterns, heritage, knowledge and belief systems. Cultures are not static- they have histories and contexts, and they change, especially when they are in contact with other cultures.

The approach towards culture in this Learning Area Statement encourages learners to:

- Move from being passive inheritors of culture to being more active participants in it.
- Reflect creatively on art, performances and cultural events.
- Identify the connections between art works and culture.
- Understand the geographical, economic and social contexts in which Arts and Culture emerge
- Identify the links between cultural practice, power and cultural dominance.
- Analyse the effects of time on Culture and the Arts.
- Understand how the arts express, extend and challenge culture in unique ways.

The approach towards Arts in this Learning Area Statement moves from a broad experience involving several art forms within diverse cultural contexts towards an increasing depth of knowledge and skill by the 8<sup>th</sup> and 9<sup>th</sup> Grade. The integrity of discrete art forms and the value of integrated learning experiences are recognised. The Learning Area Statement strives to create a balance between developing generic knowledge about Arts and Culture, and specific knowledge and skills in each of the art forms.

### Outcomes

**Creating, Interpreting and Presenting:** The learner is able to create, interpret and present work in each of the art forms.

**Reflecting:** The learner is able to reflect critically on artistic and cultural processes, products and styles in past and present contexts.

**Participating and Collaborating:** The learner is able to demonstrate personal and interpersonal skills through individual and group participation in arts and culture activities.

**Expressing and Communicating:** The learner is able to analyse and use multiple forms of communication and expression in Arts and Culture.

## Life Orientation

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### Definition

The concept of Life Orientation captures the essence of what this Learning Area Statement aims to achieve. It guides and prepares learners for life and its possibilities. Life Orientation specifically equips learners for meaningful and successful living in a rapidly changing and transforming society.

The Life Orientation Learning Area Statement develops skills, knowledge, values and attitudes that empower learners to make informed decisions and take appropriate actions regarding:

- Health promotion
- Social development
- Personal development
- Physical development and movement
- Orientation to the world of work

Together, these five focus areas of the Life Orientation Learning Area Statement address the human and environmental rights outlined in the Constitution.

### Outcomes

**Health Promotion:** The learner is able to make informed decisions regarding personal, community and environmental health.

**Social Development:** The learner is able to demonstrate an understanding of and commitment to constitutional rights and responsibilities and show an understanding of diverse cultures and religions.

**Personal Development:** The learner is able to use acquired life skills to achieve and extend personal potential to respond effectively to challenges in his/ her world.

**Physical Development and Movement:** The learner is able to demonstrate an understanding of, and participate in activities that promote movement and physical development.

**Orientation to the World of Work:** The learner is able to make informed decisions about further study and career choices.

## Economic and Management Sciences

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### Definition

The Economic and Management Sciences Learning Area Statement involves the study of private, public or collective use of different types of resources in satisfying people's needs and wants, while reflecting critically on the impact of resource exploitation on the environment and people.

In particular, the Economic and Management Science Learning Area Statement deals with:

- The nature, processes and production of good and services.

The South African economy and socio-economic systems in different countries,  
Investment and financial management and planning skills, either for private, public or collective ownership.  
Entrepreneurial skills and knowledge needed to manage human live and environments.

## **Outcomes**

**Knowledge and Understanding of the Economic Cycle:** The learner is able to demonstrate knowledge and understanding of the economic cycle in addressing the economic problem.

**Understanding of Sustainable Growth and Development:** The learner is able to demonstrate an understanding of sustainable growth, reconstruction and development, and reflect critically on related processes.

**Managerial, Consumer and Financial Knowledge and Skills:** The learner is able to demonstrate knowledge and the ability to apply responsibly a range of managerial, consumer and financial skills.

**Entrepreneurial Knowledge and Skills:** The learner is able to demonstrate entrepreneurial knowledge, skills and attitudes.

## **Technology**

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### **Definition**

Technology has existed throughout history as an activity in which people use a combination of knowledge, skills and available resources to develop solutions to meet their daily needs and wants. Some of these solutions are in the form of products while some solutions involve a combination of products to make systems.

Today, many people still have needs and wants. Solutions are still developed through activities that combine knowledge, skills and available resources. However, the knowledge, skills and resources used today are different because of the accelerating developments in technology. Today's society is complex and diverse.

Economic and environmental factors and a wide range of attitudes and values need to be taken into account when developing technological solutions. It is in this context that technology is defined as:

The use of knowledge, skills and resources to meet people's need and wants by developing practical solutions to problems while considering social and environmental factors.

### **Outcomes**

**Technological Processes and Skills:** The learner is able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies.

**Technological Knowledge and Understanding:** The learner is able to understand and apply technological knowledge ethically and responsibly.

**Technology, Society and Environment:** The learner is able to demonstrate an understanding of the interrelationships between Science, Technology, Society and the environment over time.



## Appendix 3

### Natural Sciences Learning Area (RNCS- GET)

#### Core Knowledge and Concepts in Life and Learning

Life processes and Healthy Living	Interactions in Environments	Biodiversity, Change and Continuity
<i>Unifying statement: Living things, including humans and invisibly small organisms, can be understood in terms of life processes, functional units and systems.</i>	<i>Unifying statement: Organisms in ecosystems are dependant for their survival on the presence of abiotic factors and on their relationship with other organisms.</i>	<i>Unifying statement: The huge diversity of forms of life can be understood in terms of a history of change in environments and in characteristics of plants and animals throughout the world over millions of years.</i>
<b>Foundation Phase</b>		
<ul style="list-style-type: none"> <li>Many of our body parts correspond to parts of animals, such as limbs, heads, eyes, ears, feet, and in many cases animals use them for the same purpose we do.</li> <li>Animals and plants have needs similar to ours, for food, water and air.</li> </ul>	<ul style="list-style-type: none"> <li>We depend on plants and animals for food, and we breed certain animals and grow certain plants as crops.</li> <li>We see cultural diversity in the kinds of food people like to eat.</li> <li>Some animals, like flies and ticks, carry germs which can make people sick.</li> </ul>	<ul style="list-style-type: none"> <li>There is a large variety of plants and animals, which have interesting visible differences but also similarities, and they can be grouped by their similarities.</li> <li>Plants and animals change as they grow, as the years pass, and as the seasons change.</li> </ul>
<b>Intermediate Phase</b>		
<ul style="list-style-type: none"> <li>Green plants produce their own food and grow by using water and substances from the air and soil. Energy from light is needed to change these simple substances into food and plant material. Green plants are the only organisms that can produce food in their own bodies.</li> <li>Living things need food for energy, to move, grow and to repair damage to their bodies ('tissues'). Animals including humans have digestive systems for getting nutrients from food. Humans need a balanced diet from certain groups of food to be healthy.</li> <li>All living things can respond to their environment in various ways; animals, including humans have specialized sense organs.</li> <li>Living things can move themselves; animals, including humans, can move themselves from place to place. Many species of animals move themselves by means of muscles attached to some kind of skeleton, which is either inside or on the surface of the body.</li> </ul>	<ul style="list-style-type: none"> <li>Animals cannot make their own food, and so some animals eat plants for food while some animals eat other animals. All animals ultimately depend on green plants for their food.</li> <li>Ecosystems are self-contained areas where a wide variety of plant and animals species live and reproduce. They depend on each other and on the non-living environment. The life and reproduction of all the organisms in an ecosystem depend on the continuing growth and reproduction of plants.</li> <li>Organisms' habitats are the places where they feed, hide, produce young and, in many cases shelter the young until the young have a better chance of survival. (such as being solitary, pairing for life, or living in packs, prides, herds, troops or colonies).</li> <li>Ecosystems depend on soil. Soil forms by natural processes from rock and dead plant and animal material, but it takes an extremely long time to form. Substances, which plants take from the soil, must be replaced to maintain fertility of the soil. (<i>Links with soil in Planet Earth and Beyond</i>)</li> <li>Water plays an important role in ecosystems, sustaining both plant</li> </ul>	<ul style="list-style-type: none"> <li>New plants can grow from certain parts of the parent plant. This is called vegetative reproduction and does not need seeds. The new plants have all the characteristics of the parent plant.</li> <li>Sexual reproduction is the process by which two individual plants or animals produce another generation of individuals. The next generation's individuals look like the parents but always have slight differences ('variation') from their parents and from each other.</li> <li>South Africa has a rich fossil record of animals and plants, which lived many millions of years ago. Many of these animals and plants were different from the ones we see nowadays. Some plants and animals have strong similarities to fossils of ancient plants and animals. We infer from fossil record and other geological observations that the diversity of living things, natural environments and climates were different in those long-ago times (<i>Links with fossils in Planet Earth and Beyond</i>)</li> </ul>



	and animal life. Industrial, agricultural and domestic activities may have a serious impact on the quality and quantity of water available in an area ( <i>Links with Planet Earth and Beyond</i> )	
<b>Senior Phase</b>		
<ul style="list-style-type: none"> <li>Humans go through physical changes as they age; puberty means that the body is ready for sexual reproduction.</li> <li>Human reproduction begins with the fusion of sex cells from mother and father, carrying the patterns for some characteristics of each.</li> <li>Conception is followed by a sequence of changes in the mother's body, and during this period the future health of the unborn child can be affected.</li> <li>Knowledge of how to prevent the transmission of sexually transmitted diseases, including the HIVirus, must be followed by behaviour choices.</li> <li>Green plants use energy from the sun, water and carbon dioxide from the air to make food by photosynthesis. This chemical reaction is central to the survival of all organisms living on earth.</li> <li>Animals, including humans, require protein, fat, carbohydrates, minerals, vitamins and water. Food taken in it absorbed into the body via the intestine. Surplus food is stored as fat or carbohydrate.</li> <li>Animals, including humans, have a circulatory system which includes the heart, veins, arteries and capillaries, and which carries nutrients and oxygen to all parts of the body and removes waste products. Oxygen, which is provided by the breathing system, reacts with food substances to release energy. (<i>Links with Energy and Change</i>)</li> <li>All living things, including humans, have means - eliminating waste products, which are produced during life processes. Water plays an important role in this process.</li> <li>Water makes up a large proportion of all living things, and their health depends on water passing through them in various ways, using structures (such as kidneys, skin or stomata), which can fulfil this function.</li> </ul>	<ul style="list-style-type: none"> <li>Human reproduction is more than conception and birth; it involves adults raising children, which requires judgement and values and usually depends on the behaviour of other people in a community and environment.</li> <li>Each species of animal has characteristic behaviours, which enable it to feed, find a mate, breed, raise young, live in a population of the same species, or escape threats in its particular environment. These behaviours have arisen over long periods of time that the species population has been living in the same environment.</li> <li>All organisms have adaptations for survival in their habitats (such as adaptations for maintaining their water balance, obtaining and eating the kind of food they need, reproduction, protection or escape from predators).</li> <li>An ecosystem maintains numerous food webs and competition for food among different individuals and populations. South Africa has certain ecosystems, which have exceptional biodiversity. All uses of these areas must be based on principles of sustainable development.</li> <li>Pollution interferes with natural processes that maintain the interdependencies and diversity of an ecosystem.</li> <li>Many biological changes, including decomposition and recycling of matter in ecosystems and human diseases, are caused by invisibly small, quickly reproducing organisms.</li> </ul>	<ul style="list-style-type: none"> <li>Offspring of organisms differ in small ways from their parents and generally from each other. This is called variation in species.</li> <li>Natural selection kills those individuals of a species, which lack the characteristics that would have enabled them to survive and reproduce successfully in their environment. Individuals, which have characteristics suited to the environment reproduce successfully and some of their offspring carry the successful characteristics. Natural selection is accelerated when the environment changes; this can lead to the extinction of species.</li> <li>Variations in human biological characteristics such as skin colour, height, and so on, have been used to categorise groups of people. These biological differences do not indicate differences in innate abilities of the groups concerned. Therefore, such categorisation of groups by biological differences is neither scientifically valid nor exact; it is a social construct.</li> <li>Biodiversity enables ecosystems to sustain life and recover from changes to the environment. Loss of biodiversity affects the capacity of ecosystems and the earth, to sustain life. Classification is a means to organise and make them easier to study. The two main categories of animals are the vertebrates and invertebrates, and among vertebrates the five classes are amphibians, birds, fish, reptiles and mammals.</li> <li>Human activities, such as the introduction of alien species, habitat destruction, population growth, pollution and over-consumption, result in the loss of biodiversity. This becomes evident when more species become endangered, or, ultimately, extinct.</li> <li>Extinctions also occur through natural events. Mass extinctions have occurred in the past, suggesting that huge changes to environments have occurred. However, these changes occurred very slowly, compared to the fast rate at which humans can destroy plant and animal species. (<i>Links with Planet Earth and Beyond</i>)</li> <li>The cell is the basic unit of most living things, and an organism may</li> </ul>

		be formed from one or many cells. Cells themselves carry on life processes such as nutrition, respiration, excretion and reproduction, which sustain the life of the organism as a whole.
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## Core Knowledge and Concepts in Energy and Change

<b>Energy Transfers and Systems</b>	<b>Energy and Development in South Africa</b>
<i>Unifying statement: Energy is transferred through biological or physical systems, from energy sources. With each energy transfer, some of the energy becomes less available for our use, and therefore we need to know how to control energy transfers.</i>	<i>Unifying statement: Energy is available from a limited number of sources, and the sustainable development of countries in our region depends on the use of energy resources.</i>
<b>Foundation Phase</b>	
<ul style="list-style-type: none"> <li>When we say we feel 'full of energy', we mean we feel ready to move fast or do a lot of work.</li> </ul>	<ul style="list-style-type: none"> <li>People who do not have enough food or the right kind of food to eat, feel tired and lack energy.</li> </ul>
<b>Intermediate Phase</b>	
<ul style="list-style-type: none"> <li>There are sources of energy in nature, which can be used for doing useful work; examples are wind, the sun, fire, animals' muscles and falling water. Energy sources can be dangerous but can also be used in the systems which people design, such as boats, windmills, carts, cookers and turbines.</li> <li>A system is made of two or more parts that work together or affect each other. Systems may be as simple as two grindstones that crush grain between them, or have several parts, like an electrical circuit, or have many parts, like an ecosystem. Systems transfer energy from one part of the system to other parts.</li> <li>We can design and make systems, which store energy. Electric cells, stretched springs, food and chemicals, which react, are examples of such systems.</li> <li>An electrical circuit is a system. It is a path of electrical components and conductors with no breaks in it, and an energy source to make electric charges flow around the conducting path. The energy source may be cells or the 'mains' electricity supply. The circuit transfers energy from the source to resistors such as bulbs, heating-wires, solenoids or motors in the circuit. <i>(Links with the Technology Learning Area)</i></li> <li>Whenever a substance changes by expanding, contracting, melting, evaporating, condensing or solidifying, it means that the substance has gained or given away some energy. <i>(Links with Matter and Materials)</i></li> <li>Sound transfers energy from a vibrating body to our ears. Vibrations travel through a medium, which may be a solid, a liquid or a gas. We hear a change in the rate of vibration as a change in pitch.</li> </ul>	<ul style="list-style-type: none"> <li>Humans and animals get energy from eating plants and from eating animals that ate plants. The sun provides energy for plants to grow and produce food. <i>(Links with Life and Living)</i></li> <li>Energy from electrical sources can be dangerous and so we need safety rules for using electricity.</li> </ul>
<b>Senior Phase</b>	
<ul style="list-style-type: none"> <li>Energy can be stored in a system as potential energy, either by the positions of the bulk parts of the system or by its particles (atoms and molecules), which have the potential to react with each other and release energy. Examples of potential energy are the stored energy of a compressed spring or the stored energy of particles, which could react in a fuel-and-air mixture, or in food and body of a living thing.</li> <li>Potential energy can be released as kinetic energy in the motion of parts of the system, either in the motion of bulk parts of the system or in the motion of particles of</li> </ul>	<ul style="list-style-type: none"> <li>Energy sources such as wind, sun and water in high dams are renewable. Fuels such as coal, gas and oil are not renewable energy resources, because they cannot be replaced. <i>(Links with Planet Earth and Beyond)</i></li> <li>Development and relief of poverty depends on energy supplies, particularly electrical energy, and the systems to deliver the energy to where it is needed.</li> <li>Large-scale electricity supply depends on generation systems, which use a few energy sources, such as burning coal, nuclear reactions, burning gas and falling water.</li> </ul>

<p>the system. Examples of the release of kinetic energy are the motion of a released spring or the faster motion of the particles of hot gases when a fuel-air mixture burns, or the body movement of humans and animals. Kinetic energy is transferred to parts within the system and energy is also transferred to the system's surroundings. When energy is transferred, it causes changes in the system and the system's surroundings.</p> <ul style="list-style-type: none"> <li>• There is an unlimited number of systems which can be made to store or transfer energy. The possible systems include electrical, mechanical (including spring and friction systems), chemical, gravitational, nuclear, solar, biomass, optical (light), acoustical (sound) and thermal (heat) systems as well as human bodies and ecosystems.</li> <li>• All physical systems that people use (for example, appliances, vehicles and human bodies) waste some of the energy they receive, and the wasted energy has gone into heating the surroundings, we can no longer use that energy to do work for us.</li> <li>• Hot objects transfer energy to colder objects, until the objects reach the same temperature. Hot objects transfer their energy, as heat, in three ways: by conduction, by convection and by radiation. These transfers may be useful or wasteful. Wasteful heat transfers can be controlled by reducing conduction, convection and radiation in a system. Similarly, useful heat transfer can be increased by improving conduction, convection and radiation in a system.</li> <li>• All organisms in an ecosystem need energy from other parts of the ecosystem. Energy is transferred from part to part of an ecosystem and each part retains only a fraction of the energy it received. (<i>Links with Life and Living</i>)</li> <li>• Light travels away from a light-giving body until it strikes an object. The object may absorb the light, or refract it or reflect it. Light transfers energy to other objects. (<i>Links with Life and Living</i>)</li> <li>• Objects can exert forces on each other, thereby forming a system which can store or transfer energy. They may do so by physical contact or by forces which act through a field. Field forces are the magnetic, electric and gravitational forces. All forces act in pairs, so that if a body A exerts a force on body B, B exerts an equal and opposite force on A.</li> </ul>	<p>Use of any of these sources has environmental implications. For example, when coal is burned to generate electricity, gases are produced that affect the atmosphere and local and global environments. (<i>Links with Planet Earth and Beyond</i>)</p> <ul style="list-style-type: none"> <li>• Other electricity-generation systems have smaller environmental impact but may cost more in the short term. Better design of buildings and appliances, and better practices in using energy, can save costs to consumers and lessen the environmental impact of exploiting energy sources.</li> <li>• Many people in South Africa use wood for heating and cooking. Plants such as trees can be a renewable energy source if more trees are planted and the soil is managed well. (<i>Links with Planet Earth and Beyond</i>)</li> </ul>
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## Core Knowledge and Concepts in the Planet Earth and Beyond

<b><i>Our Place in Space</i></b>	<b><i>Atmosphere and Weather</i></b>	<b><i>The Changing Earth</i></b>
<i>Unifying statement: Our planet is a small part of a solar system in an immense galaxy.</i>	<i>Unifying statement: The atmosphere is a system which interacts with the land, lakes and oceans and which transfers energy and water from place to place.</i>	<i>Unifying statement: The Earth is composed of materials, which are continuously being changed by forces on and under the surface.</i>
<b>Foundation Phase</b>		
<ul style="list-style-type: none"> <li>• Many objects can be observed in the sky. Examples are birds, clouds, aeroplanes, the sun, stars, the moon, planets and satellites. All these objects have properties, locations and movements that can be investigated with a view to determining patterns, relationships and trends.</li> </ul>	<ul style="list-style-type: none"> <li>• Weather changes from day to day in ways that can be recorded and sometimes predicted. There are occasional unusual weather events like storms, floods or tornados which impact on people's lives.</li> </ul>	<ul style="list-style-type: none"> <li>• Soil and rocks vary in appearance and texture from place to place. By investigation, learners can find out that some soils erode more easily than others do, while some soil types support plant life better than others. They could investigate what some of the factors involved might be.</li> </ul>
<b>Intermediate Phase</b>		
<ul style="list-style-type: none"> <li>• Day and night may be explained</li> </ul>	<ul style="list-style-type: none"> <li>• Weather may change from day to</li> </ul>	<ul style="list-style-type: none"> <li>• Earth materials are solid rocks and</li> </ul>

<p>by the rotation of the earth on its own axis as it circles the sun.</p> <ul style="list-style-type: none"> <li>The moon's apparent shape changes in a predictable way and these changes may be explained by its motion relative to the earth and sun. Many cultural traditions and special occasions are related to the shape and position of the moon.</li> <li>The stars' apparent position in relation to each other do not change, but the nightly position of the star pattern as a whole changes slowly over the course of a year. Many cultures recognise and name particular star patterns, and have used them for navigation or calendars.</li> </ul>	<p>day. Weather can be described by measurable quantities, such as temperature, wind direction and speed, and precipitation.</p> <ul style="list-style-type: none"> <li>Other changes take longer to occur. An example of this type of medium-term change is annual seasonal changes, which may be described in terms of changes in rainfall, average wind direction, length of day or night and average maximum and minimum temperatures.</li> <li>Water changes its form as it moves in a cycle between the hydrosphere, atmosphere and lithosphere in what is known as the 'water-cycle'.</li> <li>Most of planet earth is covered by water in the oceans. A small portion of the planet is covered by land that is separated into continents. At the poles there are ice caps. Only a small amount of the water is available for living things on land to use and only a small portion of the land is easily habitable by humans.</li> </ul>	<p>soils, water and the gases of the atmosphere.</p> <ul style="list-style-type: none"> <li>Erosion of the land creates the landforms that we see and also results in the deposition of rock particles that may be lithified to form sedimentary rocks. Erosion and deposition can be very slow and gradual or it can occur in short catastrophic events like floods.</li> <li>Rocks may be classified into igneous, sedimentary and metamorphic types. This classification is based on the origins and history of the rocks.</li> <li>Soil consists of weathered rocks and decomposed organic material from dead plants, animals and bacteria. Soil forms by natural processes, but it takes an extremely long time to form. Soils have properties of colour and texture, capacity to retain water, and ability to support the growth of many kinds of plants, including those in our food supply. (<i>Links with Life and Living</i>)</li> <li>Fossils are the remains of life forms that have been preserved in stone. Fossils are evidence that life, climates and environments in the past were very different from those of today. (<i>Links with Life and Living</i>)</li> <li>The quality of water resources is determined by the quality of the catchment area. Proper care and management of catchment areas and water resources is essential, and factors affecting the quality of water resources and catchment may be investigated. (<i>Links with Life and Living</i>)</li> </ul>
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#### Senior Phase

<ul style="list-style-type: none"> <li>The earth is the third planet from the sun in a system that includes the moon, the sun, eight other planets and their moons, and smaller objects, such as asteroids and comets. The sun, an average star, is the central and largest body in the solar system.</li> <li>Most objects in the solar system are in the solar system are in regular and predictable motion. The motions of the earth and moon explain such phenomena as the day, the year, phases of the moon, and eclipses.</li> <li>Gravity is the force that keeps planets in orbit around the sun and governs the rest of the motion in the solar system. Gravity alone holds us to the earth's surface.</li> <li>The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle.</li> </ul>	<ul style="list-style-type: none"> <li>The outer layers of the earth are the atmosphere, the hydrosphere and the lithosphere. We live in the biosphere, which is where all these layers interact to support life.</li> <li>Climate varies in different parts of the globe. It tends to be cold in the Polar Regions and hot in the tropics. Different types of plants and animals are adapted to living in different climatic regions. (<i>Links with Life and Living</i>)</li> <li>The atmosphere is a mixture of nitrogen and oxygen in fairly consistent proportions, and small quantities of other gases that include water vapour. The atmosphere has different properties at different elevations.</li> <li>The atmosphere protects the earth from harmful radiation and from most objects from outer space that would otherwise strike the earth's surface. The atmosphere is the most important factor in keeping the</li> </ul>	<ul style="list-style-type: none"> <li>The planet earth has a layered structure, with a lithosphere, a hot, convecting mantle and a dense, metallic core.</li> <li>Lithospheric plates larger than some continents consistently move at rates of centimetres per year, in response to movements in the mantle. Major geological events, such as earthquakes, volcanic eruptions and mountain building, result from these plate motions.</li> <li>Landforms are the result of a combination of constructive and destructive forces. Constructive forces include crustal deformation, volcanic eruption, and deposition of sediment, while destructive forces include weathering and erosion.</li> <li>Many organisms in South Africa's fossil record cannot easily be classified into groups of organisms alive today, and some are found in places where present-day conditions would not be suitable for</li> </ul>
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<ul style="list-style-type: none"> <li>Space exploration programmes involve international collaboration in the use of earth-based telescopes (such as SALT in South Africa) and telescopes in orbit. Robotic spacecraft travel long distances to send back data about the planets and other bodies in our solar system, and research is being done on ways to send people to investigate the planet Mars.</li> </ul>	<p>earth's surface temperature from falling too low or raising too high to sustain life.</p> <ul style="list-style-type: none"> <li>Human activities and natural events can slightly change the composition and temperature of the atmosphere. Some effects of these small changes may be changes in annual weather patterns and long-term changes in rainfall and climate.</li> </ul>	<p>them. This is evidence that life and conditions on the earth have changed through time. (<i>Links with Life and Living</i>)</p> <ul style="list-style-type: none"> <li>Fossil fuels such as coal, gas and oil are the remains of plants and animals that were buried and fossilised at high pressures. These fuels are not renewable in our lifetimes. (<i>Links with Energy and Change</i>)</li> <li>Mining is a major industry in South Africa, with local examples in all the nine provinces. It is important in terms of the supply of coal for energy, essential for raw materials for other industries, employment and earnings for the country. A great number of other industries depend on the mining industry. Legislation controls mining, with regard to safety and environmental effects.</li> </ul>
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## Core Knowledge and Concepts in Matter and Materials

<b>Properties and Uses of Materials</b>	<b>Structure, Reactions and Changes of Materials</b>
<i>Unifying statement: We can classify materials by their properties, in order to establish types and patterns. Properties determine the selection of materials for particular uses.</i>	<i>Unifying statement: We can modify materials in ways we choose, through our understanding of their sub-structure.</i>
<b>Foundation Phase</b>	
<ul style="list-style-type: none"> <li>Materials have different properties such as texture, colour, strength and heaviness, and can be classified by these properties. We make things with materials, which have the properties we want.</li> </ul>	<ul style="list-style-type: none"> <li>Substances can be mixed and sometimes changes can be seen, such as the dissolving of a solid or new colours when food colouring/ paints are mixed.</li> </ul>
<b>Intermediate Phase</b>	
<ul style="list-style-type: none"> <li>Pure substances have melting temperatures and boiling temperatures, which are characteristic for each substance, and help us to identify the substance.</li> <li>Materials are evaluated and classified by their properties (such as hardness, flexibility, thermal conductivity or insulation, electrical conductivity or insulation, whether they can be magnetized, solubility and rusting).</li> <li>Major classes of materials are metals, ceramics (including glasses) and polymers (including plastics and fibres). Composite materials combine the properties of two or more materials.</li> </ul>	<ul style="list-style-type: none"> <li>Some changes to materials are temporary but other changes are permanent.</li> <li>Substances change when they receive or lose energy as heat. These changes include contraction and expansion, melting, evaporation, condensation and solidification. (<i>Links with Energy and Change</i>)</li> <li>The dissolving of a substance in a solvent depends on variables, which affect the rate of dissolving.</li> </ul>
<b>Senior Phase</b>	
<ul style="list-style-type: none"> <li>Substances in different states ('phases') have different properties such as crystalline structures, or compressibility/ incompressibility, or tendency to diffuse.</li> <li>Dark-coloured surfaces get hotter than light coloured surfaces when exposed to radiating sources of energy like the sun. Dark-coloured objects radiate their energy as heat more readily than shiny light-coloured objects. (<i>Links with Energy and Change</i>)</li> <li>Some materials are magnetised by electric currents or magnets. Some materials can be electrically charged by rubbing them with a different material. (<i>Links with Energy and Change</i>)</li> <li>Some conductors and circuit components reduce the</li> </ul>	<ul style="list-style-type: none"> <li>A particle model of matter can explain physical changes of substances such as, melting, evaporation, condensation, solidification, diffusion and heating by condensation.</li> <li>Many household substances are acidic or basic. Indicators are substances that react with acids and soluble bases to produce products that have distinctive colours. Acids and bases neutralise one another to form salts. Acids have characteristic reactions with metals, metal oxides, hydroxides and carbonates.</li> <li>Many chemical reactions need some energy to get started; many chemical reactions give off energy as they happen.</li> </ul>



<p>current in an electric circuit to a significant extent and are called resistors. Resistors can be selected or designed to control currents.</p> <ul style="list-style-type: none"> <li>• A pure substance cannot be separated into different substances, with a mixture can be separated, usually by physical means. Differences in properties can be used to separate mixtures of different substances (by means of filtration, distillation, evaporation, chromatography or magnetism). <i>(Links with Matter and Materials)</i></li> <li>• Specific gases may be separated from the air or produced in reactions, and have many uses in industry and other sectors of the economy. Oxygen, hydrogen and carbon dioxide have characteristic properties and reactions by which we can identify them.</li> <li>• Extracting useful materials from raw materials depends on chemical reactions and methods of separation.</li> <li>• Raw materials, from which processed materials are made, must be mined, grown or imported from other countries. Raw materials that are mined are non-renewable and mining has environmental costs. Growing raw materials involves choices about the use of arable land and water catchment areas.</li> </ul>	<ul style="list-style-type: none"> <li>• Elements are made of just one kind of atom, whereas compounds are made of two or more kinds of atoms in fixed proportions. Elements may react to form compounds, and compounds may be decomposed into their elements. Energy input is needed to break a compound into its elements, whereas energy is given out when elements react to form a compound.</li> <li>• Oxygen has characteristic reactions with metals and non-metals, forming oxides. Some of these oxides dissolve in water to form acidic or alkaline solutions. Some metals react more readily with oxygen than other metals. Corrosion of iron is an economically important reaction, which can be prevented through an understanding of the reactions between iron, water and oxygen.</li> <li>• The reaction of oxygen with food releases energy in the cells of living things. <i>(Links with Life and Living)</i></li> </ul>
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## **Appendix 4**

### **Natural Sciences Learning Area Assessment Standards (RNCS Grades 5- 9)**

(DoE 2002)

#### **Learning Outcome 1:**

**Scientific Investigations: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.**

#### **Grade 5**

We know this when the learner:

- **Plans investigations: Lists, with support, what is known about familiar situations and materials, and suggests questions for investigation.**  
*Achievement is evident when the learner, for example*
  - Contributes to a class list of interesting aspects of the situation;
  - Helps build a list of questions which self or classmates consider important;
  - Responds to teacher's suggestions of 'what would happen if...'.
- **Conducts investigations and collects data: Carries out instructions and procedures involving a small number of steps.**  
*Achievement is evident when the learners, for example*
  - Follows a simple worksheet to set up equipment and obtain observations;
  - Records observations by drawing and labeling;
  - Preserves until the phenomenon happens or can be observed over a longer period of time (e.g. plants grow toward light from a mirror).
- **Evaluates data and communicates findings: Reports on the group's procedure and the results obtained.**  
*Achievement is evident when the learners, for example*
  - Offers observation data which have a connection to the focus question;
  - Describes before-and-after situations when they varied some factor in the situation.

## Grade 6

We know this when the learner:

- **Plans investigations:** Helps to clarify focus questions for investigation and describes the kind of information which would be needed to answer the question.

*Achievement is evident when the learner, for example*

- Expresses focus questions in own words;
- Considers classmates' ideas about kinds of information which may be relevant;
- Suggests ways that the information could be gathered;
- Clarifies task for other learners (e.g. 'What we need to find is...')

- **Conducts investigations and collects data:** Conducts simple tests or surveys and records observations or responses.

*Achievement is evident when the learners, for example*

- Interviews people about their preferences on a particular matter or product;
- Records new notes and measurements if teacher gives format for recording (e.g. lists, tables with headings)
- Contributes entries to the class logbook (e.g. about changes in a growing plant or a caterpillar)

- **Evaluates data and communicates findings:** Relates observations and responses to the focus question.

*Achievement is evident when the learners, for example*

- Points to examples of data which confirm the finding;
- Describes the data-collection methods and how data were recorded.

## Grade 7

We know this when the learner:

- **Plans investigations:** plans simple tests and comparisons, and considers how to make them fair.

*Achievement is evident when the learner, for example*

- Identifies a testable question among a set of possible questions
- Contributes in ways that aid the investigation (e.g. asks: 'How could we measure X?' or 'Are we treating these two things in the same way?')
- Gives reasons why a particular test is or is not fair.

- **Conducts investigations and collects data:** Organizes and uses equipment or sources to gather and record information

*Achievement is evident when the learners, for example*



- Systematically tests two or more items in order to compare them on the same common property;
- Modifies procedure to obtain better observations or readings;
- Uses indexes and glossaries to find useful data in books and catalogues.
- **Evaluates data and communicates findings: Generalizes in terms of a relevant aspect and describes how the data supports the generalization.**

*Achievement is evident when the learners, for example*

- Offers a strong example of evidence that supports the finding;
- Considers what further work would be needed to decide whether the findings apply to other, similar situations.

## **Grade 8**

We know this when the learner:

- **Plans investigations: Identifies factors to be considered in investigations and plans ways to collect data on them, across a range of values.**

*Achievement is evident when the learner, for example*

- Modifies a vague question to make it testable;
- Discuss suitable headings of instruments (e.g. tables, interview schedules) which will be needed to record data while working;
- Identifies factors which may be important to the investigation.

- **Conducts investigations and collects data: Collects and records information as accurately as equipment permits and investigations purposes require.**

*Achievement is evident when the learners, for example*

- Reviews data-collecting procedures during the investigation (e.g. varies the independent variable systematically while collecting data on the dependant variable);
- Sees the need to use measuring instruments, and does so with reasonable accuracy.

- **Evaluates data and communicates findings: Considers the extent to which the conclusions reached are reasonable answers to the focus question of the investigation.**

*Achievement is evident when the learners, for example*

- Lists items of evidence supporting the finding;
- Describes how the plan and data collection procedure was checked against the focus question;
- Considers factors in the group which might have affected their data.

## Grade 9

We know this when the learner:

- **Plans investigations: Plans a procedure to test predictions or hypotheses, with control of an interfering variable.**

*Achievement is evident when the learner, for example*

- Expresses a question in a testable form (e.g. 'if we do X, they Y will happen' or 'X and Y are always related');
- Identifies an interfering variable and explains how it will be taken into account
- Suggests sources of information which would provide suitable data;
- Pilot-tests an interview schedule before doing a survey.

- **Conducts investigations and collects data: Contributes to systematic data collection, with regard to accuracy, reliability and the need to control a variable.**

*Achievement is evident when the learners, for example*

- Takes sufficient measurements or responses to gauge reliability;
- Effectively controls at least one variable during data collection;
- Compares information from other sources when different views are likely or important;
- Discusses the meaning of the data being collected, comparing them with the focus question.

- **Evaluates data and communicates findings: Seeks patterns and trends in the data collected and generalizes in terms of simple principles.**

*Achievement is evident when the learners, for example*

- Shows how items of evidence support each other;
- Presents data in suitable forms in order to show trends and patterns;
- Considers possible bias in sources of information that are used;
- Suggests further investigations which would help to confirm the generalization.

## Learning Outcome 2:

**Construction Scientific Knowledge: The Learner will know and be able to interpret and apply scientific, technological and environmental knowledge.**

## Grade 5

We know this when the learner:

- **Recalls meaningful information: At the minimum, uses own most fluent language to name and describe features and properties of objects, materials and organisms.**

*Achievement is evident when the learner, for example*

- Identifies external parts of animals (e.g. noses, ears, tails, fur, gills, fins, scales, feathers) in own most fluent language;
  - Appropriately describes observable features of objects in the environment, animals, plants or features in the sky, in own most fluent language;
  - Matches moving mechanical systems to the definition of their motions (e.g. oscillation, rotation, movement in straight lines).
- **Categories information: Creates own categories of objects and organisms, and explains own rule for categorizing.**

*Achievement is evident when the learners, for example*

- Explains the grouping of a set of organisms with sentences such as: 'All these animals can get into trees, and these ones can't'.

## **Grade 6**

We know this when the learner:

- **Recalls meaningful information: at the minimum, describes the features which distinguish one category of thing from another.**

*Achievement is evident when the learner, for example*

- Explains the definitions that distinguish mammals (which suckle their young) and reptiles (which do not);
  - Describes and names different cloud formations and links them to coming weather;
  - Recalls the difference between planets and stars;
- **Categories information: Categorizes objects and organisms by two variables.**

*Achievement is evident when the learners, for example*

- Categorizes animals as mammals or reptiles, and then as carnivorous and herbivorous mammals, or carnivorous and herbivorous reptiles;
  - Categorizes leaves by the type of vein patterns, and then each class of leaf by the type of margin.
- **Interprets information: At the minimum, interprets information by using alternative forms of the same information.**

*Achievement is evident when the learners, for example*

- Finds information in science texts by using glossaries, indexes and tables of contents;
- Extracts information from bar graphs;
- Puts in order pictures of the stages in the life cycle of fruit flies, when observing real fruit flies reproducing;

- Identifies external parts of animals (e.g. noses, ears, tails, fur, gills, scales, feathers), and tells as much as possible about their function in the animal's way of living.

## Grade 7

We know this when the learner:

- **Recalls meaningful information: At the minimum, recalls definitions and complex facts.**

*Achievement is evident when the learner, for example*

- Distinguishes vertebrates from invertebrates;
- Lists the planets in our solar system, in their correct order and relations of size;
- Tells how electric and magnetic forces affect materials differently;
- Explains what is meant by a variable in an investigation.

- **Categories information: Compares features of different categories of objects, organisms and events.**

*Achievement is evident when the learners, for example*

- Uses a simple classification system to group root types of familiar plants;
- Compiles a list of uses of household acids, based on common properties, and compares them with a list of household bases;
- Takes the role of a zookeeper who needs to build animal enclosures in suitable groups, based on the particular needs of the animals.

- **Interprets information: Interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text).**

*Achievement is evident when the learners, for example*

- Creates headings for paragraphs in some passages from a textbook;
- Reconstructs jumbled or partly deleted text by reference to photos or diagrams;
- Identifies properties of materials from reading a story about the Wright brothers choosing materials to make an aeroplane;
- Generates own sentences about relationships of the type 'when X happens, then Y also happens'.

- **Applies Knowledge: Applies conceptual knowledge by linking a taught concept to a variation of a familiar situation.**

*Achievement is evident when the learners, for example*

- Identifies which processes of energy transfer were involved as a hot car engine cooled down;
- Applies the concept of reproduction to debate the question of whether rivers and fires are living or non-living things;

- Evaluates the 'fair test' aspect of simple investigations carried out by other people.

## Grade 8

We know this when the learner:

- **Recalls meaningful information: At the minimum, recalls procedures, processes and complex facts.**

*Achievement is evident when the learner, for example*

- Describes some symbiotic relationships among living things;
- Describes the steps in separating alcohol and water;
- Makes and uses a model of a flower to explain how the parts (e.g. petals, sepals, anthers, stigma) enable the functions of pollination and fertilization.

- **Categories information: Applies classification systems to familiar and unfamiliar objects, events, organisms and materials.**

*Achievement is evident when the learners, for example*

- Uses a simple classification system to group root types of plants, including unfamiliar species, and link them to dicotyledon vs. monocotyledon classification;
- Recalls and correctly applies classifications (e.g. mammals vs. birds, fish, reptiles and amphibians, metals vs. non-metals, insulators vs. conductors, planets vs. stars).

- **Interprets information: Interprets information by translating tabulated data into graphs, by reading data off graphs, and by making predictions from patterns.**

*Achievement is evident when the learners, for example*

- Annotates diagrams by interpreting text passages about the topic;
- Draws graphs of population growth over time, from data provided in a table;
- Studies photographs of fossil animals and makes inferences about their ways of feeding and moving;
- Generates own sentences about relationships (e.g. of the type 'if you change X, then Y changes also').

- **Applies Knowledge: Applies conceptual knowledge to somewhat unfamiliar situations by referring to appropriate concepts and processes.**

*Achievement is evident when the learners, for example*

- Explains why a thermal insulator keeps cold objects cold as well as keeping hot objects hot;
- Applies the concept of saturation to explain why a crystal growing in solutions begins to shrink if the water is warmed;
- Writes a story about survival from the point of view of an animal in the middle of a food chain in a natural habitat, a garden or a farm.

## Grade 9

We know this when the learner:

- **Recalls meaningful information: At the minimum, recalls principles, processes and models.**

*Achievement is evident when the learner, for example*

- Describes how heart, lungs and stomach work together to provide a human with energy;
- Describes separation of alcohol and water in terms of the relevant principle;
- Describes the key statements of the particle kinetic model of matter;
- Describes the difference between a dependant and independent variable.

- **Categories information: Applies multiple classifications to familiar and unfamiliar objects, events, organisms and materials.**

*Achievement is evident when the learners, for example*

- Uses alternative classifications for the same thing (e.g. uses information to construct three classifications of copper):
  - Copper is a solid (rather than a liquid or a gas),
  - Copper is also a metal (rather than a non-metal),
  - Copper is also an element (rather than a compound);
- Considers the implications of categorizing humans by physical characteristics.

- **Interprets information: Interprets information by translating line graphs into text descriptions and visa versa, by extrapolating from patterns in tables and graphs to predict how one variable will change, by identifying relationships between variables from tables and graphs of data, and by hypothesizing possible relationships between variables.**

*Achievement is evident when the learners, for example*

- Creates word-webs and mind maps by previewing chapters of text;
- Estimates the doubling time of a population from graph data of an increasing population;
- Reads off, from a line graph, the range of temperatures at which yeast is most active;
- Relates melting and freezing, evaporation and condensation to a particle kinetic model of changes of state;
- Generates own sentences such as 'we think that X is the cause of Y, because Y happens only if X happens'.

- **Applies Knowledge: Applies principles and links relevant concepts to generate solutions to somewhat unfamiliar problems.**

*Achievement is evident when the learners, for example*

- Interprets simple models of ecosystems in order to make predictions of the effects when one factor changes;
- Uses molecule models to hypothesise possible products in a simple chemical reaction;
- Uses provided data and concepts of life processes to list and describe the problems explorers would have in surviving on Mars.

### **Learning Outcome 3**

**Science, Society and the Environment: The learner will be able to demonstrate an understanding of the interrelationships between science and technology, society and the environment.**

### **Grade 5**

We know this when the learner:

- **Understands science and technology in the context of history and indigenous knowledge: Identifies ways in which products and technologies have been adapted from other times and cultures.**

*Achievement is evident when the learner, for example*

- Describes traditional shelters and relates some of their features to modern dwellings;
- Listens and responds to stories about people who invented known devices (e.g. the telephone was invented by Alexander Graham Bell, who also taught deaf people to speak).

- **Understands the impact of science and technology: Identifies the positive and negative effects of scientific development or technological products on the quality of people's lives and/or the environment.**

*Achievement is evident when the learners, for example*

- Expresses possible advantages and disadvantages of living in a modern city, and explains why some people might prefer to live in traditional dwellings in a rural area;
- Compares results of an audit of water use in own home with results of other learners, noting differences in amounts used and for what purposes, as well as costs of getting water.

## Grade 6

We know this when the learner:

- **Understands science and technology in the context of history and indigenous knowledge: Describes similarities in problems and solutions in own and other societies in the present, the past and the possible future.**

*Achievement is evident when the learner, for example*

- Describes different ways that people in the past might have produced light at night;
  - Generates a list of basic human needs that are common at all societies, now and in the past.
- **Understands the impact of science and technology: Suggest ways to improve technological products or processes and to minimize negative effects on the environment.**

*Achievement is evident when the learners, for example*

- Describes how technology can be used to save energy by switching off lights automatically when not needed;
- Uses personal observation or information from the local authority to flow-chart the water supply system from the taps (or water tank) back to the source, noting points of potential contamination.

## Grade 7

We know this when the learner:

- **Understands science as a human endeavor: Compares differing interpretations of events.**

*Achievement is evident when the learner, for example*

- Identifies and explains differences in two reports of investigation of the same event or investigation;
  - Describes difficulties in observing certain phenomena (e.g. behaviors of nocturnal animals), and suggests ways of gaining better information.
- **Understands sustainable use of the earth's resources: Analyses information about sustainable and unsustainable use of resources.**

*Achievement is evident when the learners, for example*

- Analyses data provided about water use in South Africa, comparing the amounts used in various production processes and noting amounts released as effluent;
- Presents the analysis as a report to a policy-making body such as Parliament, with recommendations;
- Prepares several devices for cooking on, using different types of fuel and finding out the costs and sources of the fuels.



## Grade 8

We know this when the learner:

- **Understands science as a human endeavor: Identifies ways in which people build confidence in their knowledge systems.**

*Achievement is evident when the learner, for example*

- Replicates an interesting investigation and findings at another school;
- Reports on difficulties that scientists have had in clarifying ideas and dealing with doubts;
- Describes ways in which traditional wisdom is accumulated and passed on.

- **Understands sustainable use of the earth's resources: Identifies information required to make judgment about resource use.**

*Achievement is evident when the learners, for example*

- Plans and carries out an audit of all uses of water around school premises (including gardening, car-washing and drinking), and develops an implementation plan to improve water management in the school;
- Conducts a waste-production audit at the school, analyzing types of waste, their sources, potential health hazards, and whether or not the waste is biodegradable.

## Grade 9

We know this when the learner:

- **Understands science as a human endeavor: Recognizes differences in explanations offered by the Natural Sciences Learning Area and other systems of explanation.**

*Achievement is evident when the learner, for example*

- Identifies sources and nature of authority in two differing explanations for an event, coming from two differing world-views;
- Compares ways that knowledge is held in an oral tradition and in a written, public tradition;
- Traces the way a theory about nature has changed over the centuries.

- **Understands sustainable use of the earth's resources: Responds appropriately to knowledge about the use of resources and environmental impacts.**

*Achievement is evident when the learners, for example*

- Organizes an audit of water use in sections of the community, analyses the data and prepares it for a presentation in a local newspaper or radio talk show;

- Contributes to formulating a school environmental policy, including constructive ways to deal with waste material and to improve water management.

## **Geography Assessment Standards (NCS Grades 10-12)**

(DoE 2003a)

### **Learning Outcome 1**

**Geographical Skills and Techniques (Practical competence): The learner is able to demonstrate a range of geographical skills and techniques.**

#### **Grade 10**

We know this when the learner is able to:

- Identify issues and formulate questions for an investigation.
- Acquire information from fieldwork and a variety of other sources.
- Organize information geographically, pictorially and diagrammatically.
- Analyze information obtained from a variety of sources.
- Report findings in oral and/or written form.

#### **Grade 11**

We know this when the learner is able to:

- Plan and structure a project or enquiry process.
- Acquire a variety of information from relevant primary and secondary sources which include fieldwork.
- Classify the acquired information according to different categories.
- Analyze information obtained from a variety of sources- including fieldwork data, 1:50 000 topographical maps, orthophoto maps and statistics.
- Report findings in written, oral and/or illustrative form.

#### **Grade 12**

We know this when the learner is able to:

- Plan a geographical research project of limited extent in a familiar context.
- Integrate information from a variety of sources.
- Compare and contrast information from a variety of sources.
- Analyze the acquired information in order to answer the initial question.

- Substantiate findings in written, oral or illustrative form.

## **Learning Outcome 2**

**Knowledge and understanding (foundational competence): The learner is able to demonstrate knowledge and understanding of processes and spatial patterns dealing with interactions between humans, and between humans and the environment in space and time.**

### **Grade 10**

We know this when the learner is able to:

- Describe processes and associated spatial patterns in places and regions.
- Identify similarities and differences in processes and spatial patterns between places or between regions.
- Describe the links between environmental problems and social injustices in a local and global context.
- Describe the interdependence between humans and the environment at different scales.

### **Grade 11**

We know this when the learner is able to:

- Explain processes and associated spatial patterns in a range of places and regions.
- Compare and contrast processes and spatial patterns between places and/or between regions.
- Examine issues and challenges arising from human and environmental interactions in a local and continental context.
- Explain different measures of conserving the environment while addressing human needs in a variety of contexts.

### **Grade 12**

We know this when the learner is able to:

- Explain the influence of processes and associated spatial patterns in a range of places and regions.
- Account for the similarities and differences in processes and spatial patterns between places and between regions.
- Explore possible responses to issues and challenges arising from human and environment interactions in a local and national context.

- Examine different approaches used to sustain the environment that take into account different knowledge systems in a variety of contexts.

### **Learning Outcome 3**

**Application (reflexive competence): The learner is able to apply geographical skills and knowledge to environmental issues and challenges, recognize values and attitudes, and demonstrate the ability to recommend solutions and strategies.**

### **Grade 10**

We know this when the learner is able to:

- Apply skills and knowledge to a range of phenomena, issues and challenges at local and global scales.
- Identify different values and attitudes held by individuals and groups associated with processes, spatial patterns and human-environment interactions at local and global scales.

### **Grade 11**

We know this when the learner is able to:

- Apply skills and knowledge to a range of phenomena, issues and challenges at local and continental scales.
- Examine the consequences of actions resulting from values and attitudes held by individuals and groups which influence processes, spatial patterns and human-environment interactions at local and continental scales.

### **Grade 12**

We know this when the learner is able to:

- Apply skills and knowledge to a range of phenomena, issues and challenges at local and national scales.
- Examine values and attitudes held by individuals and groups associated with processes, spatial patterns and human-environment interactions at local and national scales.



## Component B

### **Review of environmental learning in field centres practicing OBE: A KwaZulu-Natal case study.**

This component is written in the format required by the **Southern African Journal of Environmental Education**. As such, the guidelines of this journal (Appendix 1) have been followed in its writing, as per thesis requirements.



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## **1. Abstract**

This study represents a preliminary review of environmental learning in field centre settings. Outcomes and assessment standards of the Revised National Curriculum Statement Grades R-9, Natural Sciences Learning Area, and the National Curriculum Statement Grades 10-12- Geography, are reflected against water related studies occurring at field centres. Specifically those conducted at environmental education centres near Pietermaritzburg. Two centres were selected to conduct the research, namely the Entabeni Education Centre and the Umgeni Valley Nature Reserve. Two very different types of courses were observed. Firstly, courses aimed at grade 11 geography learners; and secondly, courses aimed at a grade 5-8 learners. Both types of courses, reflect water conservation issues, involving quality assessment and impacts on both biological and social issues. The study shows that the courses observed by the researcher, allowed for active environmental learning to occur. In addition, all of the courses observed reflected the outcomes and assessment standards of the Natural Sciences Learning Area Grades 6-9, of the Revised National Curriculum Statement and National Curriculum Statement Grades 10-12, Geography, to some degree, although the methodology at the two centres differed.

## **2. Background to the study**

The current state of environmental education and education in general is in flux. More emphasis is being placed on the environment and environmental education within the Revised National Curriculum Statement (RNCS) (DoE, 2002 and NEEP-GET, 2003), and National Curriculum Statement (NCS) (DoE 2003). Within the field of environmental education, there has been a definite shift in orientation towards 'education for sustainability' (Lotz-Sistika, 2004), away from the more traditional 'education for conservation' orientation. With these thoughts in mind, one considers how aspects of the lifelong environmental learning process, can be better integrated, into the curriculum and which activities at environmental education centres reflect the outcomes of the RNCS- General Education and Training (GET) natural sciences learning area and NCS- Further Education and Training (FET) subject of geography.



There is potential within environmental education centres, to facilitate the achievement of outcomes prescribed by the RNCS-GET and NCS-FET. By linking events at environmental education centres and the curriculum requirements, the possibility exists to better develop learners' capacity to become more environmentally literate. The potential exists, therefore, for citizens to become more environmentally active. Currently, visits to environmental education centres by learners, may be seen as isolated events. Although, these events may have an impact on the learners themselves, on the whole, they may not necessarily facilitate in the achievement of required curricular outcomes. In other words, although visits to environmental education centres is a valuable activity, the activities offered at these centres may not be in line with what is being taught at schools. It follows that the potential maximum growth of learners may not, by current methods, be encouraged.

## **2.1 *Aim and Objectives***

The aim of the study to identify the outcomes and assessment standards prescribed by the natural sciences learning area of the RNCS- GET and the subject of geography within the NCS- FET, and to investigate how nature based environmental education centres deliver against these. In order to narrow the focus, only water related studies were included.

The objectives of the research are to:

- Undertake a review of the literature in order to contextualise education and environmental education, within a climate of increasing environmental concern.
- Identify the outcomes and assessment standards prescribed by the natural sciences learning area of the RNCS- GET.
- Identify the outcomes and assessment standards prescribed by the subject of geography within the NCS- FET.

- Investigate how these outcomes and assessment standards are achieved, through the methods and materials used, at environmental education centres.
- Suggest possible areas where environmental education practitioners can improve their service delivery, in terms of outcomes based education.

### **3. Study Sites**

The sites included in this study, are situated near Pietermaritzburg. Both of these environmental education centres are well situated for studying water related issues. One of the centres being situated on a rehabilitated wetland and the other on a river, which has had many human impacts on it. Both of these facilities are centres of environmental education excellence, committed to promoting environmental literacy, whilst attempting to become more 'outcomes' orientated.

#### **3.1 *Entabeni Education Centre***

The Entabeni Education Centre is situated in the KwaZulu-Natal Midlands, and is positioned within the Hlatikulu Vlei, which is on the upper reaches of the Nsonga River Catchment (Begg, 1989). The Entabeni Education Centre can be found just below Giant's Castle, in the Central Region of the uKathlamba Drakensberg Mountains.

The Hlatikulu Vlei, on which the Entabeni Education Centre is situated, makes an interesting site to study wetland conservation issues. The area was declared by Begg (1989) as a wetland of provincial importance. It is also seen as vitally important in the conservation of crane species. A section of the wetland was formally under mielie plantation, and that section of the wetland was drained for this purpose. Since then, the mielies have been removed, and those responsible for the management of the area are in the process of rehabilitating the wetland. It is an important illustration for learners who visit the centre, to realise that ecosystems are fragile and not easy to fix, they require a lot of resources and time (years) to return to their former state.

## Vision for the area

*"To establish a centre which will provide a sanctuary for cranes and at which education, extension and research on wetland and grassland restoration and management will be carried out. In addition, to develop a captive breeding centre to augment depleted crane populations in the wild."*

(Thompson et. al., 1997:2)

### 3.2 Umgeni Valley Nature Reserve

The Umgeni Valley project is owned and managed by the Wildlife and Environment Society of South Africa (WESSA), and is located 1 km outside the town of Howick in the KwaZulu-Natal Midlands. The reserve is situated alongside the Umgeni River. The vegetation within the reserve consists mainly of grasslands and savannah, which supports a variety of savannah animals (Beyer and Duggan, 1997).

The Umgeni River, which runs through the Umgeni Valley Nature Reserve is an interesting case, as most people living in the area obtain their drinking water from Midmar Dam. This dam is just up stream of the Umgeni Valley Nature Reserve, and is fed by the Umgeni River. Learners are given the opportunity to investigate the river from which their water originates, making the studies on this river more relevant to them.

## WESSA Policy on Environmental Education

*'For conservation to succeed in the long term the Society believes that people need to increase their environmental awareness and become skilled in minimising their impact on the environment. (WESSA, undated)'*

The courses which were included in the study, at both centres, were selected specifically based on the inclusion of water studies within the programmes.

Consequently courses are included in the study as a result of availability. All of the schools involved in the study are private schools, this is as a result of availability and not as a result of any selection prerequisite.

In summary, both centres are geared towards providing learners with an environment in which active environmental learning can happen. In addition, these two centres have the potential to facilitate the achievement of outcomes prescribed by the RNCS.

## **4. Methodology**

In order to conduct the study, various concepts and ideas feed into each other, and a specific process needs to be followed. This section gives an outline of that process and discusses the methodology followed.

### **4.1 *Literature Review***

An initial identification of the learning outcomes and assessment standards prescribed by the RNCS- GET, natural sciences learning area, and those prescribed by the NCS- FET, subject of geography with a focus on water related issues. This was a desktop exercise, aimed at generating an understanding of the focus of the RNCS- GET and NCS- FET. The 'Active Learning Framework' (National Environmental Education Project, 2001) was considered in depth within the literature review (Component A), for later use during field observations.

### **4.2 *Assessment of Two Environmental Education Centres***

Due to time constraints, only two centres were included in the study. The study must, therefore, be considered a preliminary review of a number of selected activities at these two centres. It is therefore, not an attempt to extrapolate trends in the environmental education centres in South Africa in general. Furthermore, the study

is not aimed at comparing these two centres, but rather aimed at drawing a picture of methodologies used at both centres and the RNCS- GET (Natural Sciences learning area) and NCS-FET (Geography) learning outcomes end assessment standards to which they relate, within water-based studies. Water studies, specifically, were selected as a result of the importance and relevance of water conservation in South Africa today. In addition, both centres are actively involved in such studies.

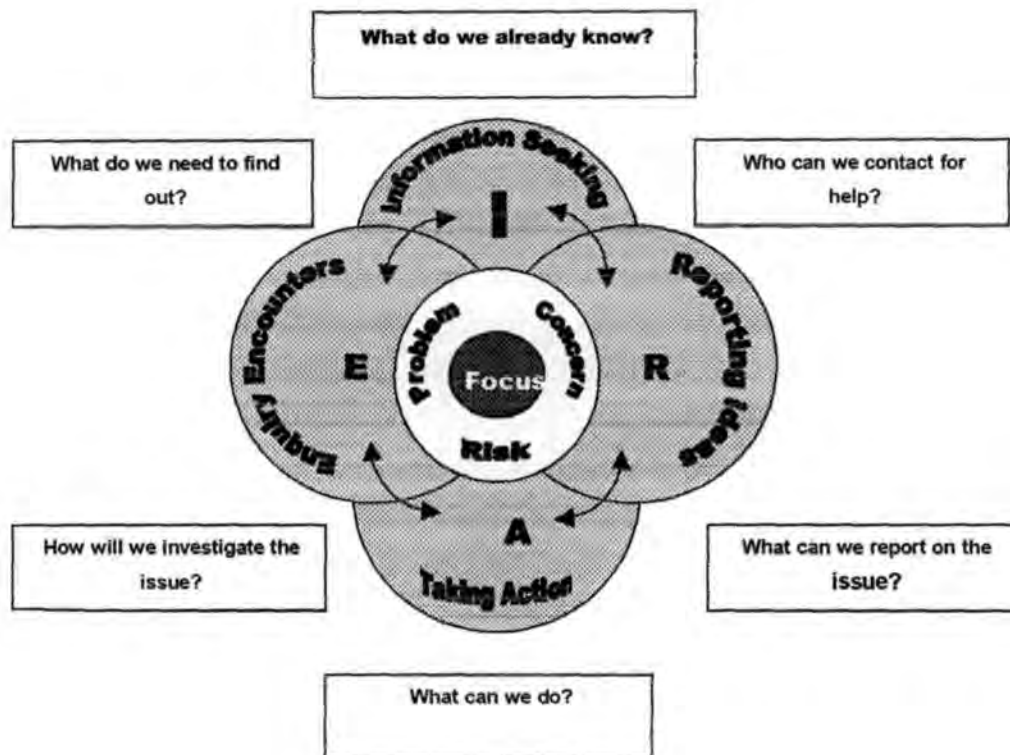
#### **4.3 Field Observations**

Observations were conducted in a semi-structured manner. In other words, there was an *'agenda of issues that will be highlighted but not strictly pre-determined'* (Cohen, Manion and Morrison 2001:305). The 'Active Learning Framework' (NEEP, 2001) (Figure 1) was selected as a lens to explore the learning process during these water study activities. It is a means to ask questions and mobilise understanding. This was then reflected back against the RNCS- GET and NCS- FET guidelines, outcomes and assessment standards, focusing specifically on the natural sciences learning area and subject of geography respectively, with an eye on the other learning areas. The aim of which, was to investigate the level of interaction between activities at these environmental education centres and the RNCS- GET and NCS-FET.

Umgeni Valley focuses on water conservation in terms of river health and related conservation issues. While Entabeni Education Centre focuses on wetland conservation and related issues.

The active environmental learning framework (figure 1) provides a picture of the process through which active learning occurs. It emphasises the importance of a holistic approach, which embraces past experience and knowledge, whilst encouraging learners to ask questions. It is an open process model, which enables learners to make connections between related issues and concepts; and creates an atmosphere in which competence may be developed. Consequently allowing for meaningful environmental learning (NEEP, 2001).

The conclusion of the study is then to identify what possible outcomes and assessment standards may be aimed at by environmental education centres with regards to water studies, and to highlight the challenges faced by centres in implementing outcomes-based education. Responses may then be developed to assist the centres in aligning themselves with the requirements of the RNCS- GET and NCS- FET bands.



**Figure 1**

Active Learning Framework, with steering questions, to be used as a lens to assess learning processes, within this study (NEEP, 2001)

#### ***4.4 Limitations to and Observations About the Study***

As discussed before, time constraints and course availability are limiting factors influencing the study. In addition to this the National Curriculum is in a state change, with the RNCS only being implemented this year for the foundation phase (grades R-3) of the general education band (grades R-9). The RNCS will be phased into other education phases over the next few years. At this stage the National Curriculum Statement or Curriculum 2005 (C2005), is to be implemented in the further education band as of 2006, and until such time as the RNCS is published for this education band (Learn undated). Due to the availability of some grade 11 courses at Umgeni Valley, these courses were included in the study, and it is for this reason that outcomes and assessment standards of the NCS- FET (Geography) are included in the study. The outcomes and assessment standards for the grade 11 courses at Umgeni Valley, are therefore reflected against those of the FET band.

In addition to problems with the current state of the curriculum, the researcher was not able to observe courses in their entirety, from beginning to end. Therefore, on some courses there are gaps in the data. An example of this was on the St Andrews/ St Catharine's course, learners did some work at night and the researcher was unable to observe at that time.

There was a concern that the environmental education staff would behave differently in the presence of a researcher. For the most part, this was avoided where possible, by observing staff whom the researcher had known previously, or at least had met before. It was also made clear to the staff that the researcher was observing them to look at potential outcomes achievement, and not assessing their performance. In addition, many of the education staff, particularly at the Entabeni Education Centre consider the researcher a peer rather than a researcher. Due to the setting of the courses and the presence of the learner's school teachers, the researcher believes that, for the most part, education staff were not particularly influenced by her presence.

## 5. Results

The courses observed at the two centres were different from each other, in that the majority of the courses observed at Umgeni Valley, were specialised geography courses for grade 11 to 12. Whilst the rest of the courses, namely one at Umgeni Valley and the courses at Entabeni Education Centre were all aimed at the intermediate and senior phases of the RNCS- GET. The two centres focus on different aspects of water conservation.

### 5.1 RNCS- GET Curriculum Outcomes and Assessment Standards

Each of the learning outcomes of the Natural Sciences Learning Area are presented here as subheadings. Under these headings the courses which were observed have been divided according to their grade. These groups of courses and the activities observed are then related to the relevant assessment standards to which they relate. Only those assessment standards which were reflected at the centres are included here.

#### 5.1.1 Learning Outcome 1 of the Natural Sciences Learning Area of the RNCS-GET

*'Scientific Investigation: Learners act confidently on their curiosity about natural phenomena; they investigate relationships and solve problems in science, technology and environmental contexts (Department of Education, 2002).'*

**Grade 5 (Sacred Heart- Entabeni Education Centre)**

**Plans Investigations: Lists, with support, what is known about familiar situations and materials, and suggests questions for investigation.**

- Contributes to a class list of interesting aspects of the situation

*This was done verbally during discussions around describing the wetland, and its importance as a source of water. Also reflected during the playing of the 'Catchment to Coasts' picture building game.*



**Grade 6 (St Charles and St Monica's- Entabeni Education Centre)**

**Plans investigations: Helps to clarify focus questions for investigation and describes the kind of information which would be needed to answer the question.**

- Expresses focus questions in own words
- Considers classmates' ideas about kinds of information which may be relevant

*This was evident during the playing of the 'Catchments to Coast' picture building game, where learners make observation and discuss environmental problems within the picture they build.*

**Grade 8 (Creston- Umgeni Valley)**

**Conducts investigations and collects data: Organises and uses equipment or sources to gather and record information.**

- Systematically tests two or more items in order to compare them on the same common property.
- Uses indexes and glossaries to find useful data in books and catalogues.

*These assessment standards were achieved through the testing of the water quality of the Umgeni River. Learners needed to refer to manuals, as well as conduct tests.*

**Evaluates data and communicates findings: Generalizes in terms of a relevant aspect and describes how the data supports the generalisation.**

- Offers a strong example of evidence that supports the finding.

*Learners had to report on their findings in the form of a poster presentation to the rest of the group.*

**5.1.2 Learning Outcome 2 of the Natural Sciences Learning Area of the RNCS-GET**

**'Constructing Science Knowledge: Learners know, interpret and apply scientific, technological and environmental knowledge (Department of Education, 2002).'**

**Grade 5 (Sacred Heart- Entabeni Education Centre)**

**Recalls meaningful information: At the minimum, uses own most fluent language to name and describe features and properties of objects, materials and organisms.**

- Identifies external parts of animals in own most fluent language
- Appropriately describes observable features of objects in the environment, animals, plants or features in the sky.

*During the crane tour various aspects, features and adaptations of cranes are discussed and described. There was also a discussion around the wetland environment. Point two was also reflected during the 'Catchment to Coasts' picture building game.*

**Grade 6** (St Charles and St Monica's- Entabeni Education Centre)

**Interprets information: At the minimum, interprets information by using alternative forms of the same information.**

- Identifies external parts of animals, and tells as much as possible about their function in the animals way of living.

*During the crane tour, various aspects of crane features and adaptations to living in wetlands are discussed with the learners.*

**Grade 8** (Creston- Umgeni Valley)

**Applies knowledge: Applies conceptual knowledge to somewhat unfamiliar situations by referring to appropriate concepts and processes.**

*Learners analyse and draw conclusions regarding their water quality investigations.*

### 5.1.3 Learning Outcome 3 of the Natural Sciences Learning Area of the RNCS-GET

**'Science, Society and the Environment:** Learners are able to demonstrate an understanding of the relationships between science and technology, society and the environment (Department of Education, 2002).'

**Grade 5** (Sacred Heart- Entabeni Education Centre)

**Understands the impact of science and technology: Identifies the positive and negative effects of scientific developments or technological products on the quality of people's lives and/or the environment.**

*This is reflected through the discussion around wetland destruction and the process of rehabilitation. As well as the values of wetlands for water production.*

**Grade 6** (St Charles and St Monica's- Entabeni Education Centre)

**Understands the impact of science and technology: Suggest ways to improve technological products or processes and minimise negative effects on the environment.**

*During the picture building game, impacts of technology on the environment were discussed. In the wetland the group were told about wetland rehabilitation and the long term effects of draining wetlands.*

**Grade 8** (Creston- Umgeni Valley)

**Understands sustainable use of the earth's resources:** Identifies information required to make judgement about resource use.

*The investigation conducted by the learners aims to assess quality of water, which relates to pollution levels, and therefore to the sustainable use of water.*

## **5.2 NCS- FET Curriculum Outcomes and Assessment Standards**

Each of the learning outcomes of the subject Geography are presented here as subheadings. Under these headings the courses which were observed have been divided according to their grade. These groups of courses and the activities observed are then related to the relevant assessment standards to which they relate. Only those assessment standards which were reflected at the centres are included here. The courses conducted were specifically aimed at completing the learners' research project for grade 12. Therefore, the assessment standards for grade 12 were reflected against the activities.

### **5.2.1 Learning Outcome 1 of the Subject Geography NCS- FET**

***Geographical Skills and Techniques (Practical competence):*** *The learner is able to demonstrate a range of geographical skills and techniques (Department of Education 2003)*

**Grade 12 (St Andrews/St Catherine's, Leeuwenhoff Academy and St Dunstons- Umgeni Valley)**

**Plan a geographical research project of limited extent in a familiar context.**

*Learners had to plan a research project, using scientific methods of investigation to compare water quality at three different sites along the Umgeni River.*

**Integrate information from a variety of sources.**

*Learners made use of various sources of information, e.g. field observations, texts, the internet and knowledge of their guide.*

**Compare and contrast information from a variety of sources.**

*Learners conducted a comparative study using information obtained.*

**Analyse the acquired information in order to answer the initial question.**

*Learners interpreted their findings,*

**Substantiate findings in written, oral or illustrative form.**

*The product of their research project is a written project, as well as a oral presentation of their findings and observations*

#### 5.2.2 Learning Outcome 2 of the subject Geography of the NCS- FET

***Knowledge and Understanding (Foundational competences):*** *The learner is able to demonstrate knowledge and understanding of processes and spatial patterns dealing with interactions between humans and the environment in space and time (DoE, 2003).*

**Grade 12 (St Andrews/St Catherine's, Leeuwenhoff Academy and St Dunstons- Umgeni Valley)**

**Explore possible responses and challenges arising from human and environmental interactions in a local and national context.**

*Some learners investigated the sociological aspects of water quality by interviewing local people who use the river.*

### 5.2.2 Learning Outcome 2 of the subject Geography of the NCS- FET

***Application (Reflexive competence): The learner is able to apply geological skills and knowledge to environmental issues and challenges, recognise values and attitudes, and demonstrate the ability to recommend solutions and strategies (DoE, 2003).***

**Grade 12 (St Andrews/St Catherine's, Leeuwenhoff Academy and St Dunstons- Umgeni Valley)**

**Apply skills and knowledge to a range of phenomena, issues and challenges at local and national levels.**

*At a local level, the learners investigated the issue of water pollution.*

**Examine values and attitudes held by individuals and groups associated with processes, spatial patterns and human-environment interaction at local and national scales.**

*On a local level, some learners interviewed and investigated the attitudes and opinions of local residents with regards to the quality of the water in the Umgeni River.*

### 5.3 The Active Learning Processes

Within the Active Learning Framework (figure 1) there are four major components. Namely, information seeking, reporting ideas, enquiry encounter and taking action (NEEP, 2001). Each of these components is discussed here, along with the events at the respective centres which relate to these components.

Various forms of information seeking are utilised within the activities at both centres, which include:

- Accessing prior knowledge through discussion.
- Investigating the environment using scientific methods and observations.
- Facilitators inform learners on issues.
- Learners are given access to texts relating to issues pertinent to their investigations.

The reporting of ideas occurred in various forms, namely through:

- Verbal communication, through oral presentations and discussions.
- Written communication through writing up a report on findings.
- Illustrative communication through the presentation of posters to indicate investigative findings.

Enquiry encounters occurred during the courses observed through:

- Investigation of habitats (wetland and river).
- Development of research questions and scientific investigations to answer these questions.
- Discussions around environmental issues.

The 'Taking Action' component of the Active Learning Framework was not presented at either centre. Although the learners presented their findings, they did not take any physical action to solve any problems they may have encountered. Some form of physical or conceptual action may have facilitated the concreting of active learning.

Various observations were made regarding the challenges facing environmental educators in the field. These include the following:

- Supporting active learning in the field was, in the case of Creston (Appendix 2) challenging in that the group was relatively large and smaller groups spread out over a distance along the river, this made it very difficult for the educator to facilitate the study.
- In many cases, specifically with the Grade 11 courses, tests were complex and time consuming, presenting a practical challenge for completing fieldwork.
- Learner attention span, presented a challenge as in a few of the courses learners became bored and disinterested with the activity.

The following observations were made regarding the role of the educator within the learning process :

- Educators need to be responsive in the active learning process. For example when learners are unaware of a particular issue.

- The use of various teaching styles within environmental settings, for example explaining issues and concepts as opposed to the use of probing questions or guided investigation to stimulate discussion. All of these teaching styles were observed.
- In some cases the active learning process was cut short by the facilitator, who gave them the information they were looking for, without giving them the opportunity to find the information out by themselves.

The following observations were made with regards to the scope and depth of information provided:

- In the case of the St Dunstons course (Appendix 2), although pollution levels were being investigated, the causes of pollution were not discussed with the learners.
- Assumptions are made based on the age of the learners and investigations are in some cases more focused on 'fun' as a result.

## 6. Discussion

### 6.1 *The outcomes and assessment standards of the RNCS- GET, Natural Science Learning Area.*

The results indicate that within the Natural Sciences learning area, the potential exists for all of the prescribed learning outcomes to be, to some degree, achieved. In addition to this, the courses being presented to learners would appear to be at an appropriate level for learners of the grades being taught. Within these learning outcomes various assessment criteria are, to some extent, being met by the centres involved.

The focus, in all the courses, was aimed at placing learners within an environment and allowing them the opportunity to explore it, using their senses (Appendix 2). Show and tell techniques are used to emphasise issues relating to wetland



rehabilitation and the conservation of wetland species at Entabeni Education Centre. In particular, these species include the three crane species found in South Africa, namely the Blue Crane (*Anthropoides paradisea*), the Wattled Crane (*Grus carunculatus*) and the Southern Crowned Crane (*Balearica regulorum*). All three of these species are represented within the centre's captive population. The methodology used here, is appropriate for the level of learner (grade 5-6), as the younger the learner, the more emphasis is placed on cultural induction (National Environmental Education Project, 2001). This is where learners are introduced to information and environments and explore these environments, whilst having fun in that environment.

While outcomes are not specifically achieved through courses at both Entabeni Education Centre and Umgeni Valley, the first hand experience of the wetland and river allows for environmental learning to occur, by providing information about an environment, in an environment, and for that environment (NEEP, 2001). It was not clear during the course whether the environmental educators had any specific learning outcomes towards which they were working, and as such therefore had no prescribed assessment standards in mind. In order for courses at environmental education centres to be more 'outcomes-based' this needs to be done (DoE 2002).

The miniSASS test, used at Umgeni Valley, is one which enables the learners to explore their environment, whilst collecting water organisms, which can be a lot of fun. In addition, the test has been proven to be a effective manner in which to identify areas of water pollution (Graham, Dickens and Taylor, 2004). One of the downfalls of the overall methods used for course at Umgeni Valley , is that the learners required a lot of input from the education staff. Without which, they would have had to read what was required from them, from the Catchment Action booklet. In doing so, learners became distracted and lost focus. This focus was returned only when the education staff rejoined their group. The educator had divided the group into subgroups, who then spread out along the river to do the water study. It was therefore impossible for her to give every group undivided attention. Less of a focus on this reference material, or alternatively, smaller group sizes, would have been more beneficial to the learning process.



## **6.2 *The outcomes and assessment standards of the NCS- FET, Geography.***

The grade 11 courses observed at Umgeni Valley were over a period of three to four days, during which learners conduct a scientific research project. Learners are expected to design and complete a research project during this time. The end result of this course, is a scientifically written report, which then is added to the learners' portfolio of evidence, for their grade 12 year. It is with this specific learning outcome in mind that the course is being run. In addition to this outcome, related outcomes are being reflected and their eventual achievement facilitated through attending the course offered at Umgeni Valley. One can therefore say that this type of course is 'outcomes-based'.

This type of course, is appropriate for the age of the learners, in which the learners take on a more critically reflective role, within the learning process (NEEP, 2001). These courses allow for environmental learning to occur, in that they provide information about an environment, in that environment, for the conservation and assessment of that environment. In addition, this type of course is issue based. Water quality assessment is the focus within these courses, learners are placed within a context in which active environmental learning can occur (figure1). The only aspect within the active learning framework, which is not covered within these courses is that of action taking.

## **6.3 *Limitations to Active Learning***

Although the learners actively participated in the learning process, a few constraints were observed, which are note-worthy. Firstly, the presence of the learners teachers, appeared to be a constraint, as at times the teachers became involved in instruction. This restricted the learning process, as learning outside of the classroom, requires an approach which differs to the more structured approach of classroom teaching. A few teachers who joined groups during their water studies,

failed to recognise this difference and therefore, did not allow the learners to freely explore their environment. In the absence of their teachers, learners tended to behave in a manner which was less restricted, and were inclined to ask more questions.

Secondly, although the aim of this study, is to link the school curriculum with activities at environmental education centres, these activities need to complement each other. In situations where learners are presented with information to read out in the field, this detracts from the field experience. Ideally, learners should learn about the issues illustrated at environmental education centres prior to their visit to such a centre. Thereby allowing for such information to be concreted through experience at the environmental education centre. As opposed to solely using a centre field visit to result in learning about such issues.

The approach to teaching and the role of the educator form an important aspect to the facilitation of active environmental learning. Learners need to be given adequate opportunity to discover answers for themselves. The style of teaching varies greatly between age groups, and while a more information giving role with younger learners versus a critical discussion with older learner is appropriate, it is an issue which environmental educators need to take cognisance of when gauging the experience and knowledge base of the learners. This is often dependant on the learners themselves and their relevant experience and not necessarily on the age of the learners per se.

## **7. Conclusion**

The development of environmental awareness and sharing of information, do not necessarily result in a change of behaviour towards the environment. It is, however, through experience, an engagement with issues, and emotion that people are motivated to act upon environmental problems. The RNCS, provides educators enough flexibility, in which learners are able to internalise and experience environmental concerns. One way in which this is done, is through visiting an environmental education centre, where learners are able to experience the natural biophysical environment first hand, and to develop an understanding and a relationship with it. In such a setting, the potential exists to enable a change in behaviour. The issue of aligning concepts, highlighted in school settings, needs to be reflected within field centre settings, in order for the curriculum to be successful in achieving environmentally orientated outcomes.

This study has shown that, although the centres involved in the study may not necessarily be aiming specifically at the achievement of predetermined curricular outcomes, these are inadvertently reflected through their activities. Placing learners within a specific environment, allows active environmental learning to occur. It is though this, that society at large may become more environmentally conscious, thereby working towards to goal of sustainable development.

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## **Appendix 1**

The guidelines for contributors of the Southern African Journal of Environmental  
Education

## Guidelines for Contributors

Articles should be written in clear and straightforward style, and be free from technical jargon. Papers should be between 3 500 and 5 000 words in length including abstract and references. Footnotes to the text should be avoided. Each paper should be accompanied by a short note of author(s)' biographical details not exceeding 35 words. This should be provided on a separate cover page with other details such as contact numbers and emails as well as manuscript title. Rejected manuscripts will not normally be returned to authors.

**Manuscripts.** These should be typed on one side of A4 paper with double spacing and a wide margin to the left. The English language used should be either South African or UK. Four copies of the manuscript should be submitted and the author(s) should retain a copy. All pages should be numbered. E-mail attachments are not acceptable, nor is it necessary to send a disk copy at this stage.

**Disk/CD-Rom and final manuscripts.** When requested by the editors, authors should send one printed copy of the final, revised version of their manuscripts and another one in electronic format on a VIRUS-FREE diskette or CD-Rom. All electronic files should be saved as a Microsoft Word document.

**Title and abstract.** The paper should have a short title (no longer than 15 words) and a short abstract of between 150 and 200 words. Your contact details and name(s) should not appear on the abstract page or any other place in the paper apart from the cover page.

**Tables and captions to illustrations.** Tables must be typed out on separate sheets, and not included as part of the text. The captions to illustrations should be gathered together and also typed out on a separate sheet. Tables and figures should be numbered consecutively. The approximate position of tables and figures should be indicated in the manuscript.

**Figures.** Please supply one set of artwork in a finished form, suitable for reproduction. Figures will not normally be redrawn by the publisher. Photographs need to be high resolution prints (black and white). Please submit each on a separate page, with descriptive headings, and indicate their preferred position(s) in the paper.

**Referencing in the text.** This should be quoted by the name and date in brackets, e.g. (Jones, 1970) or Smith (1983) or UNCED (1992) or (Jones, 1979; Smith & Le Roux, 1983).

**References.** These should be listed in alphabetical order of the author's surname. If several papers by the same author and from the same year are cited, a, b, c, etc. should be put after the year of publication. The references should be listed in full at the end of the paper in the following standard form:

*For books:* Handy, C.B. (1985). *Understanding organisations*, 3rd edn. Harmondsworth: Penguin.  
*For journal articles:* Boschhuizen, R. & Brinkman, F.G. (1990). A proposal for a teaching strategy based on pre-instructional ideas of pupils, *European Journal of Teacher Education*, 14 (2), pp.45-56.  
*For chapters within books:* Little, A. (1990). The role of assessment re-examined in international context, in Broadfoot, P., Murphy, R. & Torrance, H. (Eds.), *Changing Educational Assessment*. London: Routledge, pp.213-245.

*For policy documents:* UNCED (United Nations Convention on Environment and Development). (1992). Agenda 21 (Chapter 36). United Nations Conference on Environment and Development. Rio de Janeiro.  
*Unpublished theses:* Gobrechts, E. (1995). The recycling of domestic waste in the Cape Peninsula: Implications for environmental education. Unpublished Masters Thesis. Department of Education. Rhodes University, Grahamstown.

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*For personal communication:* Moosa, V.M. (2003). Minister of Environmental Affairs and Tourism, Ministry of Environmental Affairs and Tourism, Pretoria, 16 June 2003.

*For email:* Nhamo, G. (2003). Request for official position and update on the Plastic Bags Regulation implementation. Email, 1 October 2003.

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**Grammatical errors and factual correctness.** The author must ensure that grammar and spelling are correct and that the style of presentation is satisfactory.

**Headings and sub-headings.** The use of informative sub-headings is recommended and if used should adhere to the following form: MAIN HEADING (capitals and bold); Section or sub-heading (small caps and bold); and sub-section heading (small caps and in italics).

**Units of measurement.** Use the SI metric system for units of measurement. Spell out numbers from one to ten; use numerals for larger numbers, groups of numbers, fractions or units e.g. 4 to 27, 12kg/ha, 34 pupils. Words and abbreviations of Latin and Greek derivation e.g. et al. should be in italics. Scientific names should be given in full when a genus or species is first mentioned, and they should be in italics.

**Proofs.** Will be sent to authors if there is sufficient time to do so and should be corrected and returned to the editor within three to five days.

**Offprints.** These will not be provided. Authors will, however, be granted permission to use copies of their papers for teaching purposes.

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**Editing.** The editors reserve the right to edit articles, but will endeavour to check all significant editorial changes with the authors.

### Contributions should be submitted to the EEASA Journal Editor

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Journals will be available in pdf format on [www.eeasa.org.za](http://www.eeasa.org.za).

## **Appendix 2**

### **Observations made during course observations**

**Creston College**

**St Andrew/ St Catherine's**

**Luvenhoff Academy**

**St Dunstons**

**Sacred Heart**

**St Charles College**

**St Monicas**



15 September 2004

**Field notes – observation of water study Umgeni Valley  
Pilot Study**

School: Creston  
Grade: 8  
Number of learners: 18  
Education Staff: Louine

Note: Louine and I studied together at Saasveld, and therefore know each other. Had I not known her, she may have felt intimidated by my presence, which may have affected the manner in which the study was conducted.

Resources used: Stream and Pond life booklet  
Mini SASS test  
Catchment Action booklet  
Turbidity test  
pH Test  
Temperature test

(all available from Sharenet, Howick)

The group assembled at the camp (Nkonka) at 8h00, Louine spent half an hour describing the test and what was expected from the learners. Louine went through each part of the study, what they needed to do, and explained why they were testing each of these elements. Some of the learners had done this type of test before. Louine explained to them that each river is different and that they would learn new things at each river.

The group, which consisted of 16 learners, was then subdivided into groups of four to conduct the study. We then proceeded down to the river.

At the river, Louine explained that each group needed to conduct three separate tests at the river, in three different habitats: one in the sandy area in the middle of the river, one in the rocky area of the river, and one in the small natural spring, which is a tributary to the river. The idea was then for the groups to compare their results.

At the river, all the groups investigated all the aspects of the catchment test, however the study was only carried out in one habitat per group.

The groups were able to conduct each aspect of the water study, and were able to understand what they were doing, owing to the booklet provided.

The groups then returned to the camp and were instructed to produce a poster of their findings. The poster was then presented to the rest of the group. The presentations were then to be given to the whole group (Duncan's group as well) that night, highlighting aspects, which were highlighted by each group.

Limitations of the catchment action water study:

- Learners needed to read lengthy pieces of information in the Catchment action booklet in order to understand what was expected from them.
- Many of the organisms they found in the river, they could not identify using the stream and pond life booklet.
- Comparative study not completed, only one study area per group. The comparison would have been useful.
- Learners spread out over quite a distance along the river. And although this is good in terms of observing more, this makes it very difficult for the educator to facilitate the study.
- Time limitation of 1 ½ hours. This could have been extended a bit to allow for repeat tests to be done in the different habitats.

Other notes: The study looks at determining the condition of the river. Levels of pollution are investigated. Although it is highlighted that pollution is bad, and this causes death of organisms and a reduction in biodiversity. What was not highlighted is what causes pollution, and how this can be prevented.

The focus here was determining the condition of a river, the reason why one would conduct such a study, may not have been too clear. This may have been highlighted with the comparative study.

20-22 September 2004

**Field Notes – Observation of CIRP Water Study at Umgeni Valley**

**School:** St. Andrews/ St Catharine's

**Grade:** 11

**Number of learners:** 15

**Education Staff:** Pat Hoffman

**Note:** This is a specialise geography excursion specifically aimed at conducting a research project for inclusion within the Grade 12 portfolio of evidence. The schools are also a private schools from Johannesburg, who came down as a joint excursion.

**Day 1**

Upon arrival and following introductions to the staff and the reserve, the learners are introduced to the requirements of the project, and how to conduct a research project. During this time the group as a whole are together. At this time each different option for the research project is presented, and learners are given the opportunity to choose which project they would prefer to do. The options included a water study, a sociological study or a land slide study.

**Overall discussion on Research – conducted in a question answer style by Pat Hoffman.**

**Pat:** What is Research?

**Learner:** Gathering Data

**Learner:** Facts about certain topics

**Learner:** Investigation

**Learner:** Working towards an aim/ to answer a question

**Learner:** using resources- other people, internet etc

**Learner:** Experiments

**Learner:** Statistics

**Learner:** It has a focus

**Pat:** What methods are used?

**Learner:** Equipment

**Pat:** (Explained the difference between qualitative and quantitative research)

**Pat:** What methods are used?

**Learner:** Measuring

**Learner:** Observing

Learner: Interviews  
Learner: Experiments

Pat: What do we do next?  
Learner: Sort and compare information  
Learner: Analyse data

Pat: How do we analyse qualitative data?  
Learner: Scaled questions  
Learner: Look for commonalities/ patterns

Pat: What is the purpose of research?  
Learner: To answer your question

The three leaders then did a team teach style presentation on each of the types of studies that the learners could do during their stay.

Pat explained the water quality project. Pat explained that it would be left up to the learners to decide what they looked at, and to direct their own project. Ideas she suggested however, would be to compare the water quality of a tributary of the Umgeni to the Umgeni River itself. She explained that they would probably be doing some chemical tests on the water and well as collection of insects to assess the water quality. There is a possibility to look at the human impact on the river.

*(Explanations of the other projects not included here, as they are not relevant to the observation)*

Pat then explained to the group the requirements for the project. She presented to them in a lecture style, the IEB requirements (see CIRP guideline documents). In addition to this the format of the report was presented using overheads of the CIRP guideline documents. Sections that they need to include in the report include:

- Title

- Abstract
- Introduction
- Aims
- Methods
- Results
- Discussion
- Conclusion
- References
- Acknowledgements

The groups then split up into the groups per research project. The water study group (joined by me and their teacher) lead by Pat, took a drive into the reserve, on the main road above the valley. We stopped at the bus turning point on the road, overlooking the Umgeni River. Pat and the teacher discussed the valley and how it was formed, geographical formations were discussed, more as a matter of interest. The main purpose of stopping at this point was so that the learners could get a 'birds eye view' of the river to help them describe it.

At this point the group was divided into two. Each group had to perform two tasks. Firstly they had to locate their position on the map, and secondly they had to start designing their water study.

Pat helped them a lot with designing the study, introducing them to the tests they needed to do. Q and A type discussion.

Pat: You will need to do a water life test and a test for oxygen. We will also be testing the temperature. Why do we want to conduct these tests?

Learner: ?

Pat: We test for plant life because if there is too much then there is an indication of high nutrients.

Pat: We will also be testing the pH of the water. We can expect the water to be slightly acidic. If it is not normal, then we will need to conduct further investigations.

Pat: Then we will test for turbidity. As well as a habitat integrity test, which looks at the ecology of an area, i.e. alien plants etc.

Pat then left them to discuss these methods and to read the Catchment Action booklet, in order to join the other group. The learners read from the Catchment Action booklet. They lost focus completely at this point, until Pat refocused their attention on the task. They then read the book again.

Learner: What is the aim of our study?

Learner: To test water quality in two different rivers?

They carried on reading the booklet, they got to the methylene blue test in the book, then had to swap groups, and do the other task.

Pat gave them a map of the area, and left them to discuss and try to identify where on the map they were. They had only just received the map, and were getting their bearings when the teacher showed them on the map where they were. The learners were not given the opportunity to work it out for themselves.

After this activity, we then left this point and drove to the pine forest at Shelter falls. We walked down to the stream.

Pat: Why is there different vegetation on the two opposite slopes?

Learners: ?

Pat: Due to the amount of time the sun shines on it.

We did an interpretive trail down to the stream (discussions not noted- not strictly relevant to the study). At Shelter Falls, we stopped and discussed the waterfall, and stream.

Pat: How do waterfalls effect the water quality?

Learners: ?

Pat: Aerates the water, in the plunge pool there is a chance for the water to settle out so therefore the water is cleaner after the waterfall.

Pat: Think about where and how many sites we are going to visit, we will discuss this further in the evening.

Pat: Why are wetlands important?

Learners: Store water

Pat: For Biodiversity

Learners: Cleaning water  
 Pat: Yes they use the nutrients  
 Pat: What about the water speed?  
 Learners: Slows water down.  
 Pat: What do wetlands do for floods?  
 Learners: Slows the water speed

We then walked back up to the vehicle, and drove back to the Goldfields Centre. (The night session, I was unable to attend, due to other commitments, however, Pat gave me a run down of what happened that night, the following morning.)

The night session, during the activity, they were in there particular project groups and they discussed what their research question would be. The group made a list of possible questions and then went through each one, looking at practicality and availability of information. Through this process of elimination, they were able to come up with one practical, and achievable research question. The group decided that they wanted to only look at the Umgeni River, and that they wanted to investigate the change in water quality as you go downstream along the river.

## Day 2

The first session in the morning was a recap of the day before, and on last night. Pat then went on to explain to the learners what they would be doing that day. Basically at the first site we would do all the tests as a whole group, then at the other sites we could divide up to save on time and share results. I do not know how they decided to do three sites.

Pat: What equipment will we need to take with us?  
 Learners: 1 x mini SASS test per site  
 Net  
 Ice Cream Tubs, paintbrush and identification books  
 Nitrate strips  
 pH strips  
 Methelane blue, stove, lighter, tubes and bottles, and droppers  
 Sticky labels for the methelane blue test  
 1 x habitat integrity test per site.

**Site 1:** Site 1 is below the Midmar dam wall, just before the river enters the town of Howick. This point in the river is just below a release point for water from a water works/ solid matter settling plant. Cattle and livestock drink regularly at this point. The local people from the Informal and low cost/ high density settlement, which is across the road from this point, use this area from washing their clothes.

Pat left the group to explore the areas a bit on their own and to make their own observations about the area. They all came back together and described the area.

Observations made by the learners:

- Close to informal (Pat: low income) settlement, where there is a backwash from water works.
- We can probably expect this to be more polluted than the other sites.
- Tiny bugs in the water, there is also pollution between the rocks in the form of froth, and sediment on the edges of the river. (Pat: this encourages plant growth).
- There is life.
- The water is fast moving.
- Banks of the river has a medium income residential area.

Pat: We need to decide on a sample site size for all the sites. What about 20 meters.

Pat showed them how to do the mini SASS test. Two people holding the net, others walk in the river and kick up dirt to catch any bugs which are disturbed. The learners did this for 5 minutes. This didn't work very well, they didn't catch any bugs, so they tried catching the bugs manually with cups. The resources used to identify the bugs: Pond and Stream life and the Field Guide to insects of Southern Africa.

The learners were then shown how to do the turbidity test.

They then did the test for bacteria in the water, by testing the amount of oxygen depletion of water over a period of time. This test is quite involved, and learners have to boil glass jars and some river water to sterilise them, and then place exact amounts of methelane blue in each bottle (one test and one control), then seal the bottles, ensuring that no air bubbles get trapped in the bottle as this will influence results. The limitations of this test were discussed. This test took a really long time to do.

They then did the habitat integrity test.

Pat went through all the tests very thoroughly at the first site, and this took a few hours to do.



A small group went to the water outlet pipe of the water works, and recorded some observation there, and reported back to the rest of the group.

We then went to the second site.

**Site 2:** The second site is inside the reserve, just below a sewage outlet pipe running down from the town of Howick, near Inkonka camp. It was really difficult getting down to the river at this point, as there was not path to the river and the bush was quite thick, and infested with brambles.

The group divided into subgroups at the river to conduct each of the tests in groups to save on time. After collecting all the data required, the group joined together to share their results with each other.

We then drove to site three, it was late afternoon by this point.

**Site 3:** This site is below Indulo Camp, at the wooden bridge. This section of the river is in a relatively natural part of the river, with limited human interference at this point.

Again the group split into subgroups to save on time. The learners remained in the sub groups they were in at site 2.

We then returned to the Goldfields centre.

I was again unable to attend the night session. I was assured by the staff that this would not be a problem, and that they would not be doing to much that night. On returning the next morning, I discovered that they had in fact covered a lot, and the learners did a presentation of their research and their findings to the rest of the group. So I missed the concluding part of the study. I asked the teachers to send me a few of the final reports so that I could observe the ultimate outcome of the study, they said that they would do that with pleasure.

8-11 October 2004

**Field Notes – Observation of CIRP Water Study at Umgeni Valley**

School: Leeuwenhof Academy  
Grade: 11  
Number of learners: 7  
Education Staff: Paul

**Note:** This is a specialised geography excursion specifically aimed at conducting a research project for inclusion within the Grade 12 portfolio of evidence. The school is also a private school from Johannesburg.

**Day 1**

The introductory session was held at the Goldfields Centre at Umgeni Valley, in the hall. Paul introduced the project to the learners by going through the CIRP support pack developed by the staff of Umgeni Valley. This includes information about what is expected from the learners in terms of the format of the project, and going through definitions of what an abstract is and the various other components of a research project. This was explained using overheads on the projector.

He then went on to explain to the group what tests they were going to perform during the water study. He suggested that each person in the group consider what the focus of their project would be, and that they should try to think of aspects that were somewhat different from the others. He explained that although they would be performing the same tests that they could focus on different aspects, and use the results they obtain in different ways.

**The tests:**

**pH:** Paul explained that this is generally affected by industry, mining and the use of soaps in the river.

**Methylene Blue:** Paul explained that this is a test for bacteria in the water. For example: E.coli. He also explained how this test was performed.

**MINI SASS:** This is a test to investigate the biodiversity of the area. The concept of biodiversity was explained only in terms of its affect on genetics.

**Aquatic Organism Population Test:** Paul explained how aquatic organisms are collected, and that they are an indication of river health.

Habitat integrity test:	Explained how this is done.
Turbidity Test:	Explained how this is done, and what this meant.
Nitrate test:	Explained how this is done, and that nitrates come from pollution

### **The sites**

Paul had chosen sites beforehand which the groups would be visiting, and explained which sites would be visited while still at the Goldfields Centre. These consisted of four sites:

- Site just below the Midmar dam wall.
- Site opposite the RDP low cost housing settlement in the town of Howick.
- Site inside the reserve, on the Umgeni River.
- Site inside the reserve, on a tributary to the Umgeni River.

Paul introduced various different types of projects which the learners could cover. For example one topic could include a comparison of water quality or pollution levels at the dam wall compared to further down stream.

The group then left the Goldfields Centre and took a trip to the sites, just to get a feel for the sites, before they started gathering data. The first site the group visited was the site just below the Midmar dam wall, at the weir. At this point there is a bridge above the site, and there is a lot of litter lying around as a result.

Paul explained to the learners that they could expect that this site has the lowest pollution levels, because the dam helps to remove a lot of pollutants, as the standing water, allows pollutants to settle out of the water. The learners observed that the section of stream was probably high in nitrates because there was a lot of algae growing in that area. Paul briefly went through the habitat integrity test. Paul explained the difference between indigenous and exotic vegetation, as the group was unaware of the difference.

The group then visited the second site, in the town of Howick. At this site there is a discharge pipe for a solid waste settling tank. The group visited the outlet pipe and did a pH and turbidity test here. Paul then went through the results with them.

The group then went into the reserve. They did not actually visit the third site as it was quite a far walk into the reserve and there was not enough time to go and look at it. However, we went to a spot overlooking the Umgeni River and Paul explained to the group where the site is.

The group then visited the forth site near shelter falls (a tributary to the Umgeni River). Paul got the group to look for some water organisms and to identify them.

Once we were back at the Goldfields Centre. In the hall we looked at what kind of reports the learners would like to do. Paul explained again that each person needs to do a different project. The whole group wanted to look at pollution in the river, with the exception of one, who wanted to look at ecology. Paul suggested they divide up into groups to look at different aspects of pollution, for example social and ecological. The learners then divided up into groups of interest. In the end there were two groups one group looking at the social impacts of pollution and the other looking at the ecological impacts.

That night, Paul went through how to develop a research question with the group. He handed out a fieldwork support sheet on water quality and went through this with the group. Paul also handed out past projects as examples of what was required.

The groups spent most of the night drawing up data collection sheets to record information when conducting the fieldwork.

The group doing the social study drew up a questionnaire. I ended up becoming engaged with the learners at this point as they had various questions about the area and its history, in order to help them come up with appropriate questions and Paul was not there to answer them. For example: how long has the low cost housing settlement been there; where do people in the area get water from.

## Day 2

The group gathered together to make sure we had all the equipment need for the day. We all then left to go to **site one** at the dam wall. At first the group did all the tests as a group so that at the next sites, they could split up and do tests simultaneously, to save on time.

pH Test:	all did this test together and got results.
Turbidity Test:	Four of the learners did this test, while the rest of the group were trying to locate their position on a map.
Nitrates:	One of the learners read to the others from the Catchment Action manual, how to conduct this test, and the rest of the group did the test and interpreted the result.
Methylene Blue:	Paul did this test to show the group how it is done. This is a really difficult test, as one need to ensure that no air bubbles get into the bottle when you seal it. Paul had to refer to the Catchment Action manual on how to conduct this test.

MINI SASS:	The whole group caught organisms for 10 minutes only, so as to have a standard time frame, for all the tests. The group then identified the organisms with Paul's help.
Insect population:	Using the net stretched over 1 meter, and with two people disturbing the rocks and silt upstream of the net so that the organisms get trapped in the net. Two learners, with Paul's help did this while the rest of the group did the following test. All of the learners helped in counting the organisms on the net.
Site description:	Recoding observation about the site.
Habitat integrity:	One of the learners read the scoring criteria to the rest of the group. There was a lot of discussion around the various sections of the test, and explained by Paul. The students had to rely on Paul to interpret the site, and to guide them to an appropriate answer. This therefore seems to be a highly subjective method. For example, the area has kikuyu grass up to the banks which was recently mowed, apparently so that people can fish in the little dam between the Midmar dam wall and the weir. Paul however told the group that there was no evidence of riparian vegetation removal.
Temperature:	Two of the learners measured this.

#### **Site 2:**

This site is just before the town of Howick, and is near a low cost housing settlement. The people from this settlement regularly use this site to wash their clothing. In addition to this there is an outlet pipe here from a solid waste settling tank.

The group looking at the social impact of pollution conducted a few interviews with the people washing their clothing at the river. While the rest of the group continued conducting the other tests. This was done by sub-dividing the group. The group decided to conduct pH and nitrate tests at three points at this site, once at the outlet pipe, once just below the washing area, and one just above the washing area. The results from each site within the site did not differ, which the group found very interesting.

#### **Site 3:**

The group then went down to the third site. This was down in the Umgeni Valley near the Nkonka Stream. Paul let the learners decide exactly where they would conduct the study, and then let them carry on with the study without guidance. The group carried out all the tests by themselves. However, by this stage of the day, it was after lunch, and the group had little to no enthusiasm for the study. In addition to this it was hot, and had to take a long walk down to the site, so they were tired as well.

#### **Site 4:**

The group then went to the fourth site on the tributary to the Umgeni River. The walk down to this site was not far, however the group had less enthusiasm than at the previous site. The learners split up to do the different tests and did not seem to need any input from Paul (except to motivate them to do the tests!). The learners were able to conduct the tests by themselves at this point.

The group then returned, late that afternoon, with their results to the Goldfields Centre. Later that night the group gathered, and Paul reminded them to keep their purpose in mind and then to consolidate the data they collected that day. They were encouraged to get the data each one needs to complete their project together.

At this point the learners discovered that there was a problem with all of their methylene blue tests, in that all of them had air bubbles in them.

### Day 3

After leaving the learners to work on their projects in groups and as individuals, the groups had to put together a presentation for the rest of the group. Within the social impact groups presentation, the following main points were highlighted:

The aim of the study was to see the effects of pollution on people. They did this through conducting tests on the river as well as conducted interviews with people using the river. The people around site B use the water for washing- contributing to pollution, and that animals increase the silt load which in turn effects aquatic organisms.

The ecology group, highlighted the methods used and their main conclusion was that the river's ecology has been impacted upon by pollution and human activities.

12-15 October 2004

**Field Notes – Observation of CIRP Water Study at Umgeni Valley**

School: St Dunstons  
Grade: 11  
Number of learners: 8  
Education Staff: Michelle

Note: This is a specialise geography excursion specifically aimed at conducting a research project for inclusion within the Grade 12 portfolio of evidence. The school is also a private school from Johannesburg.

**Day 1**

The introductory discussion was held at the Goldfields centre in the hall. The group was introduced to the research by Pat Hoffman. In the introduction discussion the question was posed "What is research?"

The learners had the following responses which were then recorded on a whiteboard:

- Gathering information
- Comparison
- Hypothesis
- Structured process
- Experiment
- Investigation (add on by Pat: Clear question)
- Observation (add on by Pat: methods of research)
- Tests
- Surveys
- Interviews
- Pat: Analyse data

Pat discussed the format of the project and the research process by using an overhead. She also went through the IEB requirements for the project.

The group then split up into the different study groups, and I joined the water quality group, with Michelle. Michelle asked the group if they had any possible research questions in mind, to look at during the study. The group suggested they look at water quality.

Michelle went through the tests that they would be performing in order to gather their data. These included the turbidity/ water clarity test, the biodiversity/ organism collection, pH, nitrate, temperature and methylene blue tests.

I missed the afternoon and evening session, during which the learners visited the 3 sites that they would be collecting data at.

## **Day 2**

The group went to site one to gather data. This site is just below the Midmar dam wall, at the wier. The whole group did all the tests at this site to familiarise them with all the tests.

Organism collection: this was done using both the net and the cup collection methods. No time limit was set. In addition to this the learners were told to put the net in an area of the river where there was no water flowing. The Learners disturbed the silt in front of the net, but caught very little doing this. The learners were instructed to identify the organisms by using the identification booklet provided. However, in the end most of the organisms were identified by Michelle, and minimal reference was made to the booklet.

The learners had produced their own data sheets without being told to do so or being shown how to do this. However, the learners recorded only what Michelle instructed them to.

The pH, turbidity and temperature tests were carried out by the learners, in different areas of the site.



The methylene blue test was done by Michelle. The learners then read out of the catchment action booklet on how to interpret the results of this test.

Habitat integrity test: the whole group was involved in this, Michelle gave input into the answers to the questions. Again, as observed before, this test is very subjective and therefore not particularly useful.

The group then went to site 2. This site is in the area opposite the RDP low cost housing settlement in the town of Howick, just below the waterfall.

The tests done at this site were done exactly the same as at site 1. However, at this site the learners were not paying too much attention and looked, for the most part, bored.

Once all the tests were completed, the group then went to site 3. This site was in the Umgeni Valley Nature Reserve, near Nkonka camp. I was unable to observe this session.

### **Day 3**

The learners spent the whole day at the Goldfields centre working on their projects and presentations, assimilating data and analysing results. I did not observe this process as they did this individually.

That night (I observed the presentations) the group did a presentation for the rest of the learners in the whole group. This session was facilitated by Pat, who started the presentations off by giving each group a question which they had to consider during the presentations. These were:

- What are the strengths and weaknesses of their method
- How do we know we can trust their data?
- What have they not told us?

Each person in the group had to present something of their study. It was suggested that they do their presentation in the same format as they would a report.

The presentation:

The first learner described the Umgeni river in general, highlighting the importance of the river. As well as giving descriptions of each of the sites. The research question stated was: How does water quality differ from site to site? Their hypothesis was: Water quality deteriorates down the river.

The second learner gave descriptions of each site, including such observations as vegetation, water flow, bird life and use by people.

The following few learners each described one of the tests. Including a description of the test, the materials and methods used, the results and the problems they experienced with each test. In particular the methylene blue test and habitat integrity tests, were described by the learners as difficult and not particularly useful.

A summary of the results was given as:

Temperature: Site 1 had the coldest temperature, therefore there was more oxygen in the water, and therefore there was less pollution. (A limitation mentioned by the learners for this test was the time of day that the test was done.)

Nitrates: Nitrates were discussed at length, and an explanation given as to what nitrates are, and how they effect the water. Limitations mentioned here included human error and a difference in the time of day.

Conclusion: The further upstream the better the water quality. Therefore proving the hypothesis. All the tests conducted seem to prove this hypothesis.

Following the presentation the rest of the group responded by asking questions related to the questions posed to them by Pat at the beginning of the session. The following are responses made by the rest of the group:

Strengths and weaknesses:

- There was a lot of attention to detail, their research was backed up with evidence
- Tests needed a lot of help from Michelle

Can we trust their data:

- There were a lot of tests, so that is good
- They proved their results
- They acknowledged their limitations

What did they not tell us:

- There was no title to the report/ presentation
- Would have liked more detail about the tests.

20 October 2004

**Field Notes – Observation of Wetland Study at Entabeni Education Centre**

School: Sacred Heart  
Grade: 5  
Number of learners: 13  
Education Staff: Marcia

This was a morning wetland study, as part of a course involving adventure activities and ecology studies. This session was not very in-depth, due to the age of the learners.

The session was started by doing an interpretive trail down to the wetland.

Marcia: What is a wetland?  
Learner: This (pointing at the dam)  
Marcia: What is crucial to wetlands?  
Learner: Water

Marcia then described the wetland rehabilitation of the Hlatikulu Vlei, giving reasons as to how they did it and why. She also explained to the learners that soil in a wetland is very fertile.

The learners' Teacher joined the group at this point (Robyn Picas)

Along the road down to the wetland there is a bad spot of soil erosion. Marcia stopped here and discussed the importance of vegetation and roots for holding soil together.

At the furrow where the working for water is construction a plug, Marcia stopped the group. This is a good illustration of the vegetation point as working for water were busy planting plants on the plug to stabilise it. She explained to them that putting plugs into the furrows aids rehabilitation by helping to raise the water level in the wetland.

Marcia: Why is the wetland so green?  
Learner: Because it has been burnt  
(the wetland had been burnt...)

Marcia stopped at the power line which has many orange tags on it to stop cranes from flying into them. She explained to them (through probing questioning) why they are there.

Marcia: Why do we want to learn about wetlands?  
Learner: So we can have water

Marcia then described (through probing questioning) the importance of wetlands in terms of sponge action, filtration, flood prevention, drought prevention, and as a place for animals to live.

Marcia then took the group to the crane pens and spoke to them about crane conservation (show and tell style of presentation).

Marcia then took them down onto the wetland. At the point where they were standing was dry land. She explained to the group that although the ground was wet, that they were still standing on a wetland. She asked them to give reasons as to why the land might be dry. They responded saying that there had not been enough rain.

At this point the group was divided into three and they did a scavenger hunt in the wetland. This involved self exploration to find various items in the wetland. Marcia floated between groups to see what they were up to, and to maintain their focus.

After the group had gathered their pieces from the scavenger hunt. Marcia went through each group's findings, explaining what they had found and why it was important. One of the items on the list is a suntrap. Marcia used this to explain that plants gather energy from the sun, and that energy is transferred to other organisms when those organisms consume that plant. Explains energy transfer and nutrient cycles to the learners.

The group then walked over the dam wall. The learners wanted to know why there were tyres in the wall. Marcia explained that these are to help strengthen the wall and stop erosion.

At the old crossing, Marcia got the group to divide into twos, and they did the crane and wetland crosswords. In this crossword the learners are asked to recall information which they had learnt during the study. The learners were able to do this exercise without any help from Marcia.

The group swam a while and enjoyed the water. They then returned to the hall to do a picture building activity.

The picture building game they did was called 'Catchments to Coasts'. They played it in two teams with runners to add a competitive streak. Once the game was complete, there was a discussion around the picture as a whole, and discussed issues around the bad points on the picture, replacing them with the cards which are environmentally improved.

The main issues discussed were the collection of shells without a permit, the pollution and boating, the beach resort and the beach erosion with too many buildings, the drained wetland and the sugar estate leading to erosion.

**27 October 2004**

**Field Notes – Observation of Wetland Study at Entabeni Education Centre**

School: St Charles  
Grade: 6  
Number of learners: 22  
Education Staff: Caroline and Geoff

This was a morning wetland study, as part of a course involving adventure activities and ecology studies. This session was not very in-depth, due to the age of the learners.

The first activity was the picture building game 'Catchments to Coasts' in the hall, because it was raining outside. Many of the group had played the game before, but were keen to play it anyway.

During the game, Caroline was explaining various issues. She explained the pros and cons of shark netting, and dams. She explained what wetlands are.

After the picture was built, Caroline and Geoff did a team teach of the various issues which come out in the game. The following issues that were mentioned by the group and explained further by the group leaders:

Pollution in the water

The drained wetland - this was explained in detailed, and Geoff went into how and why wetlands are drained as well as the effects of draining wetlands

The pollution from the factory

Pollution in the sea- the effects of this was explained

Scuba divers taking coral- the effects of this activity was explained

People collecting mussels- discussed why mussels are important and how to prevent over utilisation

Sustainable utilisation of resources- ie: the people collecting fire wood in the reserve, why this is a good thing.

The pine plantations too close to the river and why this is a bad thing

The sugar cane fields

The city by the beach and cars driving on the sea shore.

After the game and the following discussion, the group then took a walk down to the crane pens. Caroline did a crane tour with them. Show and tell style, explaining the importance of cranes, and that they are endangered species.

At this point the group then split into two, and each group went into the wetland separately. I joined Geoff's group. Geoff explained more about the cranes and how they are adapted to live in the

wetlands. He explained how South Africa is a water poor country and that we are running out of water resources.

Geoff explain the importance of wetlands and the different functions of wetlands through asking probing questions. The group went for a walk through the wetland, and Geoff suggested that if they see anything interesting that they should ask about it.

In the wetland Geoff explained to them that even through the ground seems dry, they are still in a wetland, and that some wetlands are only wet during certain times of the year, you can test however by looking at the soils and at what plants grow there. Geoff explained to them that the area is in the process of being rehabilitated. This area is a good place to do this as the rehabilitation program has been going on for many years (15) and it is not completed yet. This illustrates nicely that habitats like this take a really long time to fix. This was explained to the learners. The learners were keen to know how many more years it would take to be natural again. Geoff (and I) could only guess how long this would take.

Geoff also explained that the wetland is heavily impacted upon by alien plants such as brambles.

When the group got to the old crossing, they joined up with the Caroline's group, and they were given time to explore and play in the mud.

On the walk back to the centre, Geoff asked the group what they had learnt that morning, they responded:

- Learnt about cranes

- There are more than three species of crane

- How to rehabilitate a wetland

- About adaptations of animals to live in a wetland

- There are different types of wetlands

- One can distinguish between the different types by looking at the soil and vegetation

- Wetlands clean the water

- Many animals live in wetlands

- Wetland slow the movement of water down

2 November 2004

**Field Notes – Observation of Wetland Study at Entabeni Education Centre**

School: St Monica's  
Grade: 6  
Number of learners: 12  
Education Staff: Sarah

This was a morning wetland study, as part of a course involving adventure activities and ecology studies. This session was not very in-depth, due to the age of the learners, the focus on this wetland study was to have fun while learning.

On the walk down to the wetland, the learners played a game called camouflage. This game makes the learners engage with their environment and become part of it, by hiding in it. The group was really good at it, and they all hid, so that we could not see them.

The group visited the crane pens, and Sarah told the group about the cranes and their importance and that they are endangered. This is very much a show and tell style presentation.

Just before the dam wall in the wetland we stopped to have a discussion. Here Sarah discussed what a wetland is. And that even though the ground they are standing on is dry, it is still a wetland. She explained to the learners why wetlands are important using probing questions.

Sarah explained why it is therefore important to conserve wetlands and to fix those that have been destroyed. There was a brief discussion around the rehabilitation of the Hlatikulu vlei. The group then walked through the wetland and along the dam wall. At the old crossing they stopped and Sarah made them all walk into the mud without their shoes on, to illustrate how wetlands feel and the sponge effect of wetlands. They did a scavenger hunt here, and this allowed the group to explore the wetland by themselves. Sarah moved from group to group to ensure that they remained focused on finding the stuff on the list. Once they had all collected what they need to, Sarah gathered the group together where they discussed each groups findings.

The group then returned to the centre.