

**THE USE OF LEARNING SUPPORT MATERIALS IN
THE RURAL SCHOOLS OF MAPUTALAND,
KWAZULU-NATAL**

A HALF THESIS

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by

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Declaration

I, the undersigned, hereby declare that the full-thesis entitled: *The use of learning support materials in the rural schools of Maputaland, KwaZulu-Natal* submitted for the degree of Masters of Education (Environmental Education), is my original work, except where otherwise acknowledged, and has not in its entirety or in part been submitted to any other university or institution for a higher degree.

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Date

Abstract

The African Coelacanth Ecosystem Programme (ACEP) was established in 2002 after the discovery of a colony of coelacanths off the Maputaland coast at Sodwana Bay, KwaZulu Natal. The environmental education and awareness sub-programme developed learning support materials (LSM"s) for use in schools and the materials were disseminated annually through teacher education workshops.

This study aimed to uncover the use of these LSM"s in the rural schools of Maputaland. The active learning framework was used to analyse the materials. Collectively, the ACEP materials cover a range of active learning aspects; however alignment with the curriculum has resulted in an increased focus on experiments, accompanied by a loss of environmental content and a narrowing scope for active environmental learning.

Workshop questionnaires and four school case studies revealed the patterns of practice of use of materials in schools. The stated use of materials by teachers is not fully realized in the actual classroom practice which centres on learning content and concept definitions. There is no culture of use of materials in the schools following the annual introduction of ACEP materials. It was also found that the marine and coastal knowledge holding power is outside the realm of the teachers" practice and control.

The findings of this study come at a time when there is uncertainty over the future of South African education and the curriculum. This research may inform the environmental education and coastal and marine education field as to their role in education and more specifically the development of learning support materials.

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List of Abbreviations

ACEP	African Coelacanth Ecosystem Programme
C2005	Curriculum 2005
DEAT	Department of Environmental Affairs
DoE	Department of Education
DST	Department of Science and Technology
EE	Environmental Education
LSM	Learning Support Material
NCS	National Curriculum Statement
NEEP-GET	National Environmental Education Programme for General Education and Training
NRF	National Research Foundation
OBE	Outcomes Based Education
SAEON	South African Environmental Observatory Network
SAIAB	South African Institute for Aquatic Biodiversity

Chapter 1 Introduction and Contextual Background

1.1 Introduction

This research was initiated by the African Coelacanth Ecosystem Programme (ACEP), which offered a funding opportunity for me to conduct research related to their environmental education work. I accepted the opportunity as the potential research project appealed to my interests.

Although I have an academic and work background in the field of nature conservation, I have always had a holistic view of the environment and a passion for environmental education, which led me to register for this Masters degree. The opportunity to conduct research for ACEP appealed to me, in that this natural science based programme had expressed interest in reflecting on their environmental education practice through research, which would draw on current educational thinking and the social sciences. I would now be able to critically reflect on and understand the environmental views of a conservation programme like ACEP by drawing on this thinking, something that had interested me in conservation work I had undertaken in the past. The research opportunity appealed to my need to learn more about environmental education in schools and the curriculum and this interest had stemmed from previous work experiences with the Eco-schools programme and the rural schools in northern Zululand. I grew up in the Zululand area and so the opportunity to investigate the ACEP environmental education and the use of their resources in the rural schools around Kosi Bay and Sodwana Bay seemed ideal in terms of my research interests.

The contextual background and history of ACEP is discussed in the next section.

1.2.1 Historical and Contextual Description of the African Coelacanth Ecosystem Programme

The African Coelacanth Ecosystem Programme (ACEP) was initiated after a colony of coelacanths (a prehistoric fish) was discovered in the waters off Sodwana Bay, Maputaland (iSimangaliso News, 2009:5).

The most recent fossil coelacanths date back 60 million years. Therefore it was believed that they were extinct 60 to 70 million years ago. In 1938 a coelacanth was discovered off East London. This was thought to be the “zoological discovery of the century”. In 1952 a second discovery occurred in the Comoros islands. Then on 27 November 2000, a third discovery was made by divers in the Greater St Lucia Wetland Park (now iSimangaliso Wetland Park), in KwaZulu-Natal (Ribbink & Roberts, 2006).

Because the discovery in 2000 was made in a marine protected area (MPA) and World Heritage Site, the coelacanth and its habitat were immediately granted protection by the Minister of Environmental Affairs and Tourism. The Department of Environmental Affairs and Tourism (DEAT) and Ezemvelo KZN Wildlife immediately began drawing up a management and conservation strategy, which highlighted the need for a research project concerning conservation and research of the coelacanth and its habitat. Most important to this report was the integral role of environmental education and public awareness within the strategy recommendations (Ribbink & Roberts, 2006, SAIAB, 2008b). A planning workshop led to the formation of the South African Coelacanth Conservation and Genome Resource Project in 2001, which would have an ecosystem approach to the conservation and management of the coelacanths (SAIAB, 2008b).

The name then changed to the African Coelacanth Ecosystem Programme, due to the programme’s multinational approach (SAIAB, 2008b). The first phase of ACEP took place between 2002 and 2007 and had a focus on oceanography, marine geoscience and ecology, biodiversity, the coelacanth, genetic studies, Geographic Information Systems (GIS) and environmental education and awareness. Marine science sampling

and research took place all along the east coast of southern Africa and the south-western Indian Ocean (SAIAB, 2008a). In 2002, an expedition took place at Sodwana Bay, where the discovery was made, within the Greater St Lucia Wetland Park. The FRS *Algoa* was the research ship used, together with the German-designed submersible, the *Jago* (Snow, 2008). The second phase of ACEP was started in 2007 and will continue until 2011.

ACEP developed through the partnership of the Department of Science and Technology (DST), the National Research Foundation (NRF) and the DEAT (South Africa. Ministry of Science and Technology (MST), 2004).

The ACEP slogan of „Window to the Past, Door to the Future“ aimed to show the coelacanths“ role in scientists“ studies in evolution and history, as well as the role in “building capacity, promoting understanding, influencing management and conservation strategies, building partnerships and addressing issues of socio-economic development and achievement of Millenium Development Goals” (Ribbink & Roberts, 2006:409).

According to Ribbink & Roberts (2006), ACEP embraced an approach to conservation which was multidisciplinary and include science, the humanities, education and training. Environmental education and public awareness was upheld as an important discipline within the programme.

1.2.2 The ACEP Environmental Education and Awareness Sub-programme

Within ACEP is an Environmental Education and Awareness sub-programme. The sub-programme is following the government and private sector objectives to “promote science, to improve science literacy at school level, encourage development of black scientists (build capacity) and sustainable management of our natural resources” (Snow, 2008:3).

The sub-programme had the following focus areas, each with its own objectives (Snow, 2008):

- Consolidation, networking and integration
- Learner support materials and resource materials
- Public Understanding of Science and Technology (PUSET)
- Professional development
- Learner workshops
- Science and career awareness

Snow (2008:4) has said that in order to make a significant impact, the programme aimed to have many different approaches. The programme centred on building responsibility towards the environment within youth and adults in communities along the western Indian Ocean, by providing “learner programmes, materials development, exhibits, competitions, media and educator development”. The programme attempted to inspire these communities and promote science in order to build responsibility and develop literacy in science (Snow, 2008).

South Africa and other African countries have a low scientific output and the number of graduates in Science, Technology and Engineering is lower than that in 1994 (South Africa. MST, 2004). ACEP strives to be a multidisciplinary programme that combines the physical, chemical and biological sciences, together with technology, in order to study life processes and factors which sustain life on earth. According to Mosibudi Mangena, Minister of Science and Technology, this multidisciplinary approach creates opportunities to motivate people, especially young people, to take an interest in science. The research exploration ships, state of the art technology and fascinating discoveries that are a part of ACEP inspire and fascinate people (South Africa. MST, 2004). Mangena said that ACEP has taken on the improvement of science literacy and promotion of careers in science and it is extremely beneficial and profitable for a nation to invest in science and technology (South Africa. MST, 2004).

ACEP has adopted an approach of “attain, train, retain and sustain” in their capacity building initiatives (South Africa. MST, 2004). This means that by “attaining”, they aim to capture and inspire the youth to take an interest in science and technology and to advance towards careers in these disciplines. Research ship tours, activities and trips have been used to achieve this goal and the FRS *Algoa* has travelled to ports throughout South Africa and other countries. An estimated two thousand children have visited the ship. “Training” involves equipping people with skills in short courses on the ship as well as opportunities for Masters and Doctoral studies. “Retaining” takes on the role of ensuring that trained persons are able to find employment within appropriate fields and that young people are able to engage with employed scientists and see that the employment opportunities are real and achievable. The future of the programme centres around the word “sustain”. This involves the financial capability to provide employment for these trainees (South Africa. MST, 2004).

The second phase of ACEP is funded mainly by NRF for running costs and student bursaries. ACEP is a “flagship programme” of the South African Institute for Aquatic Biodiversity (SAIAB). The South African Environmental Observation Network (SAEON) Elwandle node manages ACEP II and is based at SAIAB (SAIAB, 2008a). There was an open call for research by the NRF and researchers were able to submit a research bid for funding. The coordinator of the ACEP Environmental Education and Awareness sub-programme made a submission and secured research bursaries for students, one of which funded the present research.

1.2.3 ACEP Materials Distribution in Maputaland

The iSimangaliso Wetland Park is a District Management Area which is mostly part of the uMkhanyakude District Municipality. Most land use in this municipal area includes agriculture and commercial timber plantations, conservation, eco-tourism and settlement (iSimangaliso Wetland Park Authority, 2008:39).

The iSimangaliso Wetland Park (see Figure 1), has co-management agreements with community trusts surrounding the Park. According to the iSimangaliso News (2009 p 16), community trusts receive benefits such as “equity in developments, jobs, training, access to the tourism industry, capacity building, SMME opportunities and natural resource use.” Ezemvelo KZN Wildlife has a partnership with the iSimangaliso authority in managing iSimangaliso Wetland Park (iSimangaliso News, 2009:11).



Figure 1: iSimangaliso Wetland Park in Maputaland, KwaZulu-Natal (<http://www.isimangaliso.com/index.php?maps>)

Currently there are eight ACEP projects linked to the iSimangaliso Wetland Park and these consist of “*integrated biodiversity and process study of African coelacanths and their ecosystems, conservation planning for the waters off KZN to recommend placement of Marine Protected Areas, coral palaeo-climate history of Sodwana and environmental education*” (iSimangaliso News, 2009:5).

The KZN Wildlife community conservation officers carry out environmental education and awareness with the schools in and around the iSimangaliso Wetland Park such as excursions, presentations, environmental special days, coastal clean-ups and competitions (Pieters, 2009). The location of these schools is seen in Figure 2.

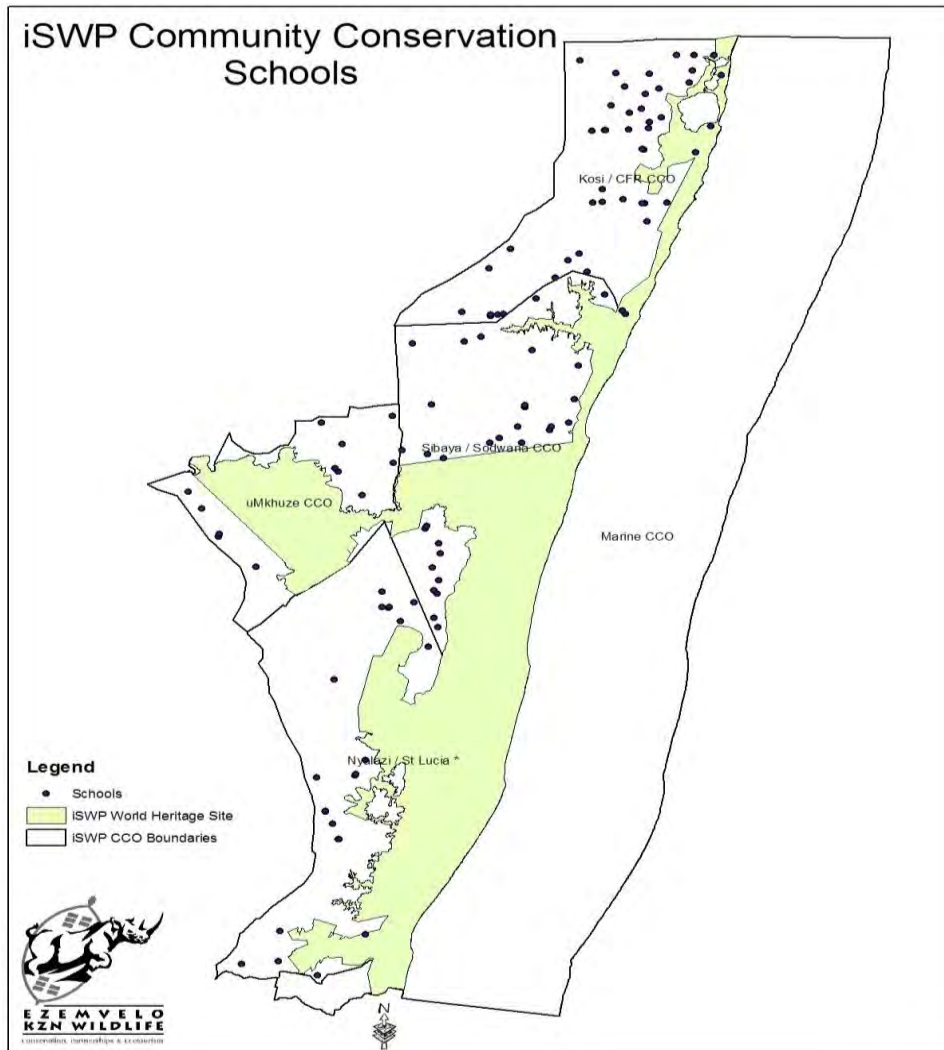


Figure 2: Location of the iSimangaliso Community Conservation Schools (Ezemvelo KZN Wildlife, 2009)

Since 2002 and the start of the coelacanth programme, each KZN Wildlife community conservation officer has facilitated some of these schools in the Eco-schools programme and the registration fees for the schools are paid by KZN Wildlife (Pieters, 2009).

Learning support materials (LSMs) were developed by ACEP to achieve the objectives of improving science literacy and motivating youth to take up future careers in science in schools. These LSMs are aligned with the curriculum and the outcomes required in many learning areas. The LSMs are distributed through workshops with teachers (Snow, 2008). The LSMs developed from 2001 to 2009 include video learning programmes, posters, brochures, workbooks, worksheets, puzzles, fact sheets, science kits and an interactive CD (Snow, 2008).

The workshops are run by the ACEP environmental education officers nationally as well as almost on an almost annual basis, with many of these schools around Kosi Bay and Sodwana Bay (Snow, 2009a). These workshops educate teachers to work with the learning materials which have been developed and show how the materials can link to the curriculum and their lesson plans (Snow, 2009b and Binning, 2009). In the beginning, the focus of education centred around the coelacanth and its conservation, but the focus very soon broadened out into issues of the marine ecosystem conservation and other areas such as weather and catchment education (Binning, 2009).

The KZN Wildlife community conservation officers working in iSimangaliso Wetland Park have been trained by the ACEP coordinator to run ACEP materials workshops. These workshops have happened annually. The local inKhosi is informed about any work or materials distribution that takes place (Snow, 2009a). The coordinator of ACEP stated that all of the materials developed by ACEP have been used in Sodwana Bay and it is therefore a good area to research in terms of the use of the range of ACEP materials (Snow, 2009a).

1.3 Research Question and Goals

Although ACEP had an intention to discover the effectiveness of their materials in order to learn and develop for future initiatives, it was decided that the *use* of materials is the key focus of the research. The research question evolved, asking “how are learning support materials being used in the rural schools of Maputaland?”

The goals of the research were:

- To critically review the historical development of the ACEP materials
- To survey their current curriculum use;
- To probe the implicit and existing patterns of use and teaching practice in four local learning contexts;
- To discuss preliminary findings with the teachers and materials developers for verification and to identify key contradictions and possible solutions.

1.4 Overview of the Chapters

Chapter 1 has introduced the historical and contextual background to ACEP and its environmental education initiatives. It also gives background to the distribution of the ACEP materials in the schools of Maputaland which then leads into the research goals and overall research question.

Chapter 2 provides a review of the literature relevant to the research question. This literature covers the socio-ecological assumptions of ACEP and the challenges to educational quality in the Maputaland schools. It maps out the trends in learning support materials development in environmental education in southern Africa. Active environmental learning is then introduced as well as literature which has looked at the use of learning support materials in schools. Chapter 2 ends with literature around school curriculum issues in South Africa.

Chapter 3 focuses on the research design. The research orientation, methodology and methods of data collection are explained. There were two phases of data collection. I then discuss the data analysis and my approach to data management, reduction and coding. This is followed by the interpretation of the data and generation of analytical statements. I conclude Chapter 3 with the consideration of research validity and ethics.

Chapter 4 is a presentation of the findings from the data. The data is presented in two parts. Part I looks at the ACEP materials and their history, workshop dissemination, the implicit design for use and Active Learning within the materials. Part II is the context, implicit and observed use and Active Learning within these, at a wider survey level and at a deeper case study level.

In Chapter 5 the discussions from mirror data workshops with teachers and the developers of materials are presented. This leads to the Analytical Statements which have been identified from the evidence and discussed in relation to suitable literature.

Chapter 6 concludes the thesis with a summary of the key findings, the broader implications of the findings for environmental education, recommendations and areas for future research.

1.5 Conclusion

As described in Chapter 1, there has been an almost ten-year history of ACEP environmental education with Maputaland schools, in collaboration with KZN Wildlife. The present research was initiated as the second phase of ACEP draws towards the end, in order for the programme to get a thorough understanding of the context and use of materials in the schools which they have worked with for so many years. This research could then give them a well-informed understanding and way forward for the future, while also providing similar guidance to other programmes and initiatives.

Chapter 2 is a review of the literature. I explore this at a deep contextual level in relation to the study, but also map out the broader landscape of literature relating to the development, dissemination and use of environmental education learning support materials in southern Africa.

Chapter 2 Review of the Context and Literature

2.1 Overview of the Chapter

In this chapter the socio-ecological assumptions underpinning the programme and materials development, as well as the challenges affecting the educational quality in rural schools, are explored. The contextual exploration leads into the broader background of the trends in environmental education materials development in southern Africa. These trends link to environmental education in Outcomes Based Education (OBE) and how the Active Learning fits in with the South African curriculum. I then investigate other research and literature which has looked at the use of learning support materials in southern Africa. Finally I discuss the issues of the South African curriculum, as an understanding of this is important for understanding the school-based use of LSMs by teachers in South Africa.

2.2 Understanding the Socio-Ecological Assumptions of a Marine Conservation Programme

According to SAIAB (2008a), the objectives of ACEP II are the following:

- Integration of physical and biological sciences to better understand ecosystem functioning in the South-West Indian Ocean
- Science research to find out more about the evolution and adaptations of coelacanths and their ecosystems
- Ecosystem monitoring in the long-term in order to investigate biological processes and climate change
- Investigate the biodiversity, species richness and biogeography of the South-West Indian Ocean
- Make recommendations for conservation, management strategies and long-term sustainability of the South-West Indian Ocean

- Capacity building in offshore marine science, including skills development and providing equal opportunities
- Marine science public awareness and understanding
- Knowledge building and the integration and sharing of Marine GIS
- Provide a platform for partnerships at a national, regional and international level in order to strengthen marine science in South Africa

As mentioned in Chapter 1, the Environmental Education and Awareness sub-programme aims to “promote science, to improve science literacy at school level, encourage development of black scientists (build capacity) and sustainable management of our natural resources” (Snow, 2008).

According to Ribbink and Roberts (2006:419), “ACEP was fulfilling a much-needed role along the east coast and within the Western Indian Ocean, as its broad-based, biophysical approach served far more than simply coelacanth studies.” Through this programme there is more knowledge about marine ecosystem processes, biodiversity and fisheries that will aid the huge number of people dependent on marine resources (Ribbink and Roberts, 2006). ACEP promotes the advancement of science, science education and technology for development (Ribbink & Roberts, 2006).

Mosibudi Mangena, Minister of Science and Technology, stated that “making science more interesting, attractive, relevant, challenging and rewarding, and inspiring learners and communities is highly commendable”(South Africa. MST, 2004). ACEP has taken on the improvement of science literacy and promotion of careers in science. It is extremely beneficial and profitable for a nation to invest in science and technology (South Africa. MST, 2004).

In an examination of the emergence of environmentalism Martinez-Alier (2002) distinguishes between three “currents of environmentalism”. These are the cult of wilderness, the gospel of eco-efficiency and the environmentalism of the poor. The “cult of wilderness current” or theme is supported by conservation biology in science.

“Preservation over market use” reigns in this current and the Biodiversity Convention in 1992 and the Endangered Species Act in the USA are clear evidence of this. The cult of wilderness focuses on preventing the loss of biodiversity as the most important issue to address. ACEP’s focus is not only ensuring that the coelacanth does not become extinct but also ensuring that the biodiversity within its marine environment, on which its survival is so dependent, is preserved. Because the marine environment is massively threatened by unsustainable harvesting and degradation and alteration in the form of pollution and climate change, the indicators of human pressure, described by Martinez-Alier (2002) in relation to the “cult of wilderness”, such as the HANPP (human appropriation of net primary production of biomass) index, are essential in policy creation and the establishing of limits and quotas in order to ensure the survival of the marine resources on which the world depends. The fact that the coelacanth was believed to be extinct for 60-70 million years places even more emphasis on the preservation of individual species and studies of their adaptations and survival a true attribute of the cult of wilderness.

At the time that the Biodiversity Convention was initiated, Beck (1992:24) noted how environmental destruction is being debated in terms of natural science. The cultural, political and social meanings are part of these discussions. He suggests that these become “discussions of nature without people without asking about matters of social and cultural significance”. “ *The scientific concern with the risks of industrial development in fact relies on social expectations and value judgements, just as social discussion and perception of risk depend on scientific arguments*” (Beck, 1992:30). Not unlike ACEP, conservation agencies in South Africa have initiated environmental education programmes within „a nature at risk and people are the problem“ in need of education to change their behaviour. Behind such environmental education programmes was an approach of using environmental education for getting to the general public and to youth in schools, so as to create awareness and resolve environmental concerns.

The critical purchase that Beck (1992) and Martinez-Alier (2002) provide here was important for my being able to stand outside the assumptions of the ideological drivers of risk and environmentalism driven education and to look carefully at the production, dissemination and use of the materials in education settings in Maputaland.

2.3 The Challenges Affecting Educational Quality in Rural Schools in Maputaland

According to the Integrated Management Plan (IMP) for the iSimangaliso Wetland Park, the main socio-economic characteristics within this municipality include: *“a historically high population growth rate which is declining in the rural areas, with migration into smaller towns in the district and other urban centres; unsustainable urbanisation trends; a high unemployment rate; decreasing formal and increasing informal employment, and the increasing casualisation of labour; Low diversity in the economy; low annual per capita income; a high incidence of HIV/AIDS; a youthful population; inadequate infrastructure and services and high levels of illiteracy”* (iSimangaliso Wetland Park Authority, 2008:43).

The IMP for the Park states that the *“distribution of the schools in the region is fairly well correlated with population distribution, distances to schools are often more than 15 km in less-populated areas; the teacher to pupil ratios are in excess of 1:40; conditions of classrooms and facilities are generally poor; and a large proportion of teachers are inadequately trained”* (iSimangaliso Wetland Park Authority, 2008:43).

When compared to the challenges represented in the Nelson Mandela Foundation Report of South African Rural Communities (2005), the challenges in these rural schools are fairly representative of the challenges facing many other rural and under-resourced schools in other regions of South Africa. Seventy-one percent of educators in rural schools consider the shortage of teaching and learning resources and materials as being the primary challenge for educational quality in their schools (Nelson Mandela Foundation, 2005). These challenges and needs are important to note when the

research aims to uncover the use of materials in a context where environmental education materials from ACEP have been developed and disseminated in these schools.

2.4 Trends in Learning Support Materials Development in Southern African Environmental Education

According to Lotz-Sisitka & Russo (2003) and O'Donoghue (2007), early environmental education in southern Africa centred on conservation communication and extension work, with aims to create awareness, educate about ecology and provide experiential education. Materials were developed for these purposes. The issues of the environment were to be solved through experiences *in* the environment, with information *about* the environment. Many materials were developed for this purpose. This approach came to be known as the "top-down" or RDDA approach (Lotz, 1997 and O'Donoghue & McNaught, 1991). The Research-Design-Disseminate-Adopt (RDDA) approach was similarly "top down" in materials development, in that it is an expert-driven approach with little consideration of the context of the learner. The materials are simply "disseminated" as an instrument designed by an expert to change the awareness of a particular target group (Lotz-Sisitka & Russo, 2003:9).

More participatory methods of materials development then followed. Democracy in South Africa also played an influencing role in this shift and a concern for participation in environmental education has played a strong role in shaping the field and the way that materials have come to be developed (Lotz, 1997). Materials development became more responsive to context and materials became more relevant and responsive to issues. Complex environmental issues and risks in the southern African region have meant materials must develop "high quality, action-orientated, contextual learning" and must be "adaptable in different and changing contexts, different languages, purposes and topics" (O'Donoghue & Russo, 2004).

The research of Lotz (1996), Taylor (1997), Mbanjwa (2002) and Lupele (2002) investigated participatory approaches to the development of materials.

Lupele (2002) not only drew on the international thinking and views that beneficiaries need to participate in development work, but also used contextual profiling to understand the local context and the global factors influencing their work. These factors were found to influence policy, funding and educational and development approaches and practice.

Taylor (1997) stresses the importance of teacher development, participatory and network approaches and “adaptive redevelopment of materials”. Mbanjwa (2002) highlighted the importance of considering language, meaning-making and the role of the educator in materials development.

In Lotz (1996) the participatory development of the *We Care* materials “emerged as a reflexive and responsive process of change”. She aimed to work with teachers in the local context. Her study highlighted “a realization of the complexities of establishing conditions for authentic participation in materials development and curriculum development” (Lotz, 1996). Teacher participation aimed to allow teachers to strengthen and change their teaching activities through critical reflection and discussion concerning their context of teaching and learning. The process of her research also explored the interdependence of curriculum development, materials development and in-service teacher education (Lotz, 1996).

Socially critical environmental education perspectives and the ideological position of education *for* the environment (Fien, 1993) were used to orientate the research of Lotz (1996).

Education *for* the environment aims to engage learners in “active resolution of environmental questions, issues and problems”. This involves a wide range of knowledge, skills, values and participation objectives which are not addressed by

teaching environmental facts and concepts (education *about* the environment) or by experiential learning in nature (education *through* the environment) (Fien, 1993:5).

Education *for* the environment starts with studies of local environmental issues. Learners are encouraged “*to participate actively in seeking solutions to the problems that concern them*” and consider global perspectives on local issues which allows learners to “*think globally, act locally*” (Fien, 1993:43).

Overemphasis on the participatory has been identified as problematic, as the actual processes of learning need to be considered. Quality materials should consider these processes, the purpose and use of the materials and the need to be focused and have sufficient “rigour” (Lotz-Sisitka & Russo, 2003).

Not only has materials development in southern Africa evolved from the awareness-raising “top-down” approach to more participatory approaches, but materials needed to be structured to support active learning and thus came to be referred to as „learning support materials” (Lotz, 1996; Taylor, 1997 & O’Donoghue, 2007).

Materials such as the *Sanitation Works* have been developed with the intention of the materials being used in active learning processes of “mobilising learner’s prior knowledge, encouraging investigations, using and finding new information and action-taking” (Lotz-Sisitka & Russo, 2003:41).

Sanitation Works was developed by „Share-net”. Share-net takes an informal approach and produces low-cost materials for the southern African region. The materials that Share-net produces respond to diverse environmental issues and risks. The social, economic, political and biophysical aspects of the environment and the interactions between them became important and took a more holistic approach to environmental education (Lotz-Sisitka & Russo, 2003; O’Donoghue & Russo, 2004). Other environmental education materials produced by Share-net include the *Hands-on* materials and *Enviro-facts*, the *School Environmental Policy Pack* (developed in

response to environmental issues); *Year of Special Days* (based on field-based research) and the *Water Quality Test* kit (partnership development materials) (Taylor, 1997; Lotz-Sisitka & Russo, 2003; O'Donoghue & Russo, 2004).

Materials such as *IK Today* have also been developed to be used to support the introduction of indigenous knowledge in the context of the local community (Taylor, 1997; Lotz-Sisitka & Russo, 2003; O'Donoghue & Russo, 2004). This process aims to encourage contextual meaning-making in the curriculum. Although indigenous knowledge has been integrated into curricula this has been mainly to make the curriculum more relevant and the value and relevance of local knowledge is still not seen by teachers and learners, who continue to consider only the knowledge from textbooks and the curriculum as being most relevant (Lotz-Sisitka & Russo, 2003).

Russo (2002) found that environmental LSMs can be used in different ways to cultivate environmental learning by different groups and in different contexts, such as the example of the *Enviro Picture Building* game. The *Enviro Picture Building* game, such as *Madlasuthe's farm*, was open-ended and learners could investigate the socio-ecological interactions and risks and change in landscapes familiar to them. These picture-building games allowed for interpretive learning processes that could take place through interactive meaning-making (Lotz-Sisitka & Russo, 2003).

Davies (2009) used picture-based narratives and photographs to get local women harvesters on the coast to tell the stories of the harvesting of mussels and other coastal natural resources. She then made use of metaphors to bring the scientific background content into relationship with the experience and context of the harvesters as observed through storytelling and pictures. This work was seeing research as education and mobilizing the agency of the women. Agency became the main focus and context of research.

Mapping out the trends in environmental education materials development in southern Africa has enabled me to locate the development of the materials within this landscape

and to begin to recognize the relationship between the development of materials and their actual use.

2.5 Active Environmental Learning

The White Paper on Education and Training (1995) required active approaches to learning and the introduction of Curriculum 2005 and *Outcomes Based Education* (OBE) after democracy in South Africa brought a new need for LSMs. OBE needed materials that were aligned with the curriculum to meet its requirement of a resource-based and learner-centred approach. Curriculum 2005 saw that the environment needed to be an important part of the curriculum and the revised curriculum would make environment an important part of all learning areas and outcomes. The Active Learning Framework (O'Donoghue, 2001) in Figure 3 was used to frame and scaffold the design of materials for curriculum use in OBE.

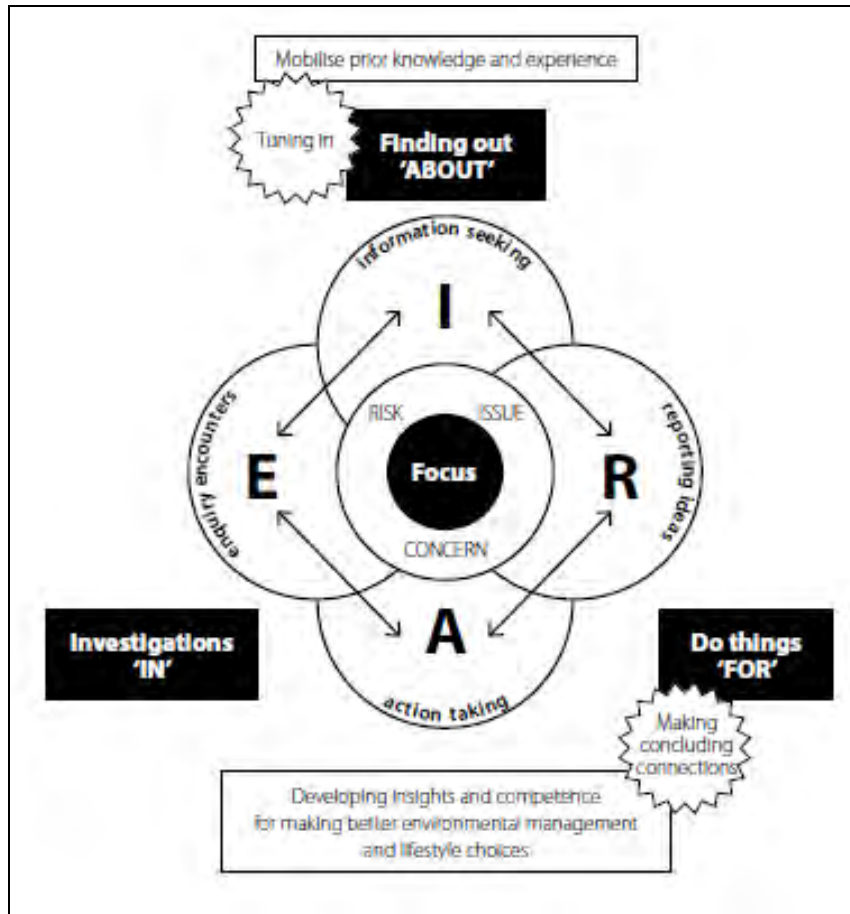


Figure 3: The Active Learning Framework
(O'Donoghue, 2001 in Rosenberg, 2008)

Fien (1993) introduced the concept of environmental education *in, on* and *for* the environment. The Active Learning Framework creates “... a notable shift from providing information about environments and environmental issues to supporting investigative work in local environments and a greater concern for practical actions for a more sustainable environment” (O'Donoghue & Russo, 2004:344). This Active Learning Framework of O'Donoghue (2001) drew on the ideas of Fien (1993), in that environmental learning activities look at local environmental issues and risks through “*finding out and sharing information about an environmental focus; undertaking investigations in local surroundings; doing things for a healthier and happier world and reporting and reflecting on actions*” (Schudel *et al.*, 2008:545). Elements of the discourse of situated learning are relative to this framework (Schudel *et al.*, 2008).

The Active Learning Framework picks up on how each learning area has an environmental focus and learning develops from “prior knowledge to better environmental management and lifestyle choices” (O’Donoghue, 2001). This framework is thus a “steering tool” to “inscribe environmental learning in school curriculum contexts” and does so in all learning areas of the curriculum. It aids in developing materials from a *“directive outside intervention to a more engaging and participatory perspectives centred on mobilising engagement and empowerment within how things are experienced and understood at a local level”* (O’Donoghue & Russo, 2004:344). The framework creates active meaning-making and allows learners to discover and actively engage with local environmental issues and actions in response to these issues (Schudel, 2010).

Schudel (2010) discusses the role of new knowledge for active learning. Informed choice is possible when this knowledge is applied. She discusses this in relation to the view that *“new knowledge consolidates and challenges prior knowledge. It feeds new actions. It lays the foundation for informed choice. It is essential for learning concerned with change”* (Schudel, 2010:21). Learners also need to engage actively with this new knowledge to ensure meaning-making and not just memorizing (Schudel, 2010).

Daniels (2008) describes how education needs the scientific content knowledge as well as local cultural and indigenous knowledge. Vygotsky refers to two types of concepts: scientific concepts and everyday or spontaneous concepts. The spontaneous concepts would be found outside of schooling and scientific concepts would be those taught by the teacher. Scientific concepts are dependent on spontaneous concepts and *vice versa* (Daniels, 2008).

Vygotsky highlights the fact that the learner should do the spontaneous in collaboration with the scientific and that the concepts are interrelated as the scientific becomes embedded in the everyday. Most importantly, Vygotsky says that direct instruction in concepts is impossible. It is just the learning of words which are memorized and not the learning of concepts. Education must therefore offer interaction and development of

everyday concepts with scientific concepts. The conceptual space between the everyday and scientific is where the concepts are developed (Daniels, 2008).

Grasp of scientific concepts develop through systematic co-operation between the teacher and the learner, where the teacher assists and participates in meaning making. The learner must do something collaboratively with the teacher and must then do something that has never been done spontaneously in order to solve a problem involving scientific concepts. The space of transition to an understanding of an idea is known as the Zone of Proximal Development (ZPD). Through *acting* on things in the world, learners engage with the meanings (Daniels, 2004).

The Active Learning Framework developed as environmental education came into the South African curriculum after democracy and more specifically, into the development of learning support materials for use in curricula. The Vygotskian learning theory describes in detail the learning processes that relate to active learning. These ways of framing and describing learning provide a view on the use of learning materials in curriculum contexts.

2.6 The Use of Learning Support Materials

ACEP was initially interested in an evaluative research approach to discover the “effectiveness” of their learning support materials. This review of the literature lays out the direction of the research away from this approach and towards the research which looks in depth at the use of the LSMs in Maputaland.

Glover (2005) conducted evaluative case study research, which investigated the use of environmental education LSMs in schools (natural sciences in the intermediate phase). Once the use of these materials was evaluated, recommendations were made to increase the use of the materials in schools. Recommendations, such as more

alignment of LSMs with the curriculum, workshops and getting teachers and schools enthusiastic about the programme were made.

There are, however, critiques of positivist evaluation models. The critiques of these models argue that: they create the illusion of providing firm answers for everything; the process of evaluation is controlled by the developer and conductor of the evaluation with no motivation for participants to act in response to any outcomes; complex circumstances mean one cannot precisely measure all aspects; there are limited explanations and a focus on the *what*, with little regard for the *how* or *why* in evaluation. This approach also has an objectivist view, which has been epistemologically challenged as it centres on social control and is not socially critical in orientation (an important aspect of environmental education) (Robottom, 1989 in Janse van Rensburg, 1999).

As with ACEP, there is a tendency for environmental educators to engage with the theories of the 1970s from where current environmental education developed. The dominant research approach of this time included applied science models of evaluation. Environmental education theory has evolved and moved on from these approaches and it is understood that environmental education is an evaluative process in itself (Robottom, 1989 in Janse van Rensburg, 1999).

O'Donoghue (1986) in Janse van Rensburg (1999:7) describes environmental education as being an evaluative process due to the reflexive nature of environmental education. Reflexivity as a social process allows for "ongoing critical, contextual review of social action, in action". Evaluation as a measure of outcomes should be rejected in favour of evaluation as being part of a social change process (O'Donoghue, 1986 in Janse van Rensburg, 1999:7).

O'Donoghue & McNaught (1991:397) state that: "*If diverse intuitive, reflective and discursive critical processes (evaluation) have a central and integrated role in curriculum change, evaluation could not simply be treated as external and rational*

processes to establish the value and effectiveness of a curriculum project". When evaluation is treated as central in curriculum change and development, there is a merging of the two aspects into research.

The reflexive nature of environmental education and it being an evaluative process itself mean that this research has taken the interpretive approach of looking at the use of LSMs in schools in a critical and contextual review, without being an evaluation as a measure of outcomes or effectiveness.

Mbanjwa (2002) discovered that there is little research on the actual use of LSMs in environmental education. Urenje (2005) found that the relationship between the development and the use of materials is important for environmental learning.

The National Environmental Education Programme for General Education and Training (NEEP-GET) has investigated the use of materials in curricula and says that there are many different views on "resource-based learning" and the use of LSMs. These seem to play out in the following ways (NEEP-GET, 2005a:39):

- A view of social constructivism, whereby knowledge and meaning is seen to be socially constructed and materials do not have a "scaffolding role in socially constructed meaning". Some view written text as "prescriptive", due to textbooks being used excessively within apartheid education and creating a preference for a sharing of oral text amongst learners.
- Contrary to these perspectives, LSMs are viewed as important to "mediating and supporting learning", particularly in schools which lack resources. LSMs are important in scaffolding and supporting the introduction of new knowledge and supporting activities in learning. (NEEP-GET, 2005a:39).

NEEP-GET (2005a) states that the use of LSMs is crucial for the implementation of OBE and for environmental education. Many environmental LSMs are not "clearly aligned with the requirements of OBE, C2005 or NCS (R-9)". The materials therefore need to be carefully developed to promote both environmental and curriculum

outcomes. Importantly, what is needed of the teacher and the role of the teacher in using the materials for teaching and learning must be considered in the development (NEEP-GET, 2005a:38). The LSMs must be linked to lesson planning and the teachers must have knowledge about learning outcomes and assessment standards (NEEP-GET, 2005a:41). How the materials link to the curriculum and active learning processes, and for what intention, will therefore influence the learning that takes place (NEEP-GET, 2005a:37).

According to NEEP-GET (2005a) materials should not be too “curriculum specific” and “narrowly defined”. Materials should be both open-ended and aligned with the curriculum in such a way that teachers are able to orientate the material to their specific phase, grade and planning frameworks (NEEP-GET, 2005a:40).

In a case from the Learning for Sustainability Project (Janse van Rensburg & Lotz-Sisitka, 2000:90), it was found that teachers struggle to use LSMs within activities and the materials are often used as “display items”. The teacher’s role is to be the mediator of the learning processes in selecting the LSMs and to use these in an adaptive way within the learners’ context. However, teachers tend to select materials that are easier to use and understand (NEEP-GET, 2005a).

In a pilot research project done by the NEEP-GET, teachers were found to use materials that are the “least challenging and that do not require much reading or further research”. This could be due to “issues of language, preparation, time, and lack of clarity on the required levels of scope and depth”. The learning that takes place is thus of a low standard. The report states that teachers need to be supported in the use of LSMs (NEEP-GET, 2005a:38).

Teachers need skills in accessing or taking information from LSMs and accessing the relevance of the information to “learners’ capacity, learning area, environmental context, outcomes, and intended pedagogical processes and applying the knowledge in curriculum processes” (Janse van Rensburg & Lotz-Sisitka, 2000:91). Teachers in rural

and under-resourced schools especially require skills to use LSMs and need to be shown how they must use the materials (NEEP-GET, 2005a:41).

Janse van Rensburg & Lotz-Sisitka (2000) found that the curriculum places emphasis on the context and values, but too little emphasis on skills and knowledge. Teachers do not have a grasp of important concepts in learning areas and there is an absence of reading culture. Teachers lack the ability to use LSMs and select focus areas that require little conceptual knowledge and are not challenging.

LSMs cannot merely be handed to teachers, because support is needed in using the materials (Janse van Rensburg & Lotz-Sisitka, 2000:92). In the NEEP-GET (2005a), it was found that teachers should participate in not only the development of LSMs but also in discussions around the effective use of LSMs. Teachers are the primary mediators of the use of materials in learning processes, especially active learning processes. The planning of lessons which meet the criteria of the curriculum and are relevant to the local context, as well as selecting materials which would be most effective in the learning process, is very important (Lotz-Sisitka & Russo, 2003).

Learning theories and teaching methods also influence the use of materials. Teachers need to be educated in how to use materials in lesson plans, how to access the materials and the “relation between teaching methods and the use of the materials”, as well as how not to “over-use” materials. Language and literacy influence the use of materials, how learners “grasp concepts” and how “activities are affected”. Teachers therefore need to “mediate language use” (NEEP-GET, 2005a:40).

The South African curriculum is designed to integrate the environment into learning areas and because it is not determined by content, it allows for core content and learning outcomes to be context specific and for teachers to adapt and design LSMs themselves (NEEP-GET, 2005b).

Lotz-Sisitka & Russo (2003) highlight the need, during the development of materials, to address how materials will be used and the learning processes that should take place. “Cultural induction” and “critical reflection” is seen as being part of environmental learning processes. This interactive process should include meaning-making; dialogue through discussions and reading about things; encounters through the exploration and investigation of issues and environments and reflection through the critical review and assessment of what is known, what has been read and discussed and what was discovered through the encounters (Lotz-Sisitka & Russo, 2003:38).

Most environmental education LSMs have encouraged learning about: “what is already known, finding out what is happening in the local context and taking action and critically reflecting on these action” for environmental learning to take place (Lotz-Sisitka & Russo, 2003:42).

Environmental education LSMs are often used with the intention of supporting active learning in OBE. NEEP-GET used the active learning framework to frame learning processes (Lotz-Sisitka & Raven, 2001; NEEP-GET, 2005b).

Mbanjwa (2002) found that using the active learning framework in developing materials effected what learning processes took place and the outcomes of these processes. He recommended that easy-to-access pedagogical guidance should be provided if such a framework is used to develop LSMs, in order for teachers to understand it. LSMs must be developed to encourage active learning and the orientation of teachers to the framework (Mbanjwa, 2002).

Mbanjwa (2002) stated that the use of environmental education learning support materials was limited and superficial in a case study of the Creative Solutions to Waste Project. He looked into how LSMs support change in teaching and learning in the context of OBE. Indicators were identified for effective use of LSMs and these were to consider the purpose and use of the LSMs (in terms of curriculum development,

knowledge growth and OBE requirements). The design and development of materials affects their use (Mbanjwa, 2002).

Mbanjwa (2002) investigated the “relationship between learning outcomes, the use of LSMs and mediation role of teachers” and found there were tensions in open-ended approaches to professional development. OBE principles and requirements influence the use of materials and, by using a range of LSMs, more learning and meaning-making through the investigation of local issues in context could take place.

Recommendations were made by Mbanjwa (2002) for LSM development to support interactive, learner-centred LSMs. He recommended teacher professional development, reflexivity and consideration of the teacher as a researcher and lifelong learner. The design of learning support materials should contribute to, teachers’ conceptual development and learners’ abilities to learn (Mbanjwa, 2002).

Mbanjwa (2002) found that language and literacy affect the use of materials and therefore reflexive processes are needed. The use of language in LSMs will influence the learning and meaning-making that takes place. This was the case in many observations of the use of materials in primary schools in the Eastern Cape. He revealed that teachers had to translate certain English materials into isiXhosa. Learners could not relate to, and interpret certain pictures and the teachers had to be able to find a language of interpretation for the pictures.

Lupele (2003) revealed that the use of language became significant in the context of materials development in Zambia where there are seven main languages and 74 dialects. However, he also found that levels of literacy and “more complex cultural/social issues” will affect the use of materials.

Mbuyazwe (2009) discovered that the process of selecting and adapting materials resulted in limited learning opportunities. “Currently naming and defining is still what teachers know and practice in school classrooms”. This practice then influenced how

the teachers searched for content which they already knew when they were selecting materials for lessons. The ways in which materials could support Learning Outcomes and Assessment Standards, their purpose and their curriculum alignment were not considered. The teachers used only the content and factual information. The materials were seen as separate topics and so they were not used for activities for achieving curriculum goals. The curriculum requirements and teacher intentions were “mismatched” and confused.

Learners were expected to learn through reproducing the facts and content information that teachers had taught and very rarely were they required to use the materials for the acquisition of their own knowledge. The teachers lacked the marine content knowledge and were unable to effectively use materials or structure curriculum-aligned learning activities from this content. They were unable to bring definitions that they did know into the lessons and were not confident in allowing learners to use their prior knowledge for the construction of foodchains. They were also not confident in using lesson plans that they developed in workshops (Mbuyazwe, 2009).

Research addressing the use of learning materials highlights the link between the development of materials and the use of materials. This literature provides a backdrop when addressing my research question of the use of materials in schools.

2.7 The Issues of the South African Curriculum

The use by teachers and learners of LSMs in schools will ultimately relate to the curriculum. According to Chisholm (2004), there is much controversy surrounding the implementation and development of C2005. It developed during a context of transformation and educational change, following the destructive apartheid education system. C2005 was to bring about the opposite of this system. The philosophy underlying the outcomes based policy aimed to achieve outcomes such as critical and creative thinking, working together, communication and evaluation skills, environmental

responsibility and the understanding of the relationships between systems and problem solving. Teachers were required to conduct learning towards these outcomes and integrate them into the learning areas. Curriculum design and its tools such as assessment thus became the main focus. The curriculum was seen to be very “complex and jargonized” (Chisholm, 2004).

Chisholm (2004) states that the principles of learner-centeredness, relevance, integration, non-discrimination, human resource development, creative and critical thinking and quality education were good but there were assumptions made about teachers and what was actually going on in the classroom. Teachers were expected to build the content of the curriculum themselves with a curriculum that had complex and difficult terminology and an assessment process which was also difficult.

Many teachers are also negative towards OBE and believe that it is not suitable for rural areas. This is due to factors such as a lack of training and the fact that talking, and not enough reading, is encouraged. The lack of resources and learning support materials means that implementation of OBE in rural schools is difficult. Learners need to develop critical thinking skills from knowledge sources other than the educator (Nelson Mandela Foundation, 2005).

These rural, under-resourced schools have little awareness and understanding of sustainability and the environmental issues within their context. Because access to LSMs is difficult, they struggle to incorporate environmental learning and active learning processes for “problem solving, social justice and change towards sustainable living” (NEEP-GET, 2005a:37).

According to Chisholm (2004), the President’s Education Initiative (PEI) report stated that the curriculum was against the use of textbooks. The TIMMS-R report found a lack of knowledge of basic science facts and understanding of science concepts. The Department of Education’s Education for All Assessment revealed that literacy and numeracy remained poorly developed in primary schools.

A constructivist approach underlies the construction of C2005, which sees everyday knowledge as being against „school knowledge“. The teacher is just a facilitator of learning and not someone with specialised knowledge and a textbook is a problem and not a support for learning. If one takes a progressivist view, C2005 placed emphasis on the process and everyday knowledge, at the expense of conceptual and content knowledge (Chisholm, 2004). OBE and C2005 prioritized skills and background knowledge at the expense of content (Schudel, 2010). Many curriculum reviews have brought up concerns about content knowledge in learning areas (Schudel, 2010). C2005 prioritized skills and background knowledge at the expense of content and once this was reviewed a framework for content knowledge was given for some learning areas (Dada *et al.*, 2009)

Young (2008) speaks of the incorrect notion that education should be learner-centred if it is to be education for all and “emancipatory”.

“Learning, according to this view, becomes to be seen as little more than the „construction of meanings“ or a „conversation“ – regardless of what these meanings are, what the conversations are about, or whether they give learners any reliable understanding of the world, or power over it. One unfortunate legacy of apartheid is that many curriculum developers have been enthused by what they have seen as the emancipator possibilities of social constructivism. This has led them to dismiss any notion of curriculum content being prescribed by specialists, and to see syllabuses as inherently authoritarian, rather than as frameworks that are necessary if genuine intellectual development is to take place” (Young, 2008:191).

Young (2008) says that “genuine intellectual development” is dependent on this specialist and “formal” content knowledge and boundaries between informal and formal learning are important because they allow for learning to go further than the “non-school” local and situated experience (Young, 2008).

When looking at the South African context, Young (2008) says that when the division between the two knowledge types becomes less apparent, the informal knowledge plays an unequal role in the curriculum policy because of this “blurring of distinctions”. Social constructivism then provides the academic justification for these policies, which have been criticised for not working and have only confused teachers. He states that the failure of the curriculum can therefore not only be because it was not implemented or resourced adequately, but also because it was based on mistaken assumptions about knowledge construction and the uncertainty of these knowledge boundaries.

Formal knowledge that learners can acquire from school and which should be the basis of curriculum offers “conceptual capacities for envisioning alternatives...the autonomy of the knowledge from the contexts in which it was developed... and contrasts starkly in conception and organization with the everyday knowledge that learners bring to school” (Young 2008:192).

In the 2007-2008 South African Eco-schools evaluation, Rosenberg (2008) discussed the following findings:

- Many teachers find the curriculum challenging due to poor training in working with the curriculum (from Apartheid years) and new curriculum changes not being implemented with good quality training.
- There is confusion about curriculum principles, practice and materials use and the use of poor textbooks. There limited understanding of the curriculum.
- Teachers struggle to combine everyday knowledge and formal conceptual knowledge.
- The curriculum focuses on learning outcomes, but knowledge comes from different contexts, including indigenous knowledge and materials.

The incorrect teaching activities, assessment and poor learning are results of such challenges. Rosenberg (2008) stated that teachers have limited environmental knowledge. “Many teachers lack adequate knowledge of the subject or learning area

they are required to teach, and many specifically lack the environmental content related to the curriculum”.

This lack of environmental content knowledge could be due to the environment not being a strong part of teacher education in the past. New environmental content or environmental content and learning outcomes have only recently been integrated into some learning areas. This limited environmental content contributes to teachers’ challenges of adapting and choosing LSMs provided by service providers, using the right learning activities and teaching the correct content knowledge (Rosenburg, 2008).

Schudel (2010) says that the intended environmental content and concepts were not known by teachers. The causes were poor teacher training in the past and inadequate recent training in the learning areas (Rosenberg, Nsubuga and Burt, 2009 In: Schudel, 2010). Apartheid legacy has influenced the implementation of C2005, in that the aim was to “graft a legalistic social framework and curriculum of organic solidarity onto a corps of teachers whose identities and roles were forged in the apartheid mills of mechanical solidarity” (Harley & Parker 1999 in Schudel, 2010). Environmental knowledge is relatively new in the curriculum and teachers still lack this knowledge of environmental concepts and content. The many curriculum changes have further limited the growth of this knowledge (Schudel, 2010).

A constructivist approach to C2005 allows for learner construction of knowledge. If teachers do not understand the concepts within their learning areas there may be an overemphasis on this construction of knowledge by learners. The knowledge, which learners do not yet know, and which would be found in a learning area, needs certain skills, content and conceptual knowledge from teachers and these are lacking (Dada *et al.*, 2009).

The most essential learning in learning areas is not specified in OBE, which centres on outcomes, skills, background knowledge and attitudes. OBE results in “curriculum and

assessment descriptors that are often vague, ambiguous, difficult to measure and low in academic content” (Dada *et al.*, 2009).

There has been a great deal of local and international research that has revealed that content, concepts and skills for teaching are not clearly specified when an outcomes approach is used (Muller, 2000; Jansen, 1999; Allais and Taylor, 2007; Donnelly, 2005; Young, 2002 In: Dada *et al.*, 2009).

Even when teachers have the environmental content, they need to be able to make it accessible to learners (the context of South Africa and issues of literacy and numeracy influence this). OBE has the potential to allow for a people and learner- centred curriculum, where learning is negotiated, is a learning process with inquiry and diverse methods of teaching, rather than rote learning methods of memorization. However it can also become instrumentalist and lack “open-endedness, unforeseen outcomes or social critique” (Schudel, 2010).

Schudel (2010) recommends: “Responsive provision of appropriate LTSMs can support teachers” ability to develop and adapt their own LTSMs” and “a strong community of practice can provide significant support for environmental learning”. Teachers are concerned with having to develop and adapt materials and curriculum when they should be teaching (Dada *et al.*, 2009). Schudel (2010:12) asks the following question “...*this means a challenge for developers of LSMs in the environmental education field. How can good quality LSMs be provided that are responsive to a changing and complex environment?*”

2.8 Conclusion

The background literature review was important to understand the field, the context and the nature of the use of materials in schools in South Africa. It was also important in

influencing the research design decisions that were made. The next chapter describes, in detail, the research design, including methodology and methods.

Chapter 3 Research Design

3.1 Introduction

Maxwell (1996) describes an interactive model of qualitative research design. The components of this model include the purposes, the conceptual context, the research questions, the methods and the validity. This model and approach affected the development of a research proposal and thus the plan and process of the research.

Chapter 3 explores the methodology influencing the research and the methods used to generate data for the study. The research question that lies behind all of this: How are learning support materials being used in the rural schools of Maputaland?

To address this question, the goals of the research were:

- To critically review the historical development of the ACEP materials
- To survey their current curriculum use;
- To probe the implicit and existing patterns of use and teaching practice in four local learning contexts;
- To discuss preliminary findings with the teachers and developers of materials for verification and to identify key contradictions and possible solutions.

In this way the evidence of patterns of resource use in learning would not only be described and clarified but critically reviewed by all involved to improve the situation.

3.2 Data Methodology

3.2.1 Research Orientation

The present research is qualitative in approach, with narrative findings. Qualitative research seeks to uncover the reality of the context of a study through historical investigations and interpretations (Smith-Sebasto, 2000). The research included an

opportunistic sample survey of teachers to find out how the ACEP materials are reported to be used. The research focused on probing and understanding the patterns of use of ACEP materials within the context of rural schools in the Sodwana Bay area. Therefore an interpretive approach and methods were most suitable (Cohen *et al.*, 2007).

3.2.2 Survey Research

The study consisted of initial survey research, which was followed by case study research. This research aims to be well designed in both scale and depth and accurately representative of the study area. A survey approach was used in order to “gather large-scale data in order to make generalizations” and “represent the wide population” (Cohen *et al.*, 2007).

Stake (1995) says that case study research is not „sampling research“ and one cannot use a specific case above all to understand other cases. The ACEP materials had been distributed to more than twenty schools in Maputaland and the research aimed to find out how the materials have been used in these schools.

“Typically, surveys gather data at a particular point in time with the intention of describing the nature of existing conditions, or identifying standards against which existing conditions can be compared, or determining the relationships that exist between specific events. Thus surveys may vary in their levels of complexity from those which provide simple frequency counts to those which present relational analysis” (Cohen *et al.*, 2000:169 in Irwin, 2009a).

A survey research approach allows insight into this “population” of schools (Irwin, 2009). It creates an opportunity for comparison, research scope and the careful selection of case studies for more thorough research. Case study research allows more depth of understanding of an external interest (Stake, 2000).

3.2.3 Case Study Research

Case study research involves the collection of extensive data in order to make more in-depth meaning of a case which was not clear or verified before (Bassegy, 1995). The case studies will thus be „instrumental“ (Stake, 2000), in that they use instruments to generate narrative evidence towards a better descriptive understanding of the use of the materials within the context of four rural schools in Maputaland.

Collective case study research is done through the merging of data from these smaller cases to understand an issue (Hancock, 2006:33). The collective case study method creates a deeper understanding of the use of materials for the larger group of school cases in Maputaland.

Jupp (2006:33) defines the comparative method as “the selection and analysis of cases that are similar in known ways and differ in other ways”. The comparative method when used in qualitative research “emphasizes the development of generalizations and of grounded theory by the systematic comparison of cases in terms of their differences” (Jupp, 2006:33). A comparative approach can focus on an interest across differing case contexts and thus probe the complexities and commonalities of, in this case, patterns of the use materials across the cases examined.

The four school cases that were selected were similar, in that the teachers had all used ACEP or other environmental education materials, as was discovered during the survey research. Generalizations about the use of materials could then be made through comparison of the cases (Jupp, 2006). Case study research leads to statements that are formed from the findings, and backed up with sufficient evidence, which allow one to make a “fuzzy generalization” of what may be happening in other cases (Bassegy, 1995).

3.3 Data Generation

Table 1 represents a breakdown of the research design and methods used to collect data.

Table 1: The research design in relation to the research goals, methodology, methods and purpose

	Research Goals	Methodology	Methods	Purpose
Phase I	To critically review the historical development of ACEP materials.	Historical data and contextual profile of ACEP and materials development.	Interviewing the ACEP environmental educators and coordinators. Document analysis (historical documents and materials content analysis). Observation of materials workshop.	To understand the context of the development and implicit design for use of the materials in the Sodwana Bay schools.
	To survey their current curriculum use.	Survey of a sample of the 21 schools in the study area.	Questionnaire with the use of a visual prompt.	Wider view of existing use of the materials and contextual profiles of the schools to inform case selection.
Analysis of questionnaire data for purposive selection of case studies				
Phase II	To probe the implicit and existing patterns of use and teaching practice in four local learning contexts.	Four Case study schools.	Interviews (one teacher from each school). Document analysis (learners' work, portfolios, lesson plans where possible). Classroom observations .	A more in-depth focus on the existing use of the materials and the context and issues facing these cases.
Level I analysis of data for interpretation and coding of themes of implicit use and patterns of practice and Level II analysis of Active Learning to present as mirror data in a feedback workshop				

Phase II	To discuss preliminary findings with the teachers and materials developers for verification and to identify key contradictions and possible solutions.	Feedback workshops.	Mirror data workshop Reporting back the initial findings of the research in order to verify data and identify key contradictions and possible solutions.	Verify data and findings and strengthen recommendations through participation of the teachers and developers of materials.
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Phase I

3.3.1 Contextual Profiling

During the first phase of the research, an in-depth contextual and historical profile of the development of the ACEP materials and their implicit use took place. Maxwell (1996:49) states that *“the research questions in a qualitative study shouldn’t be formulated in detail until the purposes and context (and sometimes general aspects of the sampling and data collection) of the design are clarified...”*. The research question needs to consider what is already known about what should be researched (Maxwell, 1996). Because this study area, ACEP and the research focus, was unfamiliar to me, the contextual profile helped to carefully refine the research questions and goals, so that they were contextually relevant and remained consistent throughout the research. Lupele (2004) used contextual profiling as a methodology in his research. These in-depth contextual profiles of two communities were conducted using methods of document analysis, questionnaires, workshops, interviews, observations and field notes, in order to collect data for his action research study on the participatory development of materials.

Much of the contextual profiling data generated through document analysis and workshop observations is represented in Chapter 1, for contextual background of ACEP

and its materials development. The data generated from the interviews with the developers of materials, school visits and workshop observations presented in Chapter 4, was analysed and influenced the analytical statements. The methods of data generation are explained:

3.3.1.1 Interviews with the Developers of Materials

Semi-structured interviews were carried out with the people who have been part of the development of the materials and the ACEP environmental education initiatives in the Sodwana Bay schools, both past and present. According to Gillham (2000:65), semi-structured interviews “can be the richest single source of data”, based on both flexibility and careful, practised structure.

Three people who developed materials for ACEP between 2000 and 2009 were interviewed. An interview schedule was carefully developed and practised with an academic colleague. However, keeping in mind the key research issues and what could “best be answered” during the interview (Gillham, 2000:65), the questions were structured but the interview process remained fairly flexible. This depended on who was being interviewed and their background with the development of ACEP materials. I was careful not to restrain the sharing of relevant information that may not answer the specific questions asked. There was much to learn at the beginning stages of this research and the questions asked aimed to identify those involvement with ACEP; the development of its approach to environmental education; the process of materials development; methods and learning perspective used; the socio-ecological issues addressed; target groups identified and the curriculum and school-based use planned and supported.

The interviews were recorded using a voice recorder and then transcribed. I focused on “identifying substantive statements” (Gillham, 2000:71) when transcribing the interviews. An example of a transcription is seen in Appendix 1. As mentioned, these interviews

were used to elucidate the contextual background (Chapter 1), as well as the data presented in Chapter 4, which was then analysed to identify the implicit design of the materials for use.

3.3.1.2 Document Analysis

Documents such as ACEP annual reports, related policies and articles and the content of the materials used by the Sodwana Bay schools were analysed to uncover the history and context of the programme, its environmental education initiatives, the ACEP materials and their context of use, nature-culture interpretations, research and policy influences and the socio-ecological issues that it is addressing. These documents were analysed in the second phase of research for the implicit design of materials for use.

3.3.1.3 Observations of a Workshop

An ACEP materials workshop was held in Maputaland with teachers from the area. During this workshop observations were made of the use of ACEP implicit materials and the interactions of the teachers and the ACEP coordinator. Observation can be either participatory (which is mostly descriptive) or detached or structured (where one classifies what is seen) (Gillham, 2000). These methods of observation were combined as I participated in the workshop, but I also made observations of materials in use with an observation schedule (Gillham, 2000). These observations were recorded in cumulative field notes. After the workshop the ACEP coordinator visited some of the schools to observe how the teachers were using the materials in their classrooms. I used this opportunity to make observations of the context of the school and record, in my field notes, any discussions with teachers.

3.3.2 Survey Research

3.3.2.1 Questionnaire with Visual Prompt

Survey research requires the design of an instrument for data collection and the instrument needs to be pilot tested (Irwin, 2009a). In this case a questionnaire was used to conduct the survey research. Irwin (2009b:2) states that questionnaires are appropriate if “one wishes to obtain a first „sweep” of data for the specific purpose of developing or informing a more detailed/in-depth research programme”. In this case, the questionnaire not only influenced the selection of case study schools, but the design of the questionnaire was such that it generated important data for further analysis in the second phase of the research.

The questionnaire (Appendix 2) was carefully designed to find out from teachers which ACEP materials have been used and how they have been used in relation to teaching practice and curriculum within a sample of schools in Maputaland. The context of the schools and the local environment was also investigated through the questionnaire. If the teachers had not used any of the ACEP materials they were asked to fill out the questionnaire, with the intention of answering the questions in relation to how they could use one of the materials. In order to do this they had access to the materials’ contents page, which they could browse through in order to answer the questions. By generating the data in this way some evidence on implicit materials use in the classroom was revealed. The questions were “open-ended”, “the respondent had control over what they wished to say and how they wish to say it” (Irwin, 2009b). However, a degree of structure was used in certain questions, such as in Table 1, but these cannot be classified as “closed questions”, as the teacher can control what she fills in on the table, depending on her experience or opinion. When questioning teaching practice in relation to the use of materials, the Active Learning Framework was used to identify activities and learning/teaching practices (implicit and actual). A set of criteria of teaching activities that allow for active learning through the use of materials was developed, drawing on the Active Learning Framework (see Table 2).

Table 2: Questionnaire item asking "What learning activities were undertaken with the material?"

Tick	What the learners did	ACEP topic/activity
	Listened to a presentation	
	Picked out, defined and discussed key ideas	
	Read for ideas or information	
	Wrote about / reported on a topic /issues	
	Conducted an experiment	
	Undertook a local investigation	
	Undertook any action projects	

A visual prompt in Power Point (Appendix 3) guided the teachers in filling out the questionnaires. This took place with most of the teachers after the ACEP materials workshops that I attended. I then visited schools and administered the questionnaire with teachers who were not at the workshops, but had a history of engagement with ACEP. The approach of using the visual prompt was to guide respondents and so clarify questions that were not clearly understood. Most of the teachers in the study were Zulu-speaking and English is their second language.

Before the questionnaire was administered it was piloted with a colleague, who gave comments on the questions and structure. Pat Irwin, who lectures on survey research at Rhodes University, also reviewed the questionnaire and provided useful comments and guidance in simplifying the questions for easy reading by the teachers.

3.3.2.2 Analysis of Questionnaires for Case Selection

The data gathered from questionnaires was analysed in order to select two high schools and two primary schools through purposive sampling. Purposive sampling includes the

selection of cases which show characteristics that meet the specific needs of the research (Cohen *et al.*, 2007). In this case the characteristics which I analysed for were those schools with teachers who had experience in the use of the materials. I aimed to select one high school teacher and one primary school teacher from the Kosi Bay area and one high school teacher and one primary school teacher from the Sodwana Bay area. Although Stake (1995) cautions that one cannot use a specific case above all to understand other cases, I wanted the case study research to derive an in-depth snapshot of the context and materials in use.

Phase II

3.3.3 Case Study Research

3.3.3.1 Interviews with the Teachers

During a second site visit to Maputaland, interviews were conducted with the selected teachers from four schools. I used the same process described in 3.3.1.1 of semi-structured interviews that were recorded and then transcribed (see Appendix 4). An interview schedule was used which was flexible. The interviews aimed to identify patterns of localized use of materials and teaching practices in the schools.

3.3.3.2 Document Analysis

When possible, lesson plans and learners' work from the case study schools were collected. When this was not possible I observed the learners work in the classroom during the lessons. I also located any learning materials that the teachers use, especially for environmental education. I recorded this through photographs, field notes or obtaining the original documents.

3.3.3.3 Classroom Observations

Classroom observations took place during one lesson at each of the schools. The teachers and principals were contacted and the observations were arranged. The intention was to fit in with the normal timetable of the teachers, in order to avoid a “staged lesson”. This, as it turned out, was not guaranteed and almost all lessons appeared to be “staged” environmental education lessons. However, it was still possible to observe teaching practices and use of materials in this setting.

An observation method was used as part of a “multi-method” approach to research (Gillham, 2000). The observation method is descriptive and makes use of provisional explanations and field notes (Gillham, 2000). The observations had an element of structured observation in that, aside from the interpretive approach to observing the classroom practice, I also had “a clear specification of what is to be observed” and its importance (Gillham, 2000:56). These specifications included the open process of the Active Learning Framework and the characteristic learning activities of this framework (O’Donoghue & Russo, 2004). I observed the teaching practice and use of materials in a flexible and interpretive way, but also relayed these observations in terms of the Active Learning criteria (the same criteria mentioned in Table 2 in 3.3.2.1) that I had established to record activities during the lesson. I observed what the learners were doing, but did not use an observation schedule with “tick boxes”. The observations were recorded through field notes, a voice recorder and photographs. These data and the transcriptions were put together in an observation sheet for each case study (see Appendix 5).

3.3.4 Mirror Data Workshops with Marine and Coastal Educators and Case Study Teachers

Feedback workshops were run with the group of teachers from the case study schools in Maputaland and with a group of marine and coastal educators in the Eastern Cape.

The workshops took place only once the data analysis in the second phase of research was complete. This was because the preliminary findings or tentative analytical statements developed in Phase 2 were brought into the workshop as *mirror data* and used to “stimulate involvement, analysis and collaborate design efforts among the participants” (Engestrom, 2007). The workshops therefore touch on the approach of the „Change Laboratory” that has been developed through Cultural Historical Activity Theory (CHAT) to foster collaborative reflection on „potential new ways of working” (Engestrom, 2007) in a very simplified way. The workshops were able to reveal the “historical origins of the current problems” (Engestrom, 2007), related to the use of the learning support materials. The tentative findings were presented to the group in the form of a Power Point presentation and then discussion and deliberation took place about the findings, to clarify some of them, identify key contradictions in relation to the findings and pose possible solutions to overcome these contradictions. The workshops enabled the verification of the data and findings and participatory engagement towards clarifying how the use of materials in active learning in the curriculum might be improved. The workshops were recorded using a voice recorder and notes written on a flip chart.

These workshops aimed to verify and strengthen the findings of the research. They were therefore another means of “member checking”, which will be discussed in more detail in the section on ethics and validity later in the chapter.

3.4 Data Analysis

3.4.1 The Modes of Analysis

There were two levels of data analysis in this research, which allowed for two modes of analysis. The first level looked into the implicit use of materials and current practice of the use of materials evident in the data, which is an inductive mode of analysis. An inductive mode of analysis or inference allows for “valid conclusions” to be made about

a “whole population” through similarities seen in cases which allow one to conclude that the similarities apply to other cases. What is common to these cases may be true for others (Danemark *et al.*, 2002). The second level of analysis looked at the elements of the Active Learning Framework (O’Donoghue, 2001) present in the implicit use and current practice of the use of materials identified in the first level of analysis. This is an abductive mode of analysis, in that it “interprets and recontextualises individual phenomena within a conceptual framework or set of ideas” (Danemark *et al.*, 2002).

3.4.2 Raw Data and Data Management

After the data collection was complete I had generated data from: transcribed teacher interviews in four school cases; questionnaires from 21 teachers; classroom observations of teaching practice and learners’ work including photographs and journal notes; the ACEP materials; historical documents; photographs of learners’ work; transcribed interviews with three ACEP materials developers and transcribed interviews with three environmental educators working with the schools from the local conservation authority.

These data were managed and filed under the following categories:

Level I Analysis

- The ACEP materials
- Survey Research
- Four Cases
- ACEP contextual profile

Level II Analysis

- Phase 1 Analytical Memos coded
- Phase 2 Analytical Memos

The raw data was then indexed in the following way in order to analyse and create analytical memos:

- Teacher questionnaire interviews (SP1-10 & SH1-11)
- Teacher interviews (P1T, P2T, H1T, H2T)
- Classroom observations (P1O, P2O, H1O, H2O)
- Materials developer interviews (D1A-C, D2, D3)
- The ACEP materials:

Table 3: Reference List of ACEP materials

Year	Name of Material	Data Source Reference
2002	Finding Old Fourlegs: An adventure story of coelacanths and scientists	Ma02
2002	Coelacanths and other special sea creatures Foundation Phase Pack	MbF02
2002	Canyon creatures and other ocean habitats Intermediate Phase Pack	MbI02
2002	Conserving coelacanths and our marine environment Senior Phase Pack	MbS02
2004	Module 1: Ocean Exploration with old Four Legs Educator's guide and learners workbook & Video	Ma04
2004	Module 2: Exploring Ocean Careers with old Four Legs Educators guide, including Learners activities & video	Mb04
2005	Coelacanths and other special sea creatures Foundation Phase Educator's Manual, including Learners' Activities	MaF05
2005	Creatures of the deep and other ocean habitats Intermediate Phase Teachers' guide, including learners' activities	MaI05
2005	Conserving coelacanths and our marine environment Senior Phase Teachers' guide, including learners' activities	MaS05
2006	Fossil Kit	Ma06
2008	Climate Change Kit	Ma08
2009	Simple Practicals for the Classroom Grade 6 & 7 Natural Science	Ma09
2009	Simple Practicals for the Classroom Grade 10-12 Physical Science & Chemistry	Mb09

3.4.3 Level I Data Analysis

Although there was a clear and structured research design before data collection began, the data analysis process evolved and was strengthened once the analysis started. A few themes were experimented with at first that could possibly address the research question of how learning support materials are used in the rural schools of Maputaland. Because the survey revealed that there was limited use of the ACEP materials, this allowed the research to probe deeper into the *implicit* use of materials in both the design of the materials and by the teachers. The theme of the patterns of teaching practice could then be used to analyse the observation data.

3.4.3.1 Data Reduction and Coding

The data was analysed and coded in the following themes (see an example of coded data in Appendix 6):

- Implicit use in the design of the materials (blue)
- Teachers' implicit use (pink)
- Patterns of practice (green)

Once the data was coded it was extracted and transferred into an analytical memo from which key statements could emerge. See Appendix ? for an example of Analytical Memo 1.2. The analytical memos developed in the Level I analysis included:

- Analytical Memo 1.1: The implicit use in the ACEP materials design
- Analytical Memo 1.2 Teachers' implicit use of materials
- Analytical Memo 2: Observed Teaching Practice in four school cases

3.4.4 Level II Data Analysis

The data analysed, coded and reduced into Analytical Memos 1.1, 1.2 and 2 in Level I were then brought into the Level II analysis. This analysis aimed to reveal the themes of active learning present, with the implicit use of materials by teacher, the patterns of practice and the implicit use in the design of the materials over time. The background to the Active Learning Framework (O'Donoghue, 2001) is explained in Chapter 2. Research which has used the framework for the analysis of environmental education research data has not been found. The framework is a widely used typology of processes derived for the South African curriculum and was seen as a useful perspective for approaching an analysis of the use and design of environmental education learning support materials.

3.4.4.1 Data Reduction and Coding

The categories of Active Learning were developed from the categories found in the Teacher Education Workbook for Environment and Sustainability Education by Rosenberg (2009), which draws on the Active Learning Framework (O'Donoghue, 2001):

- Finding out: Fieldwork, Audits and Other Enquiries
- Acting it out: Drama, Role-Play and Debate
- Thinking it through: Stories and Mini-Lessons
- Can Do: Reading and Writing to Learn
- Try It Out: Experiments and Action Projects
- Work it Out: Problem-solving and Design

These categories were designed to be representative of the kinds of activities in environmental learning support materials, such as the ACEP materials, which allow for Active Learning. The materials were carefully analysed to assess whether or not the categories were suitable. For example, trying out activities such as experiments and action projects were classified separately. It was decided that there were two types of "experiments" found within the ACEP materials, namely experimental modelling of

natural concepts and processes and experimental modelling of issues, processes and practices. Finally the following categories were developed for use to get a sense of the methods implicit in the materials and the education practices into which the materials were absorbed:

1. Reading for information
2. Concepts and factual content provision
3. Experimental modelling of natural concepts and processes
4. Experimental modelling of issues, processes and practices
5. Role-play and simulation
6. Audits and enquiry activities including data interpretation
7. Hands-on fieldwork encounters and experiences
8. Deliberation, debate and reporting towards decision-making
9. Action taking, trying out and change practices

The analytical memos in the Level I analysis were coded for these categories of education practice. Any activity noted was thus in **red** and with a number for the activity in the margin (see Appendix ?). The content of each ACEP material was also coded into the above categories.

The number of different activities were added up and transferred into a table such as Table 4 in order to create a chart in Microsoft Excel, like the one in Figure 4, to give a view of the scope of Active Learning processes within the implicit use of materials by teachers in a workshop context, the implicit and observed use in four school cases and in the ACEP materials themselves.

Table 4: The number of Active Learning activities within each ACEP material (2002-2009)

ACEP Material	1. Reading for information	2. Concepts & factual content provision	3. Experimental modelling of natural concepts & processes	4. Experimental modelling of issues, processes & practices	5. Role play & simulation	6. Audits & enquiry activities including data interpretation	7. Hands-on fieldwork encounters/experiences	8. Deliberation, debate & reporting towards decision making	9. Action taking/ trying out/ change practices
2002									
2004									
2006									
2008									
2009									

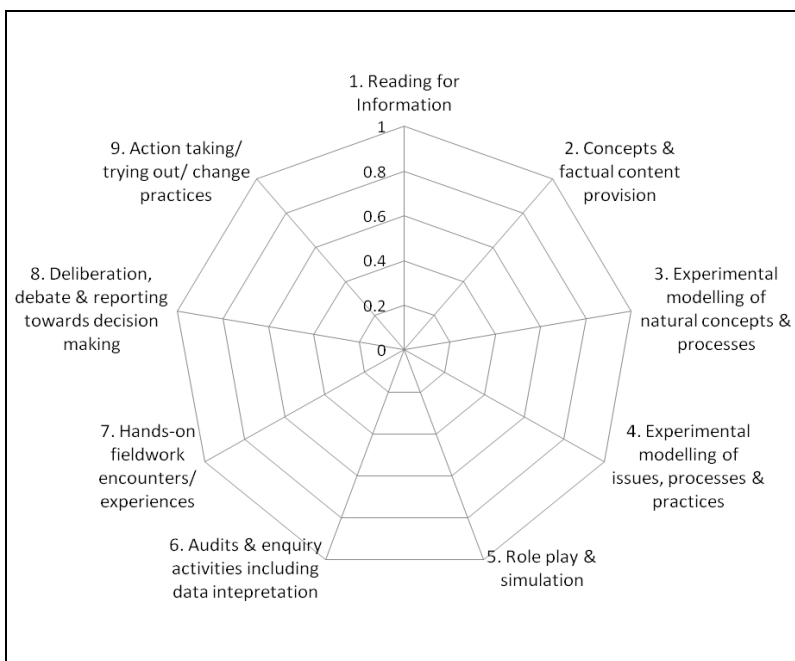


Figure 4: Chart representing the scope of Active Learning activities

The tables and charts developed from the coded data were presented in the appropriate Analytical Memos (see Appendix 9):

- Analytical Memo 3.1 Active Learning in the ACEP **materials for use**
- Analytical Memo 3.2 Active Learning in the **implicit use** of materials by teachers in a **workshop context** (questionnaires)

- Analytical Memo 3.3 Active Learning in **the implicit and observed use in four school cases**

3.4.3 Generating Analytical Statements and Data Interpretation

The data from the analytical memos mentioned above will be presented in Chapter 4. The analytical memos were used to derive some key tensions and contradictions for the mirror data workshops and to derive analytical statements to be discussed in relation to the research question. These statements were interpreted and discussed in relation to the evidence and relevant literature and research in Chapter 5.

3.5 Research Validity and Ethics

Bassey (1995) speaks of research ethics as being “respect for democracy (freedom to do the research), respect for truth (in data collection, analysis and representation of findings) and respect for persons (and their ownership of data and privacy)”. Maxwell (1996) speaks of the consideration of ethical issues being crucial in qualitative research. They must be regarded in every stage of the research process. Responsibility for the integrity and validity of the present research and discipline in maintaining subjectivity was strictly observed.

Written and verbal consent was obtained from the headmasters of the schools and the teachers in order to submit questionnaires and carry out interviews, observations and document analysis. Consent forms were signed by the headmasters (see Appendix 10) and similar forms were signed by the participating teachers. Research approval was obtained from the iSimangaliso Wetland Park Authority, as without it no research is allowed in the area. The anonymity of all individuals and schools involved in the research project has been kept anonymous.

Carrying out research with people will affect them and often creates false expectations (Janse van Rensburg, 2001). Before the interviews, questionnaires and workshops were conducted, my expectations in the role of the participants were clearly stated.

Triangulation has been used as a fluid comparative review process across the coding of interview, observation and document analysis data from diverse sources in Phase 1 and Phase 2 of the research. This review process served to check if any aspects of significance were being overlooked and if there were any conflicts and contradictions in the data generated. Field notes were taken during all school visits (see the example in Appendix 5) and a research journal was kept in order to ensure continuous reflexivity (Janse van Rensburg, 2001).

All questionnaire and interview questions were tested and practised before delivery. A local Ezemvelo KZN Wildlife community communications officer assisted with translation during site visits and interviews. However this was not needed. A member check was conducted with the individuals for every interview that took place, so that my own interpretations were checked and verified by the interviewee. The workshops with the teachers and the developers of materials further verified the findings and data, as these were “mirrored” back to the participants and they were able to agree, disagree and discuss further.

All procedures were examined by peers throughout the process (Janse van Rensburg, 2001), during regular meetings with colleagues working in the environmental education field. A code-recode process during the analysis of data in Level I and Level II played an important role in the dependability of the research (Janse van Rensburg, 2001).

3.6 Conclusion

With the review of the literature and the design of the research now complete, I proceed to Chapter 4, where the data that was collected is presented following data analysis.

CHAPTER 4 Research Findings

4.1 Introduction

In this chapter I present the data that was generated using the research methods described in Chapter 3. There were two levels of analysis, examining implicit use of materials; patterns of teaching practice or observed use and Active Learning. The data that is presented has been analysed and summarized in analytical memos. The research findings aim to answer the research question of “how are learning support materials being used in the rural schools of Maputaland?”.

In Part I, I present background to the history of the materials and their development that emerged from the data. I provide background to the development of the materials and their dissemination through workshops. The implicit design of the materials for use is presented as that which took place before 2003 and that which took place after 2003. The analysis of the materials for Active Learning and the trends over the years in the materials is presented.

In Part II the survey and case study research data is presented. This includes background to the schools that were part of the survey research and their context determined from the data. The data from this survey research is presented as the implicit and observed use of materials. Active Learning analysis of this implicit and observed use of materials at the survey and workshop level then follows. Background to the four case study schools is drawn from the data, with the implicit and observed use of materials and teaching practice in each case study school being revealed. The Active Learning within this implicit and observed use concludes the chapter.

PART I

4.2 History of the ACEP materials

After the discovery of the coelacanth in Sodwana Bay in 2002, the *Coelacanth Conservation Programme* was established and scientists were sent to conduct research and create a management plan. The Department of Science and Technology (DST) and the Department of Environmental Affairs and Tourism (DEAT) were involved in this process and it was noted that there was a large need for development of young scientists and that this should be a priority. A group was established in 2003 to begin the environmental education, awareness and capacity building in communities and schools (D1A).

The marketing and media interest may have sparked the start of the environmental education initiative, however with mainly a terrestrial focus in school education; there was a need to get the marine knowledge into the schools (D1B). The materials state the following: "*The ACEP recognizes the need to promote a greater awareness of the marine environment. ACEP specifically wants to create opportunities for the youth to learn about the oceans*" *great value to tourism and recreation, as well as their vital underpinning of the economies of Africa. Accordingly, a series of education initiatives have been undertaken...*"

(AM1.1)

Before 2003, the activities that were undertaken by this environmental education and awareness sub-programme included visits to research ships, the development of learning materials and the running of workshops. These workshops trained trainers in the use of the materials in order for them to distribute the materials nationally. The development of the materials was undertaken by members of the sub-programme on a contract basis (D3).

A coordinator for the sub-programme of ACEP was appointed in 2003. The coordinator took over the management of the sub-programme and other members of the group would meet on an annual basis. Funding was provided by the Anglo American Chairman's Fund until 2007. After 2007, the South African Environmental Observation Network (SAEON) took over the management of the ACEP, with funds being allocated to the sub-programme following the acceptance of a proposal made to the National Research Foundation (NRF) (D1B).

4.3 Design and Workshop Dissemination

There were changes in the process of workshop dissemination from the first workshops run in 2002 and 2003, and those run after this period. Prior to 2003 the workshops were aimed at training trainers who were to distribute the materials to teachers, whereas after 2003 the workshops focused on the use of the materials and were conducted with teachers and/or learners (D3, D1B). In the workshops prior to 2003, the trainers came from three provinces and they went to the schools in their area, introduced the materials and the schools did the activities. The teachers sent portfolios with evidence of working with the materials to the coordinator at the time. This coordinator assessed and analysed the portfolios (D3).

The materials were distributed at no cost to the schools. This was on condition, however, that the teachers took part in the workshops to learn how to use the materials and participate in any evaluations. The workshops were originally run with the Department of Education (DoE) participation and assistance in the development of the workshops for teachers (D1B).

There were also changes in the implicit design of materials for use. The data was coded in order to uncover this implicit design of the materials for use (blue) and more specifically the implicit design for use in relation to the curriculum (yellow). This data included interviews with the developer of the materials, who was appointed on a

contract basis prior to 2003 and interviews with the developers after 2003. The materials were analysed to find evidence of the ACEP implicit design for use.

4.3.1 ACEP implicit design for use before 2003

The 2002 story book *Finding Old Fourlegs: An adventure story of coelacanths and scientists* and the Foundation, Intermediate and Senior Phase Packs were developed to create awareness of possible careers in science and environmental issues and conservation at both a species and habitat level (D3).

Within the 2002 Packs the following is stated:

This pack has been developed for the Coelacanth Conservation Programme, which hope to share its exhilarating and pioneering scientific research on this fascinating fish to promote science and marine conservation amongst the youth of South Africa. This programme is concerned with developing the research capacity of South Africans in science, engineering and technology and with sharing the excitement of marine sciences and conservation. The coelacanth is an ideal flagship species that promotes enthusiasm for science and sustainable use of resources by sharing with schoolchildren and students the working of research ships, manned submarines, SCUBA divers, the ecology of marine life and value of eco-tourism in the face of unsustainable practices and global warming. (MbF01, MbI02, MbS02)

The materials developed in 2002 were designed in relation to the curriculum in a flexible and adaptable way (AM1.1). The developer of these materials referred to this and situation as the time regarding the changing curriculum:

“We gave our own learning outcomes and the teachers were to fill their own in. But we didn’t take curriculum specific ones because it was at the time when everything was so up in the air so we had no idea where it was going to go. So we just did our own. Assessment we left pretty open depending on the learning outcomes” (AM1.1).

The developer aimed to encourage teacher creativity and initiative in using the materials and “allow teachers to develop their capacity for the use of learning support materials” and “learning programme development” (AM1.1).

The 2002 materials also state that:

“The learning outcomes and assessment have been drawn from the Curriculum 2005 Revised National Curriculum Statement, but space has been left for teachers to adapt these or fill in appropriate learning outcomes according to the grade and learning area in which they teach” (AM1.1, MbF01, MbI02, MbS02).

4.3.2 ACEP implicit design for use from 2003 onwards

The development of the materials was handed over to the sub-programme coordinator in 2003. The coordinator highlights the focus behind the development of materials:

“We have an aim to develop scientists; we want people interested in science and want people to value the environment. You can’t do that in isolation, you need to attach to things that allow you in, we used NCS to guide us to develop something. We looked at the needs-not only the policy, but the „flavour“ of DoE, or government or DST, that’s what we used to guide us. It may not be (as in the Soil & Sediments) about the sea, but Indigenous Knowledge, and we try to find linkages. We definitely looked at NCS”.

(AM1.1)

The materials were all designed to link to the curriculum. The developers worked with DoE specialists when linking the materials to the curriculum. The developers consider the marine sciences to have many content links (such as fossils) to the curriculum which could supplement teaching and lesson plans (AM 1.1).

The 2008 Climate Change kit was developed for the year of climate change and the activities were developed in relation to the developers’ own scientific knowledge and current scientific research (D1C).

When designing the 2009 *Simple Practicals* for Grade 6 and 7 Natural Science and Grade 10 to 12 Physical Science, the developers "...went through text books and looked at which areas were covered to make sure the materials were focusing on the curriculum at all times". They feel that the materials could be used for many subjects, but "...most focus is on Natural Science as this is the easiest subject where the teachers can implement the materials" (AM1.1).

The original concept of the 2009 *Simple Practicals* materials came from the DoE in the Eastern Cape, which commissioned ACEP to develop materials for science experiments. The aim was to make learning more interactive in the classroom, particularly in the sciences and in under-resourced schools. The DoE was struggling to train educators to be interactive and ACEP were asked to present a workshop with teachers to encourage them to do "practicals". The materials were identified as a good resource and were packaged as a complete practical kit to be used by teachers in other schools (D1C).

The ACEP wishes to empower the schools to meet science, maths and technology requirements through education which is "fun, exciting, engaging, interactive and with good quality background information" (AM 1.1).

The educator guidelines within many of the materials state:

"...this theme should be facilitated in a non-threatening manner, that encourages learners to learn more about the marine environment and about themselves. Educators should create an atmosphere that encourages learners to freely express their ideas and opinions without fear of criticism. Educators should not dictate the answers to learners, but rather provide opportunities for learners to develop their own responses to the various activities, to make mistakes, and to decide on their own solutions. Sufficient time should be allowed for learners to work through the various module activities, at their own pace".

The coordinator said that the programme aims to develop teachers and teaching practice and provide teachers with content knowledge and adaptable materials. Although many schools cannot use ICT materials because they do not have access to computers, many teachers seek the information they provide for themselves and not only their learners (AM 1.1).

The developers are aware of teachers misinforming learners. They feel that teachers in township and rural schools lack knowledge, are not trained and educated correctly and struggle to “think outside the box” (AM1.1).

According to the coordinator of the sub-programme, the ACEP has the following intentionality for environmental education in relation to influencing policies:

“...Also the mandate of NRF is to produce more postgraduate students, especially the disadvantaged and women. When developing materials, especially the video materials, we try to encourage woman and people of colour and the previously disadvantaged. So we look at DST & NRF policy. NRF’s aim is to produce PHD’s and SAIAB is an NRF facility and is under that mandate”.

(AM1.1)

“Many schools are under model C schools-rural/township and they are very under-resourced. The teachers battle to implement the new curriculum as they do not have the knowledge and skills. The key is to show them how to link the resources to the curriculum. It depends on the teachers and their enthusiasm.”

(AM1.1)

4.4 ACEP materials in relation to Active Learning

The content of the ACEP materials was analysed for active learning processes (purple). The categories of Active Learning in relation to the materials were identified within the

activities in each set of materials. In order to identify the scope and focus of active learning within all of the materials, the average percentage of occurrence of a category within each material was calculated. Figure 5 illustrates the scope and focus of active learning in the materials



Figure 5: The overall scope of Active Learning in the ACEP materials between 2002 and 2009

It can be seen that overall, the materials touch on all aspects of active learning, but none can be used as fieldwork materials. Content materials for teachers to use to teach and materials for experiments occur the most, with the latter having a higher average occurrence in 2008/9 than Active Learning with the other materials.

4.5 Trends Over Time of ACEP materials in Relation to Active Learning

The developer of the 2002 Packs has said that, initially, the design was based on the Active Learning Framework, but when this became complicated, through budget and time constraints, the materials focused more on providing content. The developer stated the following concerning the focus when developing the materials: "...language literacy which wasn't my intention then, but I just think nowadays there is just so much focus on literacy and trying to get environmental stories into literacy and in a sense that's what I

was trying to do with this story. Wrote the story and then designed activities to try and get them to work with the story” (AM1.1).

The developer said that these materials aimed to provide content information for teachers and learners and also linked to other content materials such as the *Coastcare Fact Sheet Series*. The materials attempted to link to coastal environments which are relevant to the teachers and learners and to “link the coelacanth to real life issues” and their everyday lives.

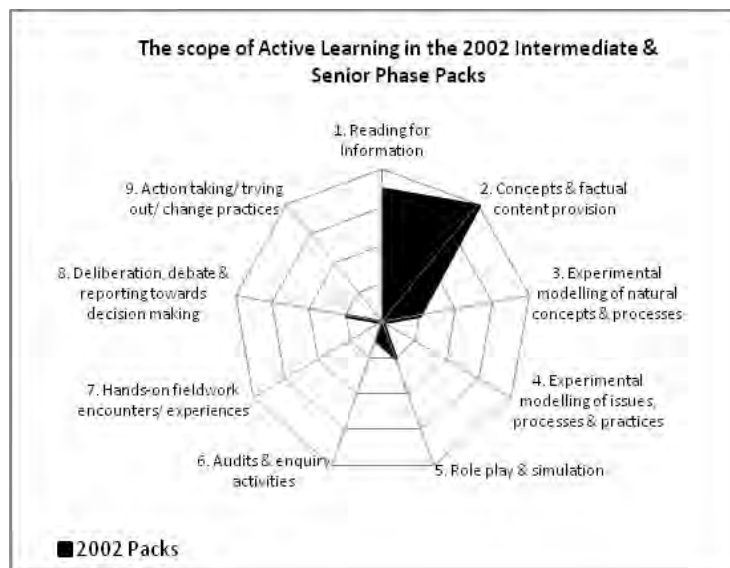


Figure 6: The scope of Active Learning in the 2002 ACEP materials

In Figure 6 one can see that the materials touch on all elements of active learning except fieldwork. The materials are strongest in reading for information and concepts and factual content provision for teachers.



Figure 7: The scope of Active Learning in the 2004 ACEP materials

The 2004 Video workbook materials are based on the video-based education and training (VBET) approach to the effective use of technology. In a typical VBET session the following occur: “preview, processing, review and reflection and polish” (AM1.1). In Figure 7 there are no „finding out“ activities within the materials. There is mostly content for teachers and some reading to learn, deliberation, debate, action and role play.



Figure 8: The scope of Active Learning in the 2006 ACEP materials

The 2002 Packs were revised and “curriculumised” into workbooks in 2006 (AM 1.1). This change is evident in the content within the revised workbooks:

“...the following information is included in each lesson: curriculum links with learning areas and assessment standards; the knowledge, skills, attitudes and values to be acquired or demonstrated in the lesson; resources required; teaching strategy including the activities that can be done; assessment standards; possible barriers that could be experienced; teacher reflection”.

Although still mostly content for teachers is found, in comparison to the 2002 Packs there is a decrease in reading-to-learn materials. There is also a decrease in the number of activities for other active learning such as enquiry, experiments and deliberation.

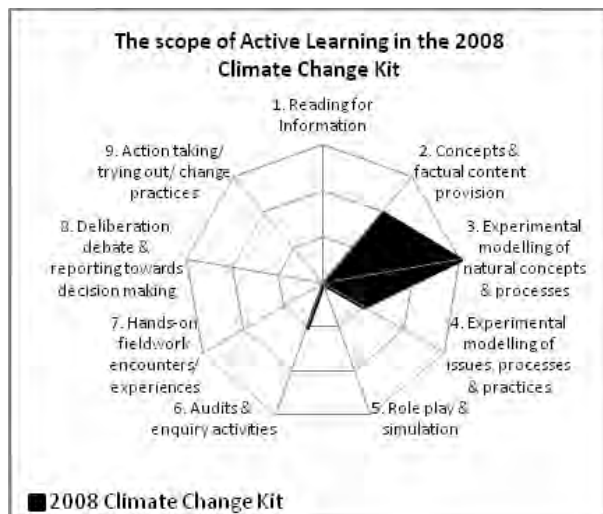


Figure 9: The scope of Active Learning in the 2008 ACEP materials

According to the developer, the 2008 Climate Change kit was designed to be distributed during the Year of Climate Change in 2008. The material stated: “...we as educators are responsible for the development of young minds, broadening their knowledge and helping them make excellent value judgments about their environments and lives. These topics highlight clearly our role in society and towards our environment, showcasing global impact.”

Figure 9 shows a decrease in content for teachers and an increase in materials which focus only on experiments, content and some enquiry. There are no activities for other elements of Active Learning.



Figure 10: The scope of Active Learning in the 2009 ACEP materials

The 2009 Simple Practicals are almost entirely materials for experiments. There is very little content for teachers and materials for enquiry and no activities for other elements of Active Learning.

The Simple Practicals initiative and idea came entirely from the DoE:

“ACEP was commissioned by the Eastern Cape Department of Education (DoE) with the task of developing these materials. This was after the ACEP developers had attended a workshop with subject advisors within the Eastern Cape DoE and discussed how to make learning more interactive in the classroom, particularly in the sciences and under-resourced schools. DoE was having a problem in training educators to be interactive and asked ACEP to present a workshop with educators during which they would encourage them to do practicals”.

DoE also tasked ACEP with creating ways of improving the teaching of scientific method and learning in schools (AM1.1).

PART II

4.6 Context of the Schools in Maputaland

The context of the schools is drawn from interviews with the KZN Wildlife community conservation officers and my own observations during school visits.

The local people in the Sodwana Bay area are able to use a subsistence fishing permit if they are unemployed, otherwise they have to purchase a recreational permit from KZN Wildlife, the authority operating in iSimangaliso Wetland Park. They are also able to harvest mussels and red bait (CCO1). In the Kosi Bay area the local peoples' indigenous knowledge of sustainable harvesting practices is good and in the past this was controlled. However, peoples' livelihoods are under pressure and there are tensions with the conservation authorities as they try to control harvesting. In this area there are no permits and the locals have open access to the ocean and coastline (CCO3). The authorities are trying to implement permits for fish traps, which have been a way of life for these people for hundreds of years (CCO1).

There are often tensions, but the local people and the learners in the schools do realise that the tourism that is generated by the Park provides jobs and is good for the local economy, especially that closest to the Park. There is no industry or agriculture which can do so and many learners have relatives working in this tourism industry (CCO1).

A range of social issues affect the learners. Security has improved, to keep learners at school and prevent them from leaving to try to find work in the Park. The children want to learn and need to be educated about career opportunities after school. Sometimes the teachers do not have faith in them finding careers, though. The Sodwana Bay area does not have as many high schools as primary schools and many learners drop out in high school. The pass rate is not high (CCO1).

The schools are very under-resourced. There are large numbers of learners in each class and often the schools do not have electricity and only use a chalk board. There is no computer literacy in the schools as there are no computers available for learners. Some schools have improved with classrooms that have been built and a library is being built in Mbazwane (CCO1, Field notes). The senior community conservation officer gave an example of how one of the high schools had two different lessons taking place in the same classroom. Another school had to read out examination questions as they could not make copies of question papers (CCO1). The teachers give their lessons in English but they often translate what they are saying into Zulu, especially when they are trying to explain something in detail (Field notes).

A teacher explained that they do not have access to science laboratories and test tubes and their teaching revolves around theory. The learners struggle to understand when they are doing projects. They also struggle with examinations as the content is often directed towards an urban context. For example, a question referred to a swimming pool and the learners in rural areas do not know what that is. The teacher felt that the learners from urban areas have an advantage (Field notes).

The KZN Wildlife community conservation officers are involved in environmental education and awareness with the schools in the Kosi Bay and Sodwana Bay areas. According to the community conservation officers, this education includes hands-on experiences with rocky and sandy shores, presentations on turtles, environmental special days, coastal clean-ups and competitions. During these activities they use teaching aids such as pamphlets, Share-net Hands-on booklets, ACEP materials, posters and models. Each community conservation officer facilitates a number of schools in the Eco-schools programme and the registration fees for the schools are paid by KZN Wildlife. They have been facilitating Eco-schools since 2002, just after the discovery of the coelacanths and the start of the coelacanth programme. The Eco-schools have done action projects such as composting, vegetable gardening, waste recycling and beadwork (CCO1, CCO2, CCO3). The community conservation officers

say that knowledge of the marine environment is improving in the community. The schools are enthusiastic about education on any topics that KZN Wildlife can offer.

4.7 The Implicit Use of Materials in a Workshop Context

The data from the questionnaires was analysed and coded in pink to reveal the implicit use of materials by teachers. The implicit use of materials refers to how the teachers say they have or could have used the materials.

Of the 21 teachers who completed questionnaires, only six reported that they had actually used some of the ACEP materials. These teachers were able to answer the questionnaire in response to how they actually used the materials, whereas the other teachers responded on how they could use such materials. Some of these teachers stated that they had attended workshops on the ACEP materials, even though they had not used the materials after the workshops (AM1.2).

The teachers that had used the ACEP materials described how they had used them (AM 1.2):

A teacher who used the 2006 Intermediate Phase workbook said *“I have used it as a visual aid, I bring the chart of different kind of fish and I told them this one it not similar to the other one it was seen caught by Peter Tim in Sodwana Bay and it is bluish colour and differ- even the legs.”* This teacher said that the material was used to *“play a drama how Peter Tim caught this fish”* (SP4, AM1.2).

The climate change kit was used by a teacher to conduct an experiment on sea level and ocean currents: *“...we poured clear water in a container and waited until the water was no longer moving and we slowly added coloured water then it was observed that water was moving or it had current, also poured pure water and the we added ice that*

overlapped above the water level we marked and waited for the ice to melt the water level raised”.

A teacher said “I photocopied four booklets. Asked learner to differentiate kinds of fish they know. They identified fishes. I explained the re-discovery of extinct creature (coelacanth)”.

Another teacher said “I have used the ACEP material in planning, preparing my lesson plans and selecting the relevant topic eg. Vertebra, I have used also to conduct experiment on how the fossils are being formed”.

(AM 1.2)

One teacher stated that the school had borrowed a video player in order to show the Ocean Exploration video and another had used ACEP materials. Thus all used different materials in different ways (AM 1.2).

The teachers who had not used the materials described how the materials could be used:

Many teachers stated that visual materials such as posters, pamphlets and videos would be useful *“to make understanding possible”* and because *“...some of the things becomes simpler and easier when you see them rather than when you heard about them”* (AM 1.2).

There is evidence that the teachers want materials which will help them to gain knowledge. *“The learning materials that I will suggest will be the following-posters, videos and pamphlets so that it will help to equip my knowledge and understanding”* and *“I would recommend Coelacanths and other special sea creatures videos, exploring ocean currents, creatures of the deep and other habitats. Its gonna help educator to absorb more information”* (AM 1.2).

Common focus areas within the materials or topics that teachers were interested in were ecology (food chains, etc., ecosystems and ecology of coelacanths) and global warming/climate change. One teacher said: *“I would recommend global warming and coelacanths. As global warming is a serious issue, I think every teacher need to have ideas on that it does not affect only the human being but all living”*. Most teachers said that materials could be used in the Natural Sciences (AM 1.2).

The teachers said that materials for experiments and practicals would be useful, particularly the experiments on the nitrogen cycle, magnetism and chemical reactions. Action projects and defining were identified as activities that could be undertaken by using the materials. Many teachers said that they would do presentations (AM1.2).

The teachers indicated in the questionnaires that they could use the materials in the following ways (AM 1.2):

“I can photocopy some pages from the book. Let learners to draw the picture on global warming and coelacanths. Let them write to their exercise books, the teacher can set some questions on what they learnt.”

“The learners listened to a presentation on coelacanths habitats, read for ideas or info on adaptation to the sea life, wrote about/ reported on corals of rocky shores, conducted an experiment on sea conditions (food, light, temperature), undertook a local investigation on the rocky shore habitat ad undertook an action project on protecting the sea life from other external factors.”

“The ACEP materials were useful for formation of fossils, rocky shore studies, habitats and adaptation, ecosystem, deep sea life, mollusca, vertebrata etc”.

These reports on the implicit use of materials, by the teachers during the workshop and in the questionnaires, are followed by the observed use of materials during these workshops and during school visits after the workshops.

4.8 Observed use in a workshop context

The observation transcripts from these workshops and school visits were analysed to identify patterns of practice in the schools.

During an ACEP materials workshop with high school teachers, the developer of the materials asked the teachers if they had any suggestions after using the Simple Practicals kits. Some teachers felt that practicals that illustrate waves, water, light and frequency would be part of the curriculum that they are teaching and should be included (Field notes). During the workshop with primary school teachers, a teacher reported that much of the learning in the materials centres around environmentally orientated topics, rather than learning outcomes. Another teacher disagreed with this statement.

In the first high school workshop only two teachers reported that they had used any ACEP materials before. One had used the climate change kit and another had used the fossil kit. In the primary school workshop a teacher had used an ACEP poster which was associated with the *Creatures of the Deep* workbook, to show learners the coelacanth as being a special creature. The other educator had used the video learning programme booklets/workbooks, but not the video, as there is no access to a VCR (Field notes).

After the workshops, 10 schools were visited to observe how the teachers used the Simple Practical kits. During the lessons the following observations were made (Field notes):

- In the high schools half of the teachers gave a presentation using the chalk board.
- Two teachers did definitions and discussed key ideas with learners,
- Half of the lessons included learners reading from a textbook.
- Half of the visits included learners writing down observations and reporting them back to the class.

- In the primary schools, most teachers gave a presentation or introduction using the chalk board and did definitions.
- In two schools the learners had to read the instructions and write down observations.

All the schools conducted an experiment because they were required to show how they were using the Simple Practicals kits.

The following are extracts from a research journal of classroom observations:

“The educator referred to a science textbook as she conducted the lesson, the learners also shared textbooks which they read”.

(Field notes)

“She introduced them to the magnets from the kit. Many had obviously never seen these before and the polarity of them was explained. The learners would write down their observations. The educator also illustrated the field lines using the magnet but asked one learner to come to front to observe and inform the rest of the class. The ACEP practical was thus not used”.

(Field notes)

The educator wrote down the scientific terms on the chalk board which the learners would recite. There was much linking of the practical to the theory and focus on definitions and using the practicals to illustrate these definitions. The learners also recorded observations, reported back and had discussions.

(Field notes)

During the school visits and questioning of teachers in order to locate materials that had been used, I discovered that two of the teachers who had worked with the ACEP materials had left their schools (Field notes). Only three schools were able to show materials to me that were in storage. In the other schools that were visited, I tried to locate teachers who had used ACEP materials and had attended workshops but no tangible connections were established (Field notes).

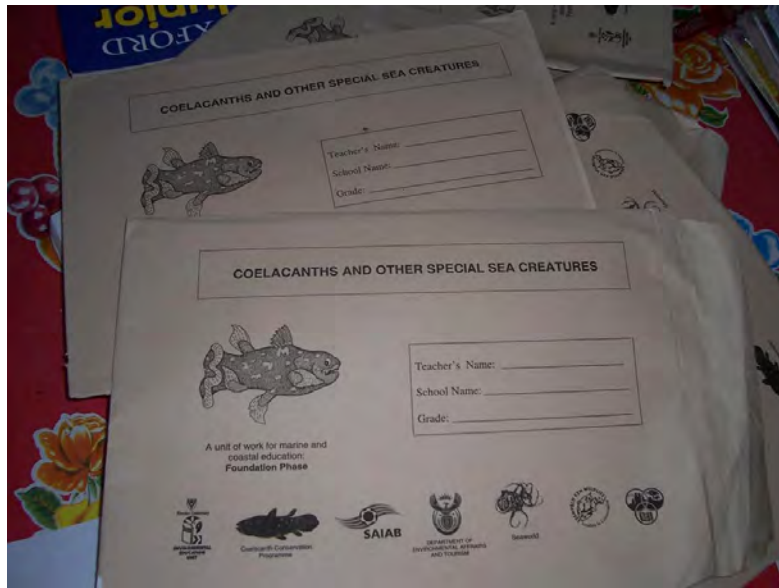


Figure 11: 2002 ACEP materials found in storage at a school

Most schools had started with their mid-term examinations. During one lesson I observed the following: “*The educators seemed to be in a hurry to attempt to try and do the activity. However this is understandable as the timing of the lesson was during the exams*” (Field notes).

4.9 Active Learning in the Implicit Use in a Workshop Context

There were elements of active learning within the implicit use of materials by teachers and this is presented in Figure 12. This implicit use included mostly concepts and factual content provision and experimental modelling of natural concepts and processes. The workshops during which the questionnaires were conducted focused on the use of materials for experimental modelling of natural concepts and processes. The greatest reference of implicit use of materials was for concepts and factual content provision. There was reference to the use of materials for reading for information, action taking/trying out/change practices, deliberation, debate and reporting towards decision making and hands-on fieldwork encounters/experiences. There was minimal reference

made to experimental modelling of issues, processes and practices and role-play and simulation. There was no reference to audits and enquiry activities. (AM 3.2, 1.2).

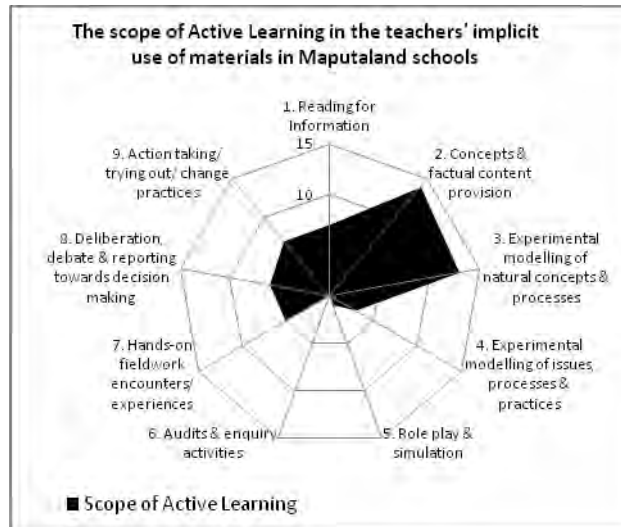


Figure 12: Elements of Active Learning in the teachers' implicit use of materials

4.10 Active Learning in the Observed Use in a Workshop Context

When the use of materials was observed in the classroom, materials were used for mostly concepts and factual content provision, experimental modelling of natural concepts and processes and some reading for information. There was no evidence of the use of materials for action taking/trying out/change practices, deliberation, debate and reporting towards decision-making, hands-on fieldwork encounters/experiences, experimental modelling of issues, processes and practices and role-play and simulation and audits and enquiry activities (AM 3.3, 1.3). This is presented in Figure 13:

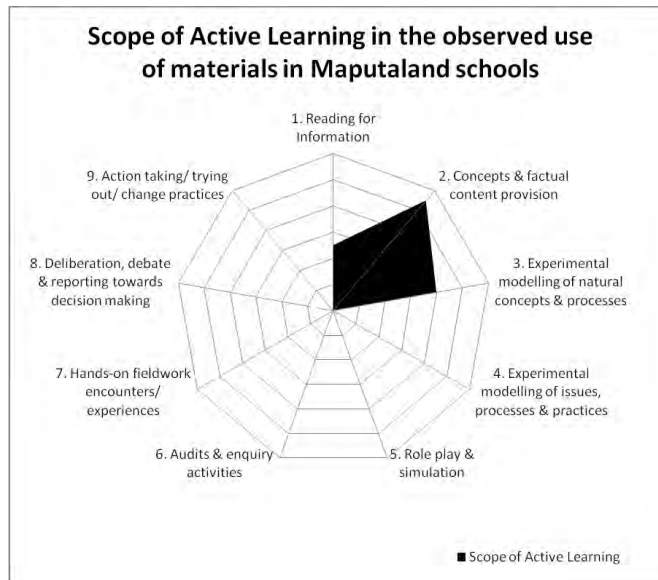


Figure 13: Elements of Active Learning in the observed use of materials in schools

4.11 Context of the Four School Cases

The context of the schools is drawn from the interviews with KZN Wildlife community conservation officers and my own observations during school visits.

According to one of the community conservation officers, school H1 has an enthusiastic teacher who runs an Enviro Club. He teaches science and tries to take the learners to the sea whenever possible. The school is not very motivated and was started when the neighbouring high school had too many learners. The Enviro Club did very well in an ACEP competition that was run a few years ago. Although they have visited the sea for rocky shores studies they have not been back for a while. The high schools struggle to fit in the extra activities. KZN Wildlife therefore focuses mostly on primary schools. This school wants to learn about any marine and coastal topic (CCO1).

H2 has been involved with ACEP before and has a coelacanth painted on one of the classrooms that were built by KZN Wildlife and have received materials. They also entered the ACEP competition. There is an enthusiastic principal who pushes science

education and supports the teachers because he thinks that it is important for further learning. He would really like to have a science laboratory for his school. This school is a good Eco-school. It has an enthusiastic teacher, has created quite a technical compost pit and has had a litter campaign. There has since been a change of teachers. As a high school they are more restricted to undertake on field trips. They have attended the “Kids in Parks” trip to neighbouring parks, arbour days and the trip to Sodwana Bay with iSimangaliso officials.

P1 has a good principal and is an Eco-school. They have focused on nutrition and have a vegetable garden. The principal is often busy with meetings. Electricity and the building of two classrooms were sponsored for the school. They have been involved with rocky shores studies and the coastal cleanup. They are eager for any chance to come to the beach and love to touch and feel new things.

P2 is a very good school, which has had many field trips to Kosi Bay. They have been involved with turtle education, coastal clean-up, made recycled material turtles, songs and have an excellent drama group. They have been an Eco-school and have a very enthusiastic teacher. The school is motivated and KZN Wildlife is invited to work with them every year. They also entered a Climate Change poster competition and their learner won.

4.12 Case 1 implicit use and observed use

Implicit use (AM 1.2)

In the first case of a high school in the Sodwana Bay area, the teacher reported that he had used the fossil kit only once with his science club members. During this lesson, the learners were given background to the formation of fossils and advised to go to Sodwana Bay to examine the rocks. He felt that the fossil kit needs to be developed more “in line with NCS”.

After an ACEP competition they received a globe (which the geography class is using), a windvane and a rain gauge. The rain gauge was put outside to record the amount of rain that usually falls in their area.

This teacher recommended that the materials should be “integrated with the curriculum”. He referred to the nitrogen cycle experiment as being an important material. The activity was a game and he felt that the learners enjoyed it and it would help their understanding.

A good marine and coastal topic that the learners enjoy is that of the turtles: the different species and how they live and reproduce. They would, however, like to go to the coast to see them laying their eggs.

A marine and coastal activity that stood out to the teacher was that of a poster competition during which the learners had to conduct “research” about issues concerning the coast. Some learners chose to look into “*encroachment of the community on the coastline and destroying the coastline, entering into the forest and cutting the trees*”. Others looked at the activities on the coast that effect freshwater species, such as agricultural fertilizers and eutrophic pollution. They study this in the classroom. They then had to look for evidence along the streams of the river and research “*how the peoples activities are effecting the forests which are supposed to be preserved, the natural trees take a very long time to mature but people go to cut them to make cupboards and handcrafts*”. They would have to write and report on this in the form of a poster. The learners who entered were part of the Science Club.

Another activity that stood out to the teacher who was interviewed was when the teachers were taken to Sodwana Bay for a materials workshop. They received materials and were taken to the sea and taught about the turtle and discussed the changing coastline. After that the learners were brought to the sea on a field trip. Environmental issues such as mining were discussed.

When asked if the marine and coastal education relates to the curriculum the teacher stated: ...”*we are supposed to relate what we teach in the classroom to the environment, to the outside experience and this area is near the coast, so the coast is actually our environment and the activities that take place along the coast effect the learners so they need to know. And they generally after school, they get jobs related to the coastal line and whenever each time we teach science when we want to look outside, the examples we usually give is related to the coastline. Because that is where we live so I think it is quite important that we get some good information*”.

Observed Practice (AM 1.3)

The lesson that I observed was an examination revision lesson with Grade 10 learners. The teacher was working through a past test paper. He discussed each question and wrote the correct answers on the board. The learners then wrote the correct answers in their exercise books. At times he would ask them the questions. When I asked to be shown evidence of learners’ work he showed me the answer papers from the nitrogen cycle game that is included in the Simple Practicals kit.



Figure 14: Teaching Practice in a Physical Science revision lesson in Case 1

4.13 Case 2 implicit use and observed use

Implicit Use (AM 1.2)

When asked what materials she uses for teaching, the teacher said that “*normally in class we just do it theoretically*” and that going to do a practical at the sea was good for the learners. She said that they use a “chart” and draw on that or the board. She uses textbooks “*for preparing the lesson, so then I just teach from the textbook*”.

The most useful materials are DVDs and videos, because it is difficult to do practicals in class. Other materials that she suggests are posters and pamphlets, because they “*will help to equip my knowledge and understanding*”. She was able to show me the Evolution DVD.

The teacher said that the materials are useful for topics such as ecosystems, energy transfer, food chains and food pyramids.

She mentioned that a good marine and coastal activity is to be taken to the coast for practical lessons: “*the marine and coastal lesson that was successful was when we went to Sodwana Bay. And so we learnt more about the marine animals and marine plants and the learners were getting knowledge there, together with us. As the teachers, we gain a lot, because some of the things we haven't known. So it was very easier for us to find that is the plant, that is the animal. When we go there alone, we never notice that this, it can be a living thing. But until we went there with the people from EKZN Wildlife, they teach us very well. It was just a fantastic lesson to us. We enjoyed it a lot and we wish it can happen time and again*”.

When asked how the teacher uses materials, she said that the “*learners are the ones that must do the work. Yes, the teacher remains the facilitator. It's not like the old days whereby the teacher was the one to do a lot of work. But now the learners are the one*

that are doing a lot of work. We just come out with the topic, so the learners are the one that are going to sit on it, discuss it so the teacher is there to help them”.

She also said that the marine and coastal education fits in with the curriculum concerning the topics of ecosystems, food chains and energy transfer.

Observed Practice (AM 1.3)

The lesson that I observed was a revision lesson with Grade 12 learners. The teacher discussed the content, definitions and terms of biology related areas such as soil, food webs, ecosystems and the lifecycle of the tapeworm. She would write these on the board and ask the learners questions. The learners listened and observed. The teacher gave me an example of a learner's work which was a test paper. The learners had scored top marks and the test paper had environmental content.

4.15 Case 3 implicit use and observed use

Implicit Use (AM 1.2)

When asked what materials the teachers had used the teacher said that they had used the ones from the workshops and some that they got from iSimangaliso. He showed me a newspaper, competition pamphlet and poster from iSimangaliso. The ACEP materials that he remembers are the video and a poster, but he does not know where they are now.

He said that videos, so that the learners can “see”, and a laboratory for practicals would be most useful. This is because *“We just theorise. You have seen in the class. Most of the things we theorise because we are running short of teaching material. We have no science kits but we are teaching science”.*

He referred to field trips to the sea being the most useful activity that they have experienced. He mentioned that being part of Eco-schools and addressing erosion problems, establishing the vegetable garden and planting trees had helped them become more aware of nature conservation. Their involvement in the coastal clean-up and Arbour Day is also important.

He felt that marine and coastal education plays a vital role, so that they can understand the importance of nature and the protected area and respect it, because it is attracting tourists and many of the learners will find jobs there. It makes them aware of pollution risks.

The teacher said the following about the marine and coastal environment fitting in with the curriculum: *“Ja it is important...we don’t separate them because if we try to separate them we find ourselves we automatically mentioning it because once you are teaching a learner you must start from known to unknown so what they know is iSimangaliso, what they know -protected area is Sodwana Bay, so once you mention those examples you are obliged to mention those things that are important in our nature”*.

An example that he gave was that the water that they use comes from Lake Sibaya. Another lake that they used is now part of the protected area. If they teach about water, they have to mention that they have to take care of water.

He felt that the marine and coastal education is useful to the curriculum because *“one of the principles of teaching in OBE, you don’t exclude native people or indigenous people and indigenous society. Whatever lesson that you make you must make sure that, for example, in technology, so you can’t say a child must solve a problem but without using available resources and he must look at economies. So once you talk about this one you can see now that you are talking about natural science, but you find yourself teaching EMS, you find yourself teaching maths, you find yourself teaching social science which means now they will be exposed now to nature that is around them that is geography. So I think it is very much important”*.

The topics that marine and coastal education is useful for is water pollution, in that their rivers flow into the sea. Alien plants are a useful topic, as they use up water.

The teacher mentioned that the materials from iSimangaliso are important for learning about the significance of protected areas and nature so that he will see the value in the natural resources for work opportunities.

Observed Practice (AM 1.3)

The teacher did a presentation on definitions and ecosystems, foodwebs and the movement of energy through systems. While doing this he wrote on the chalkboard and referred to posters showing fossils, marine resource protection and nutrition. He referred to the Natural Sciences textbook and at the end of the lesson the learners had to answer questions in their groups on an activity from the textbook by reading in the textbook and then answering the teacher's questions that he took from the textbook.



Figure 15: The observed use of poster material in a lesson

4.16 Case 4 implicit use and observed use

Implicit Use (AM 1.2)

According to this teacher, the materials that are used are science apparatus, the natural science kit, the “Coastcare fact sheet file” and a science chart (poster). She also said that the apparatus is scattered. The fact sheets and textbooks are used for the theory. She said that she had used the materials as a visual aid to show the different kinds of fish.

The marine and coastal materials fit in with the curriculum because: *“It helps them because it is something that they have to see that is practical, because it’s more easier for them if we tell them something that they have already experienced. It’s more easier for them even to answer the questions because they have to find their findings and then at the end of the day they have to tell”*.

The marine and coastal content fits in with lessons because the learners know the sea and the fishes. She also said that *“it fit with lesson because the turtle they fall under the..because we have the three kinds of animals...so there are amphibians, the birds, the mammals ,it’s perfect”*.

The topics of the importance of iSimangaliso, habitats, vertebrates and invertebrates are useful for lessons and exam questions. When they can go into the field and see these things in real life. It *“fits within the knowledge background”*.

Marine and coastal education activities that were successful include the coastal clean-up, a KZN wildlife presentation on turtles, the drama of Peter Tim finding the coelacanth, Eco-schools and a global warming poster competition.

A marine and coastal issue that she had heard of is how people take the turtle’s eggs to increase their chicken’s fertility.

The teacher showed me the winning global warming poster that was made for the competition which the learner won.

Observed Practice (AM 1.3)

During the lesson, she split the learners into groups to do one of the experiments in the Simple Practicals kit. She wrote definitions on the chalk board. The learners had to record the time taken for water to move through soil and report this back to the teacher, who wrote the answers on the chalkboard.



Figure 16: Observed teaching practice in Case 4

4.17 Active Learning in the Implicit Use in Four School Cases

All of the teachers referred to materials and activities which could provide content information. This information was mostly in the form of posters, textbooks, fact sheets, presentations and DVDs. All of the teachers said that fieldwork was important and that learners should have more opportunities to go to the ocean to see and learn about the environment. Experiments or “practicals” that model natural processes were mentioned by three of the teachers. One high school teacher raised the use of audit activities and

research projects which require the learners to find out about and investigate their local area. One primary school teacher referred to role play. The primary school teachers referred to action activities such as those which are part of Eco-schools and the coastal clean-up. Both of the high school teachers mentioned discussions and reporting.

(AM 3.3)

4.18 Active Learning in the Observed Use in Four School Cases

In all of the lessons that were observed the teachers made presentations and wrote information or drew diagrams on the chalk board. The high school teachers carried out revision lessons. Case P1 had a broad lesson and the teacher referred to environmental posters and the textbook. The learners were able to read a task in the textbook during this lesson. In Case P2 the learners performed a soil experiment. All the learners in the schools were able to report back answers to questions that the teachers asked.

(AM 3.3)

4.19 Conclusion

The findings from Chapter 4 were used to establish tentative Analytical Statements which were taken into a “mirror data workshop” with the case study teachers and developers of materials. The discussions from these workshops are presented in Chapter 5 and verify and deepen the discussions of these Analytical Statements.

Chapter 5 Participant Review and Analytical Synthesis

5.1 Introduction

In Chapter 5, I will start by presenting the discussions in the “mirror data workshops”, that took place with firstly the developers of materials and then with the case study teachers. The data presented in Chapter 4 provided evidence which I interpreted into key contradictions or tentative analytical statements. In order to verify these findings and deepen the understanding of the evidence I presented these tentative statements to the participants as “mirror data”.

From here the workshop participants identified any further contradictions through the discussions and worked together to establish possible solutions and recommendations. These are discussed in detail in Chapter 6.

The analytical statements were verified and then revised and the evidence for these statements is discussed in relation to the literature. The literature that I use is literature that has been introduced in Chapter 2, but at times it is additional literature that has been explored in order to understand certain statements that have been made.

5.2 Mirror Data Workshop with Materials Developers

The data was “mirrored” back to marine educators and the developers of the materials to generate discussions, contradictions and solutions. In this Chapter I will mention the solutions, but these solutions are taken forward to Chapter 6 to be discussed in more detail.

The possible findings of the study that were introduced and then discussed included:

(Contradiction 1) The marine environment is seen as an entity under conservation authority control and thus outside the everyday realm of the teachers' and learners' lives

The tribal authority was involved in the management of the conservation area and the people have an indigenous knowledge of the marine environment which is part of their lives. Since the park has become the bigger park, they are a smaller entity and not as involved as before.

There is a contradiction in that the people in the area have a history of association and work with the environment, but the teachers still feel that, in the schools, the environment does not belong to them for education purposes and the children do not know about it. Through the discussions it seems that the service authorities tend to appropriate knowledge and these controlling networks cannot provide the contact.

According to the community conservation officer that one participant spoke to, there has been a shift in authority. Park staff previously took the teachers and learners on excursions and now guides are taking them, but they are not allowed to touch anything. There needs to be an understanding of why they cannot touch the rocks and organisms.

There is a contradiction in the control and access. The community has access and the learners have had past contact experiences during excursions, sometimes on an annual basis, but not regular contact. If one looks at the number of learners in the schools against how many have actually been on these excursions it may not be that many. These excursions include going to the park authority that has the control and ownership. The visits are done on the authority's terms. The teachers do not have the authority or the confidence to deal with this education and content. The authority has this confidence, but they are narrowing the scope for learning within a prescriptive conservation perspective to protect the resources in the park.

A solution may be to increase the relationship between the teacher and the marine environment. The teachers could be encouraged to do something in the schools with the learners. They could work with the learners on marine activities before excursions, so that they have a sense of authority and will participate. Materials that include more engagement and working with the environment should be developed. The teachers must be given a chance to participate in the excursions. Perhaps service providers or authorities need to meet with the teachers in an informal way, to start conversations and break down barriers. They can then identify the teachers that they can work with.

(Contradiction 2) The service providers are conflicted between what they want to achieve and what the curriculum requires

There is tension between the service provider (ACEP), the education system and their own education initiatives. This links to the shift from content to experiments. The alignment to the curriculum loses environmental education goals during this evolution in materials development. The developers of materials at this workshop were of the opinion that the service providers have little sense of what is happening on the ground and that they only want outputs such as the number of schools given materials. A solution may be a model of an education network system, whereby service providers work with smaller numbers of teachers where these teachers are based.

If there is an awareness and outreach mandate you cannot run according to this network model. It is the contact that the teachers need, not necessarily the materials, and a service provider cannot always provide this. These kind of solutions need to be fed back to the service providers. They need to be creating confidence and platforms for engagement with teachers and this will then transfer into the school environment. There is a need or a call for experiments, because teachers cannot do practicals and so the service providers will question the importance of their environmental content. The fact that there cannot be content without contact is a problem and the learning needs to be situated. An example given on the inland schools was that the DoE will not accept marine and catchment related materials, because their focus is on mining. This is linked

to policy. It is not easy to surface contradictions and their causes and more research is needed.

The ACEP materials started with a theoretical approach and the teachers said that they did not know how to use them. ACEP tried videos, so that the teachers would not need to know the content, but the ACEP coordinators could just be “facilitators” of the process of sharing that content knowledge with teachers. ACEP then tried to align this more strongly to the curriculum. And through this the content has been lost. If ACEP do not align this with the curriculum, the DoE will not allow them to work with the schools. The DoE needs to know exactly where the materials will fit in with the learning programme. Service providers are seen as “excursion people”.

There is a conflict concerning the reasons that the materials went from providing content to being more hands-on. The ACEP developers wanted to show that teachers can do practicals with very little, by “thinking out of the box”, and developers of the materials are of the opinion that the teachers do not do this. Their opinion is that the teachers’ lack of knowledge of science shows that the learners do not have the content knowledge of science and this seems to be a curriculum problem. The curriculum is activity based, but this does not allow for content. The service provider has thus responded to what the DoE wants and this has led to loss of content.

There is thus a contradiction between the curriculum requirements and what marine education wants to achieve.

(Contradiction 3) There is an overall coverage of active learning with an emphasis on content and experiments

There was not anything contradictory about this finding, as over this period the design of the materials is appropriately slanted. But when looking at *Curriculum alignment and an increase in experiments is accompanied by a loss of content*, this contradiction stimulated much discussion. There was agreement with the ACEP developers that there

was a focus on the content in the beginning. Videos could show learners life under water, the coelacanth and career opportunities. The materials “alluded” to the curriculum. There was only a table that summarised the links to the curriculum that was provided with the materials.

In 2005 the materials started to align with the curriculum more strongly. ACEP wanted to align with the curriculum and provide the necessary content so that the teachers can use this.

The DoE then started to drive things more strongly. There was a major problem in the sciences, in that learners were not doing practicals and experiments and they did not have the content. The materials then started to emphasise experiments.

The next discussions linked to the research finding that the *alignment of the materials with the curriculum is narrowing the scope for active environmental learning and successive innovations of ACEP materials appears to have worked against a built-up use of materials in schools.*

Between 2002 and 2009 there was an increasing alignment of the materials with the curriculum, with the intended reduction in content and emphasis on experiments.

When considering the implications of this finding, it was mentioned that there is not a package of all the ACEP materials. There has been a progression driven by the DoE and the practice of experiments is losing content and so marine educators need to know what to do. Something new is developed as funding is made available, but what has accumulated is not being used. What can be done with the “debris” of materials that is left in the schools and what can be pulled together without narrowing the scope of environmental learning? There is not a cumulative build-up of materials. There is a good coverage of active learning through all of the materials, which have the same focus areas. The participants of the workshop felt that this finding seems to be linked to the teachers having a lot of “buy in” during the materials workshops, but very few use the materials in the classroom. There are very few teachers that implement, adapt and use

the materials. There is also very little “debris” of materials that can be found in the schools.

There is a loss of teachers in schools. ACEP will need to keep this in mind. These programmes must know how to work with schools that are losing teachers. A possible solution could be using the principals as custodians and the local resource centres. ACEP have annual “once off” workshops but the local conservation authority (KZN-Wildlife) is given materials and trained so that they can workshop these with the schools and do follow-up visits. KZN-Wildlife works with the same schools each time. ACEP needs to see if the materials are being used beyond the workshop. There needs to be a decision on whether or not ACEP must produce more materials or repackage existing ones.

There needs to be a custodian group such as Share-net. Share-net was given as an example where materials that were developed many years ago are still housed and used. This could be SAIAON or the Makana Science Alliance or a publisher. It is difficult to find a network that accepts the way that the service provider develops materials and, because of the government funding, ownership is an issue.

The DoE will not accept materials unless they are developed through an academic institution. DoE are now contracting professional development to service providers such as the universities. Teachers will not be doing a once-off experience but could do a course in science and marine education. The content could be consolidated into a professional development course with a registered service provider like a university.

There was a model of science advancement where outreach and science expositions were used, but these are expensive. The NRF are now seeing the value of research, monitoring and evaluation and money is going into these areas.

Another solution is for the marine content (the materials from 2002 to 2009) to be scaled down to fit into an education module for science teachers. The students would be able

to access the materials. There is concern that the service providers' mandate is being shifted again. Another question concerned which model the service providers should consider for the development of materials and how they should engage with environmental education, while still fulfilling their mandate of building sustainable living and scientists of the future. Rather than repackaging, what do service providers make from what has been learnt? And how do they respond to the changing curriculum? There are examples of designs of sustainable living materials in the context of marine and coastal environment, such as the *Handprints for Change* materials.

5.3 Mirror Data Workshop with Teachers

The data that was then "mirrored" back to the school case teachers generated new discussions, contradictions and solutions. There was agreement with certain findings and contradictions. In this Chapter I will mention the solutions, but these solutions are taken forward to Chapter 6 to be discussed in more detail.



Figure 17: The teachers discussing some of the findings of the research during the "mirror data" workshop

The possible findings of the study that were introduced and then discussed included:

(Contradiction 1) New materials every year appear to have worked against the built up use of ACEP materials

There is a high turnover of teachers in the rural schools and there are few ACEP teachers still in schools. Different teachers have attended the annual workshops. Although ACEP materials are evident in schools, the teachers are not effectively working with them. There is little evidence of a culture of taking ideas and materials from workshops into classrooms and using them.

When these findings were discussed, all agreed that there is a high turnover of teachers in their specific schools. Teachers often want to move to urban schools. There is no handover of skills or the actual materials once the teachers leave. Conditions are improving in the high schools and teachers are staying as the government is offering training. The teachers have to stay on at the schools if they receive the training. This system has been in effect for almost five years, but it has only started working more effectively recently. There is more stability now.

There is no communication with, and distribution to, other teachers after the workshops. When sending teachers to workshops it is a disadvantage to send only one educator, when the teachers are working with many different grades. There is no feedback/report back from the workshop to the other teachers and they often even keep the materials for themselves. The teacher then takes the knowledge and the material.

The materials are not easy for the learners to understand when the teachers try to use them. It seems that this is a language and literacy problem, but also the content of the materials is not understood by the learners. During training, the teachers were taught to theorise mostly and so they are not skilled in using materials. Teaching is thus done theoretically. Now teaching is learner-centred, but teachers are not moving fast enough to pick it up and have no skills in handling materials.

The size of their classes is a problem and there is a lack of facilities. At times there are 70 learners in a class and it is so crowded that even if a teacher tries to use the materials it is not easy in such a large class.

The National Curriculum Statement is so compact that even if they wanted to deal with things such as the marine environment they do not have the space or time. If they use the kit, areas such as the nitrogen cycle and chemistry can be used, but other areas cannot be used. They are rushing to finish their work with the learners and there is no time for other interests such as fossil kit moulds, etc.

Teachers have not been exposed to the aquatic/marine sciences. This is a new science to them and they fail to link the information from the resources to what is done in the classroom. Recently teachers have been working in this area with uShaka Marine World, but in the past it is a discipline which has belonged to whites. Gradually, more experience will be gained.

Possible solutions introduced by teachers:

- There is now training to secure posts.
- Posts are not frequently advertised.
- Government are now paying the teachers' salaries so there is no shift towards better offers and salaries are comparable.
- A rural allowance or incentive for teaching in rural areas should be paid.
- Laboratories or a storage area for materials with a learner who is an assistant who manages this.
- Training with experience in the field is key..
- Emphasis on responsibility in schools.
- A specialist is needed in the schools to manage materials.
- The materials have to relate to NCS and a handout has to be included to show teachers this in both primary and high schools.

(Contradiction 2) How teachers say they could use materials is not fully realized in classroom practice (emphasis on learning content and concept definitions):

The following was presented to the teachers for discussion:

Implicit use of materials:

- Concepts/content and fieldwork (mostly)
- Experiments of natural concepts
- Action taking
- Reading
- Modelling issues and practices (for example, a research project on deforestation)
- Audits (for example, a rain gauge activity)
- Role-play (for example, a drama)
- Deliberation/discussion

Observed practice: this is mostly concepts and factual content provision. A little reading and experiments for natural concepts.

The teachers said that this could be a result of their background. They are used to theorising and not using learner-centred approaches. They are interested in concepts and facts. It has taken time for change to take place because the curriculum is changing so often. The curriculum allows for these different approaches but it is the change which is hard. DoE workshops only give a little guidance in how to use other methods but not how to do it practically. In the beginning there was intense training on lesson plans, learning outcomes and assessments standards, but content was not provided. Now there is beginning to be a focus on content. As mentioned, how can someone be trained to prepare a lesson when he does not have the content? People do not understand new concepts and topics and are not trained to teach these concepts or topics. They are only learning class management.

When doing an investigation (experiment), a teacher can take the learners through the activity when he/she is comfortable with the outcome and the facts. Other approaches to learning will come in once the content is there; this is why it hasn't happened. Teachers are also teaching the wrong content for their grades. Often a teacher uses the

policy document and a book and then confuses the children when combining this and other activities/learning approaches. Much blame rests with the South African education system in the past.

Possible solutions:

- Facts and content for teachers must come first.
- The facts need to relate to their everyday lives.
- There needs to be integration between the different content areas and other activities/approaches to learning.

(Contradiction 3) The marine environment is seen as an entity under conservation authority control and so it is outside the everyday lives of the teachers and learners:

There is an emphasis on fieldtrips by teachers to „see“ marine and coastal environment but only when invited by the authority, who will provide the education.

The teachers agreed with this finding and one teacher mentioned that it is a sensitive subject. The other teachers said the area needs to be protected and the community is not prohibited from using it. They need to protect it and there is relatively easy access. However, fishing is where the difficulties lie. There are the large boats (these are owned mostly by white people who are not local) and take a lot of fish, more than the local poor people. They felt that subsistence fishing should be allowed and that local people should not be prevented from coming to fish for food.

There is a protected area but no forum where people can sit together and agree how it can be run. A teacher spoke of a fence is being put up for the “Big Five” to attract tourists, but they are not discussing this with the community. Regulation is needed but the community as a whole has little knowledge. The counsellors possibly accepted this without discussing it with the community. There is a trust which communicates with the authorities but there needs to be better feedback from the trust to the community. The leaders use force and that is how they deal with the community.

The schools within the iSimangaliso zone of influence are able to access the coastline free of charge. The other schools pay R20 a child.

Possible solutions deliberated/noted:

All schools within Maputaland should be allowed free access to the coastline for education purposes.

- The authorities should regulate and protect the coastline, but must not prohibit visits.
- The locals should be allowed to conduct regulated subsistence fishing, but this fishing must be done without nets and boats.

5.4 Analytical Statement 1: Alignment of the materials with the requirements of the curriculum has placed an emphasis on experiments, with a loss of environmental content and a narrowed scope for active environmental learning.

If one looks at the trends in the development of ACEP materials over time (between 2002 and 2009) in relation to active learning (4.4), there is a shift from an emphasis on environmental content and opportunities for various active learning activities to a narrowing of the scope for active environmental learning activities as the materials become more focused on technical experiments which model natural concepts and processes. The environmental content, as a result, is gradually lost. See Figures 6 to 10 in Chapter 4 (4.4).

Prior to 2003, the materials were developed in relation to the curriculum in a flexible and adaptable way (4.3.1). After 2003, the materials were developed and aligned with the curriculum with the help of curriculum specialists. The materials were also further developed according to certain requirements of the DoE (4.3.2). If the developers of the materials do not align the materials with the curriculum, the DoE will not allow them to

work with the schools. The DoE needs to know exactly where the materials will fit in with the learning programme (5.2). This is explained by the developer of the materials in the following statement:

“We have an aim to develop scientists; we want people interested in science and want people to value the environment. You can’t do that in isolation, you need to attach to things that allow you in, we used NCS to guide us to develop something. We looked at the needs, not only the policy, but the „flavour“ of DoE, or government or DST, that’s what we used to guide us. It may not be (as in the Soil & Sediments) about the sea, but Indigenous Knowledge, and we try to find linkages. We definitely looked at NCS”.

(AM1.1, 4.3.2)

The earlier materials (Figure 6 to 8) focused on the provision of environmental content knowledge provision. The environmental content in the materials decreased and the final ACEP products focus primarily on technical experiments for modelling concepts and processes (4.5). In 2009 ACEP developed materials for science experiments, following requests from the DoE, because teachers were not doing interactive experiments or practicals in the classroom. The developer of the materials, during the feedback workshop, verified that they tried to align the materials with the curriculum and through this the environmental content was lost (5.2).

A constructivist approach underlies the construction of the new South African curriculum that was developed after democracy. This is a learner-centred approach and the teacher is seen as a facilitator of learning, not someone with specialised knowledge. If one takes a progressivist view of curricula, this curriculum placed emphasis on the processes and everyday knowledge, at the expense of conceptual and content knowledge (Chisholm, 2004). Schudel (2010) states that OBE and Curriculum 2005 prioritized skills and background knowledge at the expense of content.

Chisholm (2004) states that the principles of learner-centeredness, relevance, integration, non-discrimination, human resource development, creative and critical thinking and quality education were good, but there were assumptions made about

teachers and what was actually going on in the classroom. Teachers were expected to build the content of the curriculum themselves with a curriculum that had complex and difficult terminology and an assessment process which was also difficult.

Young (2008) states: *“Learning, according to this view, becomes to be seen as little more than the „construction of meanings“ or a „conversation“ – regardless of what these meanings are, what the conversations are about, or whether they give learners any reliable understanding of the world, or power over it. One unfortunate legacy of apartheid is that many curriculum developers have been enthused by what they have seen as the emancipator possibilities of social constructivism. This has led them to dismiss any notion of curriculum content being prescribed by specialists, and to see syllabuses as inherently authoritarian, rather than as frameworks that are necessary if genuine intellectual development is to take place”* (Young, 2008:191).

Through the prioritization of skills, background knowledge and an outcomes based curriculum, the content knowledge is sacrificed. This has therefore played out in the ACEP LSMs which revealed a loss of environmental content over time as they became more closely aligned with this outcomes based curriculum. This content is the formal or specialist knowledge referred to by Young (2008).

Young (2008) says that “genuine intellectual development” is dependent on specialist and formal content knowledge. Clear boundaries between informal and formal learning are important because they allow for learning to go further than the “non-school” local and situated experience. When looking at the South Africa curriculum context, Young (2008) says that when the division between the two knowledge types becomes less apparent, the informal knowledge dominates in the curriculum policy because of this “blurring of distinctions”. Social constructivism then provides the academic justification for this curriculum policy, which has been criticised for not working and has led to confusion amongst teachers. Young (2008) says that the failure of the curriculum can therefore not only be because it was not implemented or resourced adequately, but also

because it was based on mistaken assumptions about knowledge construction and the uncertainty of these knowledge boundaries.

Analysis of the ACEP LSMs revealed that alignment with the curriculum resulted in a narrowed scope for active environmental learning. However, when looking at all of the combined materials, there is an overall coverage of active learning, with an emphasis on content and experiments. See Figure 5 in 4.4.

Schudel (2010) highlights the importance of developing environmental learning skills and not just the environmental content. Analytical, reflexive, problem-solving explanations and evaluative skills should be developed for environmental teaching and learning. The teaching methods and skills for active learning should be developed around the content and local environment. Once teachers are given environmental content they need to understand this environmental knowledge in order for their learners to make meaning of the knowledge. Schudel (2010) says that “*environmental and sustainability initiatives should be selected so that they contribute to active learning and the needs of the local people*”. The Active Learning framework is a “steering tool” to “inscribe environmental learning in school curriculum contexts” and does so in all learning areas of the curriculum (O’Donoghue & Russo, 2004).

Schudel (2010) discusses the role of “new knowledge” for active learning. Informed choice is possible when this knowledge is applied and new knowledge from experts is needed to allow learners to move beyond their prior everyday knowledge. She discusses this in relation to the view that “*new knowledge consolidates and challenges prior knowledge. It feeds new actions. It lays the foundation for informed choice. It is essential for learning concerned with change*” (Schudel, 2010:29).

5.5 Analytical Statement 2: How teachers say they could use materials is not fully realized in classroom practice (emphasis on learning content and concept definitions).

At the survey level the teachers mentioned how LSMs could be used for many of the activities within the categories of active learning. This uncovered their implicit use of materials which is illustrated in Figure 12 in 4.9.

The greatest reference of implicit use of the ACEP LSMs by teachers was for concepts and factual content provision. The teachers also referred to all of the other categories of active learning for the use of LSMs: reading for information, action-taking, trying out, change practices, deliberation and debate, reporting towards decision making and hands-on fieldwork encounters and experiences. There was minimal or no reference made to experimental modelling of issues, processes and practices, role-play and stimulation, audits and enquiry activities (AM 1.2, 4.9).

At a case study level the teachers said that they could use LSMs which could provide content information (especially visual aids such as posters, fact sheets, presentations and videos); fieldwork; experiments; audit activities; research projects which require the learners to discover and investigate in their local area; role play; action activities; discussions and reporting. Many teachers in this study described successful marine and coastal education lessons as those that provide the teachers with knowledge and successful LSMs as those that “*will help to equip my knowledge and understanding*” (4.12; 4.13; 4.14; 4.15).

However during observed lessons within the context of the four school cases, all of the teachers did presentations on definitions and concepts. The two high schools did revision lessons. One primary school used a textbook for a short reading and discussion activity and the other primary school did an experiment using the recently acquired ACEP science kit, but most of the lesson time was spent teaching concepts and factual content (4.12; 4.13; 4.14; 4.15).

When asked what materials were used for teaching, a teacher said that “*normally in class we just do it theoretically*” and “*We just theorise. You have seen in the class. Most of the things we theorise because we are running short of teaching material...*” (4.13).

During the teachers’ feedback workshop, in which the initial findings were discussed, the teachers agreed with this evidence, saying that they are accustomed to theorising and not using learner-centred approaches. They reported that they are interested in teaching concepts and facts and this is a result of their history, which will take much time to change because the curriculum is changing so often. The curriculum allows for different teaching approaches, but changing in teaching practice is difficult. The teachers said that they have received plenty of training in other methods, lesson preparation, assessment, learning outcomes and classroom management from the DoE. However, they have not been provided with content (5.3).

One teacher said: “*How can someone be trained to prepare a lesson when he does not have the content? People do not know new concepts and topics and are never trained to teach these concepts or topics. They are only learning class management*” (5.2).

The formal content knowledge loss in Outcomes Based Education is significant. The resulting loss of environmental content in LSMs such as those developed by ACEP, is significant, especially as evidence suggests that the Maputaland teachers had limited environmental content knowledge and were seeking LSMs and activities which provide this. In the 2007-2008 Eco-Schools Evaluation, Rosenberg (2008) found that teachers had limited environmental content knowledge which is related to the curriculum. Mbuyazwe (2009) found that teachers did not have marine knowledge to teach in their lessons. The teachers in her study felt that they needed to acquire content. Mbuyazwe (2009) says that “*...there is a direct link between the quality of learners’ learning and the role of teacher knowledge of content so as to support learning*”.

Mbuyazwe (2009) stated that “*currently naming and defining is still what teachers know and practice in school classrooms*”. In her research, this teaching practice influenced how the teachers searched for content which they already knew when they were selecting materials for lessons. How the materials could support Learning Outcomes and Assessment Standards, their purpose and their curriculum alignment were not considered. The teachers used the content and factual information, only. Mbuyazwe (2009) found that learners were expected to learn through reproducing the facts and content information that teachers had given them.

The curriculum has gone through 10 years of intensive reform and this has resulted in much insecurity, confusion, criticism and a lack of confidence in the system (Dada *et al.*, 2009). Teachers have not been trained and prepared sufficiently in teaching methods, especially training in learning area content. Teachers also need guidance in subject specific teaching methods and understanding of the content. In many schools the teachers do not teach the same learning area or subject for more than a year, as they are rotated. This increases the complexity of this issue (Dada *et al.*, 2009).

5.6 Analytical Statement 3: There is no clear culture of use of materials in schools following the annual introduction of new ACEP materials.

Of the 21 teachers who completed questionnaires, only six reported that they had actually used some of the ACEP materials. Some teachers said that they had attended workshops on the ACEP materials, even though they had not used the materials after the workshops. ACEP has run workshops with the intention of showing teachers how to use materials and “how the materials link to the curriculum”. Only then could they take the materials back to their schools (AM 1.1, 1.2, 4.7).

During the school visits teachers were questioned in order to locate materials that had been used. I discovered in two cases that teachers who used to work with the ACEP materials had left their schools. Only three schools were able to show the materials that

were in storage. In the other schools that were visited, I tried to locate teachers who had used ACEP materials and had attended workshops, but no tangible connections were established (field notes, 4.8).

During the feedback workshop, the teachers agreed that there is a high turnover of teachers in their schools and teachers often want to move to urban schools. There is no handover of skills or the actual materials once the teachers leave. But the teachers reported that the situation is improving in the high schools and the teachers are staying in the rural schools because the government is offering training on condition that teachers stay (5.3).

During this workshop the teachers said that during their teacher training they learnt to mostly „theorize“. They therefore reported that they have no skills in using LSMs. They said that they are not “moving fast enough” with a new learner-centred curriculum and getting the skills in “handling materials”. Their classes are extremely large (sometimes 70 learners) and this makes the use of materials difficult (5.3).

The teachers stated that the National Curriculum Statement is very compact and fitting in marine environmental education (even if they wanted to) is difficult, as there is not the space or time. The teachers have also not been exposed to the marine sciences before and say that this is a new science to them and so they fail to link the information from materials to their classroom practice (5.3).

Mbanjwa (2002) found that the use of environmental education learning support materials was limited and superficial in a case study of the Creative Solutions to Waste Project. In a case from the Learning for Sustainability Project (Janse van Rensburg & Lotz-Sisitka, 2000:90), it was found that teachers struggle to use LSMs within activities and the materials are often used as “display items”. Mbuyazwe (2009) found that teachers were unable to effectively use materials or structure curriculum-aligned learning activities from the content (facts and definitions).

Teachers need skills in taking information from LSMs and accessing the relevance of the information to “the learners” capacity, learning area, environmental context, outcomes, and intended pedagogical processes and applying the knowledge in curriculum processes” (Janse van Rensburg & Lotz-Sisitka, 2000:91). Teacher professional development, reflexivity and consideration of the teacher as a researcher and lifelong learner are important when developing LSMs. The design of LSMs should contribute to both teachers” conceptual development and learners” abilities to learn (Mbanjwa, 2002).

Learning theories and teaching methods influence the use of materials. Teachers need to be educated in how to access the materials and the “relation between teaching methods and the use of the materials” (NEEP-GET, 2005:40). The teacher”s role is to be the mediator of the learning processes in selecting the LSMs and using them in an adaptive way within the learners” context. However, teachers tend to select materials that are easier to use and understand (NEEP-GET, 2005).

Teachers in rural and under-resourced schools especially require skills to use LSMs (NEEP-GET, 2005:41). LSMs cannot only be given to teachers, they need to be supported in using the materials (Janse van Rensburg & Lotz-Sisitka, 2000:92). Teachers should participate in not only the development of LSMs but also in discussions concerning the effective use of LSMs (NEEP-GET, 2005). Lupele (2002) used participatory approaches to materials development but also used contextual profiling to understand the local context and the factors influencing the participators” practice and educational approaches.

Teachers are the primary mediators of the use of materials in learning processes, especially active learning processes. Lessons which meet the criteria of the curriculum and are relevant to the local context need to be planned. Materials should be selected according to which how effective they will be in the learning process (Lotz-Sisitka & Russo, 2003). Schudel (2010) speaks of the responsive provision of appropriate LSMs

and how this can support teachers' ability to develop and adapt their own LSMs for teaching.

5.7 Analytical Statement 4: The marine and coastal knowledge holding power is outside the realm of the teachers' practice and control.

The environmental education initiatives in the area are run by the local community conservation officers. These initiatives include rocky and sandy shores fieldtrips, presentations on turtles, environmental special days, coastal clean-ups, competitions and the Eco-schools programme (4.6).

All of the teachers in the case study schools referred to field trips when asked to discuss a successful marine and coastal activity. They mentioned the annual coastal clean-up, the local conservation authority's presentation on turtles, the drama of Peter Tim finding the coelacanth, Eco-schools and a global warming poster competition. Although these activities are broader than only fieldtrips, they are all activities that are initiated by the conservation authority and environmental education service providers. The conservation authority funds the registration of schools in the Eco-schools programme and has sponsored the building of classrooms in some schools (AM 1.2, 4.6, 4.12; 4.13; 4.14; 4.15).

Most of the teachers stated that marine and coastal education materials could be used in the Natural Sciences. Common focus areas chosen within the materials or topics that teachers were interested in were ecology (food chains, ecosystems and ecology of coelacanths) and climate change (AM 1.2).

There is therefore evidence that the teachers in this area seem to equate marine and coastal environmental education with the activities that are provided or controlled by the local conservation authority. Even when asked to describe the useful marine and

coastal LSMs, the teachers would refer to mostly field trips and competitions run by the authorities and service providers such as ACEP (AM 1.2, 4.6, 4.12; 4.13; 4.14; 4.15).

The environmental education initiatives in the Sodwana Bay and Kosi Bay areas are arranged and supported by the local conservation authorities and service providers such as ACEP (4.6). The teachers associate any environmental education as being part of these initiatives, especially excursions. Ketlhoilwe (2007a) found that “normalising strategies” were applied by teachers in their interpretations of environmental education policies. Normalization is defined in Ketlhoilwe (2007b) as being “norms of behaviour, attitudes and knowledge”. The “powers of expertise” or “symbols of scientific authority” create assumptions about knowledge which are internalized by individuals and normalized.

The three normalizing strategies that were identified in Ketlhoilwe’s research included: equating environmental education with environmental management activities in schools; expressing frustration with a lack of resources to undertake field trips and equating environmental education with environmental science (Ketlhoilwe, 2007a).

The teachers only described the environmental education practice that they were comfortable with and they associated environmental education with field work and excursions (Ketlhoilwe, 2007a). In Mbuyazwe’s (2009) research, the teachers felt that seeing the marine ecosystem would help their understanding. Ketlhoilwe (2007a) describes this type of normalising strategy of seeing environmental education as fieldwork as having a narrow understanding of increasing human-environment complexities in an African context.

Ketlhoilwe (2007a) discusses how environmental education policy discourse interpretation is influenced by local power-knowledge relationships. Similar to the Maputaland context, environmental education support was provided for by conservation bodies in Botswana and this led to a conservation discourse and emphasis on fieldwork and environmental management. This, in turn, influences teaching practice, both

epistemological and pedagogical practice and creates science-based interpretations of the environment and environmental education. The content and activities were narrowed to being only nature-based and environmental education discourses, such as problem-solving and issues-based approaches, the social and historical causes of issues and economic development aspects found in issues and risks were omitted (Ketlhoilwe, 2007a). In the Maputaland schools, environmental LSMs were seen to be useful for the Natural Sciences and the chosen focus areas were limited to mostly ecology.

5.8 Conclusion

This research aimed to discover how learning support materials are used in the rural schools of Maputaland. In this chapter I have revealed the findings which address this question through the data that was generated. By drawing on the direct evidence and findings and then reporting the interpretations of the teachers and developers of materials after being exposed to these findings, I believe that the research provides an in-depth account of this case of the use of materials in schools in Maputaland.

Chapter 6 will conclude and summarize the thesis. Most importantly, Chapter 6 provides possible recommendations that are drawn from not only my interpretation of the findings of the research, but that of the developers of materials and most importantly, the teachers in schools who **use** learning support materials.

Chapter 6 Conclusion and Recommendations

6.1 Introduction

Chapter 6 reflects on the findings of the research and what it means for the discipline of environmental education. It discusses the limitations of the research and where there is a need for further research in light of these findings. Recommendations are made which draw on the findings and on the advice given by teachers and developers of materials.

6.2 Summary of the Key Findings

Four key findings emerged from this research:

1. Alignment of the materials with the requirements of the curriculum has placed an emphasis on experiments, with a loss of environmental content and a narrowed scope for active environmental learning.
2. How teachers say they could use materials is not fully realized in classroom practice where there is emphasis on learning content and concept definitions.
3. There is no clear culture of use of materials in schools following the annual introduction of new ACEP materials.
4. The marine and coastal knowledge holding power is outside the realm of the teachers' practice and control.

The key findings were discussed in detail in Chapter 5. They are taken into the next section and discussed in relation to the implications for the field of environmental education.

6.3 Broader Implications for Environmental Education

In July 2009 the Minister of Education in South Africa assigned a panel of experts to research the major issues and challenges in the implementation of the National Curriculum Statement and to make suitable recommendations for improvement (Dada *et al.*, 2009). The review team in Dada *et al.* (2009) stated that they supported the DoE's move away from OBE. In order to address the issues of knowledge gaps, the review suggested that "...outcomes be replaced with clear content, concept and skill standards and clear and concise assessment requirements" (Dada *et al.*, 2009). The "highly criticized" OBE education system is being changed and adapted to a new curriculum called "Schooling 2025". There will be more focus on content knowledge with the use of textbooks and workbooks (The Witness, 2010).

One of the findings was that there has been a loss of environmental content knowledge as the LSMs became more closely aligned with the curriculum and the requirements of the DoE. The new curriculum will come into practice in 2011 and the structure of the syllabus will limit teachers to selecting environmental topics that are relevant to local needs and issues (Schudel, 2010). The appropriate learning skills, content and concepts, texts, pedagogical approaches and assessment requirements will be specified in the new curriculum and assessment documents. Textbooks will be reintroduced and a national catalogue of approved and screened, curriculum-aligned LSMs will be developed (Dada *et al.*, 2009).

With this in mind, there is a question which will ultimately decide the role that environmental education service providers will play. The question is where they will fit into the new changing curriculum, which is more structured and has specified curriculum content? How and what role will they play in LSM provision and development for use in schools? There was an obvious loss of environmental content, but a need for this content knowledge (Rosenburg, 2008, Schudel, 2010). Schudel (2010) has discussed the role of "new knowledge for active learning". Environmental education service providers who develop LSMs, such as ACEP, could take up this role. The existing

ACEP LSMs, when combined (see Chapter 5), provide a range of activities for active learning and specialist marine environmental content for new knowledge.

The research revealed that there is no clear culture of use of materials in schools, following the annual introduction of new ACEP materials. Developers of environmental education LSMs need to be responsive in providing LSMs that are relevant to local needs and fit in with suitable learning processes such as active learning (Schudel, 2010). Active learning allows for learning that can develop from the learners' prior knowledge to more sustainable living and environmental management (O'Donoghue, 2001). A challenge is to respond to changing environmental issues (Schudel, 2010). This challenge is relevant to the Maputaland context, where the local people around iSimangaliso Wetland Park in Maputaland face many social pressures, such as unemployment, a high population growth rate, increasing casualisation of labour and others which will further increase demands on the local marine and coastal natural resources (iSimangaliso Wetland Park Authority, 2008).

It was revealed that although teachers say they could use materials, this is not fully realized in classroom practice, which emphasises on learning content and concept definitions. Teachers have not been trained and prepared sufficiently in suitable teaching methods, particularly training in learning area content. Teachers need guidance in subject-specific teaching methods and understanding of the content (Dada *et al*, 2009). Environmental education service providers can play a role in the professional development of teachers, to address these needs. The use of LSMs, such as those developed by ACEP, can be strengthened by teacher development in the skills and methods needed to implement appropriate environmental learning processes within specific learning areas.

It was found that the marine and coastal knowledge-holding power is outside the realm of the teachers' practice and control. Professional development in the use of environmental education LSMs will need to consider the power-knowledge relationships and normalization strategies that have been discussed. While there is a place and role

for the local conservation authorities and service providers to create learning opportunities in the form of excursions, presentations and the provision of LSMs, they should strive to allow the teachers to take ownership of the informal knowledge that they possess and the formal knowledge which they are being exposed to. Professional development initiatives should strive to allow teachers to have the confidence and skills to lead in environmental teaching and learning in various local contexts, including the classroom.

The environmental education field in South Africa will need to be strategic and draw on the findings and lessons from educational research in order to meet the needs of the curriculum, to meet the learning and teaching needs of the learners and teachers and to encourage active environmental learning for more sustainable living in the rural areas of Maputaland.

6.4 Recommendations

The recommendations are drawn from the research and the mirror data workshops that took place with teachers and developers of materials.

The recommendations established from the workshop with the case study teachers are:

- Improve teacher confidence in carrying out environmental education in the classroom. Encourage classroom engagement before an excursion. Teachers must be given a chance to participate in the excursions, so that they have a sense of authority and will participate. Materials should include more interaction with the actual environment. Service providers or conservation authorities need to meet with the teachers in an informal way to start conversations and break down barriers. They can then identify teachers that they can work with.
- Re-package and consolidate the ACEP materials in order to pull together the best of these materials, without narrowing the scope of environmental learning.

There is good coverage of active learning through all of the materials and they have the same focus areas.

- Use the school principals and the local resource centres as custodians of the materials.
- Have a suitable custodian group (for example Share-net), where materials are housed and used.
- Run professional development courses for teachers (in science and marine education for example) with a registered service provider, such as a university, to meet the requirements of the DoE and use the consolidated content from the materials.
- Scale down the marine content from the ACEP materials (2002 to 2009), to fit into an education module for science teachers.
- Develop locally relevant, sustainable living materials in the context of marine and coastal environment, such as the *Handprints for Change* materials.

The relevant recommendations established from the workshop with the case study teachers were:

- Laboratories or a storage area for materials with a learner who is an assistant who manages this.
- Training that includes experience in the use of materials.
- A specialist is needed in the schools to manage materials.
- The materials have to relate to the curriculum and a handout has to be included to show teachers the curriculum links in both primary and high schools.
- Facts and content for teachers are most important.

- The facts need to relate to learners' everyday lives.
- There needs to be integration and compatibility between the different content areas and other activities and approaches to learning.
- All schools within Maputaland should be allowed free access to the coastline for educational purposes.
- The authorities should regulate and protect the coastline, but must not prohibit visits.
- The locals should be allowed to conduct regulated subsistence fishing, but this must be done without nets and boats.

These recommendations aim to inform the environmental education service providers involved in this study, as well as the environmental education field involved in the development of teaching and learning resources and marine and coastal education. The focus of the study is the use of LSMs and so these recommendations relate to this focus. In drawing on the recommendations mentioned above and the research and literature that has been discussed throughout the study, there are five primary recommendations that should be considered:

1. The consolidation of the existing environmental education materials, to provide environmental content knowledge and activities for active learning.
2. Professional development of teachers in the use of LSMs. The consolidated materials can provide the marine and coastal content and active learning activities for a module to be used in teacher training, through tertiary education institutions approved by the DoE.
3. Professional development and participation of teachers in coastal environmental education to improve confidence in carrying out environmental education activities, accessing environmental education content and using LSMs in the classroom.

4. There needs to be a custodian group to hold and care for the materials and ensure their on-going use.
5. Environmental education materials are needed which are relevant to the local context and local sustainable practices.

6.5 Areas for future research

With the changes that are taking place in the South African curriculum, it will be interesting for a researcher to draw on the findings of this research and conduct a similar study, investigating the use of learning support materials in schools. Exploration of the knowledge assumptions within the curriculum and the relationship between this and teaching practice or the use of materials in schools would be valuable.

I think there is a need for research that looks into the development and use of learning support materials in relation to the professional development of teachers.

There is a definite need to explore in more depth the finding of this research that the “marine and coastal knowledge holding power is outside the realm of the teachers” practice and control”. The context of this finding in Maputaland is a complex but interesting area of research that this study has only touched. There are also social, economic and political aspects which have not been investigated.

6.6 Conclusion

We are at a time on earth where life is characterised by risk and learning for change becomes more and more critical. ACEP began as a result of one of the important biological discoveries of all time. The prehistoric fish, the coelacanth, holds important information regarding evolution and adaptation which is becoming an extremely relevant issue for human beings, as the risks of climate change threaten our existence as a

species. We are in a time where the unsustainable use of our natural resources and the consequences of this are now beginning to become a part of our everyday lives. We will need to adapt and do what we can to extend our time on earth and ensure the livelihoods of future generations.

“Africa’s long and beautiful coasts and the abundance of marine resources can contribute to providing economic, food and environmental security for the continent. These coastal and marine resources, like the rest of Africa’s environmental resources, cannot continue to be exploited in a manner that does not benefit Africa and her people. This is a paradox of a people dying from hunger, starvation and poverty when they are potentially so rich and well endowed.”

- President Mandela, Excerpt from a message to the forthcoming meeting of the Advisory Committee on the Protection of the Sea, to be held in Cape Town in December 1998. (DEAT, 1998).

This study was commissioned by ACEP and has looked at how learning support materials are used in the rural schools of Maputaland. The research design allowed for a wide and in-depth look into this question. The findings of this research are important, at this time, when the South African curriculum is facing new changes. The findings are also important in light of the increasing risks that face the people of Maputaland and more importantly, the next generation of learners from the schools of Maputaland. Quality of education is a critical issue to the teachers and learners from these rural schools. Quality of education will determine the next generation’s capabilities in coping with the many risks of the present and future. We cannot continue to live as we have in the past. Environmental education has a critical role to play here. Reflexivity and more sustainable ways of doing things are needed. LSMs and their use are important part of this education. Nelson Mandela wrote that *“Education is the most powerful weapon that you can use to change the world”*. It is hoped that the findings of this study will contribute to quality education in these schools and the development of materials that support learning for change.

Reference List

Bassegy, M. 1995. *Creating education through research: a global perspective of educational research for the 21st century*. Kirklington Moor Press. London.

Beck. 1992. *Risk Society: Toward a New Modernity*. SAGE: London.

Bernstein, B. 1999. Vertical and Horizontal Discourse: an essay. *British Journal of Sociology of Education*. 20 (2): 157-173.

Binning, K. 2009, March 4. Involvement and contextual and historical background to the ACEP environmental education programme. (Interview with Michelle van der Merwe, M.Ed student, Rhodes University, Education Department).

Chisholm, L. 2004. The state of curriculum reform in South Africa: The issue of Curriculum 2005. In: *The State of the Nation 2003-2004*. HSRC Press: Cape Town.

Cohen, L; Manion, L and Morrison, K. 2007. *Research Methods in Education* (6th Edition). Routledge: London & New York.

Dada, F., Dipholo, T., Hoadley, U., Khembo, E., Muller, S., & Volmink, J. (2009). Report of the task team for the review of the implementation of the National Curriculum Statement. Pretoria: South Africa. Department of Education.

Danemark, Bert et.al. (2002) *Explaining Society. Critical Realism in the Social Sciences*. Routledge: London.

Daniels, H. 2004. *Vygotsky and Pedagogy*. Routledge Falmer: London.

Daniels, H. 2008. *Vygotsky and Research*. Routledge: New York.

Davies, S.M. 2009. *Exploring the Potential of a stratified ontology for developing environmental education materials in community-based coastal marine environmental educational processes*. Unpublished Masters of Education (Environmental Education) thesis. Rhodes University, Grahamstown.

DEAT. 1998. Coastal Policy Green Paper: Towards Sustainable Coastal Development in South Africa. Wynland Printers.

Engestrom, Y. 2008. *From Design Experiments to Formative Interventions*. Paper presented at the ISCAR Conference in San Diego, September 2008.

Fien, J. (1993). *Education for the environment: Critical curriculum theorizing and environmental education*. Victoria: Deakin University.

Gillman, B. 2000. *Case Study Research Methods*. Continuum: London & New York.

Glover, D. 2005. *The evaluation of environmental learning support materials: A case study of the AWARE Teacher's Guide*. Unpublished Masters of Education (Environmental Education) thesis. Rhodes University, Grahamstown.

Hancock, D.R; Algozzine, B. 2006. *Doing Case study research*. Teachers College Press. Columbia University, New York.

Irwin, 2009. *An Introduction to Surveys*. Rhodes University, Grahamstown.

iSimangaliso Wetland Park Authority. 2008. *iSimangaliso Wetland Park: Integrated Management Plan (2009- 2014)*. In: ACER Africa iSimangaliso IMP web page (cited 2009/06/11). Available from Internet URL <http://acerafrica.co.za/isimangaliso>.

Janse van Rensburg, E. & Lotz-Sisitka, H. 2000. Learning for Sustainability: An environmental education professional development case study informing education policy and practice. Learning for Sustainability Project, Johannesburg.

Janse van Rensburg, E. 1999. Environmental Education and Evaluation. MEd Class notes for discussion. Education Department, Rhodes University.

Janse van Rensburg, E. 2001. "They say size doesn't matter"...Criteria for judging the validity of knowledge claims in research. Paper prepared for the Rhodes University Environmental Education Unit Research Methods Short Course.

Jupp, V. 2006. The SAGE Dictionary of Social Research Methods. SAGE Publications, London.

Ketlhoilwe, M. 2007a. Environmental Education Policy Interpretation Challenges in Botswana Schools. *Southern African Journal of Environmental Education*. 24: 171-184.

Ketlhoilwe, M. 2007b. *Genesis of environmental education policy in Botswana: construction and interpretation*. Unpublished PhD thesis, department of Education, Rhodes University.

Lotz, H.B. 1996. *The Development of Environmental Education Resource Materials for Junior Primary Education through Teacher Participation: The Case of the We Care Primary Project*. Unpublished Ph.D. Thesis. University of Stellenbosch, Stellenbosch.

Lotz-Sisitka, H. and Russo, V. 2003. *Development, Adaptation and Use of Learning Support Materials. In support of environmental education processes*. SADC Regional Environmental Education Programme Course Developers' Toolkit. Howick, Share-Net.

Lotz-Sisitka, H.B. & Raven, G. 2001. *Active Learning in OBE: Environmental Learning in South African Schools*. Research Report of the National Environmental Education Programme-GET Pilot Research Report. Pretoria: Department of Education.

Lupele, J. 2002. *Action Research Case Studies of Participatory Materials Development in Two Community Contexts in Zambia*. Unpublished M.Ed thesis. Grahamstown, Rhodes University

Martinez-Alier, J. 2002. *The environmentalism of the poor: a study of ecological conflicts and valuation*. Cheltenham, UK: Edward Elgar.

Mbanjwa, S. 2002. *The Use of Environmental Education Learning Support Materials in OBE. The case study of the Creative Solutions to Waste Project*. Unpublished M.Ed thesis. Grahamstown, Rhodes University

Mbuyazwe, M. 2009. *Exploring the influence of new socio-ecological content knowledge (of marine and coastal resources and issues) in contextualised curriculum and Learning Support Materials development in the Intermediate Phase*. Unpublished M.Ed thesis. Grahamstown, Rhodes University.

NEEP-GET. 2005a. *A critical dialogues monograph. Building capacity for environmental learning in South Africa's education system: Openings for the UN Decade on Education for Sustainable Development*. National Environmental Education Project for General Education and Training/ Share-Net. Howick.

NEEP-GET. 2005b. *Guidelines for developing environmental learning and teaching support materials (LTSM)*. National Environmental Education Project for General Education and Training.

Nelson Mandela Foundation. 2005. *Emerging Voices. A report in South African Rural Communities*. HSRC Press: Cape Town.

O'Donoghue, R & Russo, V. 2004. Emerging Patterns of abstraction in environmental education: a review of materials, methods and professional development perspectives. *Environmental Education Research* 10: 331-351.

O'Donoghue, R. 2007. Environment and sustainability education in a changing South Africa: A critical historical analysis of outline schemes for defining and guiding learning interactions. *Southern African Journal of Environmental Education*. 24: 141-157

O'Donoghue, R., 2001. *Environment and Active Learning*. NEEP guidelines for facilitating and assessing active learning in OBE. Howick, Share-Net.

Pieters, M. 2009, March 4. Involvement and contextual and historical background to the ACEP environmental education programme in the Sodwana Bay area. (Interview with Michelle van der Merwe, M.Ed student, Rhodes University, Education Department).

Ribbink, A.J., & Roberts, M. 2006. African Coelacanth Ecosystem Programme: An overview of the conference contributions. *South African Journal of Science*. 102: 409-415.

Rosenburg, E. 2008. Evaluation of the Eco-Schools South Africa Programme 2007-2008. Howick: Wildlife and Environment Society of South Africa.

Rosenburg, E. 2009. Teacher Education Workbook for Environment and Sustainability Education. Rhodes University Environmental Education and Sustainability Unit, Grahamstown. Distributed through Share-net, Howick.

Russo, V.K. 2003. *A resource-based learning approach to professional development- the case of the ACEE (Rhodes University Advanced Certificate in Environmental Education)*. Unpublished Masters of Education (Environmental Education) thesis. Rhodes University, Grahamstown.

SAIAB. 2008a. *African Coelacanth Ecosystem Programme: Phase II*. Retrieved February 20, 2009, from <http://www.saiab.ac.za/index.php?pid=136>

SAIAB. 2008b. *Historical Highlights*. Retrieved February 20, 2009, from <http://www.saiab.ac.za/index.php?pid=11>

Schudel, I. 2010. *Schools and Sustainability Evaluation Report: Towards A Deeper Understanding of Environmental Education in Context*. Grahamstown, Rhodes University.

Smith-Sebasto, N.J. 2000. Potential Guidelines for Conducting and Reporting Environmental Education Research: qualitative methods of inquiry. *Environmental Education Research*, 6 (1), 9-26.

Snow, B. 2008. *Ocean Literacy and Education*. Anglo American Chairman's Fund Proposal: 2007-2008. SAIAB, Grahamstown.

Snow, B. 2009a, February 9. Contextual and historical background to the ACEP environmental education programme with emphasis on involvement in the Sodwana Bay area. (Interview with Michelle van der Merwe, M.Ed student, Rhodes University, Education Department).

Snow, B. 2009b, February 21. Contextual and historical background to the ACEP environmental education programme. (Interview with Michelle van der Merwe and Rejoice Batyi, M.Ed students, Rhodes University, Education Department).

South Africa. Ministry of Science and Technology. 2004. *Address by the Minister of Science and Technology, Mr Mosibudi Mangena, at the African Coelacanth Ecosystem Programme, Gallagher Estate*. Retrieved February 20, 2009, from <http://www.info.gov.za/speeches/2004/04111209151001.htm>

Stake, R. E. 1995. *The Art of Case Study Research*. Sage Publications: London.

Stake, R.E. 2000. Case Studies *In*: Denzin, N.K & Lincoln, Y.S (eds). *Handbook of qualitative research*. Sage Publications: London.

Taylor, J. 1997. *Share-Net: A Case Study of Environmental Education Resource Material Development in a Risk Society*. Unpublished Ph.D. Thesis. Rhodes University, Grahamstown.

The Witness. 2010. *Education Overhauled*: July 7, 2010.

Young, M. 2008. *Bringing Knowledge Back In*. In: From social constructivism to social realism in the sociology of education. Routledge: London & New York

Appendices

Appendix 1: Contextual Profiling Interview Transcription

D2

Developer2 Interview

Current work description: **Environmental education consultant**

Place of work: self-employed in Port Elizabeth

Place: her home in Walmer, P.E.

Date and time: 04/04/2009 at 13:00

Q: What is your involvement (past and/or present) with ACEP and the environmental education programme?

A: Was employed full-time with ACEP Environmental education and was involved in developing and running the resources and workshops. Was part-time in 2004 and became full-time employee in 2005 until October 2008.

Development of the following materials:

- The three booklets (helped Berny revise them, create stapled notes of the booklets for the under-resourced schools, redid them towards the curriculum).
- Ocean exploration
- Careers
- CD Rom
- Lotto ones (being done now)
- All the packs and kits (climate change kit)

Q: With who and where has this involvement been? (eg. Schools in the Grahamstown district)

Schools nationwide-Eastern Cape, KZN, Cape Town, Bloemfontein, Johannesburg, Palaborwa, Polokwane, Graaff Reneit, Cradock

Q: How do you promote school involvement and implement the workshops and ship visits?

It depends on the context and the area. For e.g. Joburg Zoo invites those schools on their network base to workshops, KZN Wildlife organize their own schools involvement. Some are driven by the organisation or DoE, DST. Or an invite is sent to all schools. Shows such as Sci-fest and Techno ext? This draws in schools. They have had ACEP information stands.

Q: What methods and approaches did you use when using/developing the ACEP materials?

Depends on where they went. Could be a more technologically orientated place, or science orientated (eg. Sci-fest). All the resources link to the curriculum. At first ACEP's focus was on the coelacanth but then it broadened out and even brought in weather and catchments.

The resources cater for many different subjects. Most focus is on Natural Science as this is the easiest subject where the teachers can implement the materials. A lot of the materials are aimed at Natural Science.

Q: What social and ecological issues is the ACEP environmental education programme and its materials responding to and how?

Many schools are under model C schools-rural/township and they are very under-resourced. The teachers battle to implement the new curriculum as they do not have the knowledge and skills. The key is to show them how to link the resources to the curriculum. It depends on the teachers and their enthusiasm. Some are negative, they complain of having no video player whereas others make the most of what they have or work with the little they have-they make a plan like bringing their own video player to school. Overall however the teachers enjoyed the resources and work with them. If there were set-backs or comments (from the teachers as well as their evaluation forms) then recommendations and suggestions were given to help them.

The biggest challenge however is that the feedback may be positive but how to see if the resources are being implemented and how?

The problems with the workshops that the teachers complained about were the time of the workshops (after school) and the food. But generally the feedback was positive.

Inland there are only certain teachers which are not interested and consider the resources to not be useful but most were able to use them-show the video, taste „sea water“. The key was for them to show the links to the sea e.g. eating fish, oxygen, painting the walls. The ocean is a part of their lives. Trying to get across that the marine environment is important. Focussed then on careers and what the sea gives us, not littering etc.

In the more rural and township schools the teachers either come from a complete science or no science background. They therefore have no ability to implement the resources. Many cannot even do the basic maths in the resources.

Q: Are there any sustainability practices (e.g. materials workshops with teachers) which are responding to the issues and risks that you have mentioned?-I just brought up the ship visits.

Karen was involved. They took teachers and learners (four) to sail with the ship.

Otherwise they also did tours and visits to the research ship. These were very well-received and were an excellent tool in motivating the teachers and learners to use the resources. They could now be more familiar with the content.

Not many of the schools are Eco-schools. Palaborwa was the one school with an „eco“ mindset.

Curriculum links: Worked with a DoE curriculum specialist from PE when linking the resources to the curriculum (especially the 3 booklets). A school teacher helped with the

CD rom and then piloted it at the school. All materials are piloted first and then improved.

The workshops were run with DoE-they take part in a workshop and then helped develop the workshop for the teachers.

Q: Any future recommendations in your experience and opinion?

Do more workshops with DoE and work on the materials to get them into more schools. You have to work with the right people from DoE though. The maths/science based people-run workshops with them. Find a focus area they need to cover and then work with that. For example she did Astronomy (part of Grd 6 syllabus) help add to the lessons, do things that fit in with this. DoE can then show schools that how they can run their normal syllabus but that the ACEP programme can link to the syllabus. There might be more buy in.

There are lots of syllabus links. For example fossils is in the syllabus and ACEP ran workshops on this subject and had resources that the teachers could use to supplement their teaching and lesson plans.

The workshops for teachers are very important. If the teacher likes the material then they use it, so they need to be shown the value of it.

The headmaster is also very important. If negative and uninterested its not done. For example the school that looked run down and was not keen on doing workshops. But down the road the primary school was very enthusiastic and took part.

A few private school teachers thought the materials were too basic for their standards. The resources were developed with the more rural/township schools in mind. But many private schools loved the resources , it depends on the teacher and school. (I say majority over minority!)

ACEP materials and workshops overall were well received. The workshops are good in that the teachers are able to evaluate the learners. The workshops are set up so that the teachers take part and can then do the same technique/format with the learners. Workshop the learners.





*summaries of evaluations and school data bases @ SAIAB otherwise Karen or Berny

ICT-materials not brilliantly received as many schools do not have computers. A teacher at collegiate (PE) used them at two schools. Many teachers feel it is good information for them-not necessarily the learners. The workshops targeted schools that had computers.

Berny and Karen did not have the budget to check or follow up on how the resources and schools were doing (implementation).

Sodwana used all the materials-it's a good area to study

Appendix 2: Questionnaire

A questionnaire for gathering information on the use of ACEP materials by teachers

Who used the materials and where?

1. Name: _____

2. School: _____

3. Which grades do you teach? 4 5 6 & 7

4. Which learning areas do you teach? NATURAL SCIENCES, TECH, ENGLISH

5. Your story: Write down how you found out about ACEP and got materials.
THERE WAS MY SCHOOL IS IN A PROJECT FOR ECOSCHOOL SO THERE WAS A LETTER ISSUED TO MY SCHOOL AND THE CONVENOR IS SBUSISO WORKING FOR WILD LIFE SO WE HAVE AN WORKSHOP THEY ISSUE THE MATERIAL

6. What curriculum topics/themes were the ACEP materials most useful for?
WATER CYCLE
FOOD CHAIN
SOLUTION
TRANSFER OF HEAT

7. What are the marine and coastal issues in your area?
SOCIAL :
- TURTLE EGGS THERE ARE TAKEN BY PEOPLE FOR
- THE ENVIRONMENT
- USE THE WETLAND FOR PLANTING
- CUTTING OF TREES
- PLANTING OF ALIEN PLANTS

Your contact details:

1

Which of these materials have you used? (Tick if yes)



Foundation Phase workbook

- Have you seen this material?
- Have you attended a workshop on this material?
- Have you used the material?

Your assessment:

The material was (Tick a box):

- 1. not very useful
- 2. useful
- 3. very useful



Video 2: Exploring Ocean careers with Old Fourlegs

- Have you seen this material?
- Have you attended a workshop on this material?
- Have you used the material?

Your assessment:

The material was (Tick a box):

- 1. not very useful
- 2. useful
- 3. very useful



Intermediate Phase workbook

- Have you seen this material?
- Have you attended a workshop on this material?
- Have you used the material?

Your assessment:

The material was (Tick a box):

- 1. not very useful
- 2. useful
- 3. very useful

Fossil Kit

- Have you seen this material?
- Have you attended a workshop on this material?
- Have you used the material?

Your assessment:

The material was (Tick a box):

- 1. not very useful
- 2. useful
- 3. very useful



Senior Phase workbook

- Have you seen this material?
- Have you attended a workshop on this material?
- Have you used the material?

Your assessment:

The material was (Tick a box):

- 1. not very useful
- 2. useful
- 3. very useful

Climate change Kit

- Have you seen this material?
- Have you attended a workshop on this material?
- Have you used the material?

Your assessment:

The material was (Tick a box):

- 1. not very useful
- 2. useful
- 3. very useful



Video 1: Ocean Exploration with Old Fourlegs

- Have you seen this material?
- Have you attended a workshop on this material?
- Have you used the material?

Your assessment:

The material was (Tick a box):

- 1. not very useful
- 2. useful
- 3. very useful

Exploring ocean currents

- Have you seen this material?
- Have you attended a workshop on this material?
- Have you used the material?

Your assessment:

The material was (Tick a box):

- 1. not very useful
- 2. useful
- 3. very useful

Remote Operated Vehicles (Physics)

- Have you seen this material?
- Have you attended a workshop on this material?
- Have you used the material?

Your assessment:

The material was (Tick a box):

- 1. not very useful
- 2. useful
- 3. very useful

Your use of an ACEP resource

Select an example of the resource that you used the most.

- Title of the resource: CREATURES OF THE DEEP AND OTHER OCEAN HABITATS
- List lesson(s) you have taught with the ACEP material:

Learning area	Grade/s	Details of ACEP material used	Learning outcome/s
NATURAL SCIENCE	7	KIND OF FISHES	COELACANT FISH IS THE FISH WHICH WAS CAUGHT IN SODWANA BAY WHICH WE NOT FAMILIAR WITH IT ACTIVITY

- Please explain to me how you used the ACEP material.

I HAVE USED IT AS A VISUAL AID
 BRING THE CHART OF DIFFERENT KIND OF FISH
 AND I TOLD THEM THAT ONE IT NOT SIMILAR
 TO THE OTHER ONCE I WAS SEEN I CAUGHT BY
 PETER TIM IN SODWANA BAY AND IT IS BLuish
 COLOUR AND DIFFER EVEN THE LEGS

4. What learning activities were undertaken with the material?

Tick	What the learners did	ACEP topic/activity
✓	Listened to a presentation	
✓	Picked out, defined and discussed key ideas	CANYON
	Read for ideas or information	
	Wrote about / reported on a topic /issues	
	Conducted an experiment	
	Undertook a local investigation	
✓	Undertook any action projects	PLAY A DRAMA HOW PETER TIM CAUGHT THIS FISH

5. What marine and coastal issues were learnt about by using the materials in your classroom?

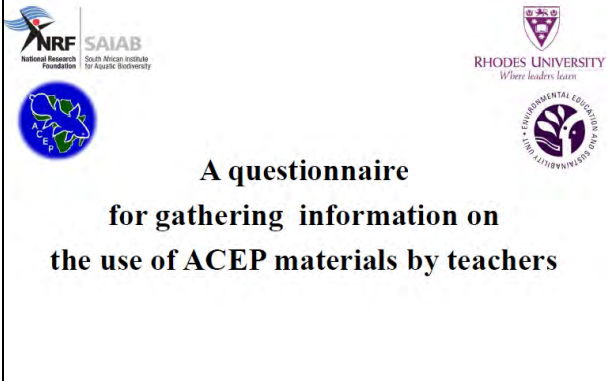
TO take of the fishes which make
our place be proud of as
we have Isimangaliso

6. Which of the other ACEP materials and activities would you recommend to other teachers?

Why?

I recommended this material because
science is about practical things
but more of our teachers done it
in theory so it helps.

Appendix 3: Visual Prompt Slides



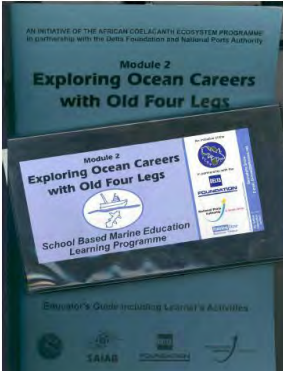
**A questionnaire
for gathering information on
the use of ACEP materials by teachers**

Who used materials & where?

1. Name:
2. School:
3. Which grades do you teach?
4. Which learning areas do you teach?
5. Your story: Write down how you found out about ACEP and got materials.
6. What curriculum topics/themes were the ACEP materials most useful for?
7. What are the marine and coastal issues in your area?

Your contact details:

Which of these materials have you used?



Tick if yes

- Have you seen this material?
- Have you attended a workshop on this material?
- Have you used the material?

Your assessment:
The material was (Tick a box):

- 1. not very useful
- 2. useful
- 3. very useful

Your use of an ACEP resource

Select an example of the resource that you used the most.

1. Title of the resource:
2. List lesson(s) you have taught with the ACEP material.

Learning area	Grade/s	Details of ACEP material used	Learning outcome/s

3. Please explain to me how you used the ACEP material?

Use of an ACEP resource contd...

4. What learning activities were undertaken with the material?

Tick	What the learners did	ACEP topic/ activity
	Listened to a presentation	
	Picked out, defined and discussed key ideas	
	Read for ideas or information	
	Wrote about / reported on a topic /issues	
	Conducted an experiment	
	Undertook a local investigation	
	Undertook any action projects	

5. What marine and coastal issues were learnt about by using the materials in your classroom?
6. Which of the other ACEP materials and activities would you recommend to other teachers? Why?

Appendix 4: Case Study Interview with Coding for AM 1.2: Teachers' implicit use of materials

H2T

Case H2 Teacher interview

Date: 08/10/2009 08:19am

M: I just have a few questions, could you please describe a successful marine and coastal learning activity that has taken place at your school?

T: The marine and coastal lesson that was successful was we went to Sodwana bay and so we learnt more about the marine animals and marine plants and the learners were getting knowledge there together with us. As the teachers we gain a lot because some of the things we haven't know, so by then, so it was very easier for us to find that is this the plant is this the animal even though when we go there alone we never notice that this- it can be the living thing. But until we went there with the people from KZN Wildlife they teach us very well it was just a fantastic lesson to us. We enjoyed it a lot and we wish it can happen time and again.

M: And how does the marine and coastal environment feature in any of your lesson plans and exam preparation?

T: So it features a lot when coming to ecosystems and together with regard to food chains cause we find that even in the case of animals the way they eat each other the way energy is lost and gained

M: And could you then give an example of a question or a lesson or a question in an exam just an example that would feature the marine and coastal environment?

T: So when the learners have to explain about the environment or the habitat of some of the marine animals, where like, they can say where is the fishes they can be found and the lifespan and the way they feed themselves. Yes.

M: And what learning materials have you used and how do you teach with these materials?

T: Mmm, normally in class we just do it theoretically even though when we went to Sodwana, it was like a practical and that is why we enjoy it a lot because when learners put hand on something it is not easy to forget. Unlike when we teach them in class and making some drawings- this is like this and that, it is not like the way and the time they have to touch like this is a fish it feed on this type of a plant.

M: And what materials in the classroom do you use?

T: So in the classroom we just use the chart and we use to draw on the chart or we just draw on the board and we find that some of us we are not good in drawing and so it becomes difficult for a learner to find some of the features or the structures. Is this a limb? Is this a fin? Is this whatever... unlike when they see with the naked eye.

M: And so do you use textbooks when it comes to the lessons?

T: I am using a textbook for preparing the lesson, so then I just teach from the textbook.

M: And other materials that help, have there been any other materials which, you know and some people develop extra materials which supplement the teaching. Have there been any?

T: No, it's just like in the case of Grade 12 in Evolution, we are having a DVD. The thing is we were having the DVD's with other chapters, the thing is the syllabus is changing time and again.

M: *What topics around marine and coastal are the learners enjoying the most?*

T: So the topic they are enjoying a lot in the case of marine is that, the activities that they do in close like that, so the time they have to see those animals doing practical things.

5:00

M: *And where does the curriculum fit in with this marine and coastal? What is included from the curriculum?*

T: So the OBE it do fit a lot in this curriculum. Because learners are the ones that must do the work. Yes the teacher remain the facilitator. It's not like the old days whereby the teacher was the one to do a lot of work. But now the learners are the one that are doing a lot of work. We just come out with the topic, so the learners are the one that are going to sit on it, discuss it so the teacher is there to help them. Yes.

M: *And its fits in, um, within these marine and coastal topics how does it fit in the curriculum?*

T: It fit a lot like in the case in the one of the pyramids, like the one of foodchains as I've said so we find that when maybe we are there in marine, so learners have to see, maybe this is a plant, this is an algae, so the animal that fit on this kind of plant is this one showing them, so and then this animal is the one the fish is going to eat and then life continues like that

M: *What materials or support materials would you like to use within your teaching?*

T: Mmm, like the DVDs and maybe the videos are very much important. Because...like in the case of practicals it is difficult to do some of the practicals in class but if maybe we can get time maybe invited to the marine land like the time we went to Sodwana so if maybe we can get lessons like like it can mean a lot to our learners.

M: *And what material do you think has been the most useful? Learning or hands-on learning support material?*

...you mentioned the DVD?

T: I should think...what do you call it.. the chart, yes the drawn chart some of them they are useful, unlike if I can say I can draw myself, because some of us we are not good at drawing.

M: *Do you have any examples in the school of an activity or materials that you used that you can show me?*

T: It's only the DVD on evolution.

M: *Can I see that? Do you know where it is? So that I can take a picture?*

Do you have any examples of learners' work that they have done around marine and coastal issues or something related to that that I could just see what the learners are doing?

T: Yes I do have.

M: *It would be so nice to see...*

T: It's just that I forgot to inform them and some of them they don't have their books with them because now is the time for revision so sometime they don't have the books now because they are just revising but I will try to get some.

M: Yes maybe we can check if some of them have them here otherwise the next time I come. That's all I have to ask, thank you.

T: Let me just fetch the DVD now.

Appendix 5: Case Study Observation Sheets with Coding for AM 2: Observed Teaching Practice

H10

High School 1 Observations

Date: 05/10/2009

Time: 11:54

Recording Extract:

To test whether you understand...you see the way the paper is arranged according to performance. NCS 1.right and it was quite, a paper on the last topic that we did at the end of last term.

No 1 when you read the question you should actually understand the question. And mark the key words what it is asking. These key words will help you answer the question. You must have the key words, you should pay attention. There may be a lot of stories but the key words that you must look for. Now section A this is the short answer question. Q1 (see paper) ...name the instrument capable of showing that a body is charged. He is showing them the instrument and rubbing it on his head to show charge (Figure 2). I remember I brought the instrument here. Do you remember? No! no! That's the problem that we are not in the lab. (recording continues)

Pictures:

Figure 1: learners looking at test paper that they wrote

Figure 2: teacher showing the instrument that shows charge by rubbing it on his head

Figure 3: Teacher writing the answers on the chalkboard and explaining them with diagrams

Figure 4: Example of learner's work given by the teacher (a Simple Practicals activity)

Figure 1



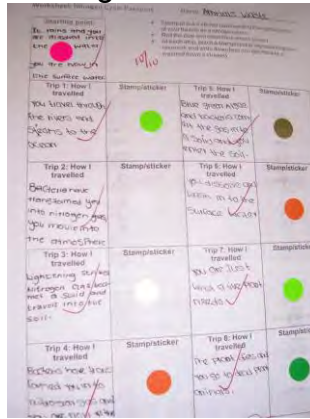
Figure 2



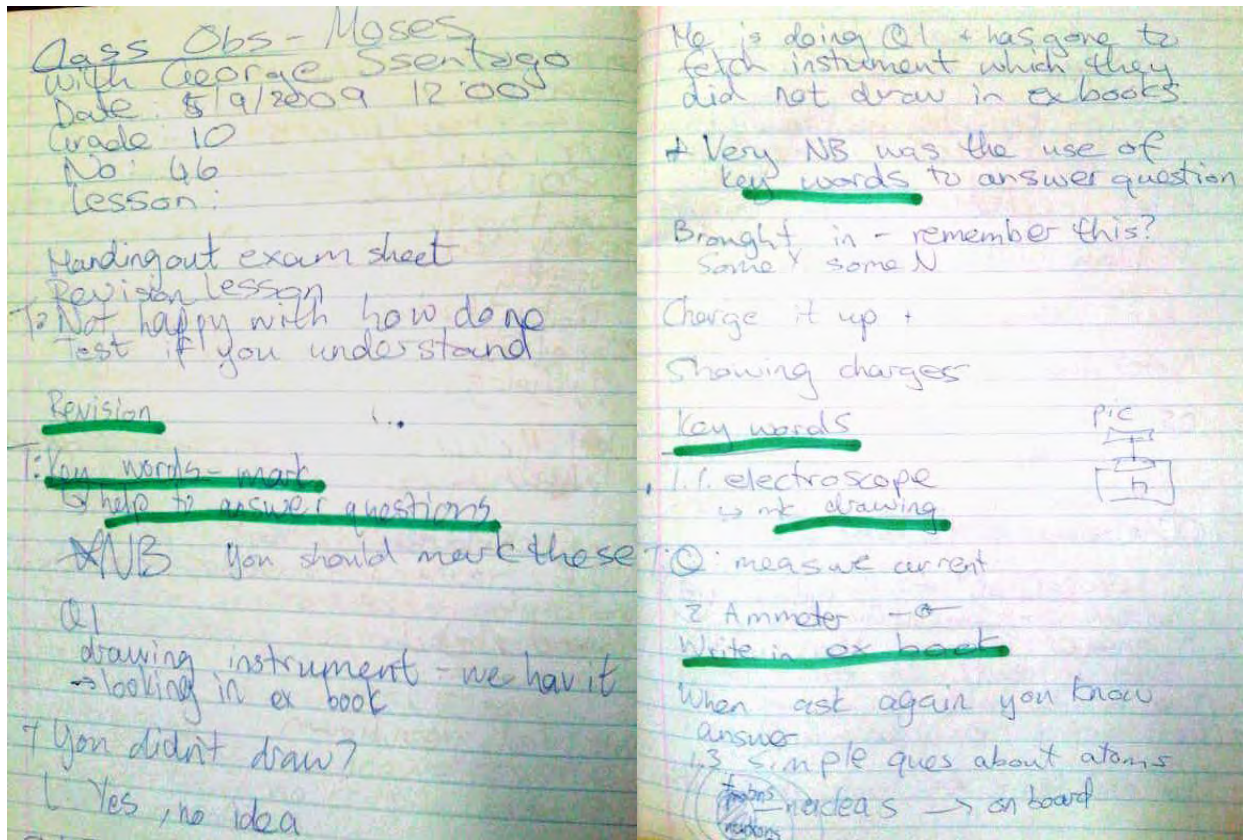
Figure 3



Figure 4



Example of Journal Notes:



Appendix 6: Analytical Memo 1.2 Teachers' implicit use of materials

Category	Summary of comment/statement	Data source
Teacher intent (pink)	Curriculum topics ACEP materials most useful for-nitrogen cycle, magnetism, environmental issues	SH1
	Fossil kit: Used it after school with science club members. Voluntarily done. Learners were given background to the formation of fossils, then advised to go to sodwana and examine the rocks Used it with grade 8-12 (the fossil moulds and worksheet) for investigation	SH1

Fossil kit: Asked questions about how to age fossils, how they formed	SH1
Fossil kit: they read the posters	SH1
Fossil kit: some of them went to Sodwana and looked for fossils	
I recommend the fossil kit to educators who teach NS and life sciences. It needs also to be improved to be in line with NCS.	SH1
If using the ocean exploration with old fourlegs video workbook in Grd 10 LFSC could achieve the LO of: learners will be able to identify what a coelacanth are and how special are they?	SH2
The material like pamphlets, posters and videos may be useful to some learners as they will be trying to make understanding possible. Some of the things becomes simpler and easier when you see them rather than when you heard about them	SH2
If using the ocean exploration with old fourlegs video the following activities could take place: Video, the educator presenting a topic to learners	SH2
Case study learners can skim or key ideas and discuss them	SH2
Case study can be read in class	SH2
Debate learners can report on the issues as topics they were reading about	SH2
An experiment can be conducted so as to gain more knowledge	SH2
Investigation about the local area can be done so as to know more about their knowledge about topic	SH2
Action project is also useful because learners will be able to identify their understanding	SH2
I will be teaching about environmental studies with regard to pollution, the learners must learn that they must not pollute marine and coastal in fact that this will harm marine lives	SH2
The learning materials that I will suggest will be the following-posters, videos and pamphlets so that it will help to equip my knowledge and understanding	SH2
The curriculum topics where materials were most useful were in physics – electromagnet, chemical systems and in technology; a lot in electricity	SH3
Would recommend the mathematics worksheet	SH3
Could use the senior Phase workbook –Ecology of the Coelacanths in Grade 10 Physical science for LO 2 and 3.	SH4
Could use it to do experiments for testing substances, whether the substance is acidic or alkaline. Test whether the material is a metal or non-metal. Does it conduct electricity or not	SH4
The learners could listen to a presentation of the ecology of coelacanths using the resource	SH4
The learners could undertake any action projects by doing a project on the ecology of coelacanths using the resource	SH4
The learners will know about food chain and animal living in the sea and near the sea. Even the type of useful stones and water	SH4
I would recommend the electric circuit so that children will know how to use a circuit and understand it	SH4
The ACEP materials most useful for chemical reactions, nitrogen cycle and magnetism	SH5
The senior phase workbook –ecology of the coelacanths could be used in the life sciences for LO3 science, technology and environments and learners will be able to know how coelacanths adapt to their environment.	SH5
The ACEP materials could be used to see how different living components adapt to their ecosystems (environments)	SH5
The material could be used to do a presentation on the ecology of coelacanths	SH5
The material could be used to undertake an action project by doing a research on the ecology of coelacanths	SH5
The learners should learn how coelacanths adapt to its changing environment	SH5
I would recommend global warming and coelacanths. As global warming is a serious issue, I think every teacher need to have ideas on that it does not affect only the human being but all living	SH5
The ACEP materials was useful for nitrogen cycle, magnetism and chemistry practicals in curriculum	SH6
The climate change kit was used in physical science Grade 10 lesson 1 and 3 (sea level rise & convection currents)	SH6
The climate change kit was used: we pored clear water in a container and waited until the water was no longer moving and we slowly added coloured water then it was observed that water was moving or it had current, also poured pure water and the we added ice that overlapped above the water level we marked and waited for the ice to melt the water level raised.	SH6
The climate change kit was used to conduct an experiment on sea level and ocean current	SH6
Would recommend the fossil kit and science kit. For fossil kit it assists learners to understand the fossils and evolution. Science kit helps learners to understand and clearly see how the practicals, nitrogen cycle. I would recommend other educators to use them.	SH6
It was interesting and the material was right and the learners enjoyed it. And the material help us because for that time we had no materials in our school.	SH7
There is no topics were useful.	SH7
The Simple Pracs Grade 10-12 Nitrogen Cycle was used for Grade 10 in Physical science	SH7
We use the stamps as the resources with different colours, we have 10 learners per each group and do that activity and at the end of the lesson the learners knew how the nitrogen cycle comes from.	SH7
the learners listened to a presentation on the nitrogen cycle	SH7
The learners picked out, defined and discussed key ideas around the nitrogen cycle	SH7
The learners conducted an experiment on the nitrogen cycle	SH7
The ACEP materials was right, it help us to assist the learner when we are using it as our resources. The material that is not enough at school is about waves and light.	SH7
The ACEP materials are useful for chemical reaction, nitrogen cycle and magnetism in the curriculum	SH8
The workshop was interesting and fruitful. It taught us a simple way of doing practical.	SH9
The ACEP materials were useful for ecosystem in the curriculum	SH9

The ACEP materials were useful for magnetism, nitrogen cycle and chemistry in the curriculum	SH10
The ACEP materials were useful for chemical system change and electromagnetism in the curriculum.	SH11
The ACEP materials were useful for matter and materials and earth and beyond in the curriculum	SP1
The Simple Pracs (natural science): solution & saturation could be used in grade 6 & 7 for matter and material; hot and cold density for earth and beyond and for Grade 7 maths scientific methods for measurement	SP1
I tested different materials whether they can dissolve in water or not eg. salt in water. And view whether the solution will become saturated and does it happen I cold water and also in hot water	SP1
In using the Simple Pracs the learners listened to a presentation, picked out, defined and discussed key ideas and conducted an experiment on solution and saturation	SP1
I would recommend Simple Pracs for the classroom because makes easy for the learners to understand some of the aspects in Natural Science. But it what I think because I haven't use it. It makes things simpler.	SP1
The ACEP materials were useful for global warming and nature biodiversity in the curriculum	SP2
The Ocean Exploration with Old Fourlegs was used for Grade 7 Natural Science	SP2
I photocopied four booklets. Asked learner differentiate kinds of fish they know. They identified fishes. I explained the re-discovery of extinct creature (coelacanth)	SP2
The learners listened to a presentation on amazing fish	SP2
The learners read for ideas or information and wrote notes on what they learnt	SP2
I think the module that stole my mind was ocean exploration with old fourlegs and exploring ocean careers with old fourlegs	SP3
The ocean exploration video was used for Grade 4, 5, 6 Natural science for science investigation-exploring into science	SP3
We combined intermediate classes and borrowed video and cassette player	SP3
The learners listened to a presentation, picked out, defined and discussed key ideas, read for ideas and information, wrote about/reported ion a topic/issues, undertook a local investigation and undertook action projects	SP3
In workbook because teacher need to be explored into deep sea picture for they cant teach about them which lead to a lack of aquaristsists science	SP3
The ACEP materials were useful for water cycle, food chain, solution and transfer of heat in the curriculum	SP4
The creatures of the deep and other ocean habitats was used with Grade 7 Natural Science for kinds of fishes. Coelacanth fish is the fish that was caught in Sodwana Bay which we not familiar with it activity	SP4
I have used it as a visual aid bring the chart of different kind of fish and I told them this one it not similar to the other one it was seen caught by Peter Tim in Sodwana Bay and it is bluish colour and differ even the legs.	SP4
The learners listened to a presentation, picked out, defined and discussed key ideas on the canyon and undertook action projects: play a drama how peter tim caught this fish	SP4
I recommend this material because science is about practical things but more of our teacher done it in theory so it helps.	SP4
I found it very useful. It can help teachers and our learners to do things practical. Our learners can learn to keep nature and clean it. They will have love to be come an environmental members	SP5
The materials can be used for Sea level and rise. Because it can help the water cycle ad food chain.	SP5
The senior phase workbook could be used for Grade 7 Natural Science in Global Warming and Coelacanth for the importance of global warming ad prevention of it and underlie causes.	SP5
I can photocopy some pages from the book. Let learners to draw the picture on global warming and coelacanth. Let them write to their ex books, the teacher ca set some questions on what they learnt	SP5
The learners could listen to a presentation, pick out, define and discuss key ideas, read for ideas or information, write about/report on a topic/issues, conduct a experiment (science practical) and undertake local investigation (they went to the library) and draw diagrams like unwanted trees and wanted.	SP5
Yes because it is going to encourage our learners to look after the environment ad our learners ca be good to do experiment and like to investigate things and to involved in this career	SP5
The ACEP materials were most useful for helping our learners to get more knowledge	SP6
The senior phase workbook could be used for Grade 4 to 6 Natural Science Global warming and coelacanth	SP6
I will make photocopies and give to the learners and explain to them	SP6
The learners could listen to a presentation, pick out, discuss define key ideas, read for ideas or info, conduct a experiment and undertake a local investigation	SP6
Foundation phase workbook: it is important to let the young children to know about their environment and their surroundings so that they will equip themselves in earlier stage	SP6
ACEP materials useful for scientific investigations through practical experiments with relevant resources	SP7
Would recommend: yes, paints (coloured) for art and culture and measuring tape for maths so the kit will be useful even in other learning areas. All in all im glad that things in NS will be practical	SP7
The ACEP materials were useful for formation of fossils, rocky shore studies Habitats and adaptation, ecosystem, deep sea life, mollusca, vertebrata etc	SP8
Creatures of the deep sea and ocean habitats could be used in Grade 6 Ns in the Teachers guide and activity book for LO2 Constructing science knowledge as well as in Grade 7 for LO3 Science, society and environment	SP8
The fossil kit can be used in Grade 6 NS for LO3 science, society and the environment	SP8
I have used the ACEP material in planning, preparing my lesson plans and selecting the relevant topic eg. vertebra, I have used also to conduct experiment on how the fossils are being formed	SP8
The learners listened to a presentation on coelacanth habitats, read for ideas or info on adaptation to the sea life, wrote about/ reported o corals of rocky shores, conducted an experiment on sea conditions (food, light, temperature), undertook a local investigation on the rocky shore habitat ad undertook an action project on protecting the sea life from other external factors	SP8
Recommend: Coelacanth and other special sea creatures videos, exploring ocean currents, creatures of the deep and	SP8

other habitats. Its gonna help educator to absorb more information	
The ACEP materials can be used for biodiversity and environmental science in the curriculum	SP9
Recommend the Simple Practicals for the classroom, practical ad inline with the current global, environmental issues. Fun and cost effective	SP9
The ACEP materials are most useful because we do some practical things with them	SP10
Recommend the senior phase workbook it is good for the learners because it got more information	SP10
Ok, ja, I think that's when we went to Sodwana bay and we had a workshop whereby first it was a workshop for teachers and we were given materials, just before making moulds of fossils. Then we also given charts, then we had discussions about the tortoise.	H1T
And then afterwards we had to take the learners. They were also addressed and then they were taken along the beach to look at the coastline.	H1T
And so we had a discussion and we found that it was because of the salt water entering into the fresh water so that the fish, which are in the fresh water could not survive so they had to die	H1T
Along the coast we discovered that there are certain minerals and we were told it was ...um..titanium? Along the coast and we were told that they weren't to mine it as it may effect the natural environment along the coast. I think that it was quite informative and we also participated in some competitions.	H1T
They do fit because according to the NCS there is, we are supposed to relate what we teach in the classroom to the environment, to the outside experience and this area is near the coast, so the coast is actually our environment and the activities that take place along the coast effect the learners so they need to know. And they generally after school, they get jobs related to the coastal line and whenever each time we teach science when we want to look outside, the examples we usually give is related to the coastline. Because that is where we live so I think it is quite important that we get some good information.	H1T
Eh..the materials are actually related, maybe the materials that you have already given to us the ones we got from the box, which were distributed to us. The fossil one? The fossils we have not fully used there as such. But the materials when we went for example and we had the competition we got a globe which the geography class is using, we got a wind vain, we got a rain gauge, and we put it outside ..I think I need to ask the teacher what happened..because we were able to get the amount of rain that usually falls in our area. We were able to determine how much.	H1T
Actually we had to make research, it was mainly research concerning the coast. Related. Then I was , it was concerned with the life along the coastline. Then learners had to come up with certain research. One of the research was encroachment of the community on the coastline: destroying the coastline, entering into the forest cutting the trees and so on. Then another one was the activities of the people around the coast effecting the life of the animals that live in the water like people who are farming using fertilizer and entering the streamlines and effecting life. Like eutrophism which we study in the classroom. So we had to go and they find out that along the streams of the river, trees were overgrowing and covering the water which made it difficult for the animals that stay in that water to live properly. So they had to write on that one. And they also had to write on, make also research on how the peoples activities are effecting the forests which are supposed to be preserved with the natural trees which take a very long time to mature but people go to cut them to make cupboards and handcrafts. And once these trees are cut it will take another 100yrs before they mature but the people are interested in making money and there is no replacement. So it means the forests are gradually being wiped out.	H1T
Eh I think it was. Because to give them an insight and then at the end they were giving proposals of how they could preserve the environment and I remember in their research they were saying that these trees, instead of having the nursery for foreign trees they should have the nurseries for the indigenous trees and then keep on replacing them and planting.	H1T
The topic, mainly they enjoyed the topic when it came to the tortoise. The animals that lay eggs, they were interested maybe to visit. We had been promised that during the rainy season they would be taken because usually it is at night, they come out at night. They would be taken along the coast and they would see when the tortoise come out and lays its eggs and so on. I think they enjoyed that topic a lot. And I remember we moved along the coast seeing the types of tortoise and how big and the size and so on. We are told they are so big, and heavy and slow. I think that topic they enjoyed, the marine life.	H1T
eh, um...marine.its becomes...I don't know..the materials that should be integrated.. for example this one we talked about.. the nitrogen cycle. I found that one quite important. That the nitrogen cycle how it goes that it even goes into the ocean then nitrogen comes back and so on and so forth. Such materials I think are very important. That the kids they enjoyed that game and through that game actually they understand when we talk about the nitrogen cycle. It was quite important. Eh..I think materials of that nature should be developed. Yes. I think that one was one of the successful materials that you have made. It is quite good. It's wonderful.	H1T
The marine and coastal lesson that was successful was we went to sodwana bay and so we learnt more about the marine animals and marine plants and the learners were getting knowledge there together with us as the teachers we gain a lot because some of the things we haven't know so by then so it was very easier for us to find that is this the plant is this the animal even though when we go there alone we never notice that this it can be the living thing. But until we went there with the people from ekzn wildlife they teach us very well it was just a fantastic lesson to us. We enjoyed it a lot and we wish it can happen time and again.	H2T
so it features a lot when coming to ecosystems and together with regard to food chains cause we find that even in the case of animals the way they eat each other the way energy is lost and gained	H2T
so when the learners have to explain about the environment or the habitat of some of the marine animals where like they can say where is the fishes they can be found and the lifespan and the way they feed themselves.yes.	H2T
So in the classroom we just use the chart and we use to draw on the chart or we just draw on the board and we find that some of us we are not good in drawing and so it becomes difficult for a learner to find some of the features or the	H2T

structures is this a limb is this a fin is this whatever unlike when they see with the naked eye	
I am using a textbook for preparing the lesson, so then I just teach from the textbook	H2T
no, its just like in the case of grd 12 in evolution we are having a dvd. The thing is we were having the dvds with other chapters, the thing is the syllabus is changing time and again.	H2T
so the obe it do fit a lot in this curriculum. Because learners are the ones that must do the work. Yes the teacher remain the facilitator. its not like the old days whereby the teacher was the one to do a lot of work.but now the learners are the one that are doing a lot of work. We just come out with the topic, so the learners are the one that are going to sit on it, discuss it so the teacher is there to help them.yes	H2T
It fit a lot like in the case in the one of the pyramids, like the one of foodchains as ive said so we fiind that when maybe we are there in marine so learners have to see maybe this is a plant this is an algae so th eanimal that fit on this kind of plant is this one showing them, so and then this animal is the one thefish is going to eat and then life continues like that	H2T
Mm like the dvds and maybe the videos are very much important.Because...like in the case of practicals it is difficult to do some of the practicals in class but if maybe we can get time maybe invited to the marine land like the time we went to sodwana so if maybe we can get lessons like it can mean a lot to our learners.	H2T
I should think...what do you call it.. the chart, yes the drawn chart some of them they are useful unlike if I can say I can draw myself, because some of us we are not good at drawing	H2T
Ja it is important...we don't separate them because if we try to separate them we find ourselves we automatically mentioning it because once you are teaching a learner you must start from known to unknown so what they know is isman what they know protected area is sodwana bay so once you mention those examples you are obliged to mention those things that are important in our nature.	P1T
For example here as you see the water that we use it comes from lake sibaya where have got only one lake that we are using and the other which is known as bhangazi is no longer used because it is under the protected area so once we talk about water we must mention that we will have to take care of water	P1T
Yeah an example of a question that we have done is water pollution. Once we talk about water pollution therefore we are going to mention rivers that are around rivers that are around is inkombozi lake then inkombozi goes down to the sea so once we talk about sea everyone in our zulu will be exposed once we talk about textile everyone knows what textile is. Therefore I think it plays a role.	P1T
yeah..even though as I have said that our school is still poor so we are running short of some of the supporting materials, teaching support materials. But those few of them that we got from the workshop which we go we use them and some of them they are here. (walks away) which I recently got from isman.. and the pla an important part. ...So here if you look here is the isimang school award so this one took place at mtubatuba, this mtuba school now expose now to this, isimang, the function of isimang, the benefit of isimang, as they are going to now be exposed to other schools that do a lot of ??..job. this newspaper we also use it	P1T
yes we use them once I am talking about aqua elements then they will see this proper animal.	P1T
you see this guy he was talking about diving so he will know oh down in the sea there that is just like this one then that learner is going to be interested toi look after the nature and then he will not end up now trying to now to work for the people who are touring here but he will try now to establish his own job because he knows that his place is very rich in natural resources yeah. and other one you see, in art also we do involved in so these are the competitions that we enter.	P1T
yes we had the video, and I don't know what happened about the pictures of the coelacanth but I remember that while I came here because I arrived here around 2000yrs they were there these materials and these materials were useful because once we talk about coelacanth children started to understand what the coelacanth looks like rather than a person who assume what a coelacanth is.	P1T
eh.. they enjoy.. once you take them to the sea, let me say field work, they like it..they like it. Because even at thened of the day you ask them what they learnt? They says many many answers but just to expose themselves they like it.	P1T
yes it is helping us. because one of the principles of teaching in obe, you don't exclude native people or indigenous people and indigenous society whatever lesson that you make you must make sure that, for example in technology, so you cant say a child must solve a problem but without using available resources and he must look at economies. So once you talk about this one you can see now that you are talking about natural science but you find yourself teaching ems, you find yourself teaching maths, you find yourself teaching social science which means now they will be exposed now to nature that is around them that is geography. So I think it is very much important	P1T
I think that if we were rich enough we would buy videos because even though they ever seen it once but it is easy for them if you are talking about something that they can see. And they, if perhaps we was rich enough even a laboratory is special in this area.	P1T
We just theorise. You have seen in the class. Most of the things we theorise because we are running short of teaching material. we have no science kits but we are teaching science.	P1T
Most of the time in september we do coastal clean up and other helped by Sbu and done the turtles. To take care of turtles. And other thing, but not the same , we have done the drama of how peter tim he caught the coelacanth fish. And then yr before last we did theme talking about wetlands so that people they must take care of wetlands. In ecoschools to take care of environmental. And then last week we were so lucky we went to enter the competition which was talking about the global warming. And then our learners got position one and going to represent the provincial .. she was just representing by having the chart and then presenting the presentation. Yes she was talking about global warming, doing research about that	P2T
Yes it helps a lot because its something that they know the sea, talking about the kinds of fishes the coelacanth fish a fish not usually, fins not the same as the others so they explain a lot	P2T
Yes It fits when they answer the question which is why they do this it fits within the knowledge background. And the habitats. Yes because last time we went to sodwana bay were they having a lot of species I was doing the animals. And then they grouped invertebrate and vertebrates, so they were looking at those animals that were classified as vertebrates and seeing some of them and looked at them,	P2T

why is isimangalisso special to you? Yes like that one they say isimang special because there are dunes, there are many different kinds that are unusual like the fish I mentioned..eh.. the coelacanth fish.	P2T
Most of the time we are using, we do have the apparatus like science but now they are scattered we are using the natural science kit and then the school later on they brought the chart so we are using those charts but most of the time there is no practical	P2T
textbooks..we use the textbooks for the theory and then we also use the book for marine (coast care fact sheet)	P2T
It help them because it is something that they have to see that its practical, because its more easier for them if we tell them something that they have already experienced yeah its more easier for them even to answer the questions because they have to find their findings and then at the end of the day they have to tell	P2T
the topics they enjoy they enjoy the one with the coelacanth fish because they were able to meet with peter tim.glad to see and talk with that person and he was signing everything...	P2T
And they like again the turtle although they never see them walking but the wildlife people they come with their pictures or what the turtles that they do have	P2T
No it fit with lesson because the turtle they fall under the..because we have the three kinds of animals...so there are amphibians, the birds, the mammals,its perfect	P2T
The assessment standard: ass1 sub 2 generates a list of basic human needs that are common to all societies now and in past	P1LP
The lesson plan learning outcome: the learners will be able to demonstrate an understanding of interrelations between science and technology	P1LP
The teacher activity and learner activity will be: 1. I will ask them to define the word energy and tell what gives energy. The learners will: they will express themselves. Definition of the word „energy“ and mention examples of the source of energy. 2. I will give them more explanation about energy and let them know about forms of energy in order to remind themselves of those energy they have learnt in previous grades. The learners will: learner will give forms of energy with the source. 3. I will give them groupwork to write. The learners will write forms of energy and report back to the class, learners discuss importance of ecosystem and energy transformation.	P1LP
the resources to be used are textbook and pictures, educator, learners and chalkboard	P1LP
The expanded opportunities: I will check their group work whether they are correct	P1LP

Appendix 7: Analytical Memo 2: Observed Teaching Practice in four school cases with Level II Active Learning Coding

Case	Lesson	Notes on comments and practices	Data Source
H1	Grade 10 Physical Science Exam revision, going over exam paper	<ul style="list-style-type: none"> ➤ To test whether you understand...you see the way the paper is arranged according to performance. ➤ when you read the question you should actually understand the question. And a mark the key words what it is asking. These key words will help you answer the question. You must have the key words, you should pay attention. There may be a lot of stories but the key words that you must look for. ➤ learners looking at test paper that they wrote ➤ teacher showing the instrument that shows charge by rubbing it on his head ➤ Teacher writing the answers on the chalkboard and explaining them with diagrams ➤ Learners looking in exercise books ➤ Made drawing of electroscope on chalkboard ➤ Write in your exercise book ➤ We discussed this and written in books-you don't read! Groups, periods, you have them in your books! ➤ Tells them what to write in exercise books ➤ Question 2, someone to read? ➤ You don't write! ➤ Read your books, it is out of this ➤ Use this chance to understand, tick in the exercise book, always open to questions and answers, otherwise the answers have no meaning ➤ Name the elements in question... ➤ One learner reads question 5 ➤ When we talk about induction what did I say? Remember when we were using the magnet? ➤ Write in the proper way-I will check 	H10, Figure 1-3, Research journal 1 2 3
H2	Grade 12 Life sciences	<ul style="list-style-type: none"> ➤ A prepared lesson about environmental studies, not exam preparation ➤ We are supposed to use English today because Michelle is here ➤ Doing terms and definitions 	H20, Figure 1-3, research

		<ul style="list-style-type: none"> ➤ She is writing the living relationships on the chalk board ➤ T: back to parasitism, two organisms? L: one benefit, one harmed T: example? L: Person and mosquito ➤ (tapeworm in pig) L: can you see? T: you can see dots ➤ T: What is an ecosystem? Learner says definition ➤ T: So this living organisms also known as? L: Biotic ➤ T: If you can think of soil how important is soil to our lives? So we depend on the staple food like? Rice and what. It consists of carbohydrates are you all agree? L: Yes ➤ T: Lets look at the interactions between the biotic component. So lets think of the way energy is transferred from the first organism to the last organism.if maybe I have the locust, the frog, maybe the fish, the grass. So if you can come across these organisms. Are we agreeing that they are living organisms? Are you with me? L: Yes ➤ T: And lets look at the interactions. If maybe you come across a question like this was there in our previous question the one we write in September about the food chain and the food web. So we have to know about the food chain and the foodweb. A food web is formed by the? L: Food web ➤ the teacher is drawing the life cycle of the tapeworm while explaining to the learners. The learners are listening and answering questions together. ➤ the teacher is drawing a picture of the structure of the tapeworm 	journal 2
P1	Grade 6 Natural Science lesson	<ul style="list-style-type: none"> ➤ T: I said to you, these carnivores when they die they make a compost, the question is where do they die? So it is said everything that exists in world has a period of living, once the period is over that something is going to die and make a particular world. for eg her I have got the world that exists , or let me say let me expose to an aquatic world. so these fishes they feed on each other but at the end of the day you will find that they are going to die biut the question is what is going to happen to them when they die. When these plants, fishes die it is said according to the ns they are washed away into the sea.you are going to remember that sea doesn't like anything that is dirty. So when sea now mix with something that is just like oil so this sea is going to wash all dirt into the back.now along here at the back there will be a sewer line then once these fossils they decay they form a layer of oil. Remember oil does not mix with water for that reason this oil is going to be buried. Because why they come now and again they bury this oil until this oil goes down into the soil. Down into the ground is where these people like saddam hussain , while living in the middle eastern, they are able to suck that oil down there and that oil again is used as a source of energy.That's why today we have got electricity. In fact this electricity is made up there where there are coals. Because even the coals they are formed after these animals have decayed and as well as the plants. These plants when the decay they form the rock down there. These rock then has the energy. Energy doesn't die. So we as the people ensure we keep the land green, that is why we as the people we even try as our school to make our school green.it is because we want to restore this green colour.why must we restore the green colour. We restore this green colour in the short term or the long term. In the short term is why we plant some vegetables as we do in the garden. Do you understand? L: Yes ➤ T: Here I have got an activity. There is a book here I think it talks about pictures. So pictures are not easy to be predicted. We are going to see now these movement of energy and im going to ask you some questions in this pictures. So the pictures that are there have been represented by numbers. Let us now answer some questions looking at the movement of energy. O? O? How many books are there? One? Ok you are going to share this one. Ok on page 50 what does number 1 stand for? L: That is the sun ➤ the teacher is drawing and describing the energy cycle on the chalk board ➤ the learners are putting up their hands to ask questions ➤ the learners are watching as the teacher refers to the poster on marine resources, the learners are watching as the teacher refers to the poster on fossils ➤ the learners are looking in the textbook (two per textbook) ➤ one learner is looking ahead as another puts his hand up to answer a question ➤ the textbook and activity they are referring to, the fossil poster, the national marine week 2005 poster, the greening schools poster ➤ lesson plan ➤ forms of energy ➤ T: in which form? L: sunlight ➤ T: The green colour makes a plant to make its own food? L: photosynthesis ➤ The pictures talk about fuel ➤ Ecosystems in energy is... (definition) ➤ Who belong to the eco-club?....L: coastal clean up ➤ Overharvesting...compost...fishes...fossils...electricity...greening the school...activity ➤ Activity-reading out textbook: what are the elephants doing? L: they are drinking water. T: water is formed while photosynthesis takes place. He asked the questions according to the textbook 	P10 & Figures 1- 12, research journal 2, 1
P2	Grade 6	<ul style="list-style-type: none"> ➤ the teacher is writing the types of soil on the chalk board while asking the learners to 	P20,

Natural Science practical	<p>mention them</p> <ul style="list-style-type: none"> ➤ the teacher put them into groups to do group work ➤ they are going to do the properties of soil which is a practical investigation and will see how the water runs through it ➤ she copied the instructions and hands these out to the learners ➤ the teacher is handing out activity sheets from the simple pracs for the learners to read and then answer the questions ➤ the learners collect 3 kinds of soil and follow the instructions ➤ they have the materials ➤ she said they must bring a watch ➤ they are reading the practical ➤ they are cutting the bottles ➤ they make a measurement of water ➤ the learner has measured and is now pouring water into the cutout bottle with soil and the other learners are observing ➤ they are using time-write how much time does it take for the water to run through ➤ T: yes you must write ➤ the learners are writing down observations in groups ➤ T: write down!- how much time! They struggle to understand this. ➤ T: and measuring this water-write down how much water and the time. They seem to struggle with the measurements and time, she goes around and repeats this. ➤ The group next to me has not recorded time ➤ She walks around to see how far they are ➤ T: we are going to summarise: groups are finished, tell us their findings. They are going to tell us then I will summarise ➤ She is writing on the chalk board ➤ the teacher is writing down each groups measurements on the chalkboard ➤ a representative from each group is reporting their measurement to the teacher ➤ All of the groups have completely different answers ➤ On the observation sheet there are questions: ➤ Which soil is allowing the liquid to pass through quickly? The learners all say loam soil ➤ Which soil is the least permeable? They say clay ➤ You tell me-does gravel let it pass through it takes less minutes, see it starts to go through ➤ Why more or less permeable? Hard to understand, why? Some say more soil, some say to heavy, some say its smooth, soft. ➤ How many phases of water? 3 phases they all repeat ➤ She starts explaining that the particles are loose 	<p>Figures 1-6, research journal</p> <p>2, 3, 1, 8</p>
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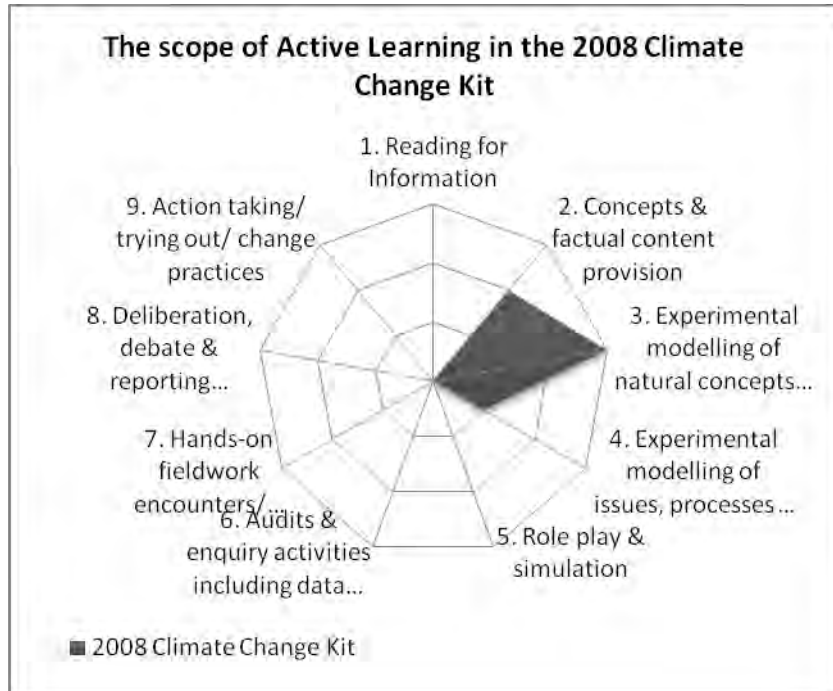
Appendix 8: Analytical Memo 3.3 Active Learning in the observed use in four school cases

Active Learning	Notes on comments and practices	Data Source
1. Reading for Information	when you read the question you should actually understand the question. And a mark the key words what it is asking	H10, Figure 1-3, Research journal
	Activity-reading out textbook: what are the elephants doing? L: they are drinking water. T: water is formed while photosynthesis takes place. He asked the questions according to the textbook	P10 & Figures 1-12, research journal
	the teacher is handing out activity sheets from the simple pracs for the learners to read and then answer the questions	P20, Figures 1-6, research journal
2. Concepts & factual content provision	teacher showing the instrument that shows charge by rubbing it on his head	H10, Figure 1-3, Research journal

	<p>Doing terms and definitions</p> <p>She is writing the living relationships on the chalk board</p> <p>the teacher is drawing the life cycle of the tapeworm while explaining to the learners. The learners are listening and answering questions together.</p>	H20, Figure 1-3, research journal
	the teacher is drawing and describing the energy cycle on the chalk board	P10 & Figures 1-12, research journal
	the teacher is writing the types of soil on the chalk board while asking the learners to mention them	P20, Figures 1-6, research journal
3. Experimental modelling of natural concepts & processes	Teacher writing the answers on the chalkboard and explaining them with diagrams	H10, Figure 1-3, Research journal
	they are going to do the properties of soil which is a practical investigation and will see how the water runs through it	P20, Figures 1-6, research journal
4. Experimental modelling of issues, processes & practices		
5. Role play & simulation		
6. Audits & enquiry activities including data interpretation		
7. Hands-on fieldwork encounters/ experiences		
8. Deliberation, debate & reporting towards decision making	T: we are going to summarise: groups are finished, tell us their findings. They are going to tell us then I will summarise	P20, Figures 1-6, research journal
9. Action taking/ trying out/ change practices		

Appendix 9: Example of Active Learning Analysis Tables and Charts for Analytical Memo 3.1 Active Learning in the ACEP materials for Use

Materials & Content	1. Reading for Information	2. Concepts & factual content provision	3. Experimental modelling of natural concepts & processes	4. Experimental modelling of issues, processes & practices	5. Role play & simulation	6. Audits & enquiry activities including data interpretation	7. Hands-on fieldwork encounters/experiences	8. Deliberation, debate & reporting towards decision making	9. Action taking/ trying out/ change practices
2008 Climate Change Kit									
Lesson 1 sea level rise- experiment				1					
Lesson 2 Antarctic oceanography info & activity (essay, hypothesis/scientific question, experiment)		1	1						
Lesson 3 convection currents-info & experiment			1						
Lesson 4 climate change- info & experiment		1	1						
Lesson 5 inland & coastal climates-info, experiment and activity 2: select a coastal town and an inland town, everyday write down from the newspaper the daily temperatures for these two towns. Plot the temperatures on a graph. What do you observe?						1			
TOTAL	0	2	3	1	0	1	0	0	0



Appendix 10: Consent forms for school principals



INFORMED CONSENT DECLARATION FOR DISCUSSIONS & QUESTIONNAIRES Sodwana Bay School Principals, 2009

A case study of the development, dissemination and use of marine science learning support materials in rural schools in the Sodwana Bay area

The African Coelacanth Ecosystem Programme (ACEP) has been presenting educational materials for schools and conducting interactive workshops with educators and learners in Sodwana Bay National Park since late 2002. In 2007 there was a change in the operational management and funding for the ACEP. ACEP II as it is now known includes strong research sections that investigate various approaches and

scientific endeavors of ACEP. The research linked to environmental education is aiming towards developing a framework for environmental education not only for ACEP but other EE initiatives.

Therefore the discussion and questionnaire that a teacher or teachers at your school will be participating in is part of a research project that is investigating the development and use of the ACEP learning support materials in schools in the Sodwana Bay area, with the aim of improving these materials and developing a framework for the future.

This questionnaire involves both specific, pre-determined questions as well as questions that have not been determined in advance during a discussion and will depend on the way in which discussion develops. The questionnaire will be guided by a Power-point presentation while the teacher fills out a questionnaire form, and this will be followed with a discussion. The teacher may at any time decline to answer questions and is free to withdraw from the research process at any time, without any negative consequences to the teacher or the school. The discussion and questionnaire session will be taped/videoed and transcribed by Michelle van der Merwe, and the data held in a safe place in her office that is not accessible to others. The questionnaire and discussion will contribute towards research informing ACEP and a Rhodes University Masters of Education (Environmental Education) degree, which is funded by the National Research Foundation (NRF). All responses will be treated in a confidential manner and anonymity will be ensured in any publication of the findings. Your agreement will contribute further to the wonderful partnership already in place between ACEP and your school.

I (full name) hereby confirm that I understand the contents of this document and the nature of the research project, and consent to allowing(teacher name/s) from.....(school name) to participate in the research project.

Signature of school principal:

Date:

Should you require any further information please contact:

Michelle van der Merwe

Bernadette Snow

Research Candidate

Grantholder: ACEP EE

Rhodes University

South African Institute for Aquatic Biodiversity

Grahamstown

Grahamstown

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(Interviewer to keep the original signed copy, and the interviewee to obtain their own copy)