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Exploring how teachers acquire content knowledge of marine and coastal issues to contextualize the natural science curriculum.

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Degree of

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By

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Declaration

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and has not previously in it's entirely or in part been submitted at any university for a degree.

Signature **Date**

ABSTRACT

The transformation process in the South African curriculum has highlighted a need for teachers to change from being passive implementers of curriculum. They are required to interpret the curriculum, adapt materials and develop lesson plans that will be responsive in their own context. They are also required to use materials and mediate learning. This research explores teacher acquisition of content knowledge on marine and coastal issues and probes how teachers work with materials in the development of lesson plans to contextualize the curriculum.

A participatory action research process engaged 3 teachers in a contextualizing process of curriculum development. I started to work with the teachers to adapt and re-develop coastal and marine resources to support learning in local context.

The research developed in two phases. The first examined existing teacher knowledge of marine and coastal issues and probed how content was integrated into lesson planning. Teachers identified knowledge acquisition as the priority to enable them to work with the materials and curriculum in their context. The second phase set out to enhance teachers' knowledge of marine and coastal resources through workshops and field trips to improve the adaptation and use of materials.

To document these processes and outcomes in the context of this study, I employed a range of data generation strategies including questionnaires, workshops and classroom observations, field notes, focus group discussion and the review of lesson plans, learners' work and materials used. All participants collaboratively discussed and reflected on the process, but I was responsible for the final interpretation presented here.

This study showed that teachers are still entrenched in their normal practice of working with content as facts and definitions, the delivery of abstract propositions that is not aligned with the curriculum goals. The new curriculum required teachers to change their teaching practice by using materials to mediate learning in context. The data revealed a mismatch between teacher practices and what the curriculum required from them.

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LIST OF ABBREVIATIONS

NEEP-GET	**National Environmental Education Project-General Education Band.**
WESSA	**Wildlife and Environment Society of South Africa.**
RSA	**Republic Of South Africa**
DoE	**Department of Education**
DWAF	**Department of Water Affairs and Forestry**
LTSM	**Learning and Teaching Support Material**
RNCS	**Revised National Curriculum Statement**
OBE	**Outcomes Based Education**
NCS	**National Curriculum Statement**
SAIB	**South African Institute for Biodiversity**
MCEN	**Marine and Coastal Educators Network**

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CHAPTER ONE: OVERVIEW OF THE STUDY

1.1 INTRODUCTION

This chapter describes the background to this study. It includes a brief description of the changing South African educational setting. It provides an overview of the professional development programmes that have influenced my role as a teacher as well as factors that motivated me to conduct the study. Secondly, it describes the context of the study with reference to the marine issues and the question of socio-ecological content knowledge that was the focus of the research. Finally the aims, goals and objectives of the study are articulated as they relate to the research question. The introduction ends with an overview of each chapter.

1.2 BACKGROUND OF THE STUDY

1.2.1 Curriculum change in South Africa

The democratic elections of 1994 signaled a major turning point in the history of South Africa. The constitution of the Republic of South Africa (Act 108 of 1996) provides the basis for curriculum transformation and development in South Africa (DoE, 2002a:1).

The aims of the Constitution are to heal the divisions of the past and establish a society based on democratic values, social justice and fundamental human rights. Education and curriculum are regarded as to have an important role to play in realizing this aim. The Outcomes Based Education forms foundation of the school curriculum in South Africa and strives to enable all learners to achieve to their maximum ability (*ibid).* It does this by setting the outcomes to be achieved. These outcomes encourage a learner centered and activity based approach to education. The Revised National Curriculum Statement for Grades R-9 (Schools) adopts an inclusive approach by specifying the minimum requirements for all learners. It also attempts to be sensitive to issues of poverty, inequality, gender, and challenges such as HIV and AIDS (DoE, 2002a:2). This it does by emphasizing the relationship between *social justice, human rights, a healthy environment and inclusivity* (DoE, 2002a). This statement has led to

'environment' being regarded as integral to all learning areas (NEEP-GET, 2004), adding a need for teachers to develop lesson plans with an environmental focus. Teachers are thus expected to have assumed new roles of being interpreters and designers of Learning Programmes and materials and are required to mediate learning using materials (DoE, 2002a:3). Here the mediation of learning will ensure that learners will be able to make meaning with understanding as they learn.

To guide professional development programmes, the Norms and Standards for Educators policy has defined a number of new competencies required for teaching. The Norms and Standards for Educators policy statement indicates that these will need to be refined through implementation and research (DoE, 2000a).The National Environmental Education Project in the General Education and Training Band (NEEP-GET) was established by the Minister of Education in 1999. Its establishment was in line with the broader commitments to human rights in education (Lotz-Sisitka & Raven, 2001).The primary focus of the NEEP-GET project was to assist in the professional development of teachers IN the General Education and Training band in the South African Education system (See section 2.3).

With the advent of the new curriculum, the NEEP GET project made a contribution to the curriculum transformation processes by providing tools and expertise towards the meaningful interpretation of the new curriculum policies. A set of professional development outcomes, closely linked to the Norms and Standards for Educators, were developed within an outcomes based framework, and informed direction and orientation to professional development in the NEEP –GET. These provided a broad framework for all professional activities in the NEEP-GET; within responsive, participatory and open-ended processes which were developed through deliberations with educators, in particular contexts (ibid).

In the area where I work, we participated in this professional development initiative as a cluster of four schools: Byletts (my school), Cintsa, Bulugha and Nkwezana in 2001.We focused on the development of lesson plans with an environmental focus. With the help of Laura Conde from WESSA (Wild life and Environment Society of South Africa) and Lungi Nduna from the

Department of Education we were able to get support and develop lesson plans using the new approach to teaching and learning.
As part of the project we had an opportunity to work with other service providers like DWAF (Department of Water Affairs and Forestry), to get materials, ideas and knowledge about the new environmental topics and how to approach them in lesson planning. We were also able to understand the meaning of 'environment' and the use of new approaches to teaching and learning such as 'active learning framework'. The curriculum that we developed was localized and we developed a Perm culture food garden to respond to health issues in our area. We used the garden as a place to learn about environmental issues and risks and the activities were based on teaching learners about their cultural background and link that with available knowledge. Later on we were joined by other schools and in 2003 and the Eco-schools programme was launched. Our schools became Eco-schools.

Because of my involvement in NEEP-GET and the Eco-schools programme I was able to reflect ON my classroom practice, examining how I had developed my skills and to what extent my teaching helped the learners to be creative in solving environmental problems. Being in a leadership role in the Cintsa cluster, I was reflecting on an informal basis on the effects of our activities to improve teaching and learning. Through my reflections, I considered the extent to which these programmes and new policies that we were involved in helped us to encourage the active learning which is envisaged by the curriculum. There has not only been an improvement in how I plan lessons, but I have developed learners' awareness of environmental issues and risks. Furthermore, there are some improvements that are significant with regards to the educative part of these projects as learners are now able to do action projects in their schools. Nonetheless I felt that my and other teachers' use of learning and teaching support materials (LTSM) was still not adequate. This was clear in the curriculum development initiatives where I and another teacher participated in the 'Adopt-A-Beach' programme as part of a Coast Care initiative introduced by the Wildlife and Environment Society of South Africa (WESSA). The aim of this programme was to create awareness of coastal and marine issues, and to support environmental education in schools (WESSA, 2004).

As part of this project, the schools were provided with learning support materials, but there was no direct support in terms of how to use these materials effectively. As teachers, we lacked adequate background knowledge of marine conservation and this inhibited us from working with the materials to achieve the learning area outcomes (Gwebani pers comm., 2005). In addition, previous environmental education activities in our schools tended to be mostly extra-curricular and the activities were not integrated into learning programmes, work schedules and lesson plans as required by the RNCS policy. These experiences motivated me to undertake research to explore how enhancing teachers' socio-ecological content knowledge of marine and coastal issues might strengthen curriculum development and the use of the materials provided by the WESSA Adopt-a-Beach project. To develop the proposed research project I had to get an understanding of marine and coastal issues in the region. This allowed me a better grasp of the environmental issues so as to formulate my research question.

1.2.2 Marine resources depletion along the Coast of Southern Africa

Along the South East Coast of Southern Africa (where this study was situated), coastal communities are widely accepted as users of marine natural resources. Lasiak (1992) noted that indigenous coastal people of Transkei supplemented their predominantly maize based diet with shellfish as their major source of protein, and this formed an integral part of their diet. Due to recent political changes in South Africa, increased human population growth and an increase in poverty levels has led to new demands for access to these resources. The Marine and Coastal Management Group and The Institute of Social and Economic Research (both based at Rhodes University) showed that shellfish along the East London / Port Alfred coastline are being depleted rapidly, with Perlemoen being allowed to grow to only half their size because of their high economic value (Kaehler, 2003). According to Fatman (2003), many traditional collectors believe that to have marine resources at their disposal is a 'God given' right. This implies a belief that the resources will never completely be depleted. According to scientific research (Kaehler, cited in Fatman 2003:18) and government management strategies, this belief would appear to present a problem in terms of government strategies for the management of these resources. According to Fatman (ibid), it is imperative that the views of the collectors need to be changed so that they can participate in the management of coastal and marine resources.

The interviews I conducted during the contextual profile of the Cintsa area showed that there is local knowledge available around marine issues amongst the people. People used marine resources in the past but with the introduction of new policies around marine resource management they were no longer using them (Moody, pers communication). Most of them only visited the beach during festive seasons. For the purposes of this study it is assumed that the local knowledge that exists in people can contribute to curriculum development which will be meaningful to the learners.

The studies reviewed above, showed that there was a need for better management strategies with communities where teaching of environmental principles and use of indigenous languages at school were regarded as vital to improve the interactions between scientists and the consumers of mussels (ibid). In line with these marine and coastal conservation concerns, the WESSA Adopt-a-Beach Project was developed in the Cintsa coastal area.

The Cintsa Marine Project and Participants

The earlier work with NEEP-GET meant that teachers and schools also got involved in the Adopt-a-Beach programme. Because of our continuing struggle to work with environment and the new curriculum, we teachers continued our work on environmental issues and the use of materials in lesson planning. The WESSA project also became the context for my research as I was now studying for a Master of Education at Rhodes University.

After my reflections on the NEEP-GET process (mentioned earlier) my main professional interest became the question of teacher content knowledge, materials and lesson planning. The focus came out of my own lack of knowledge of marine ecosystems and issues. This lack of content knowledge was something that we had in common as educators trying to work with the new curriculum. Content Knowledge thus became a start-up concern for the group that had already worked together as a NEEP-GET cluster. It was thus natural for us to continue working on the new project together and for me to take up a support and research role around the problems of content knowledge, the use of materials and lesson planning.

The teachers involved in the project and participating in the emerging research process were:

- Teacher NK, a foundation phase teacher, at a farm school. She teaches a combination of grades one to three. She has been teaching there for the past fourteen years. She participated in this research because she was already attempting to develop learners' knowledge through field trips. These activities were regarded as extra mural activities and not exactly integrated in the curriculum. She was involved in marine issues with her principal who was teaching grade seven, a combined class of twenty learners with ages ranging from twelve years to sixteen years. It was evident that the school had some knowledge resources on marine issues.

- Teacher CI is a foundation phase teacher, working with a grades three and four class. The number of learners in her class was thirty and their ages range from nine to ten years. She stays at the school permanently and only goes home during holidays. She had been involved in a number of environmental education projects like Adopt-A–beach and a permaculture food garden in her school.

- Teacher BU is a grade seven teacher combining it with grade six. There are a number of projects that take place in his school like a Permaculture food garden project and cultural concerts. The number of learners is twenty-two in his class and their ages range between fifteen and seventeen years.

As we worked together on the challenges of teaching of marine and coastal issues in the new curriculum, my research question and purpose developed.

1.3 EMERGING RESEARCH QUESTION AND GOALS

This research developed within the teacher professional development project of the Cintsa cluster. Its focus was to explore ways in which teachers' socio-ecological content knowledge of marine and coastal issues developed so that they acquire knowledge on marine ecosystems, adapt materials to the local context and use these in the development of lesson plans. The research

goals emerged from, and were aligned with, the action research being undertaken by us as a cluster of educators in Cintsa, namely to:

- Investigate existing knowledge of marine and coastal resources and issues.
- Review available LTSM on marine and coastal resources and issues, which may be appropriate for environmental learning in the Natural Sciences.
- Investigate how teachers' knowledge of marine and coastal resources and issues is influenced by the introduction of and engagement with LTSM (knowledge resources) on marine and coastal resources and issues.
- Investigate how knowledge of marine and coastal resources could be a foundation for decision making in adapting and redeveloping Learning and Support Material.
- Investigate how teachers' knowledge of marine and coastal resources and the adaptation and redevelopment of LSM influences lesson planning in the Natural Sciences learning areas.

These goals were formulated with the group of participating teachers and the research was undertaken over a year within a collaborative process of action research. As a researcher undertaking my Master of Education research project I undertook a facilitating, data generating and reporting role as the project unfolded. My broad research interest and question became:

> **How does the introduction of new socio-ecological content knowledge (of marine and coastal resources and issues) contribute to the selection and adaptive use of Learning and Teaching Support Materials in lesson planning for a contextualized curriculum that is more relevant to teachers and learners?**

The framing of my research interests in the literature, the development of a research design and the reporting and analysis of the data in relation to the research question are outlined below and then fully developed in the unfolding chapters of the study that follow.

1.4 OUTLINE OF THE CHAPTERS

Chapter one introduces the research and describes the background of the study with its emerging aims and objectives. It also explains the context of my work as a teacher and how this shaped my concern for content knowledge and lesson planning in the new curriculum.

Chapter two reviews literature to outline the contextual influences within which this study took place. It includes a brief review of aspects of educational policy and change in South Africa as well as examining the development of environmental education as integral to all learning areas. This chapter contextualizes some of the challenges with regards to the implementation of Outcomes Based Education, probing the role of materials in teaching and learning and the role of the teachers to adapt and use materials in lesson planning. This chapter also reviews theory to probe questions of curriculum in context. Finally it overviews recent research findings that relate to the concerns that emerged in the project and are examined in the research process.

Chapter three describes the methodology and data generation techniques used in the study. It outlines the research design decisions and explains that the research was conducted as a participatory action research process with a small project team of educators working on coastal issues and the curriculum. It provides details on how the participatory action research and case study approach was applied in the study. Finally, it describes how various methods were used in the study to generate data, and how these data were analyzed and reported back into the developing project.

Chapter four presents the data generated through focus group discussion, workshop deliberations, classroom observations and the review of learners work. It reports two phases of the participatory action research process. Phase one of the research process reports on the issues and findings that emerged from focus group interviews and review of materials during the research process. The findings from cycle one of action research are provided, which then further informed cycle two of the participatory action research process where the materials were used in lessons and the learners' work was reviewed.

Chapter five is structured around a series of analytical statements that are developed to interpret the data on knowledge of marine issues and the adaptive, contextual use of materials in lessons. The discussion provides insight into implications for supporting teachers and their content knowledge in the new curriculum.

Chapter six provides a summary of the research and draws attention to key issues related to the research question. It also provides recommendations for further research to strengthen the development of teachers' knowledge so that they are able to develop lesson plans and use materials that are localized.

1.5 CONCLUSION

This chapter has provided a background to the study. It highlights the changes in the curriculum system in South Africa. An overview of the policies influencing curriculum are provided and how they are related to the acquisition of teacher's content knowledge of marine ecosystems. In this chapter I draw from my experience and explain the reasons and the purpose of the study. An overview of participants and schools involved is also provided. This is followed by a summary of chapters in the next chapter I provide literature review which will support the development of research goals.

CHAPTER TWO
LITERATURE RIVIEW

2.1 INTRODUCTION

This chapter reports literature reviewed in relation to the research focus on the challenges of teachers acquiring knowledge of marine ecosystems and working in local context with the new Natural Science Curriculum.

In this part of the study I discuss the change in the South African education system that included environment and use of local context as integral to all learning areas. I then review different curriculum conceptions and examine literature on how they influence teachers' decisions in working with materials and content knowledge to create opportunities for learning. The review then develops a perspective on Outcomes Based Education and points to how teachers need both content knowledge and a critical understanding of the role of materials in supporting learning. This aspect of the review leads to a discussion on curriculum in context and its implications for teachers to be able to develop teaching strategies that will support learners in meaning making

and understanding what they learn. Finally, I explore literature on the challenges encountered by teachers in the implementation of Outcomes Based Education and to achieve curriculum goals.

The review of this literature informed the study and allowed me to formulate the action research case study design to generate data on some of the content knowledge and lesson planning challenges in environmental education work on marine ecosystems and coastal conservation in the new curriculum.

2.2 ENVIRONMETNAL EDUCATION POLICY CHANGE IN SOUTH AFRICA

In South Africa the new constitution *enshrines the right of every South African citizen to an environment that is not detrimental to his /her well being* (NEEP-GET, 2004:2). The Bill of Rights also emphasizes the need for *sustainable utilization of resources for the well being of both current and future generations, and a better quality of life for all* (ibid).This right is implemented through the development of new policies. The key dimension of these policies is the recognition of the role of environmental education processes and capacity building in addressing or responding to environmental issues (Mbanjwa, 2002:11).

In line with international developments, the Department of Education (DoE) in South Africa has recognized environmental education as a key response to the environmental crisis (Lotz-Sisitka & Raven, 2001:13). The White paper on Education and Training (RSA, 1995:13a) recognized the need for environmental education processes *"involving an interdisciplinary, integrated and active approach to learning"*. It is also stated in the principles of the Revised National Curriculum Statement that environmental education is regarded as:

> *a vital element of all levels and programs of the education and training system, in order to create environmentally literate and active citizens and ensure that all South Africans, present and future, enjoy a decent quality of life through the sustainable use of resources (DoE, 2002:10).*

These developments have led to the defining of an environment and sustainability focus in all Learning Areas, which also takes into account the context of learners (NEEP-GET, 2005a) (See section 1.2.1).

In this new curriculum, teachers are required to interpret and design teaching and learning support materials with an environmental focus. The environmental focus is guided by the Learning Outcomes and Assessment Standards as described in the NCS (R-9). In the NCS (R-9) environment and opportunities for environmental learning have been consciously incorporated into the curriculum in an integrated way (NEEP-GET). This is unlike the past, where environmental concerns were seen as external to the curriculum, something that could be added to lessons to make them exciting or to improve environmental learning in an ad hoc way (Hoffman, Timmermans, & Wigley, 2005). These authors explain that very few educators were able to integrate environmental learning activities into the classroom (ibid).Teachers are required to interpret and design materials, mediate and scaffold learning. This ensures that learners are able to make meaning and understanding of what they learn.

However the effectiveness of these policies depends upon a high level of environmental literacy amongst teachers. Unfortunately, the questions of environmental literacy and content knowledge seemed not to be asked in this transformation process. (Lotz-Sisitka & Raven 2001) note that for the policy to be conceptualized into action, citizens, teachers and learners in schools need a high level of environmental literacy. Environmental content knowledge has often been under emphasized for the key role it can play in:

> *Enabling citizens to improve environmental management practices in all walks of life, and to make sustainable life style choices (Lotz-Sisitka & Raven, 2001:2).*

2.3 OUTCOMES BASED EDUCATION AND CURICULUM TRANSFORMATION

The year 1994 proved to be a turning point in the history of South Africa (see section 1.2.1). The old education system was structured according to a syllabus which predetermined the structure of the content to be learnt and how it should be taught in schools. This structure informed the teacher of how to teach and what to teach by outlining topics and providing teachers with materials with which to teach and assess learners. Critical theorists like Cornbleth (1990) and Grundy (1987) highlighted the limitations of this approach to curriculum. They argued that this contributed to teacher deskilling by adopting a strategy of regarding teachers as implementers of policies that are decided outside of their classroom contexts.

The outcomes of these controlling policies resulted in the new democratic government being driven by a new purpose in education, and the need for social re-dress in South Africa. The purpose of OBE as a new curriculum policy framework is to empower and emancipate teachers and learners so that they are able to work critically with knowledge in ways that will relate to their own contexts. In the new outcomes-based curriculum teachers were required to be actively involved when they plan lessons and work with materials. This meant that they had to manage the curriculum and to mediate learning for the curriculum to be effectively implemented.

This teacher purpose is clearly articulated in the White paper on Education and Training (RSA, 1995) which provides for major changes in education and training in South Africa. After 1994 the new government actively started the process of completely changing the apartheid school syllabus and system. Outcomes Based Education calls for pedagogical approaches that are different from those in content-based education. According to NCS(R-9) (DoE, 2002) lesson plans are to be developed with specific learning outcomes and assessment standards. Content and the process of learning should be spelled out and are regarded as important. Learning outcomes and assessment standards provide the process of learning. An emphasis is placed on learner centered activities. This requires the teacher to show creativity and content knowledge by carefully interpreting and designing materials and making decisions about their use.

The problem that teachers are having in developing curriculum in the context of the science curriculum became the focus of this case study. The review thus examines literature on some of these challenges in OBE.

2.4 CHALLENGES WITH THE IMPLEMENTATION OF OBE

2.4.1 Misinterpretation of learner- centered approaches and the use of content knowledge

Numerous challenges have been reported by many researchers (Lotz-Sisitka & Raven, 2001; Harley & Wedekind in Chisholm, 2004; Christie &Jansen, 1999; Harley & Parker in Christie & Jansen, 1999; Nduna, 2003; Mbambisa, 2006) on how teachers interpreted learner –centered approaches introduced by the new curriculum. These researchers share the same view with regards to the demands and the challenges of OBE. The emphasis of the new curriculum is a

learner –centered approach to curriculum. Teachers are required to identify different types of competencies that learners are expected to achieve ((Harley & Wedekind cited in Chisholm, 2004: 256). This approach means that teachers had to change their practice. They should be engaged in learning new ways of teaching and learning. They have to move from regarding curriculum as separate subjects into learning area with content that should be learnt in context (Mvula-Jamela, 2006:14). They had to use multiple representational contexts for their tasks (Jansen & Christie, 1999: 210).

Despite these policy expectations, reports on teacher practice showed that teachers and their pedagogy have been displaced. However schools are doing their own thing, and there is a situation in which anything goes as part of learning in schools (Harley & Wedekind cited in Chisholm 2004: 201). This practice is associated with teachers required to give up space, the instrument of control, content and the use of textbook (Harley & Wedekind cited in Chisholm 2004:210).The above commentaries showed that teachers are unable to fulfill the requirements of being designers and implementers (2004:260).

Harley & Parker (cited in Jansen 1990:186) argue that the focus of teachers has been on interpreting learning outcomes with little attention paid to the inputs necessary to achieve outcomes. Lotz-Sisitka & Olivier (cited in Mbambisa, 2005:220) also points to the implications of teacher's new roles on teachers practice and learning. They noted that teachers are generally unable to interpret appropriate levels of scope and depth which are required for Senior Phase Natural Science learning area. (Harley & Parker in Jansen & Christie 1990:186) argued that the crucial role of the educator as interpretive designer, manager and teacher has not been addressed.

Sayed in Chisholm (2004:58) note that this new structural landscape in curriculum is linked to change in teacher education. Newly qualified teachers with the skills to operate in an Outcomes Based framework are needed. This implies a need for teacher training to enable them to work in a leaner-centered focus. Sayed in Chisholm, (2004: 260) points out that the introduction of Outcomes Based Education is closely tied to the seven new roles of teachers and therefore implied a pedagogical shift from a content-centered approach to a critical approach to

curriculum. This requires teachers to develop new conceptions of teaching and knowledge construction and thereby change their culture and identity.

All of these expert commentaries and reviews of the complex implications of the new curriculum resonate with the tensions that we have experienced as a cluster trying to work with OBE in ways that are more contextually relevant. It has not been easy to re-think our roles and to work in different ways without an explicit curriculum or textbooks that specify content and learning activities, as we used to have.

2.4.2 Ineffective teacher training influences teachers work and knowledge

The structural changes in school curriculum are seen to present some curriculum challenges which are linked to teacher education and training. A new picture of the classroom teacher is created by the policy, a person who is multi-skilled, critical and active, rather that one who merely dispenses knowledge or content (DoE, 2002a). The Department of Education made provision for the training of teachers in order to support teachers to be able to perform these new roles. The challenges associated with training have major implications for teacher's personal and professional identity. (Lotz-Sisitka & Raven, 2001); (Nduna, 2003); (Mbambisa, 2005); explain the cascade model or structure that was used by the National Department of Education to train teachers as inappropriate for the professional developmental goals that are needed. These researchers report that the provincial curriculum coordinators were trained mostly on the structural aspects of the design of the curriculum. There was *less emphasis being placed on teaching and learning processes and teaching and learning support* materials (Lotz –Sisitka and Raven cited in Mbambisa, 2006:19). (Harley & Wedekind in Chisholm, 2004:200) further argued that this was a *crash-course training* which cascaded the training down through the system to the districts and schools. Harley & Wedekind cited in Chisholm (ibid) further argued that:

> *The complex new curriculum quickly became associated with a few obvious dimensions that provided teachers with simple hanger on which to peg their understanding. Complex issues of pedagogy with major implications for teachers personal and professional identity were reduced to simplistic dichotomies such as 'teacher–centered' (an 'old', undesirable practice) and 'learner-centered' (a 'new', esteemed practice)…. 'Content'*

was replaced by 'outcomes'. Learner centered quickly became one of the teachers defining features and group work became the major symbolic identifier of the new curriculum and for many teachers, implementing group work was the core pedagogical shift required of them by C2005.

2.4.3 Misunderstanding of constructivism

Ian Moll (202) noted that misunderstanding of constructivism are likely to have serious consequences for the development of teachers knowledge, and hence the learning of children if they are not corrected (*ibid*). In clarifying constructivism (Moll, 2002:17) reject the common sense ideas related to the role of the teachers knowledge and learners that, teachers are simple" facilitators" of learning environments and that learners are essentially independent, free ranging problem solvers who construct their own pathways.

This interpretation according to (Moll, 2002) might mean that success of teaching and learning depends on leaving the students entirely free to work or play as they will. When constructivism is interpreted this way the role of the teachers knowledge in controlling the learning environment might be limited and the learners might have control which could be disastrous for teaching and learning (ibid) .This unclear position on roles in relation to learning has compromised the role of the teacher who is supposed to be active and critical in mediating learning. This showed the disjuncture between policy intentions on teaching and learning and the classroom realities.

This concurs with our experience as teachers because most of the time we are trained by people with insufficient knowledge about the Outcomes Based Education and who lacked the relevant skills to support teachers. This also relates to the fact that after the workshops there is no ongoing support to ensure that workshop knowledge is integrated with classroom activities. Mbambisa (2006:16) argues that the subject advisers who are responsible for training teachers are not all subject specialists as some of them were classroom teachers who were absorbed into their positions during earlier re-structuring processes in education. The problems with these structural processes are that policy making is seen as a discrete area of activities instead of being seen as overlapping.

2.5 THE ROLE OF THE TEACHER AS AN ACTIVE ORGANISER OF LEARNING EXPERIENCES

To understand the meaning of constructivism Vygotsky (1978: 86-90, cited in Moll 2002: 18) insist that learning is systematic cooperation between a learner and a teacher. The teacher is an active organizer of learning frameworks by knowing exactly what is it that she wants learners to learn, how they will be enabled to learn and how the teachers will know that learning has taken place. Piaget (1978:16, cited in Moll, 2002:18) emphasized the importance of the teachers mediation role and notes that the "teachers as organizer remains indispensable in order to create the situations and construct initial devices which present useful problems to the child". The teacher, being the more experienced 'other' in the teaching and learning relationship, has a responsibility to scaffold the learners learning process, and to create challenges that are realized within the learners 'zone of proximal development' (Vygotsky, 1978, cited in *ibid*).This means teachers knowledge and their role in the adaptive structuring of materials for learning in the local context of marine ecosystems was going to be a key focus for the emerging research. The process of reviewing teacher content knowledge of concepts and scientific principles as well as his knowledge of the selection and review of materials was relevant for this study to find out what they already know. The pedagogical shift that is needed according to critical theorists (Cornbleth, 1990:78) is the teachers to develop their mediation roles as the curriculum issues unfolds, mediation is regarded as important.

Moll (2002:17) develops the argument that both Piaget and Vygotsky's theory shows that the active construction of knowledge on the part of the teacher means the unity and transformation of natural and social-cultural processes into new embodied forms of knowledge. However for Vygotsky the mechanism of this construction is social rather than individual. Both Piaget and Vygotsky share the same view that in constructivism, new knowledge is understood to arise from a structured relationship between the external, cultural environment and the mind of the teacher. The structure means that there should be a set of organized learning activities directed at the construction of more and more complex ways of knowing (Moll, 2002:17). Below I discuss the literature on Shulman's theory of pedagogical content knowledge which provides insights on

how teachers can acquire and work with content knowledge of marine ecosystems and develop relevant lesson plans in their own context.

2.6 PEDAGOGICAL THINKING AND CONSTRUCTION OF NEW TEACHER KNOWLEDGE OF MARINE ECOSYSTEMS

Shulman (1987) argued for pedagogical content knowledge which regards the relationship between content knowledge and pedagogy as important to improve teaching and learning. This approach is based on the fact that subject matter knowledge is as equal important as pedagogy in teaching and learning. But children could learn best if teachers know their students, their school culture and the movement of content well. They can create wonderful learning tasks tailored to their own students not only knowing facts and concepts .Teachers should know representation and formulation of concepts and the knowledge of what make concepts difficult or easy to learn. These are relevant knowledge resources based on teaching strategies that incorporate appropriate conceptual representation to address learner difficulties and misconceptions and foster meaningful understanding. There is also knowledge of what the students bring to the learning situation, knowledge that might either be facilitative or dysfunctional for the particular task at hand. This knowledge of students includes their strategies, prior conceptions, misconceptions students are likely to have about a particular domain and potential misapplication of prior knowledge

Shulman's seminal paper work on pedagogical content knowledge and the more recent development of his ideas in the fields of mathematics (Ball, 2008) and science education (Rollnick, 2008), argue that teaching involves far more than content or curriculum knowledge. The papers argue that knowledge for teaching within these fields require both subject matter knowledge (common content knowledge, specialized content knowledge, and pedagogical content knowledge) and pedagogical content knowledge (knowledge of content and students knowledge of content and teaching, and knowledge of curriculum (Ball, 2008).

According to Shulman (1987) Pedagogical Content Knowledge (PCK) has been seen as a radical move away from the notion of pedagogy as a content free skill. PCK also shows the importance of subject matter knowledge in pedagogy for effective teaching. He argued that in the past

content knowledge and pedagogy was treated as mutually exclusive domains. The practical consequence of such exclusion was production of teacher education programs in which a focus was on either subject matter or pedagogy dominated. Such learning of content presented problems for science teacher educators. The problems identified by NSTA (National Science Teachers Association (state that:

There is a poor match between learner needs and teaching methodology", in many traditionally taught courses the emphasis is on learning large amounts of information as a rapid pace", and " division of knowledge, for convenience into disciplines, fields and subfield" that" may contain the development of linkages among concepts across fields (NSTA, 1998).

To address this dichotomy Shulman (1987) proposed to consider the necessary relationship between content knowledge and pedagogy by introducing pedagogical content knowledge. Its assumptions are that teachers who know their students, their school and their movement content well can create wonderful learning tasks specifically tailored to their own students. Shulman (1987) describes several knowledge domains applied by teachers with well developed pedagogical content knowledge. It is knowledge concerned with the representation and formulation of concepts and the knowledge of what make concepts difficult or easy to learn. These are relevant knowledge based on teaching strategies that incorporate appropriate conceptual representation to address learner difficulties and misconceptions and foster meaningful understanding. There is also knowledge of what the students bring to the learning situation, knowledge that might either be facilitative or dysfunctional for the particular task at hand. This knowledge of students includes their strategies, prior conceptions, misconceptions students are likely to have about a particular domain and potential misapplication of prior knowledge.

In relation to the theory of pedagogical content knowledge this study critically considers the decisions and actions taken by teachers in acquiring and using content knowledge of marine ecosystems in their local environment. How these decisions informed them to structure activities that are more local and relevant to their learners context and the curriculum demands. The focus is on how they planned activities organize and adapt materials for instruction and how assessment was conducted. In this study teachers are observed and analyzed on how each

knowledge domain they use helped them to contextualize natural science curriculum and deal with student needs.

Rollnick (2008) in her study of the South African context noted challenges that teachers face not only in teaching content, but in interpreting and recontextualising the curriculum and promoting active learning and assessment. She argued that teachers in the majority of schools feel ill-equipped to teach content in a manner that enables learners to construct knowledge and develop conceptual understanding. This review provides insights for this research to explore and understand the influence of subject matter knowledge on teaching key concepts of marine ecosystem and address learners needs. How the understanding of these concepts can impact on how teachers develop a contextualized Natural Science curriculum. These two questions can be captured and portrayed in the classroom interactions with regards to:

- Awareness of curricular demands
- Lesson preparation
- Use of representations
- Instructional strategies

Ball (2008) argued that a constructivist approach to teacher knowledge development holds that children's learning of subject matter is the product of an interaction between what they are taught and what they bring to any learning situation. Framing this study in a constructivist view of knowledge acquisition teachers can be regarded as learners as they explore and learn the new content knowledge of marine issues to develop their pedagogical content knowledge. Based on this view the research provides opportunities for the recognition of their prior knowledge as it may be influential in improving their acquisition of marine content knowledge and their learning of marine ecosystem. This powerfully affects the ways in which they make sense of new ideas.

Ball argued that like pupil's teachers bring their prior concepts and past experiences to the learning situation. What they think and know about marine issues and the use of materials is explored. How they teach about marine issues and how they think about themselves and the learners learning is relevant. How they feel about their teaching of marine issues. All of the above knowledge about teachers is relevant for this study because teachers need to know more in order to learn new ways of teaching and become effective. This study showed that teachers cannot be regarded as empty vessels when they participate in learning but they bring a lot of

ideas and ways of thinking and feeling related to understanding marine ecosystems and its teaching. They need to know more about their learning about marine ecosystem should draw from their own personal experiences

Fieman-Nemser, 1983 extend the influence of constructivism in acquisition of marine content knowledge. He argued that teachers should be treated as active learners who construct understanding about content knowledge of marine issues and its pedagogy. To base teacher education on a conception of the "teacher as learner" (Feiman-Nemser, 1983), noted that there is a need to know more about these teachers and to develop strategies for working with what they bring with them. This belief is based on the fact that it is their professional knowledge and growth that is likely to affect their learning to teach and contextualize Natural Science curriculum. This approach to knowledge acquisition is not about teaching teachers "how to teach" but providing teachers an opportunity to identify and understand problems involved in the teaching and learning of Natural Science curriculum. This approach allows teachers to raise more questions than answers .According to this view teachers should be encouraged to examine the nature, types and the role of content knowledge that is relevant in teaching Natural Science curriculum. This will help them to understand and bring to the surface new knowledge that is relevant to improve their context. This can help to extend their existing knowledge and improve their current ideas about teaching, learning and learning to teach. This prior knowledge should guide the programme of teachers acquiring content knowledge of marine issues and provides insights and understanding on how to address their needs to improve teaching and learning in their own context. This study provides teachers an opportunity to learn about how they can acquire content knowledge of marine ecosystems and it further guides them to the needs and strategies that are relevant to teach natural science curriculum better.

To extend the idea of constructivist approach to teacher content knowledge development I draw on Grundy (1987) and Cornbleth (1990).Corbnbleth, 1990 argued that acquisition of content knowledge of marine ecosystem should be viewed as a contextualized social process rather than as a product. In this case acquisition of content knowledge of marine ecosystems by teachers should be regarded as an ongoing social activity that is shaped by contextual influences within and beyond the classroom (Cornbleth, 1990:26). If OBE is conceived in this way then the views

of knowledge in the curriculum serves the practical and emancipatory interest and not the technical interest only. Teachers are required to change their views of knowledge and curriculum by moving from content centered approach and its methods to teaching and learning that require the development of critical thinking skills, problem solving and doing investigations. This required teachers to be flexible and multi-skilled when dealing with knowledge construction and learning. The process of generating knowledge through curriculum also changed from regarding knowledge as a 'commodity' into knowledge as socially constructed through meaning making in situated practice.

This means teacher knowledge acquisition is generated through engaging them in interpreting and analyzing their context in terms of the extent to which it can help and become meaningful to achieving the curriculum goals .Central to OBE, teachers are given a responsibility to devise and implement a system of teaching and learning that will facilitate the achievement of learning outcomes and address context specific issues which are related to student learning. The active involvement of teachers in meaning making and understanding is important and that extend the role of the teacher from being only the subject teacher to being the mediator, the teacher and the manager of teaching and learning by assessing the teaching and learning context. The desired change should be known and teachers' planning should represent a process of intentionally and effecting change in the structure of the education system and organization (Cornbleth, 1990:55).

In an OBE framework planning of lessons should be an iterative process of action and reflection in situated practice so that plans are made and actions are changed which will eventually change the initial plans. Plans are not just mere description of activities or events but are evaluated in terms of how they assisted in meaning making and understanding (ibid). The role of the teacher is not only to teach but to evaluate the learning process, assess her methods of teaching and learning, mediate and assess learning. This process of lesson planning does not serve the purpose of implementing lesson plans but contributes in formulating content knowledge base that will support teachers in further action. However this implies a role of planning and assessment as being crucial on the part of the teacher.

The above commentaries shows that the process of acquiring marine content knowledge by teachers does not become something that can be taught to teachers nor does it occur when teachers have acquired the intended knowledge. Instead knowledge acquisition is about the provision of activities that create knowledge as well critique of it. This involves differing and conflicting meanings or constructions of content Knowledge (Grundy, 1987).This is related to a process of praxis which emphasize knowledge in context. This allows teachers to work with knowledge resources and deliberate about their actions other than imposing a body of knowledge in them (ibid). I adopted these perspectives and used them to inform the action research process outlined in Chapter 3 and reported in Chapter 4. A central concern for us, as teachers, was the question of acquiring knowledge in order to improve. In this study teachers seek to explore ways to acquire content knowledge of marine ecosystems that will support them to select and adapt materials that will be more local and relevant to learners. Below I further discuss issues that affect the role of the teacher in teaching and learning and learning to teach about marine ecosystem in the context of teaching and learning support materials (LTSM).

2.7 THE ROLE OF TEACHERS AND THE USE OF TEACHING AND LEARNING SUPPORT MATERIALS (LTSM).

Educational policy in South Africa requires that teachers not only rely on textbooks, but should develop the skills to adapt and prepare LTSM themselves. According to (DoE, 2003:65) the role of teachers in developing LTSM is emphasized by curriculum 2005 to ensure that classroom based activities are supported by relevant and appropriate LTSM generated by the teacher. Good quality LTSM can support the teachers to meet the objectives of the curriculum, can be effective in the context in which they are used and can provide scaffolds for learning, and support the teacher in terms of methodology only if they are interpreted and aligned with materials.

It is also required that teachers are able to select and use existing materials effectively to ensure that the direct needs of a particular group of learners are considered. The policy state that the provision of materials in schools will not automatically result to effective teaching and learning but the teacher had to devise and implement a system that will ensure the effective use of materials (DoE, 2003:66).

Generic guidelines for the production of LTSM (DoE 1998, cited in Lotz-Sisitka & Raven, 2001:48) indicates a role for teachers to both use and produce LTSM, with much of the training being focused on the production of LTSM. Several kinds of knowledge are important for the task of adapting LTSM such as knowledge of the discipline to be taught, nature of learners, context of the school and community at large, characteristics of the learners who will use the LTSM and knowledge of the materials development process itself (Ben-Peretz 1990:11). Alignment with the curriculum and active learning approaches and the educators mediation role (what the educators are required to do to use materials in teaching -learning interactions) are further factors that need to be considered in LTSM development (NEEP-GET 2005:38).

The teachers' ability to select and develop appropriate activities that are relevant to the learners and the issues being addressed is related to the teacher's knowledge of the subject or topic (Mbanjwa, 2002). In this case teachers should be able to access and understand available information on marine and coastal resources and issues to enable and support learners to access such information. For teachers to adapt and use LTSM, conceptual understanding and content knowledge of the topics to be dealt with would seem to be important. This could enhance the ability of the teacher to design educational experiences that are meaningful for learners.

Taylor and Vinjevold (1999:130) reported that one of the most consistent findings of a number of Presidents Education Initiative (PEI) research projects illuminated teachers "… low levels of conceptual knowledge, their poor grasp of the fundamental concepts in the knowledge areas for which they are responsible", and that topics are dealt with at low levels of challenge. This finding was also reported in the Learning for Sustainability research (Janse van Ransburg & Lotz-Sisitka, 2000), in the NEEP-GET pilot research (Lotz-Sisitka & Raven, 2001) and in the NEEP-GET research (NEEP-GET, 2005b). Pile and Smith (cited in Taylor &Vinjevold, 1999:139) further reported that when teachers lack background knowledge in their discipline it becomes difficult for them to develop learning activities effectively, leading to poor quality learning outcomes. According to this study poor understanding of the subject causes teachers to lack confidence in what they do and to make factual errors. Teacher's poor grasp of knowledge structures acts as a major inhibitor of teaching and learning and this has been perceived as a general problem in South Africa (Lotz-Sisitka & Raven 2001; Chisholm et al. 2000). These researchers (*ibid*) share the view that it is not only the provision of materials but selection and

capacity to use materials that are important in enabling improved quality in teaching and learning. Mbanjwa's (2002) research into the use of learning support materials established that improvement of teacher knowledge (through available materials / knowledge resources) is an important dimension of improving the quality of the teaching and learning activities presented to learners, while Nduna's (2004) research highlighted the importance of the teachers' capacity to effectively mediate learning using learning support materials. This raises the question of how teachers could be supported to access and use appropriate knowledge resources and how they could be supported to use these resources in localized curriculum development work.

(Russo & Lotz, 2003: 11) the lack of reflexivity occurs when teachers neglect consideration of how materials are going to be used. They argued that materials in this case are often viewed as products that are detached from learning process. (Russo and Lotz, 2003:12) noted that this view of materials development process may lead to a commodofication of learning support materials where the materials are seen as 'objects' or 'commodities'. In this way the relationship between product and process is often neglected. (Russo & Lotz, 2003:12) argued that various ways of adapting materials are evident for example there is 'adoption' of existing materials without a clarification of learning processes associated with the use of these learning support materials. A further example is the adoption of ready-made diagrams and illustrations (in development of new materials) without proper adaptation these to the intended learning processes. Learning support materials can be 'adopted' in ways that are inappropriate to the context for which they are intended. Content may also be misunderstood or learning support materials may not be appropriate for a particular learner group. The study showed that teachers lacked the skills to understand the purpose of the materials and that presented some challenges in improving lesson plans and also improving their teaching and learning.

The research report on Education in South African rural schools mentions that lack of textbooks is perceived by teachers as problematic as they are not enough and teachers find materials difficult to explain to learners (Mandela, N. 2005:83). Research findings indicates that under resources schools experienced difficulties to access appropriate resources(NEEP-GET 2005:37).In the new curriculum educators are faced with the challenge to mediate environmental learning and in many cases teachers have limited knowledge of environmental issues(ibid.)There is a relationship between LTSM, learners work and assessment however the research emphasizes the purpose of the material and the extent in which LTSM could be aligned with the curriculum and active learning approaches. The research employs several kinds of knowledge

that are important for the task of adaptation of resources such as knowledge of marine issues, nature of learners ,context of the school and community at large ,characteristics of the learners who will use the LSM and knowledge of the materials development process itself (Ben-Peretz1990:11). Furthermore NEEP-GET project suggest that the design of materials should consider the educators mediation role (what the educators are required to do to use materials in teaching -learning interactions) (NEEP-GET 2005:38).

The research focus on Natural Science learning areas with emphasis on the curriculum principle which requires educators to establish the relationship between a healthy environment, social justice, human rights and inclusivity .The NEEP-GET has provided guidance on how this principle influences all learning areas, and consequently how lesson planning is influenced by this policy framework (NEEP-GET 2005a).The RNCS principles, learning outcomes and assessment standards strongly emphasize an environmental focus in teaching and learning. Identifying environmental issues (such as degradation of coastal and marine resources) and investigating them requires science process skills (NEEP-GET 2005a:12). Learning outcome number one of the Natural Science learning area suggests a focus on strategies used by people to understand a new situation. Scientific knowledge and understanding is highlighted by learning outcome number two as the building blocks from which learners should construct relevant science tasks (*ibid: 12*).

Focusing on these learning outcomes, and on the adaptation and use of available knowledge resources which focus on marine and coastal issues, a reflexive orientation which allows teachers to plan, act and reflect on how and why they develop, adapt and use materials will be used. Russo and Lotz-Sisitka (2003) contend that a focus on process in materials development is likely to enable environmental educators to better understand the pedagogical assumptions and approaches which inform and underpin the LSM they use.

Alluding to this, Olivitt (2004) argues that materials become "learning supportive" only when the teacher can develop the skill to devise a teaching system in which materials will be used to ensure the development of assessment standards and learning outcomes. That means the

materials become useful when the teacher knows the purpose for the learning processes and how to use materials to structure the teaching and learning process in ways that relates to assessment. The misinterpretation of active learning framework and limited understanding of working with materials affected the learning opportunities provided to learners. She further argues that the effectiveness of the learning support materials is the 'supporting and stimulating role' that could help teachers to develop curriculum activities out of the established Learning Area Outcomes and Assessment standards.

The Learning for Sustainability project indicated that an educator requires adequate conceptual capital, relevant local knowledge, access to, and the capacity to use learning support materials (Lotz-Sisitka & Olivier, 2000: 85). Lots-Sisitka and Olivier (ibid) further note that educators also need relevant learning area knowledge and expertise for the design of learning support material at local level. They also argued that it is not materials that bring about change but rather the quality of interaction around materials. Taylor (cited in Lotz, 1996:5) describes the focus on materials to bring about change as a myth that is prevalent in environmental education. He notes that while materials may be able to support better education processes, as technologies (they) can never direct social change.

Lotz-Sisitka and Olivier (2000: 100) notes that an integrated approach to professional development, materials and curriculum development seems to have been what was neglected, while emphasis has been placed on professional development. These research findings emphasize the role of LTSM in enabling educational transformation, and make the point that LTSM alone will not make a difference without professional development support. It is the integrated approach to curriculum materials and professional development that is significant. These findings informed the design of the project so that the development of the content knowledge and educational practice was designed to happen through work with materials in a context of professional development support from the Museum education service that specialized in marine ecosystems.

2.8 ACTIVE LEARNING AND MEDIATION OF LEARNING

The use of active learning framework was based on supporting teachers to 'learn about learning'. This framework is supported by a constructivist view of learning and is widely supported by

environmental education processes and is also a view of learning underpinning the transformation to OBE (NEEP-GET, 2005). This accords with active learning approaches such as those developed by NEEP-GET (2005) that allow for recognition of prior knowledge and knowledge construction processes involving interactions (with text and context) and meaning making. O'donoghue (2001) notes that present perspective on Environmental Education and diverse notions of education for sustainability were developed in response to emerging socio-ecological risks. These perspectives require a wide range of perspectives as well as teaching and strategies. These are centered on activities involving contextual social processes of cultural induction and critical reflexive re-orientation within important and open-ended educational processes for sustainable human interaction in healthy, just and equitable environments.

NEEP –GET, 2004:27 argued that the use of active learning framework in lesson planning is meant to support teachers in acquiring content knowledge and develop a range of strategies to mobilize learner's prior knowledge and use LTSM to provide additional information of marine issues. Teachers have a responsibility of mediating environmental learning with learners in their environment. They are required to mediate learning in a pro-active and carefully planned way. The framework supports and guides teachers in using processes of investigation, seeking information, take action and reflecting on the outcomes of learning. Some common sense questions can spark ideas and help teachers and learners to structure enquiry based active learning and to take action for the environment (NEEP-GET, 2004:26).
These questions are:
What do learners already know?
What do learners need to find out?
How will they investigate the issues?

Considering these questions in lesson planning would enable teachers to mobilize learner's prior knowledge and scaffold them to a higher level of understanding. In this way teachers planning of lessons can support learner-centered and constructivism as required in NCS (R-9). A learner centered approach to Education in OBE is explained as responding to what learners already know, challenging them to learn more than they already know and engaging learners actively in meaning making through relevant activities and support from the educator (NEEP-GET, 2004).

When learners are encouraged to interact in social and cultural context through the process of dialogue (talking), encounter (doing things) and reflection (thinking about what has been done) such learning is centered on the ideas of active learning(NEEP-GET, 2005)

Lotz-Sisitka & Raven, 2001:33 noted that active learning should not be viewed as a thing or a particular method to be implemented across curriculum. It should be regarded as tools towards informed pedagogical practice. In this study the active learning framework was used as a scaffolding activity with teachers to make pedagogical choices on the materials they used. They reviewed materials on marine issues and develop lesson plans in interaction with learners. When teachers use active learning framework as a strategy to learn and teach about marine ecosystems that can contribute to an improved pedagogical practice.

Engaging teachers in processes of active learning planning processes contributes to acquisition of marine ecosystems and content knowledge of teachers. Using active learning framework as an approach to teacher knowledge acquisition allows teachers to explore, find strategies and use new knowledge and materials that will be relevant in their own contexts. This could make it relevant for teachers to structure lesson activities and mediate learning .This framework is also relevant to help teachers develop a range of different strategies to mobilize learners prior knowledge and use LTSM to provide additional information. These processes could also support teachers to foster enquiry skills (NEEP-GET, 2004:26).

Constructivist approach which is a view of learning supported by OBE and Environmental Education processes emphasize the social aspect of learning where learning context and active learning is encouraged (Moll, 2002). Constructivist views of learning as suggested by Klein and Merit (1994) emphasize the posing of a question or real life problem for students to investigate. The teacher needs to modify questioning based on an understanding of students prior knowledge and thought processes. The role of the teachers should be to create a learning environment that is conducive to the construction of knowledge, providing guidance, assigning appropriate tasks, making resources and materials available to students and supporting students in their interaction with others (ibid). As identified above, in the South African context this requires attention to

teacher knowledge of the subject being discussed with learners. By working in groups students develop listening and group interaction skills and discover new insights and ideas related to the problem they investigate (ibid). As identified above, in the South African context this requires attention to teacher knowledge of the subject being discussed with learners. By working in groups students develop listening and group interaction skills and discover new insights and ideas related to the problem they investigate (ibid). Jonassen (1991, cited in Klein & Merrit, 1994) also views effective assessment as integrated into instruction. Jonassen (ibid) recommends a need to clarify the skills and processes of assessment that are being evaluated at a given time and the setting of high standards for student performance.

2.9 ASSESSMENT AND LESSON PLANNING

Assessment is a very important part of teaching and learning and it should form part of planning and preparation for effective teaching and learning. According to the curriculum policy assessment should be viewed as a critical and integrated part of teaching learning process along with planning for teaching, learning and assessment activities that begins with a lesson plan. When planning for assessment teachers need to know what knowledge, skills, attitudes and values the learners are supposed to know. Teachers should be able to integrate the assessment programme within teaching and learning activities (DoE, 2003:16).

Lesson planning and assessment should be based on the learning outcomes and assessment standards provided in the curriculum policy to ensure high knowledge high skills for all (NEEP-GET, 2004: 29).Using learning outcomes and assessment standards for planning assessment will ensure that activities will not be too superficial, and it will ensure that the required minimum level of knowledge and skills are developed and assessed. This will also ensure that learning activities and assessment tasks progress from grade to grade (ibid: 29). To progress learners need to demonstrate ongoing development of skills, knowledge and values described in the learning outcomes (ibid: 29).The assessment standards provides an indication of the minimum level of achievements.

Assessment is seen developmental rather than being judgmental and teachers and learners work together to improve performance. In this study Learning outcomes and assessment standards framework was used to provide a learning opportunity for teachers to learn about developing quality lesson plans which provide meaningful learning opportunities for learners. According to this framework learning activities should show links between Learning Outcomes and Assessment Standards. The learning activity should show how LTSM are used and how assessment will be conducted and reflections on the active learning approaches will be approached (NEEP-GET, 2004).This lesson planning process helps the teacher to review, and reflect on their lesson plans which could inform further planning.

This means that assessment is not something that should be taught at the end of a lesson. In outcomes based education assessment is used to monitor progress (NEEP-GET, 2004:29). It is learner centered and focuses on each learner being able to reach his or her full potential. Curriculum policy documents provide opportunity for teachers to allow for extended assessment activities other than the content explicit in the assessment standards. This allowed for meaningful integrated teaching and learning across other learning area (DoE, 2003). Teachers need to be creative and allow learners to reach further than minimum requirements in a process of conceptual progression. Providing other forms of content within learning contexts can do this and will help to extend the depth of activities within the grade (DoE, 2002).This can inform both the teacher and the learner for improved teaching and learning and what kind of lessons to plan in future (Ncula, 2007:90).

Outcomes based approach to assessment emphasizes the observation and measurement of performance (Jansen, 1999:83). Outcome statements indicate what learners must be able to do when they have successfully completed a specific learning programme (ibid). The teacher has to carefully observe the specific performance that can be checked against a 'task'. This required the teachers to explicitly, spelled out in activities which are related to the context of the learners (ibid). This approach to assessment is informed by formative and continuous activities. These activities have a great potential to form and shape the teaching and learning process.

Learning is always contextualized and developmental within specific practices. It is a continuous process that uses constructive feedback to help learners and teachers to grow (DoE, 2005). Teachers need to think about testing and evaluation as an extension of instruction, not as separate from the instructional process. This includes checking for understanding and misunderstanding during interactive teaching as well as testing students understanding at the end of lessons or units. It also involves evaluating and assessing one's own performance and adjusting for different circumstances.

The assessment policy required teachers to collect evidence for assessment purposes. They should ensure that different tools and strategies are used for conducting and recording assessment. Assessment activities should be based on the assessment standards and assessment tools should be planned alongside learning activities and different assessment tools can be used to assess learning (NEEP-GET, 2004:43). Teachers are required to collect evidence to evaluate what they have done and also help learners to reflect on the learning outcomes and their learning achievements. Planning for assessment is integral to lesson planning and teacher knowledge development. These assessment demands provided insights in engaging teachers and learners in teaching and learning activities.

2.10 CONCLUDING SUMMARY

This chapter presents a broader view of the context in which this action research case study of the acquisition of content knowledge of marine ecosystems, adaptation of materials and lesson planning by teachers. It includes discussion about the new curriculum and its demands on teacher's acquisition of content knowledge of marine ecosystems and new teacher practices. It also considered the theories of curriculum in context and how this approach can be implemented to support OBE in schools. It further noted the pedagogical content knowledge as a strategy for teachers to learn and develop their content knowledge of marine ecosystems. In the next chapter I discuss research design which will support the research goals.

CHAPTER 3
RESEARCH METHODOLOGY

3.1. INTRODUCTION

This chapter outlines the research design decisions, methodology and methods employed to generate data. As described in Chapter One, the research process seeks to generate data to answer the research question about how teachers' knowledge of marine and coastal issues can be developed so that they are able to adapt materials and develop meaningful lesson plans. I further describe the theoretical framework that informs the methodology and methods used in the study. The emphasis is on broader trends and emergent reasons for decisions taken rather than a detailed description of the techniques. This chapter provides a picture of how some of these methodological decisions have been implemented in the research.

3.2. RESEARCH ORIENTATION AND METHODOLOGY

In designing this research I decided to work within an interpretive and qualitative approach because it focuses on understanding social practice (Scott & Usher, 1996: 180). The interpretive paradigm provides an understanding based on interpreting human action in a social context. According to Connole (1998:13) interpretive research concentrates on contextual meaning making rather than generalized rules. The aim of the researcher in this case is to understand the motives, beliefs and thoughts of teachers, and how these influence LTSM development and use and contextualized curriculum development (as outlined above).

From an interpretive perspective human actions have reasons. Actions are preceded by intentions and may be accompanied by reflections (ibid). Actions take place within a structure of social rules within which they have meaning for both the actor and observer (ibid). Meanings are generated and shared through language and other forms of symbolism and are negotiated (Connole, 1998: 13). In this case the task of the researcher becomes that of understanding the situation as it unfolds during the research process. To do this requires not detachment, but active involvement in the process of negotiated meaning, using the researcher's social competence (ibid). Action takes place within a context and is often ambiguous; therefore the interpretive perspective places its primary emphasis on this process of understanding. From this, the

researcher can identify patterns of meaning which emerge, and then possibly generalize from them (ibid).

An interpretive research framework recognizes that the researcher works directly with individuals and their interpretations of their practice so as to develop theory with them and from the perspectives and experiences they share (Cohen et al., 2000). These authors suggest that theory should emerge from the data arising in particular situations (Cohen et al, 2000). Data and interpretation of results should, therefore, be tied to the context of the research (Neumann, 2000). This is relevant to my research as the data generated will be examining how the theory behind the development of teachers' knowledge ties up with the actual ways in which teachers make decisions on how to use materials and develop lesson plans.

The interpretive case study provides an opportunity to take a closer look at individual teachers in a "naturalistic" setting, using an in-depth case study (Janse van Rensburg, 2001:16). Case study research provided me an opportunity to narrow down my goals to specific schools with a specific purpose. I decided to work with three schools with one teacher in each school. This case study is developed to explore and understand the particularity and complexities of a single case (Stake, 1995; Bassey, 1999). A case study provides descriptive, rich information about a specific situation and allows room for new ideas to emerge from data.

Bassey (1994: 40) describes case study as "…an empirical enquiry conducted within a localized boundary of space and time, focusing on data collection". Educational case studies generate knowledge based on observation, and are often qualitative (McTaggart, 1990: 34).). Educational case study involves "… enquiry into aspects of educational activities in context to inform decisions of practitioners or policy makers" (Bassey 1994:58).Yin (2003) states that case study research involves direct observation of events, and normally involves interviews with the persons involved in the events. Stake (1995:85) supports Yin's statement that "…case studies are undertaken to make the case understandable" and indicates that a single case "…is not a strong base of generalization but forms a new opportunity to modify old generalizations."

Walker (1985:4) defines a case study as an "…examination of an instance in action, it is a study of particular incidents and events". Through this case study I wanted to get an in-depth understanding using intensive descriptions and analyses (Merriam, 1998:19), Neumann (1997:331) supports Merriam in this respect and argues that a researcher, when gathering information goes in to greater depth to obtain more details on the cases being examined.

The case study approach provides opportunity to explore how teachers can work together towards a common particular goal. I also wanted to know how teachers' knowledge can emerge from context and how, as teachers, we can work together and make sense and meaning of what we do. It was on this basis that I felt that participatory action research was a relevant approach to use.

3.3. PARTICIPATORY ACTION RESEARCH

Partipatory action research is a research approach that is concerned with changing individuals on the one hand, and the culture of groups, institutions and societies on the other. These changes cannot be imposed, but people agree to work together to change themselves (McTaggart, 1997:30). It starts small and develops through the self-reflective spiral of planning, acting, and observing and then re-plans for further implementation. The collective plays an important role in deciding where the group and individuals may exert their efforts most effectively. In turn, the collective reflects on observations made about action taken and uses this reflexivity activity to inform decisions about future action steps (McTaggart, 1997:34). This approach was used in this research as it provided an opportunity for us, as teachers, to improve our practice.

3.3.1 ACTION RESEARCH CYCLES

3.3.1.1 Phase one

This phase of the research involved participatory contextual profiling research with the aim to establish information about the contextual situation through a co-engagement with the participants. "Participatory research involves shared decision making, which implies shared control and power among participants" (Narayan, 1996: 22).The purpose is to contribute towards

understanding of a problem leading to decision making that will lead to action (ibid). Questionnaires were used to obtain general information about the teacher and the school (appendix 4). This information provided insights about the context of the school and other factors that might impact on the research process. Focus group interviews and review processes of materials were used to collect data about teachers' knowledge (appendix 5a). It was noted that teachers had never seen marine resources and therefore required a workshop and a field trip. Mary Bursey who is knowledgeable about marine issues supported us in implementing these activities. This phase of the research was important to establish a process relevant to practitioner's problems (Scott & Usher 1996:107).

3.3.1. 2 Phase two

3.3.1.2.1 Cycle one

Being informed by the Museum workshop, a combined lesson plan was developed by teachers (appendix 6a). I transcribed their discussion through which they were able to explain their use of resources such as the East Coast Rocky Shores booklet as it contained suitable information. Environment and active learning in the OBE booklet was used to access information about active learning processes. A poster was used to get pictures of animals that would be used by learners when they developed food chains (appendix 11). When analyzing the lesson plan I realized that teachers wanted to develop activities that would show the concepts of food chains, food webs and food pyramids, but they did not know how to do it. The second sets of lesson plans they developed after a field trip showed that there was still a gap between what the teachers had learnt about marine issues and their use of materials to develop lesson plans (appendix 6b, 6c, 6d). I realized teachers had gained knowledge and information on marine and coastal issues but this did not help them to use learning resources materials and design lesson plans.

3.3.1.2.2 Cycle two

Reflections were made about the lesson plan and we noted that we were unable to develop lesson that encourage active learning (appendix 5b). We asked for assistance from Marietta who works in the Museum and Phillip from WESSA, both of whom are educational officers. In conjunction with the resources they gave us, we used the lesson plan from the Internet which was based on classification of marine animals. Lessons were developed and implemented and I made

classroom observations. Details of the analysis are provided in chapter four (See section 4.3.3.2.2)

3.4 DATA GENERATION TECHNIQUES

3.4.1. Focus group Interviews

I started the research process by conducting focus group interviews. A focus group interview provides opportunity to accumulate high quality data in a social context. In this research, three teachers participated in a group interview about issues that affect them (Patton 1990, cited in South wood, 2004:1). The focus group proved to be a suitable way of getting information rather than individual interviews. Because of the place where I work, it was easy to collect information in this way to establish a platform for participatory research.

Focus group interviews took place at Byletts Combined School where I teach. It was during the morning session of the marine workshop day, as the workshop was going to be on the 26-05 2004 at 12 o'clock. In addition to the three primary school teachers I introduced in Chapter One, during the focus group discussion there were two secondary school teachers who became part of the research process. The focus of the interview was on Grade Seven teaching, but because the marine campaign included grades eight and nine it was decided to include the high school teachers in the interview. Specific topics were discussed to find out what teachers already knew about marine and coastal issues and how they would include such knowledge in the curriculum. Focus group interviews were transcribed and data was analyzed into codes which were later developed into themes (Appendix 5a). A transcript of the interview was provided and teachers were invited to assist with the analysis of the interview (as this is a participatory research process). Analytic memos were returned to the interviewees for validation and further comment was made. Elliot (1991a:137 cited in Lotz, 1996) sees transcripts as a valuable supplementary record because they assist data analysis as they circulate for feedback and enable comparison with other sources of data. Further probing of issues was undertaken with teachers and a follow up workshop was planned to address the issues that emerged.

3.4.2. Workshop

According to Hope and Timmel (1986, cited in Lupele 2002) workshops have become common methods in strategic planning of community mobilization processes and provide insight for professionals (Lotz, 1996). I used inquiry-based workshops as an opportunity to work together with the educators, review materials, develops LTSM, plan and reflect on the research process. Workshops were an important component of the action research process, as they were focused on the action and reflection component of the participatory action research process (Mbanjwa, 2002:60). After each workshop the output was a set of draft learning support materials that were refined until the implementation classroom observation stage. Planning for this workshop was challenging because I had to think of the purpose and the structure as well as resources that were going to be used. I could not find information about how to review materials and I decided to use the experiences I had of reviewing materials from a Bachelor of Education Course (B.Ed). Finding materials on marine and coastal issues was also difficult. I had to associate myself with an organization which deals with marine education, like SAIB (South African Institute for Biodiversity) and MCEN (Marine and coastal Educators Network) which exposed me to knowledge of marine resources and materials. During the review there were many resources which I was able to bring to the workshop, and teachers also brought some like the marine poster, National Curriculum Policy document for Natural Sciences, MCEN file etc (appendix 11). I suggested the use of the active learning framework for the review of materials. Teachers identified topics they were familiar with from the poster and they thought about how they can teach those topics using the materials.

The workshop at the Museum was supposed to be done by means of a power point presentation, but unfortunately there was no electricity so Mary had to give us a lecture about the zonation where the animals occur, how the physical conditions like tides, temperature, waves affect the animals, and how they are adapted to such conditions. Thereafter we looked at shells. This was continued through a field trip.

In order to monitor the process I used a tape recorder to capture the discussions. I also used Lotz's ideas by collecting samples of all correspondence surrounding the workshops, workshop programme, and workshop planning and evaluation materials. Analysis of the workshop data took place both during workshop and in later reflections.

3.4.3 Journal entries and field notes

Sometimes it was difficult to distinguish between my research and my work as a project co-coordinator (Lupele, 2003:113). To help me record insights for the research process, I kept a record of important and salient events of the networking process. These were mainly events I felt had a bearing on the research process or questions. They included my own reflections, observations and interpretations of activities and occurrences in the life of the research. All field notes were recorded in my personal diary and research notebook. Throughout the research period I recorded events and ideas which I thought were worth remembering (Patton 1990). Data from field notes was used to triangulate and validate data from other sources. The observations provided me with further insight into the research process, especially as I read through some of the records from informal discussion with members. Although Creswell (2003) recommends that in taking field notes (observations) on behavior and activities of individuals, the researchers needs to develop a structured schedule beforehand, indicating what aspects he or she intends to observe, my use of note books to record field notes was done more randomly and I recorded events and activities as they happened.

Journal records and analytic memos are systematic attempts to facilitate the interpretive process that is at the heart of qualitative research. Ezzy (2002) claims, "Keeping a journal and regularly writing memos encourages researchers to reflect on their emerging understanding of the data". I used a journal to record my insights and thoughts about my actions immediately after every activity during the research process. Journals helped me and the teachers to analyze our feelings and reactions to what we experienced and saw. Kerfoot and Winburg (1997:74; cited in Nduna 2003:43) discuss journals as tools that a) offer an effective way of bringing out what was observed during the day b) promote reflections.

3.4.4. Document analysis

A further data collection strategy involved the collection of materials and documents. This included materials used, lesson plans etc. This provided documented evidence of what happened in the classroom and provided further insights into how teachers worked with materials to develop lesson plans. Yin (1994:80) states that "…documentation is a stable source that can be

reviewed repeatedly". Document analysis is also very important because documents can provide information and understanding of what is happening in the classroom (Hopkins, 1993:140). In this study documentation was used in conjunction with other sources of data. Documents (e.g. the Revised National Curriculum Statement (RNCS) and, and workshop documents and reports) provided further insight into the issues and problems (Elliot 1992:6). They were critically reviewed in the light of their relevance to the goals and purpose of the study (Lotz-Sisitka 1996:95). Patton (2001) observes that documents prove valuable not only because of what can be learned directly from them but also as a stimuli for a path of inquiry. In this case the path of enquiry begins with an investigation between the links in content knowledge, LTSM and lesson planning focusing on marine and coastal resources and issues and the opportunities that can be created for learners. Learners' work was also part of the documents that provided insight to the study.

3.4.5. Participant Observation

As noted above, I was involved in the process, and I have therefore been a participant observer in all the stages of the study. Jorgensen (1989, cited in Nduna, 2003) state that the participant observation is especially appropriate for exploratory studies aimed at theoretical interpretation. When observing, the researcher has the opportunity to look at what is taking place in the particular situation rather than getting second hand information. I also used a diary to capture field experiences as suggested by Lincolin and Guba (1985). According to Tellis (1997 unpage), for a participant observer to be successful in a study, the observer needs to join the groups being observed for an extended period. He further argues that in participant observation the researcher may be living with the group and is involved in the daily lives of its members. In my study I am involved in the working life of the teachers I am observing. Hopkins (1999: 77, cited in Nduna 2003) states that observations in educational research play a crucial role, not only in classroom research but in supporting the professional growth of teachers.

The emphasis of the research was to obtain firsthand experience of the interactions between myself and the teachers when considering and adapting the LTSM. Therefore I played two roles: that of both participant and observer (Scott & Usher, 1996). I was, therefore, able to work together with the other teachers, to reflect on the research processes I employed and to find ways

for future improvement. I used a tape recorder to capture the workshop discussions and I was able to get first hand information of what was happening. Because I shared the same experiences with them I was able to actively participate in the discussions and relate to my classroom experiences. At the same time I was cautioned not to impose my ideas on teachers, but to share my experiences with them. I was aware of my role in the research process and what I wanted to achieve. At the same time my involvement encouraged teachers to feel free to talk about their feelings and experiences and that has contributed to building a relationship of trust. At first there were tensions and teachers did not want to display any lack of knowledge or understanding of the process, but later, when the trust relationship had been established, they felt more free to talk about their feelings and experiences in an environment of openness. I was able to make observations on personal accounts, of feelings, reactions, interpretation and explanations (Kemmis et al, cited in Elliot, 1992:77).

I was also able to show them the limited understanding I had during the research process and this created a space for them to collaborate in the discussion. I think participant observation contributed in building the relationship of trust and it created a space to know each other better. The observations helped me to document interactions during discussion as well as the interactions of teachers as they engaged with materials, thus developing their knowledge and creating confidence in the process. I also made informal observations of the activities whilst the teachers were engaged with materials. Observing the materials in use was a successful way to gain insight into how they were being used ((Russo & Lotz-Sisitka 2003:50). I was able to observe teachers in their classrooms and how they used materials to provide learning opportunities for learners, and how learners were helped by the use of materials to learn to be actively involved in the learning process. My recordings were not merely what I observed, but a description of the different settings which were important during the visit (Lupele, 2004). Observation was used to triangulate and validate data from other sources and methods. I also used observations during the awareness campaign and during the teachers' workshops we had with the schools around the Coast.

3.5 ANALYSIS

According to Patton (1990) there are no straightforward tests and rules of data analysis in qualitative research that can replicate analytical thought processes. The process of data analysis started with the planning workshop data. I have used colour stickers to code all the data I have collected during the planning stage, during classroom activities and also during interviews and during focus group interviews.

Lesson planning documents were developed during the planning workshop for use in the Senior Phase. I developed categories and subcategories from the data I collected, through a process of comparing and triangulating the data from different sources. According to Yin (1993) one would be more confident in saying that the event actually took place if the study showed that information from interviews, documents and own observations all pointed in the same direction. After I had developed the categories and subcategories I used coloured stickers to further code the data. I then developed an analytical memo for each category, which helped me to organize the data coded. Data analysis was part of the research process as different stages of action research cycles that happened over time, took into consideration different sites and activities that took place (Nduna, 2003:47). Data analysis was negotiated with the research participants but it was my responsibility to do the final analysis. Glauser & Strauss (1997) suggested a method in qualitative analysis that uses constant comparing method of data analysis.

I collected all field notes, transcripts, documents and other materials and read them thoroughly so as to know the data well. As I read through the data I wrote down some points that struck my mind in the margin. I apply coding to identify responses, consequences, intentions, incidents and whatever was of interest to the research question. As I continued with coding I used a constant comparison approach to generate themes (Glaser and Straus, 1997:106). Analytic memos addressing key emerging themes were developed, as these provided an opportunity to summarize all major findings (ibid 108). By constantly comparing different pieces of data I looked for relationships or links between actual phrases, statements or paragraphs in the data (Strauss & Corbin, 1997). In this way theory emerged from data and it provided insight for the next cycles. Terre-Blanche and Kelly (1999) and Neumann, (2000) argued for organizing data in order to inform the next phase of inquiry. Neumann (2000) points out that qualitative researcher organize

data in categories on the basis of themes, concepts or similar features. The data was then coded according to themes that fell onto the same category.

3.6 ETHICS AND TRUSTWORTHINESS

I used an opportunity during our Eco-schools meeting which was on the 26-04-2005 to introduce the research to the teachers. I had a copy of my proposal and I explained to teachers the purpose of the research and how it can provide an opportunity for us to work together and improve practice. I motivated my argument by reflecting back on the problems we had during Adopt –a-Beach and I told them that I want to research about how our knowledge of marine issues could be improved so that we can be able to design lesson plans. Informed by Bassey's strategies for ethical considerations (Bassey, 1999), I explained to teachers about the research process outlined in the ethical protocol form. The following week I visited the schools to introduce the research to the principals. During the research process I collected data in a way that reflect their ownership of the data (Attiti, 2003).For data collection purposes I asked permission from teachers to use the tape-record to capture the discussion and I explained to them reasons for my actions.
Patton (2002) notes that transcribing offers another point of transition between data collection and analysis as part of data management and preparation.

3.7 VALIDITY AND RELIABILITY

In order to ensure validity and trustworthiness I have used multiple sources of information. According to Maxwell (1996:282) "…all qualitative researchers agree that not all possible accounts of some individual, situation, or program are equally useful, credible or legitimate". In this study I have used four strategies to enhance internality validity. They are as follows: Triangulation by using multiple sources of data collection like observation, interviews and document analysis (Lather 1986). Ashwell (cited in Mbambisa 2005) defines triangulation as a method of comparing and contrasting evidence using a number of different research tools or situations, in order to find points of agreement. Lather (1996) concurs with Mathson (1988), Miles and Huberman (1984) cited in Mathison [1988]) when she used more than one method to generate data in her study, and data derived from these methods was triangulated during the analysis phase.

Member checking by sharing interpretations of the study with the teachers to verify my reporting (Lather, 1986).I have also clarified and reflected on my intentions throughout, in order to address researchers bias (Merriam, 1998:204-206, Maxwell. 1996:93-94); and I have collected what is termed by Maxwell (1996:95) as "rich data" and have provided a thick description. In order to ensure the trustworthiness of this research I have used thick description to reflect what I heard from the focus group discussion and analyzed from the documents .According to Patton (1990:375), it is important that "… coherent answers to major descriptive questions should be put together before one starts to interpret the data". This is known as "thick description".

Triangulation was used to get multiple perspectives on the same event using at least three data sources (Kerfoot & Winberg, 1997). Face validity techniques were applied where research participants reviewed their findings and gave feedback. Validity was confirmed through consensus discussion and dialogue. Credibility of design and methods was established by involving stakeholders at the onset in decisions about which methods to use. Every suggestion providing new information was scrutinized to determine how the information was directly relevant to solving problems. Where users were themselves involved in data collection, information obviously had greater credibility than where it was collected by others. Thereafter, I asked teachers to facilitate this. I also took the data analysis to the teachers for further validation and comments by taking the transcript to them. Out of respect for truthfulness I kept a systematic and careful record of data in order to safeguard my work from any question of validity. I have also been truthful in data collection, analysis and reporting of findings.

3.8 CONCLUDING SUMMARY

This chapter describes the research design. It indicates the reasons for undertaking an interpretive participatory action research study. I described the data generation techniques that I used in the study, and also described the data analysis approach and outlined the categories I developed from the data. I then discussed validity and trustworthiness and how I dealt with ethical issues.

CHAPTER 4
ACQUISITION OF KNOWLEDGE, USE OF MATERIALS AND LESSON PLANNING FOR A CONTEXTUALISED CURRICULUM

4.1. INTRODUCTION

This chapter reports on the action research process of teachers acquiring knowledge of marine ecosystems and coastal issues, working with materials to develop lesson plans and then implementing the lesson plans to improve the teaching and learning of marine and coastal issues. I also report various findings where the data generated were used to inform our work on the learning of content and the improvement of lessons planning.

Phase one of the research process is based on the findings from focus group interviews and a review of materials by teachers. Here I provide an overview of the teacher's general understanding of marine and coastal issues, development and use of materials as well as lesson planning. The phase one process involved the establishment of co-engagement with teachers. This included contextual profiling of teachers' knowledge of marine and coastal issues through questionnaires and focus group interviews, followed by a review of materials. This then led to further planning and the second phase.

Phase two is based on two participatory action cycles that included a workshop on content and a field trip to the rocky shores. Cycle one of the research process reports findings on how teachers planned lessons together to integrate marine and coastal issues in the Natural Science Learning Area. Cycle two is informed by findings from cycle one and reports on how teachers adapted materials and implemented their lesson plans.

The record of the research process that follows represents data on what happened, as well as critical discussions and findings that informed the developing participatory action research around the question of content and lesson planning. In this process I was a resource person, an

action research participant as well as being an interpretative researcher gathering data to represent and reflect on the process in this study. In the first role I worked as a member of the group, with the job of documenting the activities and reflecting these records back to the group for member checking and discussion. When in the second role, I kept a full research record and recorded my thoughts in a research diary. The accumulated evidence is reported in this chapter and is then examined with analytical statements to answer the research question on contextualization and the introduction of content knowledge on marine issues in Chapter 5.

In summary, the data that I gathered and analyzed at each stage was reported back to the other participants and used to inform a way forward. At the same time these data gave me cumulative evidence for a deeper analysis with analytical statements (Chapter 5). These findings will finally be reported back to the group through this thesis.

4.2. PHASE 1: INITIAL SCOPING AND PLANNING STAGE

4.2.1 General status of teachers' content knowledge

The focus group discussions revealed that teachers' perceptions and understanding of marine would have a direct bearing on lesson planning. For example, teacher BU had never stayed at the coast and believed that the sea was "wide and endless". He described how this made him wonder why marine resources were managed and protected to such an extent that people were arrested for harvesting endless marine resources. However, he realized that there was a need for him to teach about marine resources because the curriculum required learners to learn about things in their own context.

Teacher NK and CI showed an awareness of sustainability and conservation. They showed an understanding of the policy that governs the use of resources by explaining how marine resources could be harvested, noting the size of the resource and the quantity, which was regarded as important when harvesting such resources. They said that if marine resources were harvested without reaching the stage of reproduction sustainability would be affected. They further explained that if many resources were harvested ecosystem would be disturbed. Such disturbances will result in an unhealthy ecosystem as some of the animals may die as they will not have anything to eat.

The focus group interview provided an opportunity for teachers to identify their status of understanding about marine resources. The group identified some gaps in their knowledge and realized that they needed a workshop to develop their content knowledge of marine resources. It was indicated that this knowledge would enable them to work with learning materials and design lesson plans for the learners. Their responses also showed that if learners know about marine issues, they would be able to use this knowledge in their community.

In the focus group process we also probed how teachers used materials and these data were synthesized and reported back to the group to chart a way forward on this issue. Initially three teachers were intended to be involved in this focus group discussion but two other high school teachers were involved which are named as teacher BY and BA.

4.2.2 **Teachers use of LTSM**

From the focus group interview teacher NK, BU and CI indicated that when learning and teaching support materials (LTSM) are used in lessons, learners become more actively involved than when listening to the teacher. They seemed to draw from their experiences when they said that learners became bored and misbehaved in class in the absence of materials. The reason for their misbehavior was that they did not make sense of what they learn by listening only. However, teachers thought that when LTSM are used it makes the lesson interesting to the teacher and the learners. Teacher NK responded in this discussion by trying to show the role of LTSMs in teaching and learning. She said that "the lesson becomes more effective when the teacher has done thorough preparation and when she has got the teaching aids". The above responses show how the teachers perceive the role of LTSM in learning. However the active participation of learners is a concern for teachers and is associated with the use of LTSM.

The teachers suggested a number of ways that LTSM could be used, for example a teacher may use a poster

That shows polluted and unpolluted areas and the lesson can start from there.

- The poster could allow learners to discuss what they see.

- Learners could be asked to collect cuttings from other sources based on pollution and they could develop a poster.
- This could be followed by a discussion and later corrections to the poster could be made.

I noted that in this way learners are regarded to have participated in the activities as they brought their own prior knowledge to the classroom.

A second view of LTSM was also noted. Teacher BY understood that LTSM were developed by the teacher so as to support learners to be engaged in the activities. In her view the teachers should provide learners with activities that they will use during the learning process. She also argued that the word LTSM was problematic as she was not clear about it. To support her statement teacher BY explained that lack of information and understanding about a topic impeded the use of LTSM to mediate learning. She said that when the teacher wanted to introduce a topic and did not have enough information this affected the ability of the teacher to develop LTSM for learners. She showed a strong concern for teachers to provide relevant and up to date information to the learners and that they should understand what they are presenting to the learners. However all teachers agreed that if they did not know what they were doing then learners would be unable to grasp the concept. Furthermore, learners would not be able to apply what they had learnt at school in their everyday life and there would be no in-depth learning.

I noted that teacher BY had been part of a course where content and the use of materials had been emphasized. She had thus developed a view that allowed her to see that she had to know the content to work effectively with materials. Her input was a strong influence that was taken up by the group into the continuing work on lesson planning with marine materials.

The initial focus group data on content and use of materials was synthesized to inform a way forward into working with content and lesson planning using materials
The use of LTSM was further explored when teachers selected and reviewed materials and plan lessons.

4.2.3 Review of materials and lesson planning

Through the data generated during the review activities that followed, the three teachers were concerned about their content knowledge of marine resources and how they can use materials in their lessons. In the review process we first considered the Natural Science policy to interpret learning area requirements in relation to teaching and learning of marine issues. We identified learning outcome number three which mentioned the interrelationship between Science and Technology, society and environment. This outcome was regarded as important by teachers because it focused on science and harvesting of marine resources, which is related to people.

We also selected assessment standard number two which required learners to understand sustainable and unsustainable use of marine resources. We looked at the marine ecosystem poster and we associated it with food chains, a food web and a food pyramid that are all familiar topics in the Natural Sciences. There were many other resources which were available and we looked at these to see which ones were relevant in dealing with marine issues. We decided to use those resources that some of the teachers had seen but not used them during the marine awareness campaign.

I suggested the use of the active learning framework for lesson planning because we were familiar with it and had used it before to develop lesson plans.
The teachers discussed and planned lessons with the guiding questions from the Active Learning Framework, as follows.

- What do learners already know?

Teachers discussed how they could go about finding what the learners already know. The teachers decided to use an example of a terrestrial food chain (e.g. grass-locust-frog-snake-hawk-and cat) as this was within their experience and they had already been taught that. It was noted that this food chain would show that each one of the elements above is dependent on the other. To teach the concept of interdependence further, learners could be told that if the cat died it would decompose and make the soil fertile and that would make the grass grow. They also decided that learners could be taught about disturbances and their consequences. They would thus be asked to think about what could happen in this food chain

- What do learners need to find out?

This question led to a discussion on what could be taught to learners with the posters. Teacher BU said that there is no need to ask learners leading questions, but one has to ask them to use prior learner knowledge to ask leading questions and to work with the marine food chain. He further explained that learners in their schools have knowledge about marine animals and plants. They could also be introduced to the marine food chain. If there are things that they did not know they should go and research. Teacher CI suggested that learners can be given a clean food pyramid on the poster and animals in the poster can be cut and learners could be asked to paste the pictures again in the pyramid. They could also be asked to go and check the different meanings of the words like consumers, producers etc. She further continued that learners could be given the pictures of food chain and be asked to draw the pyramid or the food chain from the pictures. They could be shown about what eat what and they could construct their food chains. After that they could be shown as corrections. She also noted that as the learners do not know all the animals, a community member could be invited to give a talk. This decision was also based on the fact that not all the learners know marine resources.

Teacher BU said that the picture from the marine poster that shows the concept of people over harvesting can be used to show an issue. The pictures on the posters that show the concept of sustainable and unsustainable use of resources could be selected and pasted onto the poster by the learners. He further commented that the purpose of these activities is to teach the concept of harvesting and when learners see that on the other side of the poster there are no resources then they can deduce that through unsustainable harvesting there are no resources left.

In their work with the poster they noted that there is a picture of a small mussel that could not find others because all resources have been removed from the rocks and that poor, lonely mussel shows the impact of over-harvesting mussels. Teachers felt that this poster could be given to learners and they could read and interpret what is going on, and by being involved in this activity they would learn not to harvest the small animals before they can reproduce. Teacher BU also suggested that learners understanding could be stimulated by drawing their attention to compare the two pictures from the poster. They should make decisions in relation to which people harvest

resources responsibly. In the activity learners could make decisions by taking the pictures and putting them where they belong.

- How can they investigate the issue?

It was suggested that after learners have learnt about harvesting at a school they can learn about their own practice and find out how their community harvest resources. Teachers wanted to involve learners in researching community use of marine resources so that they could take action and improve their learning.

After this review and discussions with the guiding questions, the group was stuck and we did not know what needed to be done next. I noted that the experiences from the review process and the discussion of the focus group (appendix 5b) which we used on this particular day led to teachers saying that they wanted to understand what marine issues are and what we are talking about. As a group then we decided to get in somebody who knew better about marine resources. Mary Bursey was called in to help as she knew about the topic. It was here that the teachers noted a need for content in order to be able to work with the materials. The Museum workshop was thus planned and the teachers worked with Mary to outline the topics that they needed to learn about and which they thought would be relevant in the teaching of Natural Sciences (3.4.2).

Phase one was concluded here, with the group having come to an understanding of the challenges in teaching marine topics. From this understanding the idea was that we now knew what we wanted to learn about and would be able to apply this to improving lesson plans. The museum workshop followed a week later.

4.3. PHASE TWO, CYCLE ONE: ACQUIRING INFORMATION, SELECTION AND ADAPTATION OF MATERIALS, LESSON PLANNING

4.3.1. The Museum workshop

During the Museum workshop, a lecture was given by Mary about the rocky shore ecosystem with specific reference to the zonation of animals. She provided background information about

where animals live, what are the physical conditions that affect them and how animals are adapted to such conditions.

We also looked at shells in the Museum and we were taken to the library to look at the books on marine life. Mary shared some resources with us on marine life. I noted some challenges in the content knowledge research especially for me as a facilitator. I did not know the information so I read the materials to empower myself about the topic. The reading helped me to be able to learn with the teachers and be able to use the knowledge I have learnt from materials to reflect and plan in the continuing action research process.

After the introduction of new content knowledge in the Museum workshop, teachers worked together to develop a lesson using the resources like East Coast Hands On booklet, the marine poster and the policy document. We were trying to find out if we could implement what we had learned at the workshop. We went back to the lesson plan where we had used the active learning framework during the review process and we wanted to improve it. The results are presented below:

Lesson Plan 1:

What do we already know?

Teachers introduced the lesson by making an example of a terrestrial land food chain. They said they would show learners an example of a terrestrial food chain. They will ask learners to build their own food chains that are based on land. Alternatively teachers thought that they could take the learners outside the classroom and ask them to explore the food chain by observing animals in terms of which eat which.

What do learners need to find out?

The Share-Net Hands On booklets were to be used. They would give them cuttings of marine life with information and ask them to state which animal is dependent on another. The reasons for this activity would be to engage learners in developing food chains by themselves. Learners would also be made curious because the information with which

learners would be provided would be based on the description of the animal, habitat, feeding, predators etc. Investigating and reporting Teachers said they would provide learners with the question: if one part of an ecosystem (food chain) was removed what would happen to the ecosystem? Teachers would reinforce this concept by making the demonstration of tins after the learners had discussed the food chain in details. Taking action Learners will be asked to develop a poster about what they have learnt. They can also be involved in creating an awareness campaign or they can role-play or write a poem. Enrichment Learners could be asked to collect all their food chains that they have done and join them to form food webs.

The revised lesson plan was discussed and I took notes on the discussion as well as recording notes in my research diary. Below I provide my observations and developing insights on the contributions and reflections of teachers as we worked to align materials with active learning framework and the context of the learners to improve the lesson plan.

4.3.2 Notes on improved understanding of content and concepts

4.3.2.1 Selection and review of materials

Teachers selected East Coast Rocky Shore material because it provided pictures and information that could be used to teach about marine ecosystem. Further reasons provided were that it could encourage debate and dialogue which would stimulate learners to think and reason. It also provided an opportunity for learners to develop their reading skills. The teachers' views were

that the activity would encourage the learners to be curious and learn about things beyond the concept of the food chain.

During the discussion they initially thought that they would just provide learners with the information provided by the East Coast Rocky shores booklet on animal feeding, but later thought that they want learners to be curious enough to allow them to use further information. Teacher NK said "We should give learners the whole information from the East Rocky shore booklet so that they can even read other things by themselves." It was noted that the information in the booklet provided would enable learners to be actively involved and being able to work on their own. The marine poster was also used and cuttings of the food pyramid were regarded as relevant in being used to show different feeding levels.

4.3.2.2. The use of knowledge to design and structure activities

When teachers explained the concepts of food web they said it was a combination of many food chains with many arrows pointing at different animals. We were not sure at which stage we should introduce the concepts of herbivores and carnivores because we knew that they were necessary for learners to understand a food pyramid. We further debated if we should first allow learners to use their prior knowledge of food chains and food webs and thereafter introduce the concepts, as they would be useful for the teaching of the food pyramid. As we used the poster, we brainstormed about content that we knew would involve scavengers, omnivores, carnivores etc (appendix 11) but we did not know how to create a structure for these extension activities.

Teachers wanted to introduce the concepts of herbivores and carnivores as well as energy consumed at each trophic level in the food pyramid. We continued our discussion and talked about the food pyramid. Our concern was the energy consumed which varies from different levels. We were not sure how to create a relevant activity. We thought that we could have a blank pyramid and next to it have the names explaining their meanings. We thought that we needed to explain to the learners the nature of the pyramid and why it was bigger at the base. We were uncertain about this, but finally made the decision to get the learners to paste the pictures from the empty levels. We concluded that after the teacher had explained the pyramid to the learners then she could also use the tins to explain it further. After the demonstration of the tins,

learners were required to create their own food pyramid and a question for investigation was going to be given to them. As we experienced problems in structuring the activities I noted that we needed more information on ecology. So I suggested that each of us should read about trophic levels and ecology from Envirofacts and see whether it would help us to understand those concepts of which we were not sure. This was not successful and the problem of needing more ecological knowledge was not resolved .The activity was thus left unfinished. (Journal 25-04-06).

4.3.2.3. Assessment and achievement of learning outcomes

The assessment based on the activities being developed by teachers focused on whether learners could recall the concepts taught. They would also be assessed on their posters which could be used during marine awareness campaigns and whether they could role-play or write poetry around marine knowledge.

4.3.2.4. Teachers reflections about what they have learnt.

In my journal I noted that teachers were interested in marine issues and they acknowledge learning that has taken place after the Museum workshop

As I was part of the group, I realised that our group discussion was more informed than during the phase one process. During the review of materials in Phase One, the teachers could relate only to the marine poster because they had seen it during the marine awareness campaign. However, in phase two they were now able to participate and talk about marine issues. They could identify the names of the animals, where they lived, what they looked like and which animals ate them. This was further illustrated by how they worked with materials to select and review them.

In my journal I noted that teachers were interested in marine issues and they acknowledge learning that has taken place after the Museum workshop. In their reflections teacher NK noted, "I am a better educator because I am a more informed educator now (appendix 7a, 7b). The whole experience made me to be more aware about marine life. I became more aware and more interested in the marine life. The effective use of available materials would contribute more to

the upliftment of our learner's levels of education and learning. The workshop has made me to want to integrate the Life Orientation Learning area more often with other learning areas because of the information I have gained."

Teacher CI reported "I learned about how tides are formed and what affects them. I feel this knowledge would be useful as some of the learners in my school live on the other side of the beach and I got what I expected so there is nothing I feel is not achieved". I remarked in my field notes that despite the workshop and field trip the knowledge was still limited as the group could not structure activities to achieve their outcomes and the lesson plan was left unfinished. Although content knowledge had been acquired from the Museum workshop, it was difficult to carry this over into improved lesson plans and the use of materials.

4.3.3 The second activity-Field Trip

Based on the challenges we faced with regards to working with materials and lesson planning as teachers, we undertook a field trip because we wanted to experience living marine resource for ourselves and not only about them from pictures and talks.

4.3.3.1 during the field trip

This is the summary of the field notes based on the field trip. It was mainly about explaining, feeling, seeing marine resource in its natural environment. Mary Bursey helped us to identify animals, discuss their adaptations and experiment with the response of sea anemone tentacles. We experienced the sharp spines of the sea urchin touched the *Alikrekel operculum*. We then sat down and worked with the worksheets but because of time we could not finish and we went back to Cintsa School.

Teacher CI explained her experiences during the field trip "I have learnt that there are periwinkles which are many and are found in the upper balanoid zone. Some animals live nearer to the water and some compete for space. Many of the animals can live and are always immersed in water such as cochlear and are found in the infratidal zone. In the zonation we looked for different types of animals and where they we found" (appendix 7c).

After the field trip we went to the classroom to consider what we had learned and tried to link that with the curriculum content from the policy document and to continue work on lesson planning. We got stuck working on the learning outcomes so we use the content in the back of the policy document and grouped some of the content to develop topics. This was done to make sure that we were in line with the curriculum and we gave each other work-away tasks. These lesson plans included an exercise which involved the use of mind maps to help plan lessons on marine issues. At this stage each teacher felt they could adapt materials and develop their own lesson plan with different topics using the marine poster. Below I present the three lesson plans, teachers CI, teachers NK and my lesson plan. In the beginning of the research three teachers were involved but unfortunately teacher BU was unable to complete the process.

4.3.3.2. Topic based lesson plan description and data collection

4.3.3.2.1 Teacher CI-food chains

- Choosing learning outcomes and assessment standards.

The lesson was designed with learning outcome number two in mind which requires learners to construct science knowledge. The assessment standard chosen required learners to recall meaningful information. This was going to be achieved through learners showing their understanding of the feeding relationships between animals and plants.

- Review and selection of materials

Materials were reviewed according to what the teacher regarded as useful for teaching and learning of marine issues. A grade Four textbook was used to find an explanation of concepts like predators and carnivores. Information about trophic levels was also used from the textbook. The marine poster was going to be used to get information about developing marine food chain.

  - The activities

The teacher would introduce the lesson by asking learners questions about animals that eat plants and those that eat animals. The teacher would then introduce learners to a terrestrial food chain such as grass-locust-rat-snake-eagle. Later on learners would be introduced to a marine food chain which is plankton-filter feeders (sardines)-fish-killer whale.

The teacher would introduce learners to key words like prey and predators. A prey, as it is defined by the teacher in the lesson plan, is an animal that is hunted or eaten. Predators are also introduced to the learners as hunters. A carnivore would also be introduced as the animal that is always at the top of the food chain and plants are always at the bottom. The teacher would then explain to the learners how food chain forms a food web. The teacher would also explain food pyramids.

Learners would be told to cut pictures of animals and make their food chains. The teacher would tell learners that in nature there are many food chains which can be combined with each other to form a food web. Learners would be asked by the teacher to combine their food chains they have made to form a food web. To extend these activities learners could be asked to watch cows feeding from the grass. They could also be taken to the game reserve to find out about how many times lions are fed in a week. The purpose of this activity would be to relate these concepts to a real life context. The Grade Four text book would be used by the teacher to explain how the energy levels were formulated. The teacher shows how she is going to explain the concept of food pyramid by saying, "As the food passes from one feeding level (as the food passes from one feeding level (trophic level) to the next up the chain about 10 % of the energy is used up or lost at each step. So there are many plants, seaweed or plankton at the lowest level of the chain and fewer animals at each level up the chain." It was not clear how the activities were going to be assessed to show evidence of learning.

- Teacher CI's report and reflections about her lesson plan

I provide a summary of teacher CI's transcription about how she planned her lesson and her reflections about the lesson plan. In her report she said that she would start the activity by giving learners examples of terrestrial food chains. She would ask them which animals eat grass and if they did not know she would explain to them. To introduce the marine food chain she told them about plants in the sea and that they are called plankton. From there she would introduce learners

to the concept of prey and predators. Then she explained how the food chains form food web. The teacher explained and she read a description she would use from the text book about food webs which says "In nature there are many food chain which combine with each other to form a food web". He further noted that learners would also understand that in a food web one animal may eat many animals. She explained how she will teach learners about food pyramids, reading from the book she said "As the food passes from one feeding level (as the food passes from one feeding level (trophic level) to the next up the chain about 10 % of the energy is used up or lost at each step so there are many plants, seaweed or plankton at the lowest level and fewer animals at each level up the chain". She further explained that the reason of the energy lost that most of the energy is being used to grow and reproduce and that therefore less energy is released. That is why the cow eats a lot of grass because it needs a lot of energy. The animals in the upper levels need less energy as levels move up the food chain. Teacher CI also commented that she had made notes for her preparation and thereafter showed learners' activities in her lesson plan.

She further explained that when learners are given a marine food pyramid they will be able to understand why there are more plants at the bottom and less animals as you go up the chain. She further said that she has seen from the book that plants need more energy from the sun in order to reproduce. "I have understood that primary consumers need food. They need more energy from plants in order for them to survive. That is why the cow eats the whole day. Those animals on top don't need too much energy because they eat less, as they go up the food chain they don't need more energy as those at the bottom"

I noted in my journal that the teacher was unable to organise and structure activities that will improve her teaching and learning. The materials selected were used according to existing teachers' practice, which did not contribute to a change in lesson planning.

4.3.3.2.2 Teacher NK -Classification of animals

- Choosing learning outcomes and assessment standards

LO2-the learners will know and be able to interpret and apply scientific, technological and environmental knowledge. Assessment standards were to enable learners to use a classification system to group invertebrates according to Coelenterate, echinoderms, arthropods and mollusc.

- Review and selection of materials

The teacher adapted resources from Treasure Beach. The resources were adapted because they provide pictures and information about animals. The teacher used this information to plan her lessons and used a column from these materials to provide an exercise to learners.

- Adaptation and use of materials

The teacher introduced the activity by asking learners to give examples of vertebrate and invertebrate animals found in the sea. She cut pictures of animals and asked learners to identify the differences and similarities between the animals in terms of their appearance and biological adaptation

Learners are given information on different classes of invertebrates found in the sea. They should draw animals and identify the class under which the animal belongs and they should provide reasons for their answers. They should identify the movement of the animal by saying whether the animal moves or not. They should use the table to provide their answers. After that learners should provide feedback and discuss their answers in groups. The teacher used information provided by treasure beach materials and asked learners to read the information about different classes of invertebrates. They are provided a column, which the teacher has taken from this material. In this column they should draw an animal and identify the class where the animal belongs. There is also a column, which requires learners to identify the movement of the animal. They should indicate whether the animal moves or not. After that learners should give feedback and discuss their answers in groups about different classes of invertebrates found in the sea.

4.3.3.2.3 My lesson plan - Life cycle of a mussel

Choosing learning outcomes and assessment standards

LO2-The learner will know and be able to interpret and apply scientific, technological and environmental knowledge. The assessment standard required learners to recall meaningful information

LO1- learners were to plan an investigation, conduct investigation and collect data and also evaluate and communicate findings.

- Selection and review of materials

The marine poster was selected because it was regarded as relevant for teachers to design activities based on it. It was also relevant to the learners to be able to see and discuss about some issues related to marine.

- The activities

Learners were asked to talk about their life cycle and they should draw about how they feel to have a home and when they lose their loved ones how do they feel. They are given pictures and are asked to arrange them according to the sequence of the stages in the life cycle of a mussel. The teacher wants the learners to identify the dangerous elements in the life cycle of a mussel. A poster is presented to the learners and they are asked to think about many the eggs that have been released by the mussel but very few could develop into adult mussels. They are asked to talk about the threatening things they see in the picture. They are further asked to develop a role play and others act as if they are a mussel who cannot find its home because its habitat is destroyed by people taking all the mussels that were there. So this mussel could not find its home because it could not find a cluster of mussels in rocks and is in danger of being eaten by predators. Other learners could act in the place of harvesters who believe that it is their right to have food.

Learners are asked to debate about the consequences of over harvesting where there will be no mussels anymore for the people, for other animals and for the marine environment. Learners are required to develop a questionnaire they will use to investigate and take action for the environment. They will design a questionnaire that they will use when collecting data in their community about how marine resources are used in their community.

- Achievement of learning outcomes and assessment standards

Learners will be assessed whether they are able to write about the life cycle of a mussel. Furthermore if they can identify dangers in the life cycle of a mussel and what are their causes as well as their consequences using the poster. Furthermore, they will be assessed if they can debate or create a drama (role play) about the consequences of over harvesting where there will be no mussels anymore for the people, animals and for the marine environment.

- Teacher NK and my reflections of lesson plans

In teacher NK's lesson plan she gave learners pictures of different kinds of invertebrates found in the rocky shores. From these pictures learners are required to find differences and similarities between these animals in terms of their physical and biological adaptation. Learners are also given information on different classes of invertebrates found in the sea. They are required to draw the animals and give reasons why does it belong to a certain group. Learners are also required to respond about the movement of the animals.

To show further the mismatch between the expectations of the teacher and the limited support given to learners to achieve such expectations in my lesson plan learners are given a poster to identify dangers that might affect the eggs of the mussel. Learners are also asked to develop a role-play about habitat destruction and the dangers of the mussel they face of being eaten by predators. Learners are also asked to show the dangers caused by mussel harvesters to destroy the habitat of a mussel. These activities supported the assessment standard of interpreting and analyzing information. As a group we realized that there was lack of in-depth information in our activities that could allow learners to perform the actions we required from them. After we discussed about the lesson plans we all felt that we were not confident to implement the lessons. We lacked the skills to change the materials into teaching and learning support materials. All three lesson plans showed that the way activities and information is used from the materials does not support the expectations that the teachers wanted to see from learners

Reflections were made about lesson plans and we noted that we were unable to develop lessons that encourage active learning. We decided to ask help from Marietta who works in Museum and

Phillip from WESSA, both of whom are education officers. From the resources they gave us we used the lesson plan from the Internet, which was based on classification of animals. From this lesson plan teachers commented that when they think about prior knowledge, they didn't think about knowledge that learners might bring from their background other than school knowledge. For example they noted that they would not think about classification that is used at home. I also noted that different resources have been used to develop activities in this lesson plan. There is also background information that explains the meaning of the concepts. The purpose of teaching these concepts is not clear. The use of this lesson plan helped teachers to learn about processes involved in lesson plans. Lessons were developed and implemented and I made classroom observations (appendix 9).

4.4 CYCLE TWO: TEACHERS IMPLEMENTATION AND OBSERVATION OF LESSON PLANS

4.4.1. Overview of the lessons

This section provides an overview of the lessons implemented by teachers, it indicates how materials were reviewed and adapted by teachers and learners in the classroom. I further provide the issues that emerged from these lesson plans.

4.4.2. Teacher CI -food chains

- Identification of learning outcomes and assessment standards

The teacher wanted to develop learning outcome number 2, which requires learners to construct science knowledge. The assessment standard is based on the fact that learners should recall meaningful information

- The activities

The teacher introduced the activity by writing words on the board like producers, consumers and explaining the meaning. She asked learners about animals that eat plants. She provided learners with an example of a food chain like plants that are eaten by goats and which is eaten by a lion and asked them to provide their own examples. To continue her explanation she told learners that

other animals eat both plants and animals. The teacher gives learners a class work for learners to fill in correct answers about the meaning of terms she has taught them.

The next step was to explain a food web, which she related to a spider web. Learners were asked to develop land food chain so that it could be joined to form a food web. Learners were asked to come in front with their cards and have to join them to form food webs. Teacher moves around to see whether learners know what to do. Furthermore the teacher explained marine food pyramid by using information from the poster and she made an example on the board. Teacher explained why a food pyramid has many plants but fewer animals as it goes up. This explanation was informed by the poster on marine issues. At the end of the lesson learners were given a poster and were asked to develop a food pyramid.

4.4.2.1 Teacher and learner interactions

- . Adaptation and use of materials by the teacher

The analysis I made from the lesson plan and classroom observations provided insights about the teachers and learners interaction in the classroom. The teacher selected what was relevant for her to teach the topics she had identified. When she introduced the marine ecosystem concepts she used what she already knew and gave learners descriptions in short sentences. For example, when she explained primary producers she asked learners to give examples of animals that eat plants. She also asked learners about plants and animals that live in the sea with the aim of teaching them about food pyramid. She used the poster and introduced the trophic levels by drawing the marine food pyramid on the board and explains that the first animals in the food pyramid are primary consumers. Many definitions were introduced at the same time.

When she interpreted marine content knowledge she used the definitions and concepts without understanding their meaning in that context. She used question and answer as well as demonstrations as strategies for teaching and learning. She asked learners questions which required them to recall information that was given to them. She wanted to engage learners in the activity when they were asked to come in front with the papers and wrote animals or plants.

The teacher provided limited opportunities for learners because she did not use resources to explain but she just told what she knew. The limited skill of working with a variety of resources was evident because the teacher had resources, but she did not know how to link them to teaching and learning experiences. For example, all the concepts that the teacher wanted to teach were in the poster.

4.4.2.2 Learner's engagement with resources

The second part of the lesson showed the role played by materials in supporting student learning. When the teacher gave learners exercise to develop food pyramid at the end of the lesson, learning was taking place. They did not focus on what they were supposed to do but they discussed and share information about what they saw in the poster. Whilst others were talking to each other about which animals to choose, one learner holds the poster and she reads everything that was there. The concepts that the teacher was trying to teach were in the poster in details. Other learners were talking about the resources they were familiar with, how they used them and where they had seen them. Others made decisions about which animals to choose for the marine food pyramid which they would be required to develop. Learners were actively involved, but the teacher did not notice that because she wanted them to reproduce knowledge that she developed in them during her teaching. In other words she wanted to assess what she has taught them.

4.4.2.3 Assessment and achievement of learning outcomes

The teacher gave learners exercise to fill in the concepts, to find out how much learners have understood in relation to what she has taught them. To assess the achievement of concepts taught learners were asked to develop a food pyramid. From the four learners I analyzed, two of them showed a food chain and one showed a food chain in a pyramid and the last one used drawing of plants and animals in a pyramid. This showed the misinterpretation of terms by the learners because they were unable to apply the concepts of primary consumers, and top predators to show their understanding and meaning of a food pyramid. It seemed as if they only understood the concepts of food chain. However, the teacher's remarks about learner progress is that three of those who have drawn food pyramids had highly achieved, whilst the one who has shown by pictures and a pyramid is said to have partially achieved the desired lesson outcome.

4.4.2.4 Teachers' reflections

The teacher said that she managed to encourage active learning and the learners achieved what she wanted them to know. She said she was surprised to see how learners were active at the end of the learning process.

4.4.3 Teacher NK- Classification of animals

- The activities

To find learners' prior knowledge the teacher asked learners the meaning of the word classification and one learner answered that it means to group. The teacher probed further and asked the learners to expand more on the meaning of grouping. He further explains that they can group themselves because they have eyes; ears, mouth and he specified that he did not know whether this was the correct answer that was needed by the teacher. The teacher supports the learner by explaining that even the way they are seated as they were seated in groups of boys only and girls only could show classification.

Then the girls also responded that they could group themselves according to their skin colour, height etc. Then the teacher writes the definition of classification on the board. The teacher's actions in this activity were flexible in that all the answers were written on the board.

The next activity was for learners to use shells and classify them. They managed to do that according to their shape, color, and size. This activity stimulated discussion, sharing of ideas because learners began to identify the shells according to animals. They used their mother tongue to talk about the animal called "unokrwece" which means limpets. A class discussion continued when learners show their prior knowledge in terms of where animals are found and how they are harvested and used.

Learners are now provided with pictures of animals to classify. They made decisions and classified them according to their own explanation. The criteria that were used by learners when they grouped shells were based on similar features they see: for example, those animals have shells. This criterion was based on mollusks. The other criteria were based on the fact that

animals were like stars; therefore they were similar in shape. Learners were also able to identify the arthropods because of their jointed legs. They associated it with the spider in terrestrial animals. The teacher explained that barnacles that they belong to arthropods although they do not have an exoskeleton but a shell, they belong to arthropods because of their jointed legs. Thereafter the teacher realized that she needed to explain the animals to the learners in terms of their characteristics. They worked together in groups and decided on the classification system they are going to use. After that activity the teacher gave feedback to the learners, explaining that they had not fully met the requirements of being able to classify the animals. However, the teacher told them that they have managed to classify according to what they know but not according to the assessment standard.
The teacher worked with the learners and introduced them to the classes of invertebrates.

4.3.1 Teacher and learner interactions

- **Adaptation and use of materials by the teacher**

I observed how the teacher selected and used LTSM to support learners. How she supported learners to use LTSM. The teacher played different roles in the lesson. When she introduced the lesson she gave learners shells to find out what the learners already know. Learners were able to share their information and discuss in groups. To facilitate the lesson further the teacher continued from learners discussions and explains the shell of a Venus ear has holes to allow for gaseous exchange. The teacher identifies the shells and the characteristics of that type of an animal. Learners were asked to use a worksheet and classify shells according similarities and differences.

After the discussion on how learners have classified animals according to what they know and think, the teacher used a model of a sea urchin to explain its round shape. She was able to talk about objects familiar to the learners like a gas cylinder to explain the shape of a sea anemone to show the difference. She then wrote on the board that sea urchins belong to the class called echinoderms because they are animals with spiny skin. She further explained that sea anemones on top of being cylindrical in shape have a ring of stinging tentacles around their mouth and are called coelenterates. After this explanation she asked learners to use the pictures and find an example of echinoderms and they managed to identify it as a sea cucumber. The teacher asked

them to think of animals with soft bodies and their responses were limpets, oysters and periwinkles.

The teacher further explained that there are other mollusks, which did not have shells but have soft bodies. Then learners were able to think of other examples like the sea snail. The teacher further explained some facts about mollusks by drawing learners' attention to the barnacles that are also arthropods. Later, learners were able to give examples like rock crabs, rock lobster and hermit crab. During this interaction the teacher was writing notes on the board. She had developed these with the learners. Although the teacher introduced the new knowledge limited understanding was evident, as she could not provide learners with in-depth information about the animals. This was evidence of the teacher's lack of content knowledge development, as she had not planned the scaffolds she used during the lesson. However, she was responsive within the context because she managed to do things she had not planned in her lesson. For example, the explanation she made about the Venus ear was not there in the resources she used but she was able to explain being informed by the field trip and other experiences she has. The use of resources allowed the teacher to move around and facilitate the activities. A variety of different strategies were used by the teacher and there was evidence of knowledge development.

4. 4.3.2 Learners engage with resources

They worked in groups to classify the shells. They were able to share knowledge and information in their groups in terms of which shells are similar or different. They used language to discuss and were able to compare animals according to their appearance.

Meaning was negotiated as they have differences in thinking. Learners were able to compare the animals and identify them according to different groups. The use of language for learning was encouraged as they read the names of the animals. They were able to pronounce words, although some had difficulties. As some had difficulties to pronounce the words the teacher helped them to read. They grouped the shells according to their shape, colour etc. They could easily see the difference. They made decisions about which animal to choose and why. Other learners were thinking, whilst others were just looking at pictures. When learners use resources it is easy for the teacher to see what they think. Other learners were able to take initiative and lead the groups and were willing to deal with uncertainties. Others took a backseat and later felt more at ease to

get involved whilst others took the initiative. Sometimes learners were withdrawn and were concerned about the teacher's reaction in the case of a possible wrong answer. The teacher facilitated learning by moving around the groups and explains some of the things that learners have to do. There was an open communication between the teacher and the learners.

4 .4.3.3 how teachers' knowledge was influenced by LTSM

The teacher acquired information about the animals and limited skills were developed to enable the teacher to engage learners in integrated and constructivist learning. Learners were actively acquiring knowledge.

4. 4.3.4 Assessment and achievement of learning outcomes.

Development of classification skills is not clear because learners were given a class task to put animals into groups after they had done this with the teacher, and this activity was regarded as highly successful. Nothing had been done by learners other than copying from the board what they had done with the teacher, and this activity was assessed for the purposes of the learner achieving the skill, and yet there is no evidence of this skill. Assessment standards that provide skills, knowledge and values were regarded as concepts that should be developed in learners. Assessment standards were regarded as syllabus with content that needs to be covered rather than encouraging a process of learning that will promote a certain standard. Formative assessment was evident because the teacher assessed learners informally in terms of what they knew. She introduced new knowledge to clarify concepts, which the learners were misinterpreting. The concepts were not in-depth and were not treated in context. However, there was some evidence of creativity. This knowledge was supposed to form the foundation for further learning that would make learners use that knowledge in context.

4. 4.3.5 Teachers' reflections

The teacher noted that the use of shells helped her in engaging learners in the activity. She also reflected about the limited resources she had to teach all the classes of animals. She further thought that she wanted learners to see the animals in real life. She said that the materials helped her with ideas on how to teach the learners. She spoke about her assumptions that she knew that learners know a lot about marine resources but she realized that their information was limited.

She reflected about her knowledge saying that she had problems because this was a new topic and the terminology was also new. She said that she feels it was a good start for her because there is information that she has learnt. It has been a foundation for her to develop knowledge and she hoped that next year things will be much better. I found that when resources are used the teachers methodology improved and this result to a change in teachers knowledge and thinking about learning.

4. 4.4 Lesson plan on sustainable utilization of marine resources

- The activities

Pictures were cut from the poster and learners had to analyze and interpret how resources are collected and what the implications for such actions are. The poster was used to encourage active learning and provided an opportunity for the teacher to find learners prior knowledge. Learners were able to share information and discuss. For example one learner said that mussels are like chickens if they are harvested whilst they are small then they could disappear forever. She further said that if somebody wanted to have many chickens, they keep the small ones to reproduce so that they can increase. So she said it was the same with mussels. I wrote their responses on the board and categorized those to develop a topic called Value of the Coast. Then under this topic the teacher created subheadings like Aesthetic, Nutritional, Economical, Ecological, Educational and cultural values.

In the next activity, learners worked in groups; they were given some statements to choose from. They had to analyze and interpret the pictures from the poster and say how resources were collected and what the implications were for such actions. The statements that the teacher used were informed by the discussion of the previous activity as well as the information provided by the poster. The purpose of this activity was to increase the vocabulary and concepts of the learners by providing them with statements to choose from. When learners were engaged in the previous activity I realized that they lacked the language to express themselves. In this activity the learners were given one picture to analyze and say what was wrong about what the person was doing and what should be done to make it correct. The idea was for the learners to note wrong practice and provide the correct one. Learners were unable to do as I wanted. They just

wrote whatever they knew about harvesting of resources. Others used one paragraph to talk about the wrong practice and at the bottom write another paragraph to show the correct one. Learners were actively involved.

Another picture was adapted from the poster and learners were asked to look at the picture and write about the consequences of responsible and irresponsible practices of using marine resources. They had to organize their responses into provided heading which were, Nutritional, Economical, Ecological, Educational, Cultural values of the coast. Learners had to present in orally and were able to use knowledge to make sense and meaning. For example, some groups mentioned that there would be no educational field trips in that place because people have used all the resources, and she further stated that they can go to that place to teach people about what the causes of their marine resource depletion. Learners felt that the reason why people do things that way is because they have never been taught how to use resources responsibly, and therefore education is needed in order to change practice.

The teacher developed a comprehension for the learners to read and then to answer questions. This was adapted from a research report about how people in rural villages of Hamburg and Nginisa use marine resources. The purpose of the activity was to provide learners with information so that they can work in groups and share ideas about how other people use marine resources. Firstly I thought that I would give them the comprehension so that they can compare the two villages in terms of marine resource use. But later I decided to cut the comprehension and have one group read about Hamburg and the other about Nines Village in Chalumna. Then later the groups gave feedback about what they had learnt.

4.4.4.1 Adaptation and use of materials by the teacher.

My reflections showed that I lacked the ability to interpret the skills and knowledge I wanted to develop in learners. As a result learners were asked to match words with pictures. They were also required to make decisions about collection of marine resources with insufficient tools to guide them in the activity. I lacked the ability to use information resources to design a lesson that would engage learners in a variety of contexts. Because of such difficulties, I did not see learner progression in conceptual development although they were engaged in activities in a variety of

ways. There was a need for the teacher to expose learners first to a variety of contexts to develop their knowledge before they were asked to make decisions. As a result learners were busy talking about what they already knew without being able to develop in-depth and high quality knowledge. The materials were regarded as providers of information other than tools to explore the possibilities that could be created. For example, learners had to make decisions about people's actions without using knowledge to develop their argument. When learners are engaged in a variety of activities they are able to develop their skills and change their values and attitudes. When I discussed issues that came out from the comprehension, I lacked content background to substantiate what I was talking about. For example: reasons why rules were introduced to protect marine resources. I did not have a clear direction of what is it that is necessary for learners to develop within this activity, and as a result I lacked the ability to access information and resources.

4.4.4.2 Learner engagement with resources

The lesson observations showed that learners participated in the activity and there were a number of issues that they raised. They were able to interpret sustainable use of resources and related it to their context by making an example of chickens. They were engaged in discussions although they lacked language to express themselves. Learners were able to situate themselves in the context of marine resources by showing how they felt about other people's actions. It was mentioned earlier from focus group discussion that learners are expected to play a responsible role in their communities. For example they mentioned that they can teach people about marine resources. They had an opportunity to share their ideas and show their feelings towards marine resources.

The pictures I used in the activities provided an opportunity for learners to learn about the concepts of harvesting. They were able to think and talk about what was happening in the picture, for example: talking about good and bad practices of harvesting. The written text in the poster also helped learners to construct sentences. Learners were able to make sense and meaning of the pictures. I realized that there was a need for in-depth knowledge other than the one that was provided by the poster. I used the book called "Our Coast, Our Future" because I wanted to elaborate on the picture. I provided them with the structure that will help them to look

at the picture and think about the implications of people's actions for the coast. I found that teaching from pictures only was limiting because there was no in-depth learning of the concepts. Learners were poor in spelling and sentence construction because they were using pictures with limited information.

The comprehension stimulated a dialogue. For example: learners asked me about Qamata and I had to explain this concept to them. There was also a debate about Abantu bomlambo and learners shared their stories and I also shared mine with them. We had a discussion about African Stories and I asked them to research more of those stories but we did not have time to use them. To continue the discussion from the comprehension I explained to them about scientific forms of management through which the government created a law outlining how resources should be harvested and the reasons for this. The use of comprehension allowed learners to read, although some had difficulties. I realized that integration with other learning areas was encouraged by these activities, for example social sciences.

4.5 CONCLUDING SUMMARY

As indicated in section 1.3 in chapter 1, the goals of this research were to explore ways in which improved knowledge of marine resources (amongst teachers) can strengthen school-based curriculum and materials development. In this chapter I have presented the findings on how teacher's socio-ecological content knowledge of marine issues has been developed through workshop and field trip and the use of materials. I have also discussed how they have used this knowledge to design lesson plans that are relevant in their context.

Phase one of the study focussed on the initial scoping of teachers' existing content knowledge of marine ecosystems and issues. The data presented here shows how teachers feel about their limited content knowledge of marine and coastal issues and how this can affect the learning opportunities provided to learners. This data also showed teachers used materials in lesson planning and there was a need for materials that will provide them with information and content so that they are able to teach learners. Teachers also attempted to review materials and align them with active learning.

Phase Two was informed by emerging issues from Phase One, showing how teachers acquired information through Museum and field trips, and how this knowledge helped them to learn about marine issues. They also developed lesson plans, which were later implemented, and I made classroom observations and learners work were analysed.

In the next chapter I will summarise and discuss the research findings in more depth, drawing on broader insights from contextual factors and previous research report in chapter 2.

CHAPTER FIVE
DISCUSSION OF RESEARCH FINDINGS

5.1. INTRODUCTION

This chapter provides a more detailed analysis of the evidence reported in Chapter 4. The themes reported in this chapter were developed with analytical statements that were generated through a careful interpretative reading of the action research data against the research question. The outcomes of the analysis are discussed with reference to the literature reviewed in Chapter 2

As the study was undertaken within participatory action research process, I was always working with the other teachers and member checking findings with them. Within this process teachers openly and freely shared their classroom experiences and challenges that confronted them in the teaching of lessons related to marine ecosystems and issues. The action research process generated data that we worked with together as teachers through the stages of the project:

- Reviewing existing knowledge of marine issues and the curriculum
- Undertaking a workshop and field trip for learning the marine content knowledge that we identified a need for
- Working with materials to develop lesson plans
- Undertaking classroom implementation of lessons and review of the outcomes

This chapter was developed through generation of analytical statements based on the evidence reported in Chapter Four, allowing me to deepen my understanding of the process. In the research I was a participant and also served as a resource person assisting the teachers to collect

and report data that was used to inform our further actions. I was not seen as an outside expert to any extent, as I faced the same problem of a limited understanding of marine content knowledge and was learning together with the other participants. In this chapter I now stand back from the process to review the evidence in relation to my research question on the introduction of content knowledge, use of materials and the development and implementation of lesson plans.

Based on the action research data reported in Chapter Four it was possible to make analytical statements on the introduction of content knowledge (Section 5.2), and how teachers worked with curriculum materials to develop lesson plans (Section 5.3) and finally the implementation of lessons on marine and coastal issues (Section 5.4). The chapter concludes with a review of the analysis of the evidence on the introduction of content knowledge and contextualizing the curriculum (Section 5.5 below). The analytical statements develop with some overlap to reveal a deeper sense of how a focus on content as facts developed as a process of teachers working within an established mode of content delivery. The evidence suggests that this mode of practice did not allow them to successfully work with the new curriculum

5.2 TEACHER FACT SEEKING PRACTICES

(Teacher fact seeking practices limited the scope of the learning interactions and the content learned did not necessarily lead to improved lesson plans.)

5.2.1 Working with facts and definitions

(The established practice of working with facts and definitions directed teacher attention to content gathering and the curriculum requirements were not adequately considered.)

An agenda of teachers learning marine content knowledge became the limited purpose of the workshop. They felt they could not teach the subject because they lacked content background on the issues. According to the teachers their lack of content on both marine ecosystems and issues was contributing to the learners' boredom and misbehavior in class (4.2.2).

To respond to these challenges teachers realized 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. All

teachers agreed during focus group interviews that if they did not know what they teach then learners would be unable to learn (4.2.2.). This changed the workshop focus from their initial intent to work with content to improve teaching and learning to the acquiring of content. The teachers thus worked on what they wanted to know about marine ecosystems based on the assumption that this learning would inform them to teach better lessons on these topics. They also felt that seeing the marine ecosystem would help their understanding.

When curriculum is informed or guided by a technical knowledge interest in this way, knowledge is regarded as content to be discovered and learned about, in this case, the marine ecosystem. In the past the old education system was structured according to syllabus, which predetermined the structure of the content to be learnt, and how it should be learnt in schools (2.3). This structure informed the teacher of how to teach and what to teach by outlining topics and providing teachers with materials with which to teach and assess learners. Grundy argued that this contributed to teacher deskilling by adopting a strategy of regarding teachers as implementers of policies that are decided outside of their classroom contexts. The outcomes of these controlling policies resulted in the new democratic government being driven by a new purpose in education, and the need for social re-dress in South Africa. The purpose of OBE as a new curriculum policy framework is to empower and emancipate teachers and learners so that they are able to work critically with knowledge in ways that will relate to their own contexts. In the new outcomes-based curriculum teachers were required to be actively involved when they plan lessons and work with materials. This meant that they had to manage the curriculum and to mediate learning for the curriculum to be effectively implemented (2.3).
However, the evidence suggests that the initial action research purpose of working together to improve teaching and learning through planning and implementing lessons on marine ecosystems became deflected to one of gathering factual content knowledge.

5.2.2 Content gathered as facts and definitions

(The content gathered (as facts and definitions) in the workshop and field trip made teachers more knowledgeable but their knowledge was not effectively used to structure lesson activities.)

The process of working together and attempting to increase their own knowledge was to some extent successful. On analyzing teachers' discussions and lesson planning during and after the Museum workshop and the field trip, I noted that teachers were more involved in discussion about marine issues than they were during Phase One research process. They could identify the names of the animals, where they lived, what they looked like and which animals eat them (4.3.2.4). Here the focus had shifted to facts and definitions. Despite this increased understanding they still battled to structure activities that address learning outcomes and assessment standard. The research data illustrates that it was difficult for the teachers to connect facts and definitions that had been learned at the Museum and in the field trip to lesson planning (4.3.2.2).

Teachers were thus unable to use materials effectively or to structure the content (facts and definitions) they had learnt into learning activities that were in line with curriculum goals. Although they knew the definitions of certain terms such as herbivores and carnivores they were not sure how to introduce them into a planned lesson. They were also not confident to allow learners to construct their own food chains and food webs working with prior knowledge or to use the webs to introduce the marine food pyramid concepts they were going to teach. Teachers' reflection in cycle one showed that they were not confident to use the lesson plans they have developed in a workshop context. (4.3.3.2.3)

Contrary to teaching as a content-based product or the transmission of law like discoveries, Cornbleth (1990) and Grundy (1987) argued that acquisition of content knowledge of marine ecosystem should be viewed as a contextualized social process rather than as a product. In this case acquisition of content knowledge of marine ecosystems should be regarded as an ongoing social activity that is shaped by contextual influences within and beyond the classroom (2.6). If OBE is conceived in this way then the views of knowledge in the curriculum serves the practical and emancipatory interest and not the technical interest only (2.6). Teachers are required to change their views of knowledge and curriculum by moving from content centered approach and its methods to teaching and learning that require the development of critical thinking skills, problem solving and doing investigations. This required teachers to be flexible and multi-skilled when dealing with knowledge construction and learning. The process of generating knowledge

through curriculum also changed from regarding knowledge as a 'commodity' into knowledge as socially constructed through meaning making in situated practice (2.6).

This means knowledge is generated through interpreting and analyzing the context in terms of the extent to which it can help and become meaningful to achieving the curriculum goals (2.6). Central to OBE, teachers are given a responsibility to devise and implement a system of teaching and learning that will facilitate the achievement of learning outcomes and address context specific issues which are related to student learning (2.6). The role of the teacher should change from being only the subject teacher to being the mediator, and the manager of teaching and learning by assessing the teaching and learning context. The desired change should be known and teachers' planning should represent a process of intentionally and effecting change in the structure of the education system and organization (2.6). Planning of lessons should be an iterative process of action and reflection in situated practice so that plans are made and actions are changed which will eventually change the initial plans. Plans are not just mere description of activities or events but are evaluated in terms of how they assisted in meaning making and understanding (2.6). The role of the teacher is not only to teach but to evaluate the learning process, assess her methods of teaching and learning, mediate and assess learning. However this implies a role of planning and assessment as being crucial on the part of the teacher.

In an OBE curriculum teachers are required to take a critical stance in lesson planning by allowing content to emerge as teachers and learners are involved in a lesson than having teaching and learning that is based on the application of specific pre-determined content. This does not discount teachers having content knowledge, nor does it discount planning, but planning should be well understood by teachers so that they can reflect on changes and be able to asses whether their actions will lead them to achievement of goals. For example teachers need to be able to understand concepts and definitions. These should help them to interpret and analyze the learner's context and the context of learning. Contextualized curriculum emphasized an integrated approach to lesson planning than treating knowledge as isolated bits of information. Currently naming and defining is still what teachers know and practice in school classrooms.

5.3 SELECTION AND ADAPTATION OF MATERIALS

(Despite the availability of good resource material, the process of selection and adaptation of materials resulted in limited learning opportunities.)

5.3.1 Teachers searched for the content they knew

(Teacher practices of working with facts and definitions was carried over into how they searched for the content they knew when selecting materials for lessons.)

The lesson planning evidence from chapter four showed that materials were reviewed according to teachers existing practice of teaching around isolated facts and definitions they know. This practice continued in their work with the marine resources pack, the textbooks and treasure beach materials that they used. Here the emphasis is on content and the use of materials and not on pedagogical content knowledge practice to realize this within OBE approach. Shulman (1987) argued for pedagogical content knowledge which regards the relationship between content knowledge and pedagogy as important to improve teaching and learning. This approach is based on the fact that subject matter knowledge is as equal important as pedagogy in teaching and learning. But children could learn best if teachers know their students, their school culture and the movement of content well. They can create wonderful learning tasks tailored to their own students not only knowing facts and concepts (2.6). Teachers should know representation and formulation of concepts and the knowledge of what make concepts difficult or easy to learn. These are relevant knowledge based on teaching strategies that incorporate appropriate conceptual representation to address learner difficulties and misconceptions and foster meaningful understanding. There is also knowledge of what the students bring to the learning situation, knowledge that might either be facilitative or dysfunctional for the particular task at hand. This knowledge of students includes their strategies, prior conceptions, misconceptions students are likely to have about a particular domain and potential misapplication of prior knowledge (2.6).

Learning facts and definitions didn't translate into active learning. Outcomes of fact seeking approach to materials resulted in the mismatch between familiar content-centered strategies and the requirements of lesson planning. We could only focus on subject matter knowledge whilst

the pedagogical content knowledge which is knowledge of content and students and knowledge of content and teaching and knowledge of content and curriculum was limited.

When I looked at the materials I found that the marine resources pack was developed as a structured framework that should be used as a tool to develop LO3, which required the development of sustainable and unsustainable use of marine resources in Natural Sciences. The evidence from Chapter Four showed how this marine resource pack was selected by teachers and used to organize and structure lessons. For example teacher CI focused on marine ecosystem and selected poster number one. This was regarded as relevant because it provided food web and food chain information for teacher CI to use in her preparation. She used the poster to give learners a food web exercise and to explain the concepts and her knowledge of marine issues. (4.3.3.2.1).

In my lesson I used poster number two with the topic of life cycle of a mussel. I selected marine poster because it provided pictures and information about the life cycle of a mussel (4.3.3.2.3). I used a marine poster with pictures of people who use marine resources for different purposes and the poster also provided information about how resources are used. Teacher NK selected resources from treasure beach. The resources were selected because they provided pictures and information about animals (4.3.3.2.2).

The evidence provided showed that teachers used the marine resource pack in technical terms. They neglected consideration of how materials are going to be used with and by learners and how its use can support the development of assessment standards and learning outcomes (2.7). The topics suggested by the marine resource pack were dealt with as isolated bits of information by allocating each poster for each teacher to plan the lesson (4.3.3.1). This was done around the factual information without clear understanding of the intentions and purpose of the resource pack and its alignment with the curriculum goals. When learning support materials are 'adopted' and used in this way they become inappropriate to the context for which they are intended (2.7). For example the fact that the materials were treated as separated topics changed the meaning and intentions of the materials and activities in the resource pack. The topic based lesson plans for example teacher CI's lesson plan, showed how she used the poster by cutting its pictures and

give them to learners (4.3.3.2.1) and the review of materials by teachers in the phase one process and lesson planning also showed the cutting of pictures from the poster (4.2.3). Definitions were taken from the materials (4.3.3.2.1) and learners were going to be asked to find meanings of words from the dictionary (4.2.3). Learners were going to be given pictures of food chain and be asked to draw food pyramid (ibid). Teacher CI commented that the purpose of these activities is to teach the concept of harvesting and when learners see that on the other side of the poster there are no resources then they can deduce that through unsustainable harvesting there are no resources left (4.2.3). Teacher's low levels of conceptual knowledge, poor grasp of fundamental concepts in marine ecosystem has led to topics being dealt with at low levels of challenge (2.7).

Teachers having limited understanding of marine issues coupled with little sense of what was involved in contextualizing curriculum led to the structuring and organizing of naming and defining activities that did not produce better teaching and learning. The materials were thus not used to support the structuring and organizing activities towards achievement of curriculum goals. The study showed that teachers lacked the skills to understand the purpose of the materials and that presented some challenges in improving lesson plans and also improving their teaching and learning (2.7).

Teachers selected and reviewed materials to look for content they know and this made them plan lessons which focused on explanations and descriptions without developing any new methods and strategies that would help them to achieve curriculum goals. Their teaching methods of naming and defining remain the same. This evidence is provided by the lesson plans they developed. Teacher CI's lesson plans in cycle one and two of action research process (4.3.3.2.1) (4.4.2). Teachers NK's lesson plans (4.4.3) (4.3.3.2.2) and my lesson plans (4.3.3.2.3) (4.4.4). The selection and review of materials by teachers also showed that they were looking for the content they know which was based on descriptions and explanations (4.3.3.2.1) (4.3.3.2.2) (4.3.3.2.3).When teachers lack background knowledge in their discipline it becomes difficult for them to develop learning activities effectively and this led to poor quality outcomes (2.7).Poor understanding of the subject causes teachers to lack confidence in what they do and to make factual errors (2.7). Teacher's poor grasp of knowledge structures acts as a major inhibitor of teaching and learning and this has been perceived as a general problem in South Africa (2.7).

This study makes it clear that it is not only the provision of materials but selection and capacity to use materials that are important in enabling improved quality in teaching and learning (2.7).

This study showed that teachers did not develop the skills to critically select and review materials and understand the purpose of the materials and the context in which those materials were to be used. Lack of reflexivity in the use of LTSM and lack of clarity on how learning processes takes place has led in some cases to trivialization of LTSM (Russo & Lotz-Sisitka, 2003:12). Findings from this study showed that achievement of learning outcomes and assessment standards relies on the ability of the teacher to evaluate materials and make decisions on the best materials to use.

Overall there was a limited understanding and the mismatch between what teachers intended and what the curriculum requires them to do. In all cases, including my own, we were mostly working with information and pictures that we already knew for planning the lessons. Despite the content gathering experience and the lesson planning design activity with the packs, the way teachers worked with content remained much the same. All three teachers used the poster as a source of concepts and definitions that they wanted to teach. They only considered the new marine facts and definitions to plan lessons. The review process showed that teacher lesson planning practices were still centred on content in the form of concepts and definitions. They were still unable to look beyond content alone and to link learning activities to the goals of the curriculum. The evidence of how existing content practices persisted began to reveal a clear mismatch between the teacher curriculum practices and what the curriculum was set out to achieve.

5.3.2 Mismatch between familiar content-centered strategies and the requirements of lesson planning

(Teacher selection and adaptation of material revealed a mismatch between familiar content-centered strategies and the requirements of lesson planning for the new curriculum.)

Despite the dominance of facts and defining in the lesson planning process a closer analysis of lesson plans provides some evidence of an expectation of meeting some learning outcomes and

assessment standards. However, these expectations were not clear and meaningful to such an extent that they show a clear process of teaching to support learners in achieving learning outcomes. Evidence from chapter four showed how teachers attempted to align materials with active learning approaches.

The evidence from chapter four showed that teachers wanted to make learners actively involved in the teaching and learning process. They also wanted to see them participating in an actively way rather than learning through listening to the teacher. The adaptation and use of materials were regarded as playing an important role in this regard (4.2.2). The active learning framework used in lesson planning was regarded as going to be useful to guide effective teaching and the use of materials that will contribute to participation of learners in constructing their own knowledge (4.2.3) (4.3.1). However the evidence in Chapter Four showed teachers' challenges in interpreting active learning framework. The questions that guide the framework were interpreted as fixed actions that required teachers to think about how to teach learners other than putting emphasis on the way that the learner constructs and reconstructs knowledge. In this way the focus was on the implementation of the lesson by the teacher instead of thinking about teaching that recognises the learner's knowledge and experiences as they are situated in culture and context.

NEEP-GET argued that the use of active learning framework in lesson planning is meant to support teachers in acquiring content knowledge and develop a range of different strategies to mobilise learner's prior knowledge and use LTSM to provide additional information of marine issues. Teachers have a responsibility of mediating environmental learning with learners in their environment. They are required to mediate learning in a pro-active and carefully planned way (2.8).Active learning framework is associated with learner centred approaches which is relevant to OBE. It is an approach that recognises the knowledge and experience of learners challenging them to learn more than they already know. This framework is meant to support and guide teachers in using open processes to learning. They are also required to interpret this process using questions which can enable them to mobilise learner's prior knowledge and scaffold them to a higher level of understanding. A learner centred approach to Education in OBE is explained as responding to what learners already know, challenging them to learn more than they already know (2.8). Because of limited understanding of active learning processes as a strategy to

understand the learning opportunities provided, the structure of lesson planning was not improved.

These questions were not used critically to think about teaching as an important factor that might influence learning taking into consideration of "what learners already know". The purpose that is served by active learning framework in lesson planning was not clearly understood. The questions in the active learning framework were interpreted as isolated bits of activities which did not show the progression and integration of activities that ensures the achievement of learning outcomes and assessment standards. Teachers followed the questions by interpreting what they should teach learners instead of asking critical questions in relation to the context of the learners (4.3.2.4).

Furthermore the implications of limited understanding of the active learning framework affected the activities that were designed by teacher. The activities had limited scope and depth that focused on descriptions and explanations. There was lack of focus on the conceptual development in these activities because teachers were unable to interpret appropriate levels of depth and scope, which are required for Senior Phase Natural Science learning area (2.6). In some lessons teachers expected some demonstration of actions from learners but these were not clear in their instruction (4.3.3.2.3). In this case the use of active learning framework and the adaptation of materials served the purpose of implementing procedures to achieve the end of the learning process with limited learning goals. Russo & Lotz (2003) argue that the adaptation of material should help the teacher to effectively align or scaffold activities for learners in order to achieve curriculum outcomes. But in this study instead of the materials being used to scaffold they served the purpose of simply providing a descriptive framework, which didn't have meaning in its context. Good quality LTSM can support the teachers to meet the objectives of the curriculum, can be effective in the context in which they are used and can provide scaffolds for learning, and support the teacher in terms of methodology only if they are interpreted and aligned with materials (2.7).

The theory of pedagogical content knowledge (Shulman, 1987) provides insights on the role of the teacher in learning. He argued that the teacher should know what she wants to achieve(

outcomes of the lesson), knowing the learners level of knowledge (learners knowledge) knowing the subject content (subject matter) organizing the subject matter to fit the learners knowledge (lesson planning) and organizing relevant teaching and learning materials that can be accessible in the learning environment (2.6). Olivitt (2004) argues that materials become "learning supportive" only when the teacher can develop the skill to devise a teaching system in which materials will be used to ensure the development of assessment standards and learning outcomes (2.7) That means the materials become useful when the teacher knows the purpose for the learning processes and how to use materials to structure the teaching and learning process in ways that relates to assessment. The misinterpretation of active learning framework and limited understanding of working with materials affected the learning opportunities provided to learners. She further argues that the effectiveness of the learning support materials is the 'supporting and stimulating role' that could help teachers to develop curriculum activities out of the established Learning Area Outcomes and Assessment standards (2.7).

The above discussion illustrate that there was no clear improvement in teaching and learning strategies employed by the teachers in this study. Mbanjwa (2002:141) illustrate that the design of learning support materials should contribute to both, teachers conceptual development and learners abilities to learn. He further explained that in his research he considered that the active learning framework he used had influenced the teaching and learning processes in his study (2.7). This finding is supported by Nduna (2003:23) that the way materials are used in combination with one another can also influence how learning takes place. The role of the educator in using materials for meaning making in context is therefore an important factor to consider in the development of learning support materials. It is only when teachers used materials to scaffold learning interactions that they become learning support materials (Olivitt, 2004). Meaningful work with materials can lead to improved teaching and learning because teachers will be able to assess their own learning continuously whilst they use materials. This study has shown that the selection and adaptation of materials is a complex process and that teachers may well require ongoing professional support in terms of translating them into good and effective learning interactions. This translation of teacher from transmitter of knowledge to one of facilitator required by the new curriculum is clearly a complex one and teachers require

much support in this regard. All of the above were attempts to develop lessons that will support the achievement of learning outcomes and assessment standards but they were not successful (2.7).

5.4 MEDIATING OF LEARNING

(When adapted materials were used in classroom learning activities there was little effective mediating of learning towards clear curriculum outcomes.)

5.4.1 Limited use of materials as knowledge resources

(The mediation of learning was towards the expectation that learners would reproduce teacher presented facts and information and there was limited use of materials as knowledge resources.)

The process of fact gathering and content knowledge influenced how teachers mediated learning. Evidence from Chapter Four showed how teachers used materials they had adapted in order to support and mediate learning in the classroom. The mediation of learning was mainly on facts and information from the poster and did not help learners to extend their current knowledge. Many definitions were introduced at the same time. The information shared with the learners had limited scope and depth and did not encourage active learning and meaningful understanding of these concepts. Many definitions were introduced at the same time. The information shared with the learners had limited scope and depth and did not encourage active learning and meaningful understanding of these concepts (4.4.2.1).

In my lessons I used pictures to teach learners and these allowed learners to talk and think about what was happening, for example, talking about good and bad practices of harvesting. I realized that there was a need for more in-depth knowledge other than the one provided by the poster. I used the book called 'Our Coast, Our Future' because I wanted to elaborate on the picture. I provided learners with the structure that would help them to look at the pictures and think about the implications of people's actions on the coast. I found that teaching from pictures in this way was limiting because there was no in-depth learning of concepts (4.4.4). Learners were poor in spelling and sentence construction because they used pictures with limited information. The

comprehension I adapted from materials was challenging because I was unable to explain or respond to learner questions well because of my limited understanding of the topic.

The question and answer method that was used by teacher NK was based on resources. Teacher NK in her lesson plan introduced the lesson by giving learners shells and asked them to talk about what they knew. She further developed the discussion by giving learners explanations about the shells. For example, she explained that shells of a Venus ear have holes to allow for gaseous exchange. After this introduction learners were given a worksheet to classify shells according to similarities and differences. The purpose of this activity was to find out what the learners already know. She further continued the discussion by explaining, discussing and giving activity to the learners. She also developed notes with the learners using shells by discussing and explaining concepts (4.3.1).

The teaching and learning strategies used by the teacher to mediate learning reflected that teachers were drawing on their knowledge of concepts and the names of organisms. Despite information shared during the introduction of new content knowledge and materials, the teachers' skills and knowledge about marine issues was focused on the interesting facts they had gathered and defined in the content workshop. In this case the mediation role was based on using materials so that learners can acquire facts and information at the expense. This was not aligned with curriculum goals and it was evident how teachers mediated learning. Vygotsky (1978: 86-90, cited in Moll 2002: 18) insist that learning is a systematic cooperation between a learner and a teacher (2.5). This interaction relies on what the teacher knows, based on her knowledge she can actively organize learning by knowing exactly what is it that learners have to learn, how they will be enabled to learn and how the teachers will know that learning has taken place. In this study the teachers' knowledge and understanding of marine content knowledge was limited to descriptions and explanations and their knowledge was not extended to meaning making as a result of adaptation and use of materials. The information shared with learners thus had limited scope and depth with limited purpose; this has constrained their learning. Vygotsky (1978, cited in *ibid*) argues that mediation of learning required teachers to be more experienced "other" in the teaching and learning relationship because they have the responsibility to scaffold the learners learning process, and to create challenges that are realized within the learners 'zone of proximal

development'. The interaction of learners and teachers from observed lesson plans showed how teachers mediated learning (4.4.2.1) (4.3.1) (4.4.4.1). In this case the mediation role was based on using materials so that learners can acquire facts and information at the expense of meaning making and understanding. The learning was at a low level as learners were given descriptions to recite and to memorize, and these did not relate to real life experiences. However, the evidence from Chapter Four showed learners directly interacting and learning from each other (4.4.2.2) (4.4.3.2) (4.4.4.2). The pedagogical shift that is needed, according to critical theorists (Cornbleth, 1990:78) is that teachers develop their mediation roles as the curriculum issues unfold (2.6).

Both Piaget and Vygotsky share the same view that in constructivism, new knowledge is understood to arise from a structured relationship between the external, cultural environment and the mind of the leaner, with development emerging from these phenomena. Moll (2002:17) develops the argument that both Piaget and Vygotsky's theory conceive an active construction of knowledge on the part of the learner that unifies and transforms natural and social-cultural processes into new, embodied forms of knowledge (2.5). The structure means that there should be a set of organized learning activities directed at the construction of more and more complex ways of knowing (Moll, 2002:17). The teacher's knowledge of OBE curriculum and the conditions necessary to support that curriculum are needed.

5.4.2. Assessment limited to content presented

(Teacher assessment of learners' work was not clear, was limited to content presented and did not extend to feedback on learning achieved.)

The content centered approach was carried over on how assessment was interpreted by teachers, what was assessed and how it was conducted. The evidence from Chapter Four showed how teachers CI assessed learners understanding regarding the content of marine food pyramid. I analyzed four worksheets completed by learners. Two of them drew food chains instead of food pyramids. In the case of the other two, one of them showed a food chain drawn in a pyramid .The last one showed a drawing of plants and animals in a pyramid. It seemed as if learners have understood the concepts of food chain and not the food pyramid. The teacher's remarks about

leaner progress showed that those with food chains in a pyramid were highly achieved and the other one with pictures had achieved the outcome (4.4.2.3). This evidence suggests that the teacher had misinterpreted the concept of a food pyramid and this had misled the learners. Lesson planning and assessment should be based on the learning outcomes and assessment standards provided in the policy to ensure high knowledge high skills (2.9). Using learning outcomes and assessment standards for planning assessment will ensure that activities will not be too superficial, and it will ensure that the required minimum level of knowledge and skills are developed and assessed. This will also ensure that learning activities and assessment tasks progress from grade to grade (ibid).

Teacher NK in her lesson plans wanted learners to develop skills to classify animals. The development of this skill was not clear because learners were given an activity to put animals into groups. Evidence from Chapter Four illustrates that when learners classify animals according to their own knowledge, they were told that they had not achieved the outcome (4.4.3.4). Another activity was given to them to classify animals and they were asked to copy what the teacher had done on the board. This gave them a final assessment of highly achieved (4.4.3.4) showing that the teacher had worked along with them and the learners have simply copied down what was on the board. Outcome statements indicate what learners must be able to do when they have successfully completed a specific learning programme (ibid). The teacher has to carefully observe the specific performance that can be checked against a 'task'. This required the teachers to explicitly, spelled out in activities which are related to the context of the learners (ibid). In this context assessment was limited judgment and was not used in a formative way to take learners to another level of development.

In my lesson I asked learners to analyze and interpret information about sustainable use of resources from the marine poster. I found that I lacked materials that would support me to guide and support learners with activities. For example, learners were required to consider pictures and make decisions about why people harvested marine resources. Learners were required to make decisions about people's actions without having foundational knowledge that they could use to

develop their argument. I did not think about using a variety of activities to develop this competence in learners, and because of my limited background I lacked the ability to interpret the skills and knowledge. I was also unable to use materials and design a lesson that would engage learners in a variety of contexts so that they could be in a position to make decisions I wanted them to be involved in. I realized that I used materials as providers of information other than tools that could have helped me to explore other learning possibilities. Teachers are required to use different tools and strategies for conducting and recording assessment. This will ensure that the required minimum level of knowledge of knowledge and skills are developed and assessed (2.9).

In all three lesson plans there was limited learner progression in conceptual development, and their content background was limited to facts and definitions although they were actively involved in the learning process (4.4.1) (4.4.2) (4.4.3). This study shows that the limited content knowledge of marine issues and the ability to link activities to goals was a challenge during the mediation process. Although there is evidence of all teachers in this study trying to assess learning during the lesson, there was limited scaffolding of learning to a higher level of development. It was difficult for teachers to carefully monitor activities and learning because they were not clear of the outcome of learning that is linked to a specific goal. Limited understanding of the role of materials to mediate and scaffold teachers learning about marine content knowledge affected the development and achievement of curriculum goals. This study showed that if teachers cannot use materials and understand them the chances of their content knowledge development and changes in their methodology are minimal. This showed a poorly developed relationship between LTSM, learners' work and assessment (NEEP-GET 2005:37). The assessment standards were interpreted as a syllabus that needed to be covered other than encouraging learning that will develop standard of knowledge that is required by the curriculum. Planning for assessment is an integral part of lesson planning and learning outcomes and assessment standards are provided in the policy document to ensure high knowledge high skills (2.9).

At this stage, there is clear evidence that the focus on acquiring content knowledge came from the existing 'fact and definition' practices of the teachers. Their learning in the workshop thus

became a process of fact gathering and this same perspective was applied to work with the posters where they simply picked out the concepts and definitions that they knew and thus wanted to teach. The evidence also points to how this gave rise to a mismatch between the teaching and the curriculum requirements. Within the developing mismatch some of the groups of learners were, however, learning more than the content delivered by the teacher by working together with the posters. The disjuncture between the established pattern of teaching as fact and definition delivery and the curriculum requirements became most apparent in the assessment.

Despite the acquisition of content not appearing to contribute to contextualization of the curriculum with enhanced learner understanding of marine ecosystems and issues, teachers and learners reported a sense that something useful had been learned.

5.4.3 Learners, working directly with materials

(There is evidence of how some learners, working directly with materials, were able to learn together.)

When learners were engaged with materials they worked in groups, shared knowledge and made decisions and the teacher facilitated by moving around the group supporting learners. In teacher NK's lesson plans, learners were able to use pictures, compare animals and identify them according to their differences. The use of language was encouraged as they read the names of the animals, although some had difficulties with pronunciation. Other learners were thinking whilst others were looking at pictures and thinking and not exactly involved in the learning activity. According to (NEEP-GET, 2004:34) LTSM can introduce both teachers and learners to new ideas, and new knowledge. Other learners were able to take initiative and lead the groups and were willing to deal with uncertainties. The teacher facilitated learning by moving around the groups and explaining some of the things that learners have to do. There was an open communication between the teacher and learners (4.4.3.2)

In my lesson I used the marine poster to engage learners in discussion about how people collected marine resources. Learners shared information in groups and they drew their knowledge from their environment. They were able to interpret sustainable use of resources and

related it to their context by making an example of chickens. They associated mussels with chickens saying that if somebody wants to have many chickens he keeps the small ones to reproduce so that they can increase. They were engaged in discussions although they sometimes lacked language to express themselves. Learners were able to situate themselves in the context of marine resources by showing how they felt about other people's actions (4.4.4.2).

When teacher CI gave learners an exercise to develop food pyramid at the end of the lesson, learning was taking place. Learners did not focus on what they were asked to do but they discussed and shared information about what they saw in the poster. Whilst others were talking to each other about which animals to choose, one learner held the poster and she read everything on it. The concepts that the teacher was trying to teach were in the poster in detail. Other learners shared knowledge about marine resources that they already had. Learners were actively involved but the teacher did not notice because she wanted to assess what she had taught them (4.4.2.2). Here, learner use of materials to learn is evident. However, the role of the teacher to mediate learning with the materials was limited to the assessment of content that was taught.

5.4.4 Teachers' personal learning

(Teacher action research reflections acknowledged some personal learning about marine issues but reported difficulties in carrying this into lesson plans related to curriculum goals.)

After the lesson the teacher CI said she had managed to make learners to be actively involved in the lesson. They had achieved what she wanted them to know. She was surprised to see how learners interacted with materials at the end of the lesson. Teacher NK in her reflections noted that the use of shells helped her in engaging learners in the activity. She also reflected about the limited resources she had to teach all the classes of animals. She further thought that she wanted the learners to see the animals in real life. She said that the materials helped her with ideas on how to teach the learners. She spoke about her assumptions that she knew that learners knew a lot about marine resources, but she realized that their information was limited. She reflected about her knowledge saying that she had problems because this was a new topic and the terminology was also new. She said that she feels it was a good start for her because there is information that she has learnt .It has been a foundation for her to develop knowledge and she

hoped that next year things would be much better. I found that when resources were used, the teacher's methodology improved, but what seemed to be lacking was how teachers saw their classroom experiences as an opportunity to learn and understand in order to improve their classroom practice. This study showed that learners were actively acquiring facts and definitions other than achieving curriculum goals.

5.5 TEACHERS LEARNING OF THINGS OF INTEREST ABOUT MARINE ISSUES AND ECOSYSTEMS.

5.5.1 1 some evidence of learning about things of interest.

(Where learning support materials were used, (and despite the fact-presenting way that they were used by teachers), the acquisition of content knowledge by teachers was accompanied by some learning of things of interest about marine issues and ecosystems.)

I reflected about how we have used the materials and found that the marine poster was designed as a learning programme. Its focus was to develop learning outcome number three which requires learners to understand sustainable use of marine resources. Poster number one was based on introducing concepts to learners through pictures and some few sentences that explained the pictures. The introduction of these concepts was supposed to be integrated as the poster showed pictures of a rural setting. It also showed how people harvested marine resources. Poster number two focuses on life cycle of a mussel and poster three on how people utilize marine resources for different purposes. These posters were relevant in providing an idea of how and what marine issues are and how they look like. However, the way we interpreted the poster was fragmented and not according to the materials developer's intentions so it did not helped us to design learning strategies to mediate and scaffold learning. Evidence from Chapter Four showed that pictures can stimulate discussions amongst learners to respond to pictures that depict local environmental issues but they can limit learning through limited vocabulary and limited opportunities for reading.

LTSM should focus on a few key conceptual goals and should address concepts, processes and skills in terms of incremental cognitive complexity (Taylor and Vinjevold, 1999:182). For example, the information provided by the poster was limited. Pictures and some few written text did not support the teacher to provide for the content needs of the learners. For example there

was limited information about sustainable use of marine resources for the teacher to be able to provide guidance to learners.

It was also difficult for us to use the policy document because of limited understanding of the purpose of the learning area. However, there is a different way of how knowledge should be constructed in Natural Science learning and what purposes should be served by that knowledge. This also required LTSM that will be used with the policy document to understand the learning area better. The lesson plan, which was also used during this research, provided an example of the integrated lesson plan design. This lesson plan was useful in developing teachers understanding of how to organize learning framework that is based on achieving goals.

5.6. CONCLUDING DISCUSSION

In synthesis, although teachers reported increased content knowledge they were unable to work effectively with curriculum materials and to structure learning activities. This was primarily owing to the dominance of an established pedagogical practice of teaching by passing on factual statements and working to define terms with learners. The teachers were thus unable to interpret and translate the learning outcomes and assessment standards of the curriculum into their lessons on marine ecosystems and issues that related to local context. They mediated learning around their own knowledge, requiring learners to recall factual knowledge and definitions that were communicated to them, copying these from the board in most cases.

Owing to a lack of teacher skill to work with the materials in relation to the curriculum, the curriculum purpose became separated as the lesson activities were selected and materials assembled. The separation produced learning activities in isolation that were not adequately linked to and thus did not hold together or build integrated learning that was related to either assessment standards or the local context.

Based on this evidence of a content strengthening approach used, it appears that more carefully planned curriculum and lesson-planning work with materials is needed so that teachers come to understand the purpose of the curriculum and learn to design lessons that relate to local context. It would appear that teachers need to be trained to work systematically with curriculum outcomes

and teaching and learning support materials as well as acquiring the local knowledge necessary to work in ways that can contextualize the curriculum so as to enhance student learning.

CHAPTER 6

RESEARCH FINDINGS AND RECOMMENDATIONS

6.1 INTRODUCTION

In this final chapter, I provide a critical overview and reflective summary of the main findings in relation to the research question. I also highlight some recommendations and emerging issues that developed from the findings in Chapter five. I finally review the research methods and methodology to provide critical perspective on the research process. Being informed by recommendations that arise out of the discussion in Chapter five, I end this chapter by highlighting areas that require further research.

How can the introduction of new socio-ecological content knowledge (of marine and coastal resources and issues) contribute to contextualized curriculum and Learning Support Materials development and use?

6.2 SUMMARY OF THE STUDY

The purpose of the study was to explore how the introduction of new socio-ecological content knowledge on marine ecosystems and conservation issues contributed to a more contextualized curriculum. Here a central focus in the action research process was the use of teaching and learning support materials in lesson planning to implement the Natural Sciences curriculum in ways that relate to local context. The intention of the study was to explore ways in which teachers content knowledge of marine issues can be developed so that teachers can be able to adapt materials and develop lesson plans that will be responsive to context and help learners to achieve curriculum goals (1.3). The assumption was that if teacher's knowledge of marine content knowledge can be developed, teachers will be able to design Teaching and Learning Support Materials that will be relevant in their own context and this will strengthen school-based curriculum and materials development.

To establish a context for the study, I considered recent policy changes in South Africa (2.4). In line with the international developments, the Department of Education in South Africa has

recognized Environmental Education as a key response to environmental issues and risks (2.4). The White Paper on Education and Training (RSA, 1995), states that environmental education involves an interdisciplinary, integrated and active approach to learning. The consequence of this policy decision has been the inclusion of an environmental focus with environmentally oriented learning outcomes in the learning areas of the Revised National Curriculum Statement (RNCS, 2002). I considered these policies in more depth particularly as they relate to teacher professional development, use of LTSM and curriculum implementation within OBE framework. I also reviewed previous research on learning support materials and professional development such as NEEP-GET pilot research project and their lessons learnt during resources based approach to professional development.

As I indicated in Chapter 3, in designing this research I decided to work within an interpretive and qualitative approach because it focuses on understanding social practice. Working within an interpretive paradigm helped me to work with teachers, interpret and understand teachers' and learners' interactions and develop understanding that will lead to the use of materials and improved lesson plans. To document these processes and outcomes in the context of this study, I employed a range of data collection strategies including questionnaires, workshops and classroom observations, field notes, focus group discussion, lesson plans and learners work and reviews of materials (Chapter 3 and 4). During the first phase of the research process we used questionnaires, focus group discussion and review of materials. These helped us to investigate teachers existing content knowledge of marine issues and how teachers integrate marine and coastal issues in their lesson planning. The discussions and observations made during the review of materials provided an opportunity to gather in-depth issues whilst teachers used materials. This helped to compare what was said by teachers during focus group and what is being done by teachers when they review materials (Chapter 3). The issues that emerged from these data generating techniques assisted in the planning of action research cycles. The data generated in this phase was analyzed and the emerging issues were considered for the planning of two action research cycles (See section 3.3.1). We used observations, journal reflections and analysis of workshop and lesson plans as well as learners work to document the use of LTSM by teachers and how their knowledge developed through the research process.

This study indicated that the limited purpose of fact gathering and defining that teachers adopted in the study, constrained the scope of their interaction during the research process. The teacher's agenda during the action research process was to acquire content knowledge through lectures, field trip and materials which were regarded as important for them to improve teaching and learning of marine and coastal issues in the Natural Science learning area (5.2.1). This process to teachers' knowledge development has been proven inadequate in supporting teachers to deal with practical challenges of using materials and developing lesson plans that are responsive to learners' context. Teachers were unable to use materials or the content they had acquired to structure activities that are in line with learning outcomes and assessment standards required by Natural Science Learning Area (5.2.2). This study indicated that before teachers could think of developing teachers' knowledge of marine issues, critical questions need to be asked in relation to the purpose of the content that needs to be gathered in relation to the curriculum requirements. In this case, the knowledge generation could be informed by curriculum requirements and the context in which it is used rather than by being driven by the content, as was the case in this study.

The research process showed that teachers' conceptions of curriculum influenced the research process from the beginning to the end. Their view of knowledge and how curriculum should be developed was evident. The decontextaulised conception of knowledge that teachers adopted created a gap between the expected roles of the teachers as designers and adapters of materials and what the teachers could realistically do. The mediation of teachers' knowledge needs to be developed in a way that will support them to work with materials and to scaffold learning.

6.3 RECOMMENDATIONS

The recommendations I make are based on the analytical statements that were discussed in chapter 5.They are also based on the case study undertaken with teachers from Cintas area. These recommendations are mainly relevant to our context. However they might provide useful insights for others researching about teacher content knowledge in the context of contextualizing curriculum and the marine issues.

Findings from the study showed that the teachers were interested in learning about the content of marine and coastal issues that they needed for their teaching. They thus reported that they felt

that they had achieved their goal of learning about coastal ecosystems. However, their normal practice of working with facts and definitions did not support the change required by the new curriculum. Here the study found that the normal practice of learning and working with content knowledge as facts undermines the curriculum objectives that require teachers to work with content in context so as to achieve a curriculum purpose that is then assessed.

The study showed that there is a relationship that exists between teacher's content knowledge of marine and coastal issues and the quality of learners learning. Evidence from chapter five showed that teachers made efforts to acquire content as a strategy to improve the quality of teaching and learning. . The study has shown that teachers could not use the knowledge they have gathered to structure learning activities that are related to the achievement of goals. The evidence shows a mismatch between what the teachers intended to achieve and what was achieved.

- I therefore concluded that teacher knowledge acquisition was not aligned with the curriculum and recommend that there is a need for more support so that they can be able to align their content knowledge of marine and coastal issues with the curriculum goals.

Evidence from the study showed that there is also a relationship between teacher's content knowledge of marine issues and the selection of materials. Teachers were informed by their existing knowledge of working around abstract facts and definitions when they select curriculum materials. However, teachers selected materials looking for the content they know. The marine resource pack was thus used as isolated bits of information. There was no clear understanding of the curriculum intentions and purpose of the materials.

- I therefore recommend that teachers need support when selecting materials. They need to develop the skills to critically select and review the materials. They also need to understand the purpose of the materials and the context in which those materials are going to be used. This knowledge can support them in developing new content knowledge of marine and coastal issues with teaching strategies and methods that would help to achieve curriculum goals.

This will not be an easy thing to achieve. I assumed that it was happening naturally in the workshops during teacher work with learning materials and in lesson planning activities but

data from classroom practice showed that it was not happening. This had me tracing back the cause to how the teachers were accustomed to working with facts and definitions in their own learning and then into their classroom practice

This study thus showed a relationship between teacher's content knowledge and the adaptation of materials. Teachers adapted materials to develop activities that will support learners in the construction of their own knowledge. The active learning framework was interpreted as isolated bits of activities which did not show the necessary curriculum progression and integration of activities.

- I therefore recommend that teachers should be supported to adapt materials and scaffold activities for learners in order to achieve curriculum goals. It is only when materials are used to scaffold learning that they are regarded as learning supportive (5.3.2).

There is also a relationship that exists between teacher's content knowledge of marine and coastal issues and the mediation of learning. The study showed that teachers mediated learning on facts and information from the poster. This didn't helped learners to work with information in meaningful ways. The information shared with learners had limited scope and depth .It didn't encourage active learning and meaningful understanding of concepts.

- I therefore recommend that the introduction of teacher's content knowledge of marine issues should be integrated and aligned with curriculum goals. So that teachers can be able to mediate and scaffold learning.

There is also a relationship that exists between teacher's content knowledge of marine and coastal issues and the assessment of learning. Teachers lacked materials that will support learners towards the achievement of curriculum outcomes. Learners were expected to perform action without being prepared to practice them. Learners were expected to make decisions with limited knowledge to support them.

- I therefore recommend that teachers need to be supported to review and understand materials. This understanding should be linked with the mediation and scaffolding of learning. This will also allow the teacher to monitor and scaffold learning to a higher level of development.

The research has provided me with an interesting experience to learn about how teachers were enthusiastic and interested in acquiring content knowledge but were unable to use the new content knowledge to work with the curriculum. The entrenched facts and definitions culture of their own learning of facts and their existing teaching of concept as words and definitions appeared to disallow this. There is clearly a need for continuing research to open up a better understanding of how teacher content knowledge practices relate to the requirements of the new curriculum.

6.4 RECOMMENDATIONS FOR FURTHER RESEARCH

Having focused in this research particularly on developing teacher's new content knowledge, I suggest the following area of possible research: How can the materials are better used to support teachers in developing their content knowledge more in line with the curriculum goals. This could encourage teachers to work with materials in their own context and reflect about changes that are taking place in their practice. They could also reflect about whether this process achieves curriculum outcomes.

6.5 LESSONS LEARNT

This was a long journey, which sharp curves and steep roads. Having prepared my plan to undertake this research I was sure that it would be easy for me to do it. To my surprise, it was not as easy as I thought. As the research unfolded, I experienced some challenges. These challenges took me to another stage of development. Each challenge was different from the other and I had to make decisions on how to deal with the situation. It was through thinking and taking action that I achieved the outcomes of the research. Making sense and meaning of the big ideas from the literature was a challenge but this only occurred when I related them to my own context. Working with teachers and sharing ideas in a friendly atmosphere contributed to my personal understanding of curriculum issues. Working with my supervisor and getting feedback on my actions helped me in making meaning and understanding. This process has contributed to my personal growth and understanding. With the shortage of staff challenges that we have in our schools I have seen myself being able to teacher whatever learning area I am given. With the skills I have developed through this research I can make better use of materials. I can now make informed decisions about life challenges.

6.6 CONCLUSION

This research has shown that curriculum is complex and complicated. It is shaped by various curriculum factors in a specific context. These factors need to be understood in context in terms of how they influence curriculum practice. In this case the teacher's content knowledge and the use of materials affected the curriculum opportunities created for learners. Therefore, curriculum influences need not to be taken for granted when one wants to make sense and meaning of what is going on in the classrooms. The day-to-day activities of teachers and how they think about what they do influence the opportunities provided to learners.

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PRSONAL COMMUNICATIONS

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APPENDICES

APPENDIX 1

Letter of consent

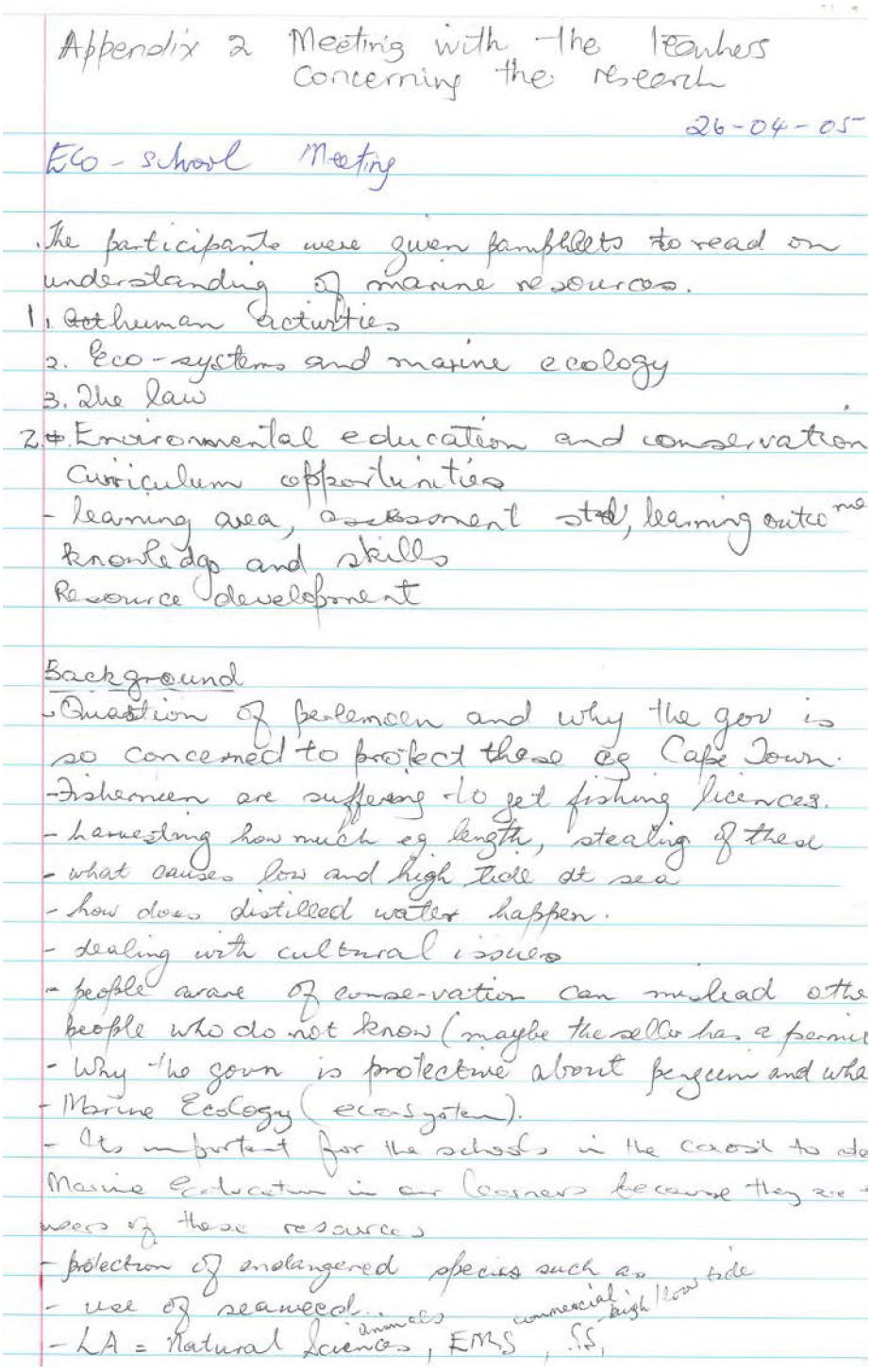
TO : Cintsa School.
FROM: Vuyiswa Mbuyazwe
Byletts Combined School
Private Bag x 9067
East London
5200
02-05-06

SUBJECT: REQUESTING ACESS TO CONDUCT A PARTICIPATORY ACTION RESEARCH CASE STUDY

The principal
I am a master of Education student at Rhodes University, Grahamstown. I am required to undertake a research as part of my course requirements. This will lead to a qualification at the end of the course.
As a teachers who is faced with challenges of implementing the new curriculum policy of Outcomes Based Education. I therefore intend to study about how teacher's content knowledge of marine and coastal issues can be developed so that they can be able to develop better lesson plans according to the curriculum outcomes.
I therefore request you to allow your teacher to be part of this research process .As we normally use your school as a venue for our workshops. I would like to get permission to use your school for our workshops during this research process.
I hope that by engaging teachers in this study they will benefit in understanding curriculum activities.
Yours truly
V.Mbuyazwe

APPENDIX 2

Meeting with teachers concerning the research process



Appendix 2 Meeting with the teachers concerning the research

26-04-05

Eco-school Meeting

The participants were given pamphlets to read on understanding of marine resources.

1. ~~Ot~~human activities
2. Eco-systems and marine ecology
3. The law

2. Environmental education and conservation
Curriculum opportunities
- learning area, assessment std, learning outcome
knowledge and skills
Resource development

Background
- Question of pelemeen and why the gov is so concerned to protect these eg Cape Town.
- Fishermen are suffering - to get fishing licences.
- harvesting how much eg length, stealing of these
- what causes low and high tide at sea
- how does distilled water happen.
- dealing with cultural issues
- people aware of conse-vation can mislead other people who do not know (maybe the seller has a permit
- Why the gov is protective about pelgeem and wha
- Marine Ecology (ecosystem).
- Its important for the schools in the coast to do Marine Education in our classes because they are users of these resources
- protection of endangered species such as abalone
- use of seaweed. animals commercial high/low tide
- LA = Natural Science, EMS, SS,

APPENDIX 3

Teacher's ethical protocol

Appendix 3a – Teacher C1 ethical protocol

ETHICAL PROTOCOL AND CONSENT FORM

Dear Ms Gwebani Gloria

Thank you for the time to read and consider this before you agree to participate in my research .I would like you to read and tick the statements below before signing at the bottom .If at any stage you feel uncomfortable about the proceedings you are free to rencgotiate any of the terms below .My research depends on your time and goodwill and your concerns will always be taken seriously .
Tick or cross out the statements below as you wish them to apply to you :

- ✓ I have read the research proposal and understand the purpose of the research
- ✓ I agree to participate in this research
- ✓ I understand that my participation is voluntarily
- ✓ I understand my part in this research
- ✓ I understand that I can renegotiate my participation at any time
- ✓ I understand that I can withdraw at any time
- ✓ I agree to participate in at least face to face interview
- ✓ I am happy for the interviewes to be tape-recorded and transcribed
- ✓ I wish to view the transcribed interviews and negotiate amendments
- ✓ I wish to be involved in the interpretation phase
- ✓ I wish to view the draft of the section in which my inputs occurs
- ✓ I understand that parts of this research could be submitted to academic journals or presented at educational conferences

My availability over the next few months is

.....

Signed Gwebani Date 26/04/2005

With thanks
Mavuyi Mbuyazwe
PS Please take a copy of this for your own records and return the original to me .

APPENDIX 4

Teacher and classroom profile

Appendix 3(b) Teacher and classroom profile

TEACHER AND CLASSROOM PROFILE

1. Name: School:

2. Which grades do you teach?
Grade 6 & 7

3. Which learning areas are you responsible for?
All the learning areas

4. How many learners do you have in your class?
Grade 6 = 14 Grade 7 = 21

5. What is the average age of learners in your class?
14 yrs

6. What is the primary language spoken by your learners?
Xhosa

7. How many years have you been teaching?
12 yrs

8. What are your formal qualifications?
SPTD

9. Briefly describe the main methods and approaches that you use in your teaching? (Eg. group work)
Group work, Question & Answer

LSM DEVELOPMENT AND USE

1. Briefly describe the learning support materials that you use for marine activities or any environmental focus or teaching?
Posters, Cartoons

2. Where do you get those resources?
Learners make them

3. How do you use them? Explain
Each group make its own poster and use it.

4. How does this LSM help you in your teaching?
A lot, but I would like to get something more

5. How does it help the learners?
It promotes creativity among them.

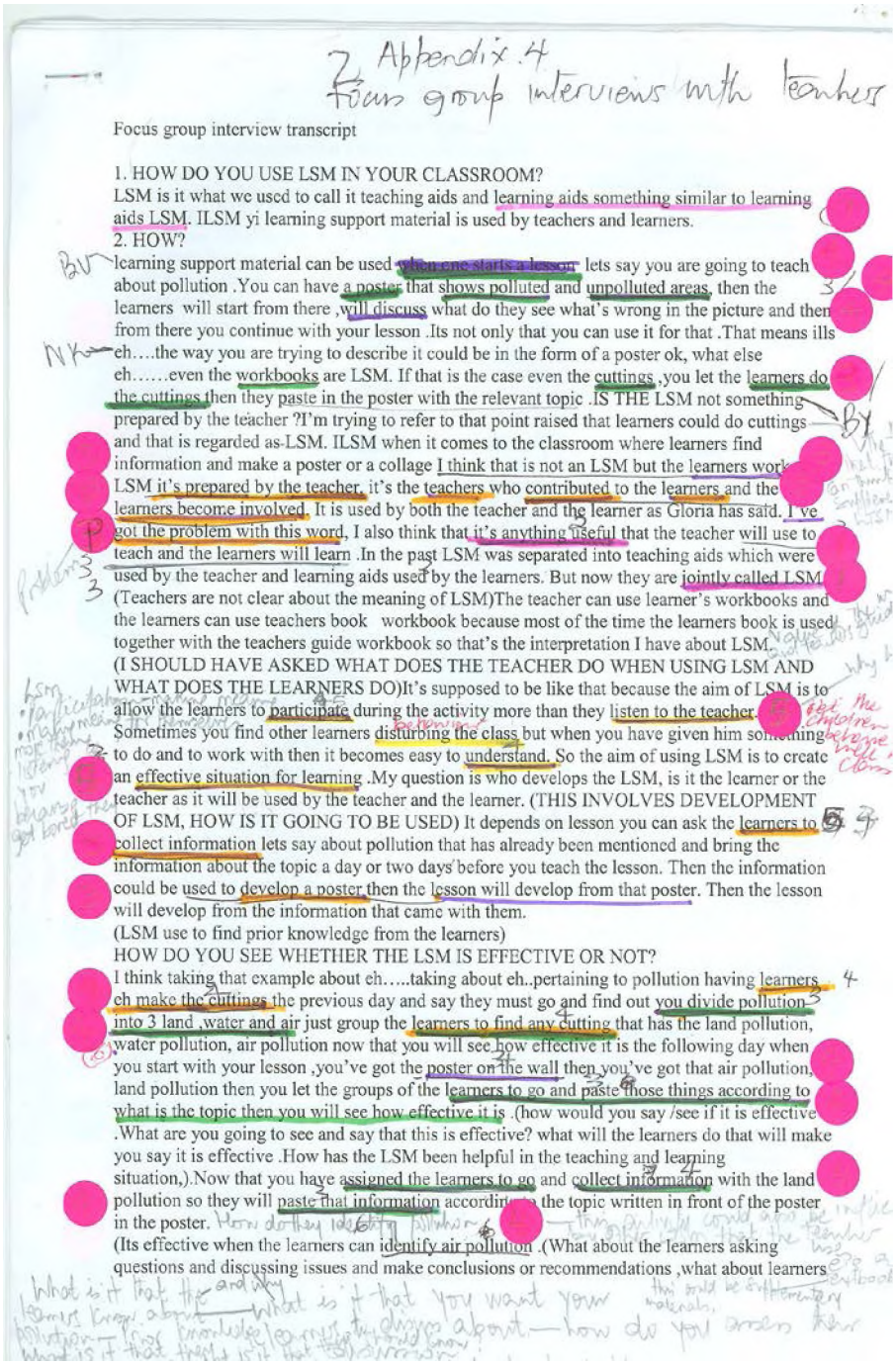
6. Do you sometimes develop or design your LSM?
Yes

7. How did this helped you?
Its long lasting

8. Do you prefer to get already prepared LSM? Elaborate.

APPENDIX 5a

Teachers focus group interviews



Appendix 4
Focus group interviews with teachers

Focus group interview transcript

1. HOW DO YOU USE LSM IN YOUR CLASSROOM?
LSM is it what we used to call it teaching aids and learning aids something similar to learning aids LSM. ILSM yi learning support material is used by teachers and learners.
2. HOW?
learning support material can be used when one starts a lesson lets say you are going to teach about pollution .You can have a poster that shows polluted and unpolluted areas, then the learners will start from there ,will discuss what do they see what's wrong in the picture and then from there you continue with your lesson .Its not only that you can use it for that .That means ills eh….the way you are trying to describe it could be in the form of a poster ok, what else eh……even the workbooks are LSM. If that is the case even the cuttings ,you let the learners do the cuttings then they paste in the poster with the relevant topic .IS THE LSM not something prepared by the teacher ?I'm trying to refer to that point raised that learners could do cuttings and that is regarded as LSM. ILSM when it comes to the classroom where learners find information and make a poster or a collage I think that is not an LSM but the learners work LSM it's prepared by the teacher, it's the teachers who contributed to the learners and the learners become involved. It is used by both the teacher and the learner as Gloria has said. I've got the problem with this word, I also think that it's anything useful that the teacher will use to teach and the learners will learn .In the past LSM was separated into teaching aids which were used by the teacher and learning aids used by the learners. But now they are jointly called LSM (Teachers are not clear about the meaning of LSM)The teacher can use learner's workbooks and the learners can use teachers book workbook because most of the time the learners book is used together with the teachers guide workbook so that's the interpretation I have about LSM. (I SHOULD HAVE ASKED WHAT DOES THE TEACHER DO WHEN USING LSM AND WHAT DOES THE LEARNERS DO)It's supposed to be like that because the aim of LSM is to allow the learners to participate during the activity more than they listen to the teacher. Sometimes you find other learners disturbing the class but when you have given him something to do and to work with then it becomes easy to understand. So the aim of using LSM is to create an effective situation for learning .My question is who develops the LSM, is it the learner or the teacher as it will be used by the teacher and the learner. (THIS INVOLVES DEVELOPMENT OF LSM, HOW IS IT GOING TO BE USED) It depends on lesson you can ask the learners to collect information lets say about pollution that has already been mentioned and bring the information about the topic a day or two days before you teach the lesson. Then the information could be used to develop a poster then the lesson will develop from that poster. Then the lesson will develop from the information that came with them.
(LSM use to find prior knowledge from the learners)
HOW DO YOU SEE WHETHER THE LSM IS EFFECTIVE OR NOT?
I think taking that example about eh…..taking about eh..pertaining to pollution having learners eh make the cuttings the previous day and say they must go and find out you divide pollution into 3 land ,water and air just group the learners to find any cutting that has the land pollution, water pollution, air pollution now that you will see how effective it is the following day when you start with your lesson ,you've got the poster on the wall then you've got that air pollution, land pollution then you let the groups of the learners to go and paste those things according to what is the topic then you will see how effective it is .(how would you say /see if it is effective .What are you going to see and say that this is effective? what will the learners do that will make you say it is effective .How has the LSM been helpful in the teaching and learning situation,).Now that you have assigned the learners to go and collect information with the land pollution so they will paste that information according to the topic written in front of the poster in the poster.
(Its effective when the learners can identify air pollution .(What about the learners asking questions and discussing issues and make conclusions or recommendations ,what about learners

APPENDIX 5b

Transcript of review of materials

Appendix 5(g) Transcript of review of materials with learners

REVIEW OF LSM ON MARINE ISSUES /IMPLEMENTATION

Teacher BU: Taking from this you won't ask them ….sort of leading questions you will say they have to apply this in water food chain.Forinstance OUR LEARNERS

WHAT DO WE ALREADY KNOW?

Teacher BU: The food chain I used was the land food chain from grass, locust, frog, snake, and hawk, cat.Then the cat dies and after that its body decomposes to make the soil fertile then the grass grows again. If there is a disturbance in this food chain lets say the boys kill all the snakes, what will happen to the frogs and what will happen to the hawks. By breaking the food chain killing the snakes that will mean this it can affect the food chain. To such an extent that the frogs will multiply (Teacher CI supported, multiply) and agree teacher BU: as the frogs multiply (Teacher CI supported, the hawks will die because they will have nothing to eat Teacher BU that is as simple as that. Myself: I think in this example I think this is what learners already know and this "this what the learners know (Teacher BU: supported) can be assessed it because the learners will give a report that if there is a disturbance in the food chain than the animals will die. Assessment: It could be in the form of a report when learners explain the consequences of a brakes food chain.

I: We are moving now with the activity they have done land food chain, do you understand-I sounded like a teacher. You have seen that they know it so you are taking them to the one that they don't know (Teacher BU: agree with this statement)-there is a lot of attention and interest from teachers. Myself: We are going to the next step which says (Teacher CI supported, (enquiry encounters).What do we mean to "find out" what is it that they don't know in this activity. How do we engage learners in inquiry? Teacher BU: agree with this statement.

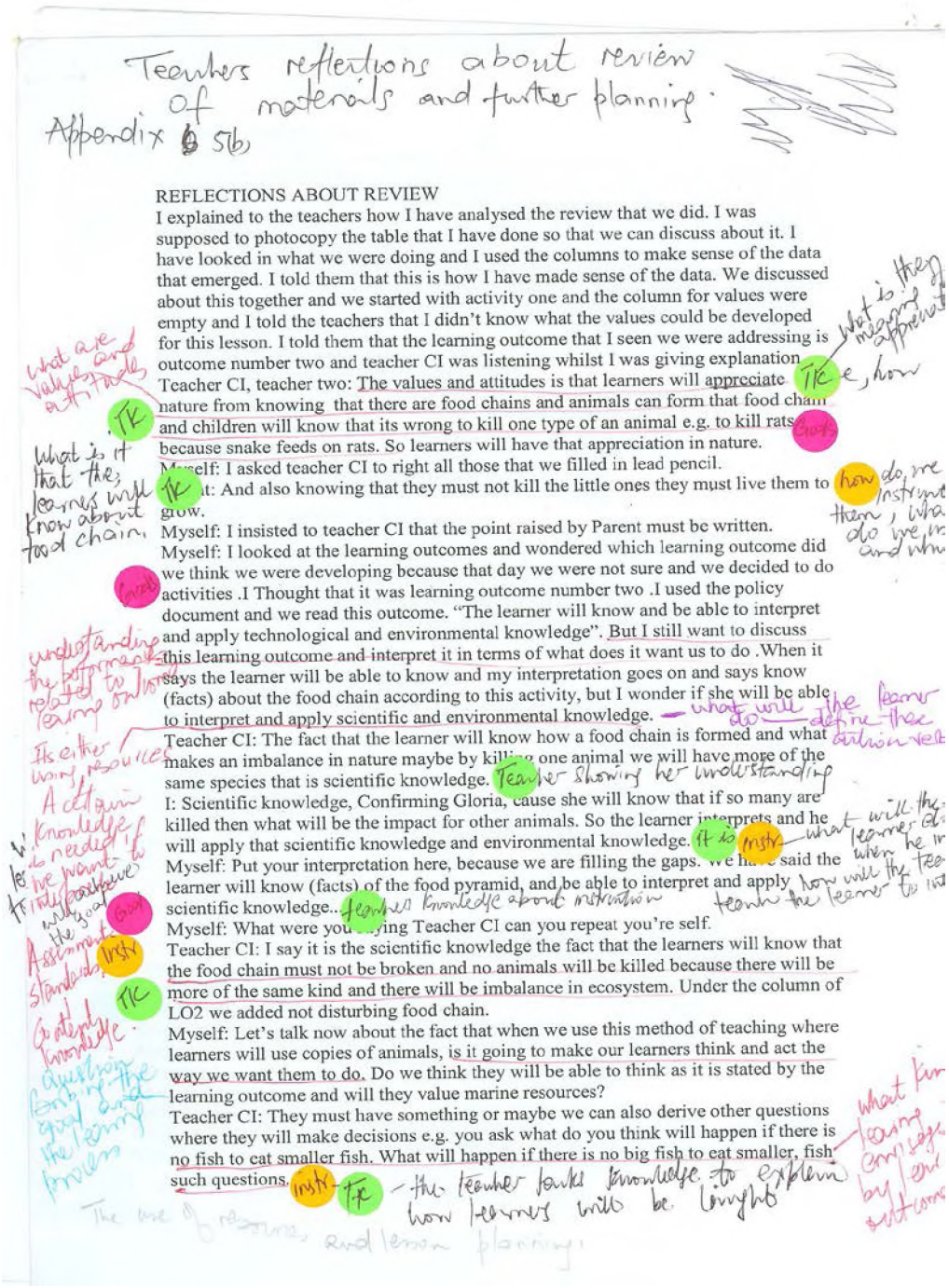
WHAT DO WE NEED TO FIND OUT?

Teacher BU: Taking from this you won't ask them sort of leading questions you will say they have to apply water food chain you are trying to get them to know the marine he just et them think. You just show that to them. Our learners are so fortunate because they grew up along the coast (I interrupted or else you can show them these pictures maybe you have cutted so that everybody can have a chance to make his or her own food chain. From these pictures, isn't it that they have done food chain? Then you can introduce them, Teacher BU, Yha then I continue in this marine food chain (marine added BU…. If you see that there are things they don't know that's where they go and research BU: OK. All teachers agree or you can give this, let them come and put pictures and then this you correct them where they have done something wrong or you correct them and allow them to check the different meanings of the words. Teacher BU: just to add having done your land food chain then you come up with the pictures of this marine food chain. Then you make them draw the pyramid of the marine food chain out of the pictures (Myself they can construct their food chains, what eat what (we all agreed)

Teacher CI: as our learners are not familiar with these animals we can call somebody if there's somebody who knows from the community about those animals who could come and give them a talk on these animals because some of them haven't seen these animals

APPENDIX 5c

Teacher's reflections about review of materials



Teachers reflections about review of materials and further planning.
Appendix 5b

REFLECTIONS ABOUT REVIEW

I explained to the teachers how I have analysed the review that we did. I was supposed to photocopy the table that I have done so that we can discuss about it. I have looked in what we were doing and I used the columns to make sense of the data that emerged. I told them that this is how I have made sense of the data. We discussed about this together and we started with activity one and the column for values were empty and I told the teachers that I didn't know what the values could be developed for this lesson. I told them that the learning outcome that I seen we were addressing is outcome number two and teacher CI was listening whilst I was giving explanation.

Teacher CI, teacher two: The values and attitudes is that learners will appreciate nature from knowing that there are food chains and animals can form that food chain and children will know that its wrong to kill one type of an animal e.g. to kill rats because snake feeds on rats. So learners will have that appreciation in nature.

Myself: I asked teacher CI to right all those that we filled in lead pencil.

Myself: And also knowing that they must not kill the little ones they must live them to grow.

Myself: I insisted to teacher CI that the point raised by Parent must be written.

Myself: I looked at the learning outcomes and wondered which learning outcome did we think we were developing because that day we were not sure and we decided to do activities .I Thought that it was learning outcome number two .I used the policy document and we read this outcome. "The learner will know and be able to interpret and apply technological and environmental knowledge". But I still want to discuss this learning outcome and interpret it in terms of what does it want us to do .When it says the learner will be able to know and my interpretation goes on and says know (facts) about the food chain according to this activity, but I wonder if she will be able to interpret and apply scientific and environmental knowledge.

Teacher CI: The fact that the learner will know how a food chain is formed and what makes an imbalance in nature maybe by killing one animal we will have more of the same species that is scientific knowledge.

I: Scientific knowledge, Confirming Gloria, cause she will know that if so many are killed then what will be the impact for other animals. So the learner interprets and he will apply that scientific knowledge and environmental knowledge.

Myself: Put your interpretation here, because we are filling the gaps. We have said the learner will know (facts) of the food pyramid, and be able to interpret and apply scientific knowledge...

Myself: What were you saying Teacher CI can you repeat you're self.

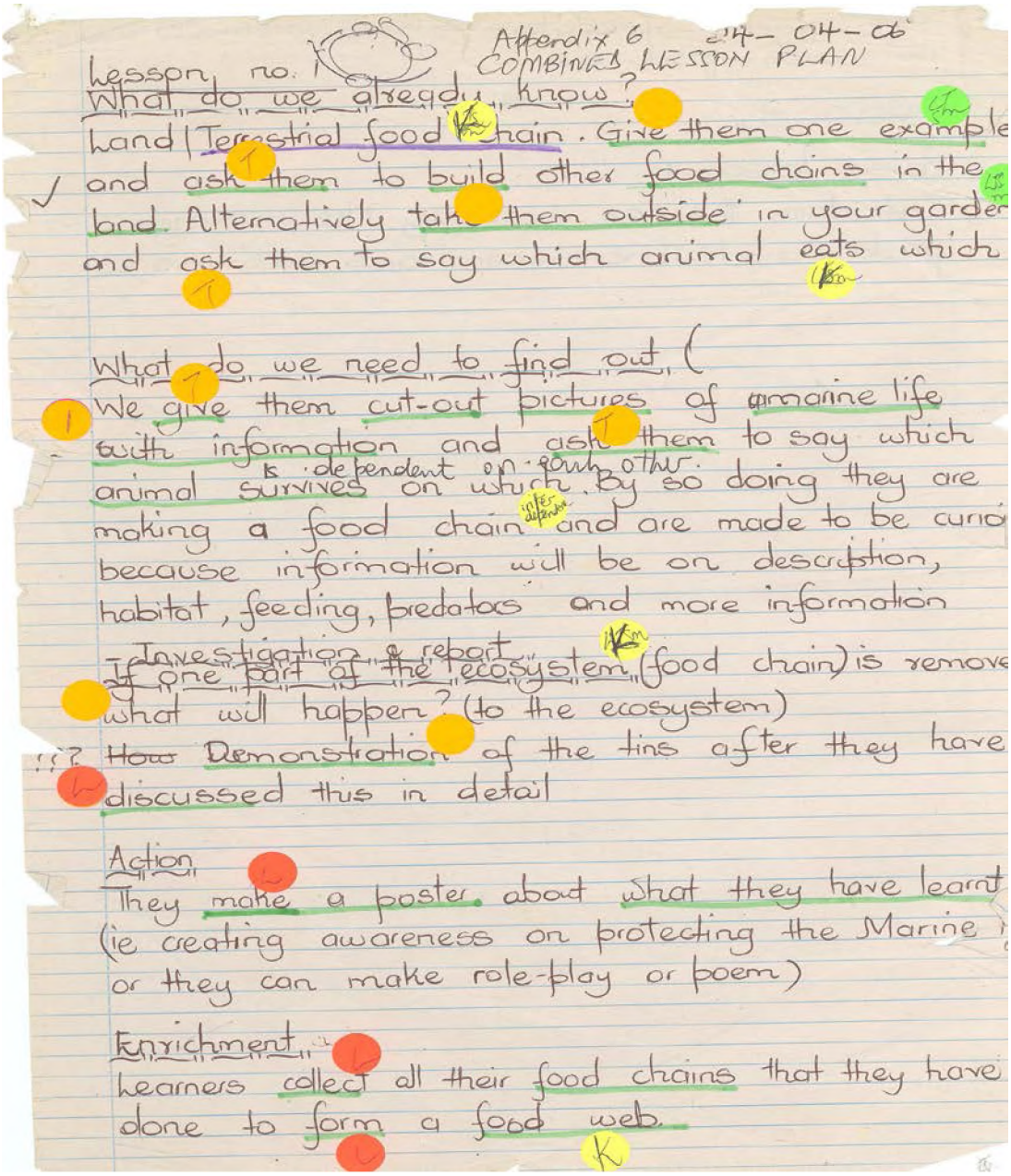
Teacher CI: I say it is the scientific knowledge the fact that the learners will know that the food chain must not be broken and no animals will be killed because there will be more of the same kind and there will be imbalance in ecosystem. Under the column of LO2 we added not disturbing food chain.

Myself: Let's talk now about the fact that when we use this method of teaching where learners will use copies of animals, is it going to make our learners think and act the way we want them to do. Do we think they will be able to think as it is stated by the learning outcome and will they value marine resources?

Teacher CI: They must have something or maybe we can also derive other questions where they will make decisions e.g. you ask what do you think will happen if there is no fish to eat smaller fish. What will happen if there is no big fish to eat smaller, fish such questions.

APPENDIX 6a

Combined lesson plan after Museum workshop



Appendix 6 14-04-06
COMBINED LESSON PLAN

lesson no. 1
What do we already know?
Land | Terrestrial food chain. Give them one example and ask them to build other food chains in the land. Alternatively take them outside in your garden and ask them to say which animal eats which

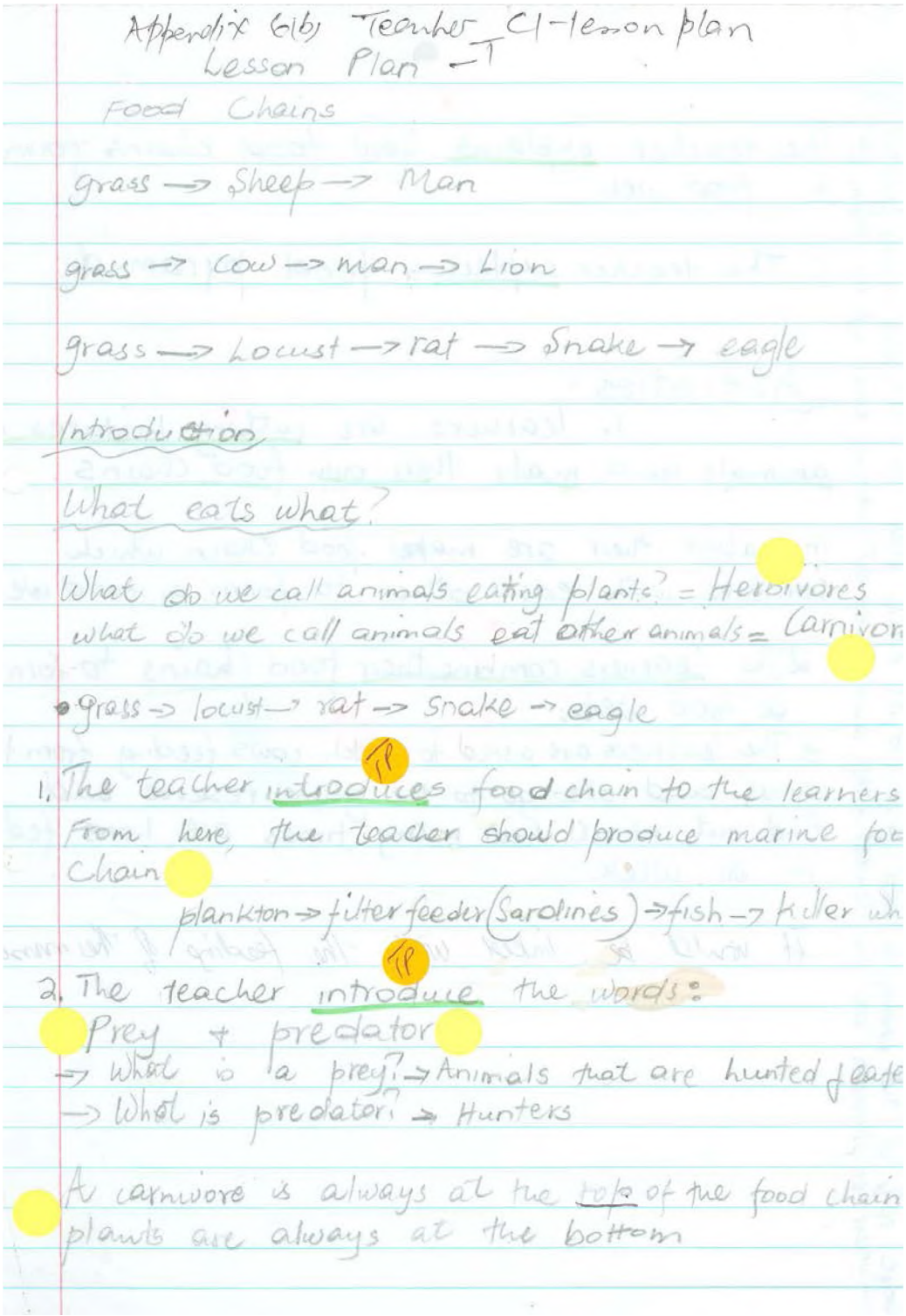
What do we need to find out (
We give them cut-out pictures of marine life with information and ask them to say which animal survives on which. By so doing they are making a food chain and are made to be curio because information will be on description, habitat, feeding, predators and more information
- Investigation & report
If one part of the ecosystem (food chain) is remove what will happen? (to the ecosystem)
How Demonstration of the tins after they have discussed this in detail

Action
They make a poster about what they have learnt (ie creating awareness on protecting the Marine or they can make role-play or poem)

Enrichment
learners collect all their food chains that they have done to form a food web.

APPENDIX 6b

Teacher CI lesson plan



Apperdix 6(b) Teacher CI-lesson plan
Lesson Plan – T

Food Chains

grass → Sheep → Man

grass → cow → man → Lion

grass → Locust → rat → Snake → eagle

Introduction

What eats what?

What do we call animals eating plants? = Herbivores
what do we call animals eat other animals = Carnivor

• grass → locust → rat → Snake → eagle

1. The teacher introduces food chain to the learners
From here, the teacher should produce marine fo
Chain

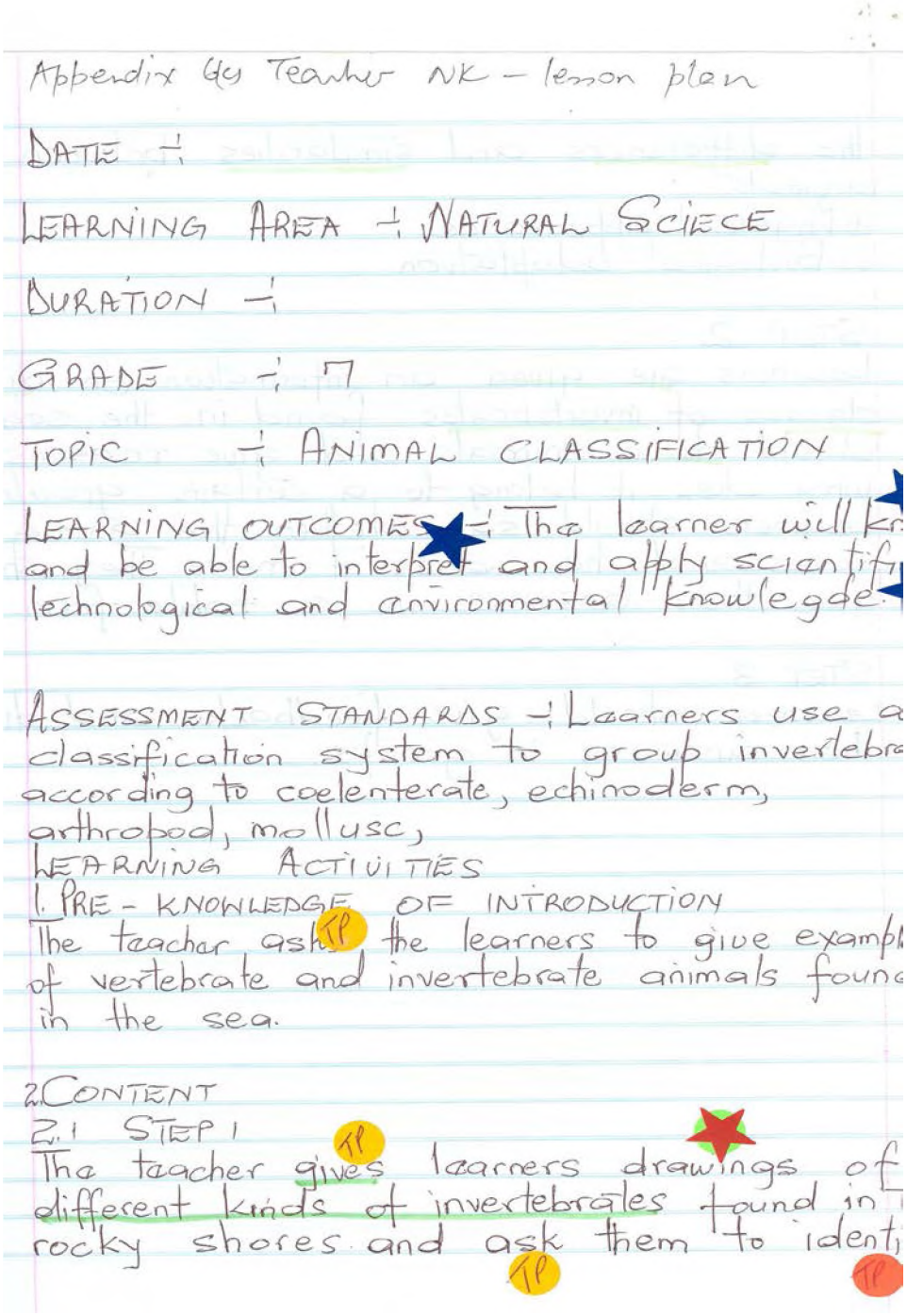
plankton → filter feeder (Sardines) → fish → killer wh

2. The teacher introduce the words:
Prey + predator
→ What is a prey? → Animals that are hunted / eate
→ What is predator? → Hunters

A carnivore is always at the top of the food chain
plants are always at the bottom

APPENDIX 6c

Teacher NK lesson plan



Appendix 6c Teacher NK – lesson plan

DATE :

LEARNING AREA : NATURAL SCIECE

DURATION :

GRADE : 7

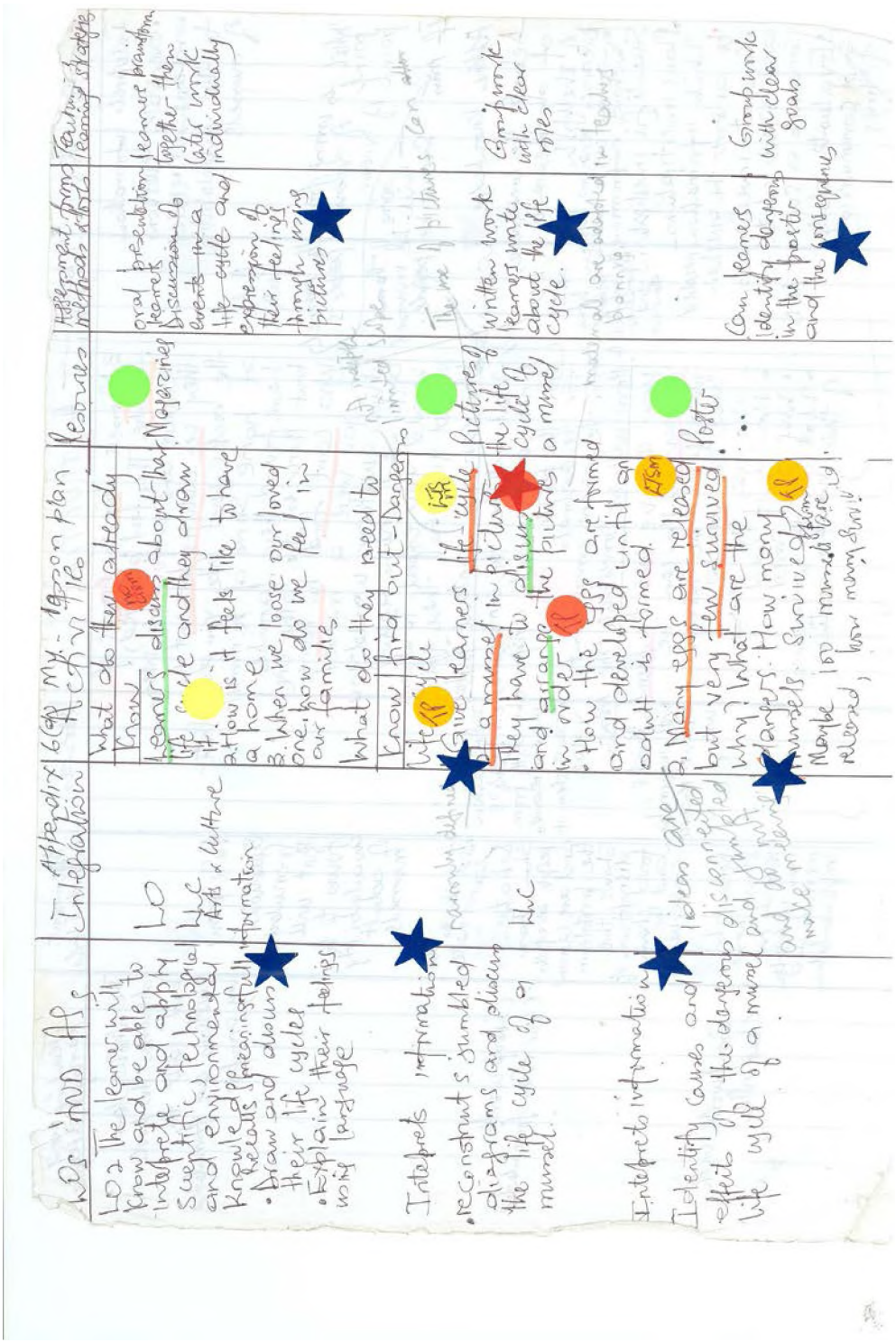
TOPIC : ANIMAL CLASSIFICATION

LEARNING OUTCOMES : The learner will kn
and be able to interpret and apply scientif
technological and environmental knowlegde.

ASSESSMENT STANDARDS : Learners use a
classification system to group invertebra
according to coelenterate, echinoderm,
arthropod, mollusc,
LEARNING ACTIVITIES
1. PRE-KNOWLEDGE OF INTRODUCTION
The teacher asks TP the learners to give exampl
of vertebrate and invertebrate animals found
in the sea.

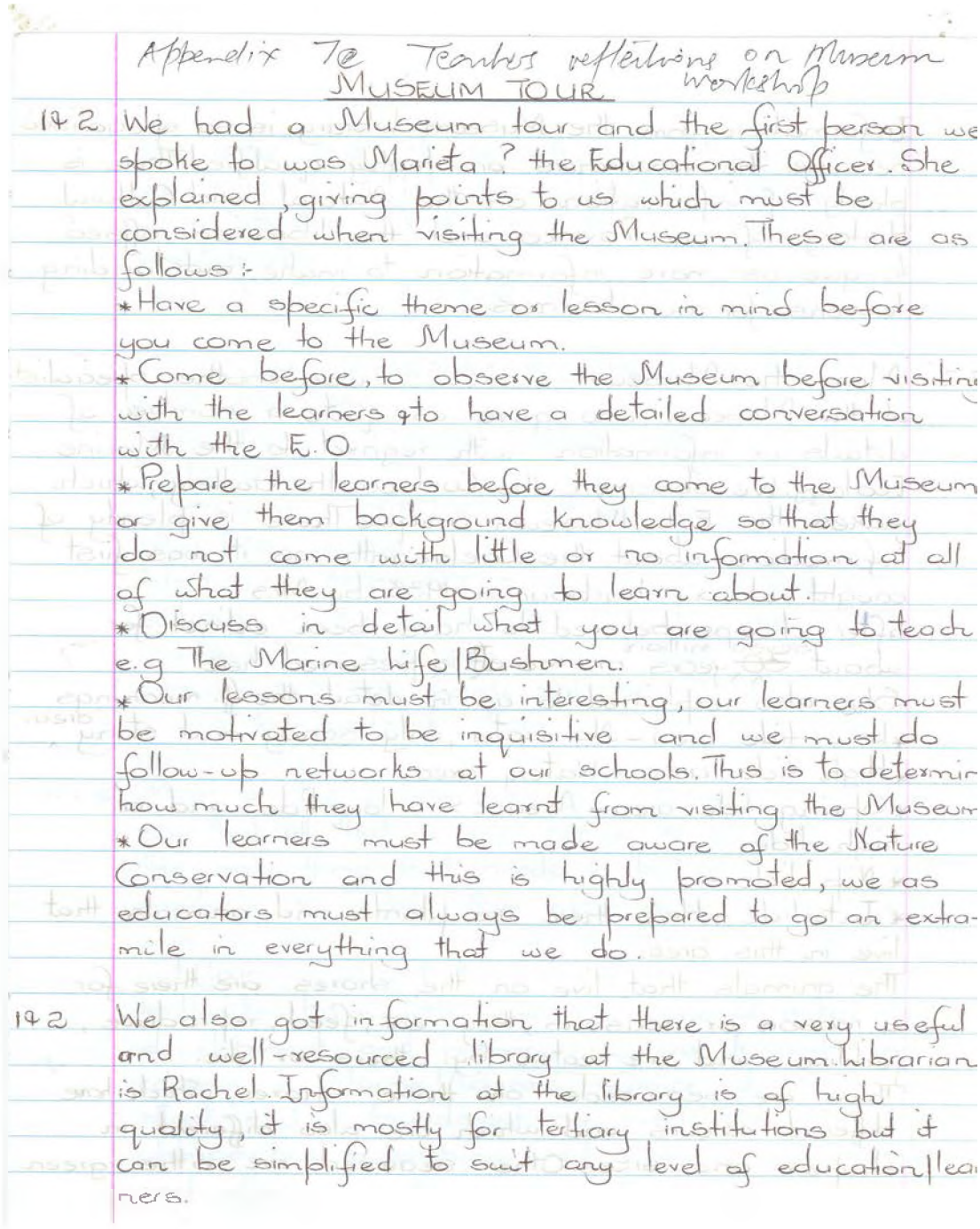
2. CONTENT
2.1 STEP 1
The teacher gives TP learners drawings of
different kinds of invertebrates found in
rocky shores and ask them to identi
TP TP

APPENDIX 6: My lesson plan



APPENDIX 7a

Teacher's reflections on Museum workshop



Appendix 7a Teachers reflections on Museum workshop

MUSEUM TOUR

142 We had a Museum tour and the first person we spoke to was Marieta ? the Educational Officer. She explained, giving points to us which must be considered when visiting the Museum. These are as follows :-

* Have a specific theme or lesson in mind before you come to the Museum.
* Come before, to observe the Museum before visiting with the learners & to have a detailed conversation with the E.O
* Prepare the learners before they come to the Museum or give them background knowledge so that they do not come with little or no information at all of what they are going to learn about.
* Discuss in detail what you are going to teach e.g The Marine life | Bushmen.
* Our lessons must be interesting, our learners must be motivated to be inquisitive and we must do follow-up networks at our schools. This is to determine how much they have learnt from visiting the Museum
* Our learners must be made aware of the Nature Conservation and this is highly promoted, we as educators must always be prepared to go an extra-mile in everything that we do.

142 We also got information that there is a very useful and well-resourced library at the Museum. Librarian is Rachel. Information at the library is of high quality, it is mostly for tertiary institutions but it can be simplified to suit any level of education | learners.

APPENDIX 7b

Teacher's reflections on Museum workshop

Appendix 7b Teachers reflections on Museum workshop 24 MARCH 2006

EVALUATION

1. WHAT HAVE YOU LEARNT?

I learned about the Coelacanth fish and how it was found in the Eastern Cape. I also learned how tides are formed and what affects them. I feel this knowledge would be useful as some of the learners in my school live on the other side of the beach.

2. WHAT HAVE YOU ACHIEVED?

You do not just bring learners to the museum with a planned lesson and you have to do research on your own with the help of the education officer at the museum. The education officer as will also give the learners more information on the lesson.

3. WHAT HAVE YOU NOT ACHIEVED?

I got what I expected to get so there is nothing that I feel not achieved.

4. HOW CAN WE IMPROVE?

I would be glad if we could visit the museum once again as there was no electricity at the time we were shown some of the marine animals.

APPENDIX 7c

Teacher's reflections after field trip

Teacher reflections after field trip
Appendix 7C
15 MAY 2006

FIELDTRIP

1. What was the activity and what we did during the activity 2. What have I learnt.

We had the activity at the beach. We went to the rocky shore. We did zonation and types of anim that are found at different zones. We also did marine animal classification where we dealtt with different types of phyla eg 1. MOLLUSCS - soft bodied animals with o or two shells. 2. COELENTERATES - Cylindrical soft bodied anima with stinging tentacles. 3. ECHINODERME - spiny or bumpy skinned body with 5 ray body symmetry and which move by many tube feet.

4. ARTHROPODS - animals with hard exoskeletons and jointed legs.

HOW THE INFORMATION WILL HELP ME TEACH MARINE

This will help me teach marine starting from the land phyla then follow with marine phyla maybe with pictures of sea animals or charts.

What have I not achieved.

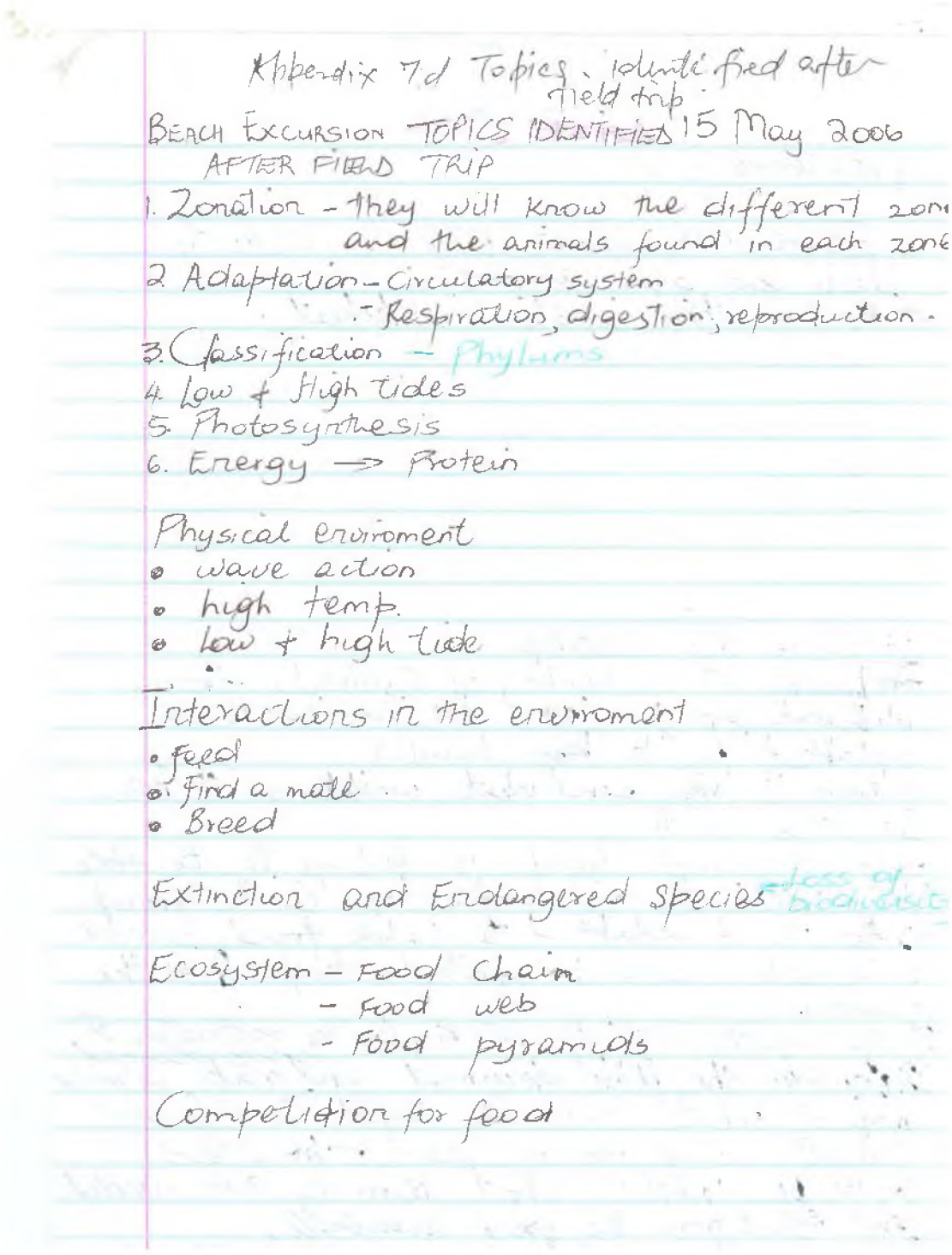
I got all the information I needed.

How the workshop was conducted.

Mary took us to the beach and showed us the zones and we identified the different types of animals that are found in the zones, using pamph with sea animals to identify. This workshop was effective and we gained a lot of information. I think when doing animals classification one ca also do the marine animal classification to reinfo

APPENDIX 7d

Topics identified after field trip



Khbendix 7d Topics identified after field trip

BEACH EXCURSION TOPICS IDENTIFIED 15 May 2006
AFTER FIELD TRIP

1. Zonation - they will know the different zon and the animals found in each zon
2. Adaptation - Circulatory system
   - Respiration, digestion, reproduction.
3. Classification - Phylums
4. Low + High tides
5. Photosynthesis
6. Energy ⇒ Protein

Physical enviroment
- wave action
- high temp.
- low + high tide

Interactions in the enviroment
- feed
- Find a mate
- Breed

Extinction and Endangered Species loss of biodiversit

Ecosystem - Food Chain
- Food web
- Food pyramids

Competition for food

APPENDIX 7e

Transcript of teachers developing lesson plans after field trip

Appendix 7e Transcript on teachers developing lesson plan after field trip

FEEDBACK ABOUT DEVELOPING A LESSON PLAN- REPORT AFTER FIELD TRIP

Teacher CI: The teacher introduced food chain to the learners from here the teacher should produce marine food chain. The teacher starts from land food chain so that learners should understand that grass is eaten by locust, then rats eat locust then snake eat rat and rat is eaten by the eagle. The the teacher introduces marine food chain instead of grass its going to be plankton since its marine food chain and filter feeder e.g. Sardines are eaten by fish and fish is eaten by killer Whale.

I: Where do learners get this information of filter feeders? How did you introduce this information to them?

Teacher CI: They started from land food chain by asking them questions about grass and they know what eats grass. Where they encounter problems you help them so that they see the chain in what eats what.

I: How did you introduce marine food chain?

Teacher CI : Before you show them marine food chain you first tell them about plants in the sea that they are called phytoplankton or you explain to them the plants , they know them they usually see them (the teacher was sure of their knowledge)

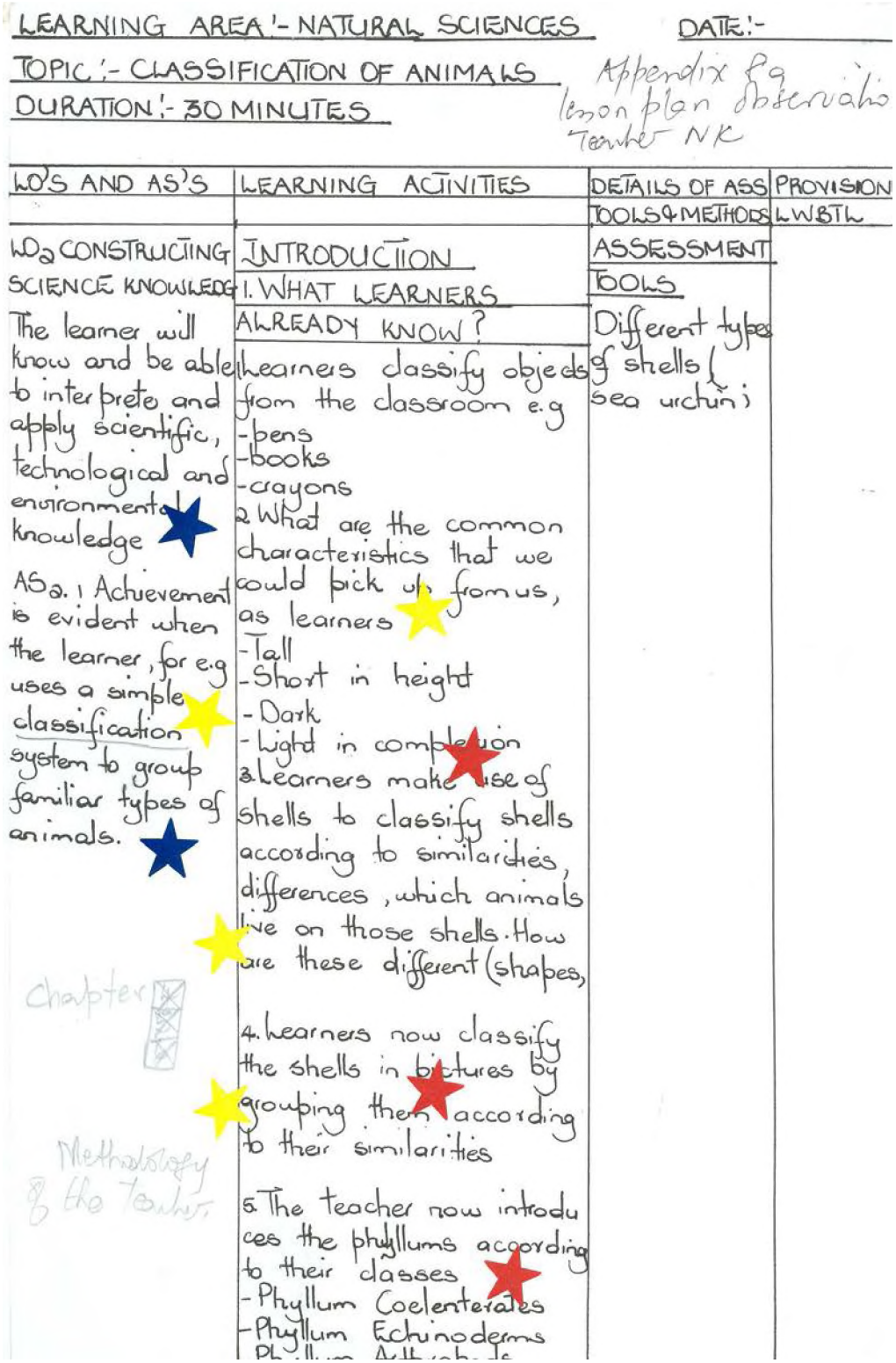
Myself: (my suggestion because I realised that the teacher wants to explain food webs and is not sure how to do it) Maybe you can just teach them using this food pyramid only. I interrupted her by suggesting that she can use the pyramid in the poster .Why? Did I do this? I'm sure it's because she was explaining about how she could introduce marine food chain without referring to the marine poster that she have. I suggested that it could be helpful to cut the part with marine food pyramid and use that poster. I also suggested that it's not wise for the poster to have many things when you use it with the learners. I added that I'm not sure but I think it like that. When I said this in a way I wanted her approval. Teacher CI: She says she can see that it will be fine. I continued by saying that in order to show this plankton you are talking about , primary producers you are talking about, the poster will be useful. I asked her to keep on as we were listening.

Teacher CI: From there the teacher introduced the word prey and predators. The teacher gives an explanation of what is a prey –its animals hunted and eaten. And predators are hunters. The teacher explains how food chains and food webs are formed.

Teacher CI: I have made the activities separately, when the learners have realised that food chains when they are combined they form food web. Learners make their own food chains combine them to form food webs. Each learner can make his or her own food chain with different animals and when they combine them they can make food webs. In nature there are many food chains which combine with each other to form food webs. The learners combine their food chains to form food webs. The learners are asked to watch cows feeding from the grass and also go to the game reserve and find out about how many times lions are fed in a week. They were learning about food chain. Then learners will come to learn about food pyramid having found out from the cows and learn about how lions are feed. Then they will link with this pyramid that you will give them. They will learn what is it and what does it have, this shape.

Myself: What is the aim of your activity, how are you going to get evidence of learning.

APPENDIX 8 a Lesson plan –Teacher NK



LEARNING AREA:- NATURAL SCIENCES DATE:-

TOPIC:- CLASSIFICATION OF ANIMALS

DURATION:- 30 MINUTES

Appendix 8a lesson plan observation Teacher NK

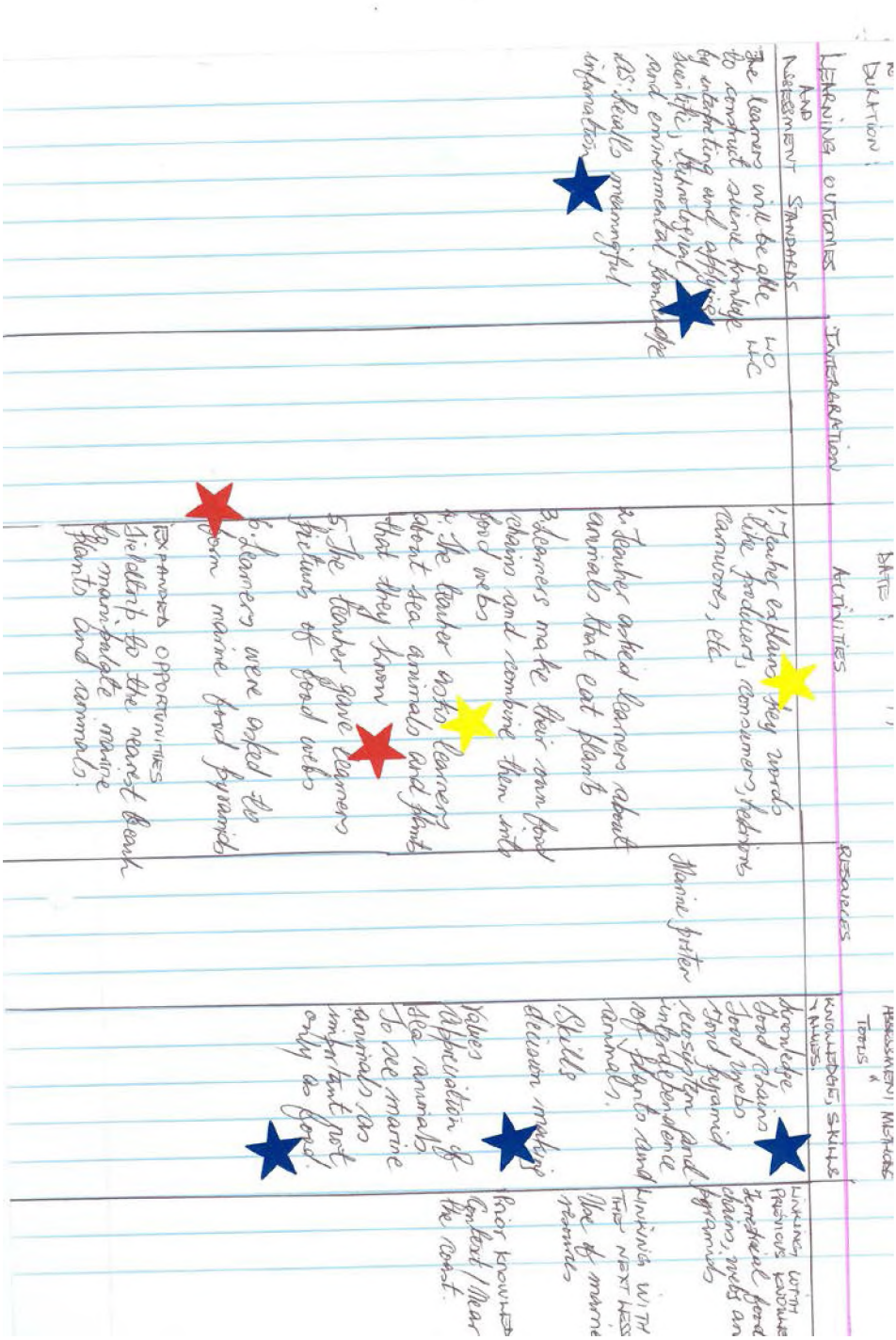
LO'S AND AS'S	LEARNING ACTIVITIES	DETAILS OF ASS TOOLS & METHODS	PROVISION LWBTh
LO2 CONSTRUCTING SCIENCE KNOWLEDGE The learner will know and be able to interprete and apply scientific, technological and environmental knowledge AS2.1 Achievement is evident when the learner, for e.g uses a simple classification system to group familiar types of animals.	INTRODUCTION 1. WHAT LEARNERS ALREADY KNOW? learners classify objects from the classroom e.g -pens -books -crayons 2 What are the common characteristics that we could pick up from us, as learners -Tall -Short in height - Dark - Light in complexion 3. Learners make use of shells to classify shells according to similarities, differences, which animals live on those shells. How are these different (shapes, 4. learners now classify the shells in pictures by grouping them according to their similarities 5 The teacher now introduces the phyllums according to their classes - Phyllum Coelenterates - Phyllum Echinoderms	ASSESSMENT TOOLS Different types of shells (sea urchin)	

Chapter

Methodology of the Teacher

APPENDIX8 b

Lesson plan –Teacher CI



APPENDIX 9

Classroom Observation tools –Teacher CI

Teacher C1 Observation tool

Appendix 9

LESSON OBSERVATION SCHEDULE

A. Name of the teacher to be observed :

Grade : 7

Name of the school: Cintsa

Date of Observation :

Name of the observer : V. Mbuyazwe

B1.Does the teacher state learning outcomes at the beginning of the lesson ?

The teacher just introduced the lesson

2.How are the activities relevant to the learning outcomes and assessment standard?

The activities didnt help the learners to achieve the intended outcome.

3.How does the material help the teacher to develop activities?

The teacher just used the material as it to allow learners to look for animals in the poster and design food pyramid.

B.THE ROLE OF MATERIAL IN SUPPORTING LEARNING

1.How does the teacher introduced the activity ,what does she do and say?

The teacher introduced the activity by explaining to the learners words like producers, consumers etc. She asked the learners about the animals that eat plants and the learners gave answers like goats, rabbits and [illegible] the teacher writes on the board that plants are producers. She explained the animals that eat plants which are called primary consumers. Learners are asked to give examples like plants – goat – lion (food chain) other animals eat both plants and animals, [illegible] end up having a web, she asked them. She asked [illegible]

2.How is the material used to mobilise learners knowledge?

The teacher didnt use the material at the begining of the lesson but ask learners questions about animals and plants from the sea. learners responded that plants in the sea are red, green and brown.

3.How does the teacher use LTSM to mediate learning or to support learners in learning?

LTSM was used towards the end of the lesson to give learners an exercise. They had to fill in spaces provided by looking for answers from the picture. The teacher moved around the groups to make sure that they know the names of the animals and what they eat.

4.How does the materials cater for different learning styles?

None of this was evident except that learners had freedom to talk to each other at the end of the activity. they also showed each other some animals and what they know about them. They were able to make decisions on which animals to include in food pyramid.

5.How do learners engage with materials during classroom activites?

The LTSM was used to engage learners in discussion towards the end. They were talking to each while the teacher was expecting them to answer questions that she gave them. they were asked to design food pyramid. When they designed their food pyramids they discussed about the animals. As they were seated in groups they shared resources they suggested some animals for them. They

6.How does the materials help to develop skills values and attitudes that link to learning outcomes and assessment standards? They were

The teacher used limited materials and even when she was explaining trophic levels which were in the poster she just explained it to the learners without engaging learners in the process. Although the teacher had been exposed to a variety of materials but she hasnt used them. It was clear that selection of sources is linked to teachers understanding of content knowledge and learning outcomes

APPENDIX 10a

Learners work –Teacher NK

30 October 2006 Appendix 10(a) learners work

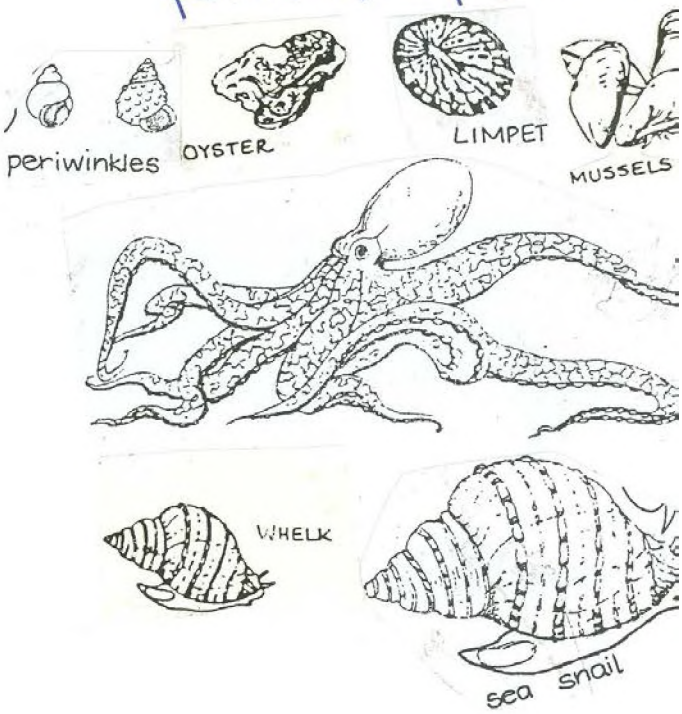
CLASSIFICATION OF ANIMALS.

To group objects according to their similarities and dif
rences.

We classify shells according to; shapes, similarities & differe

2 MOLLUSCS-

Soft bodied coverd with shells; mussels, Limpet, oyster, whe
periwinkles, octopus, sea snai



10/10 Very Good
NB 30/10/2006

APPENDIX 10b

Appendix 10(a) learners work

30 October 2006

CLASSIFICATION OF ANIMALS

To group objects according to their similarity and differences.

We classify shells according to shapes, similarities.

1. COELENTERATES.

Simple animals with cylindrical tentacles around the - Sea anemone, button anemone

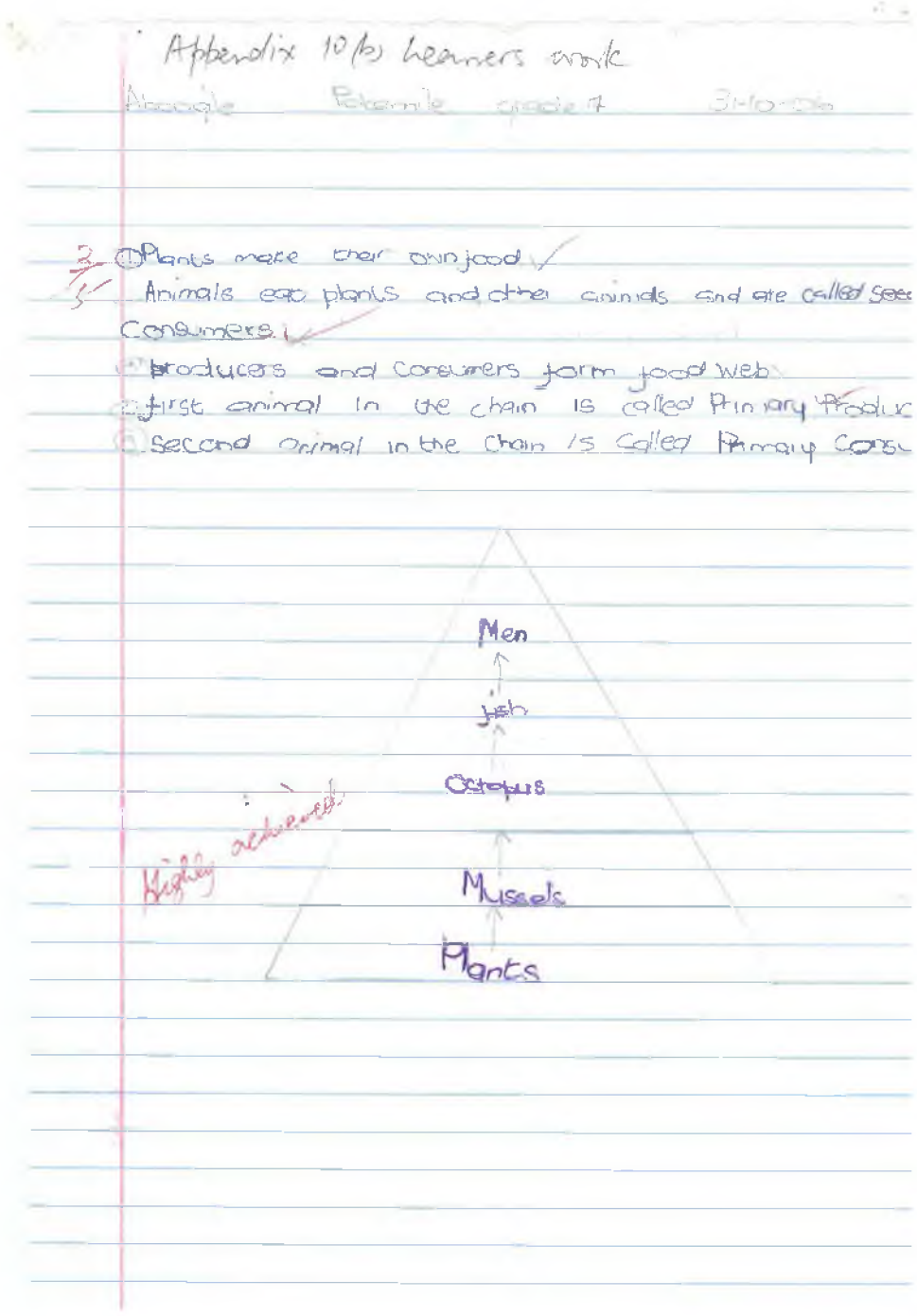
10 Very Good

10

30/10/2006

APPENDIX 10c

Learners work –Teachers CI

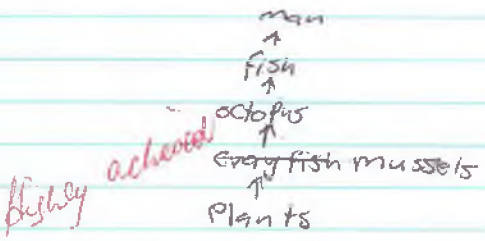


APPENDIX 10 d

Appendix 10(b) learners work

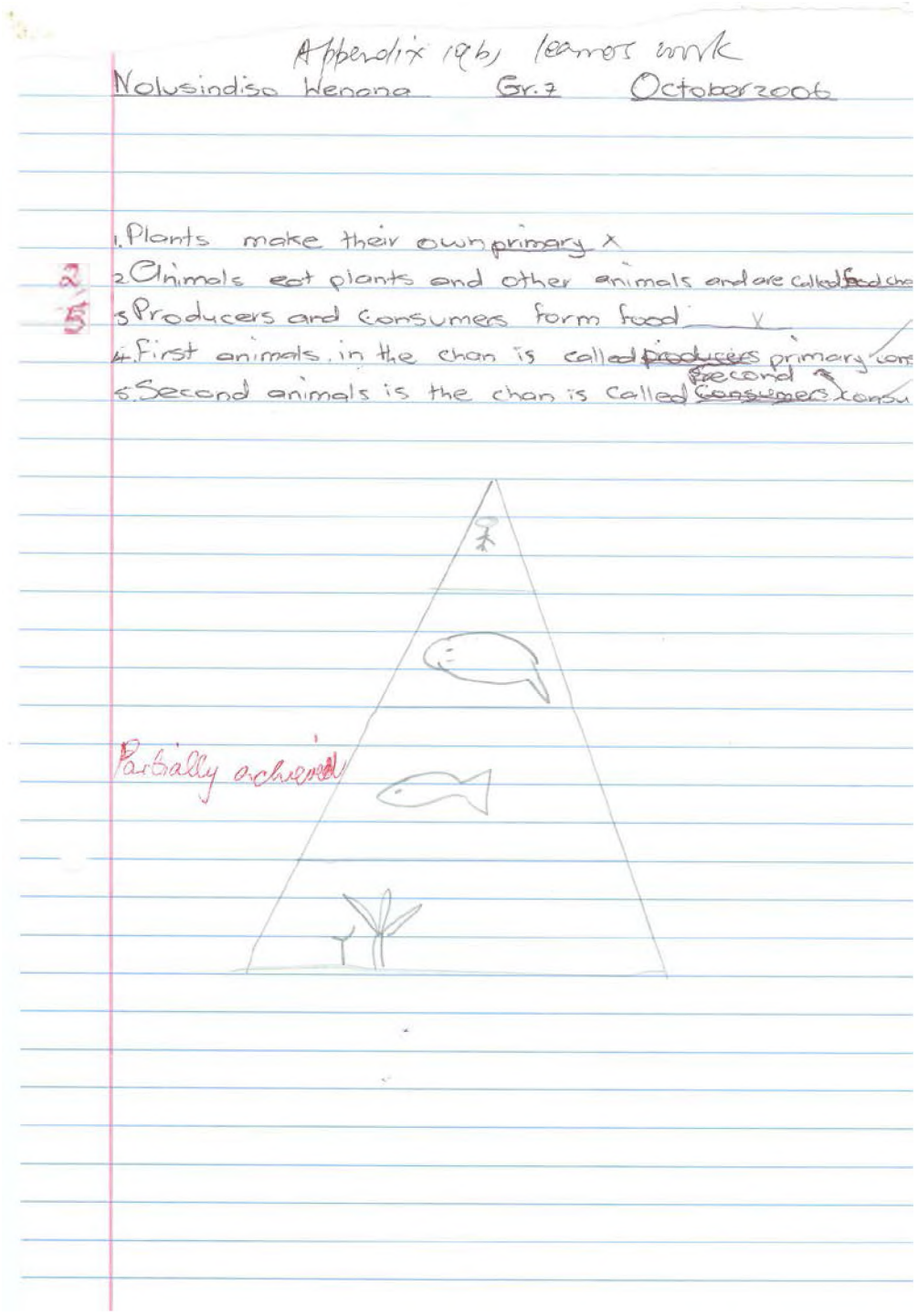
nkosinathi 31 october 2006

1. Plants make their own ~~food~~
2. Animals eat plants And other animals And are called
3. Producers And consumers form food
4. First animals in the chain is called top Predators
5. Second animal in the chain is called Predators



highly achieved

APPENDIX 10e



Appendix 19b learners work

Nolusindiso Henona Gr.7 October 2006

1. Plants make their own ~~primary~~ x

2 2. Animals eat plants and other animals and are called ~~food che~~

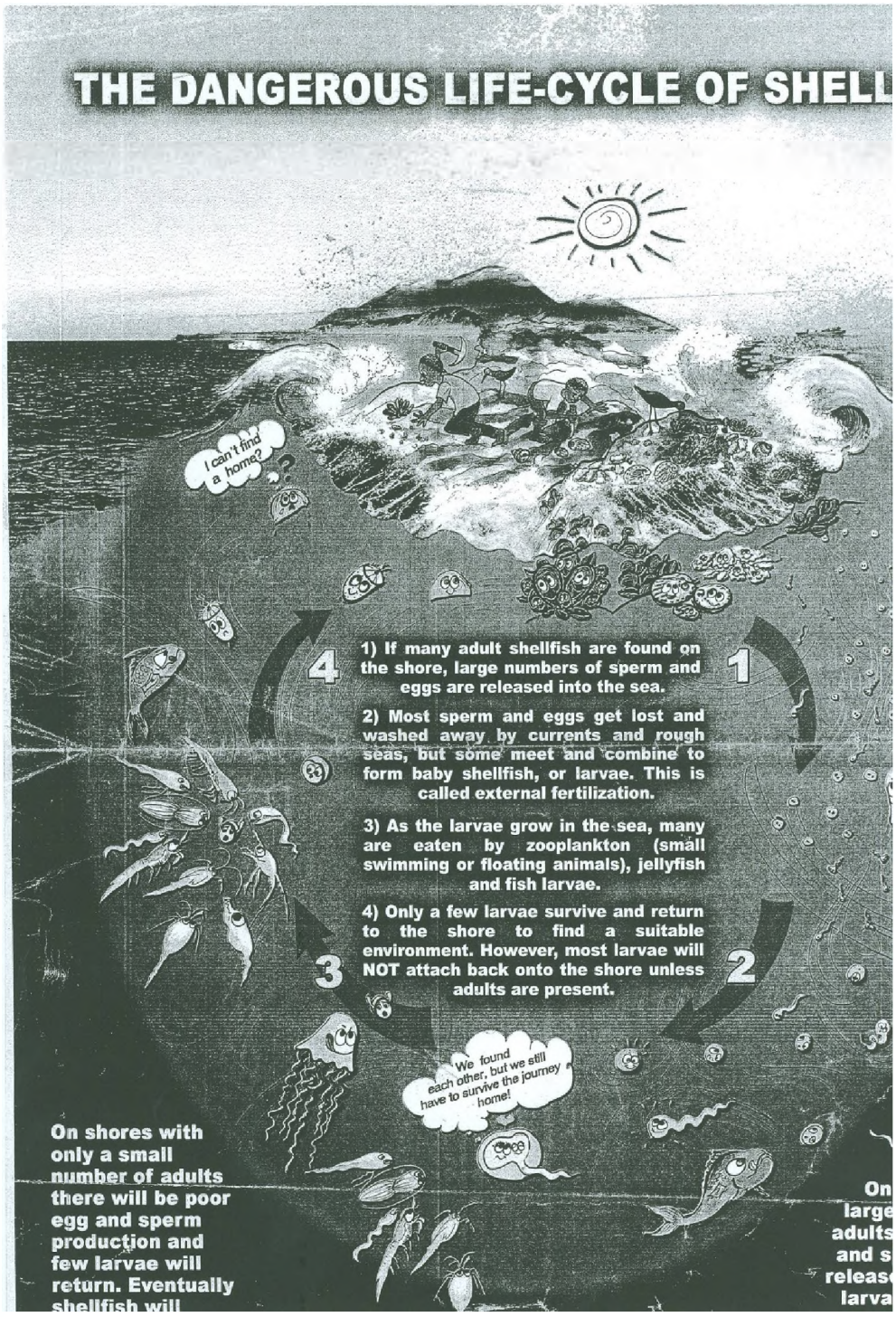
5 3. Producers and consumers form food x

4. First animals in the chan is called ~~producers~~ primary ~~con~~ second

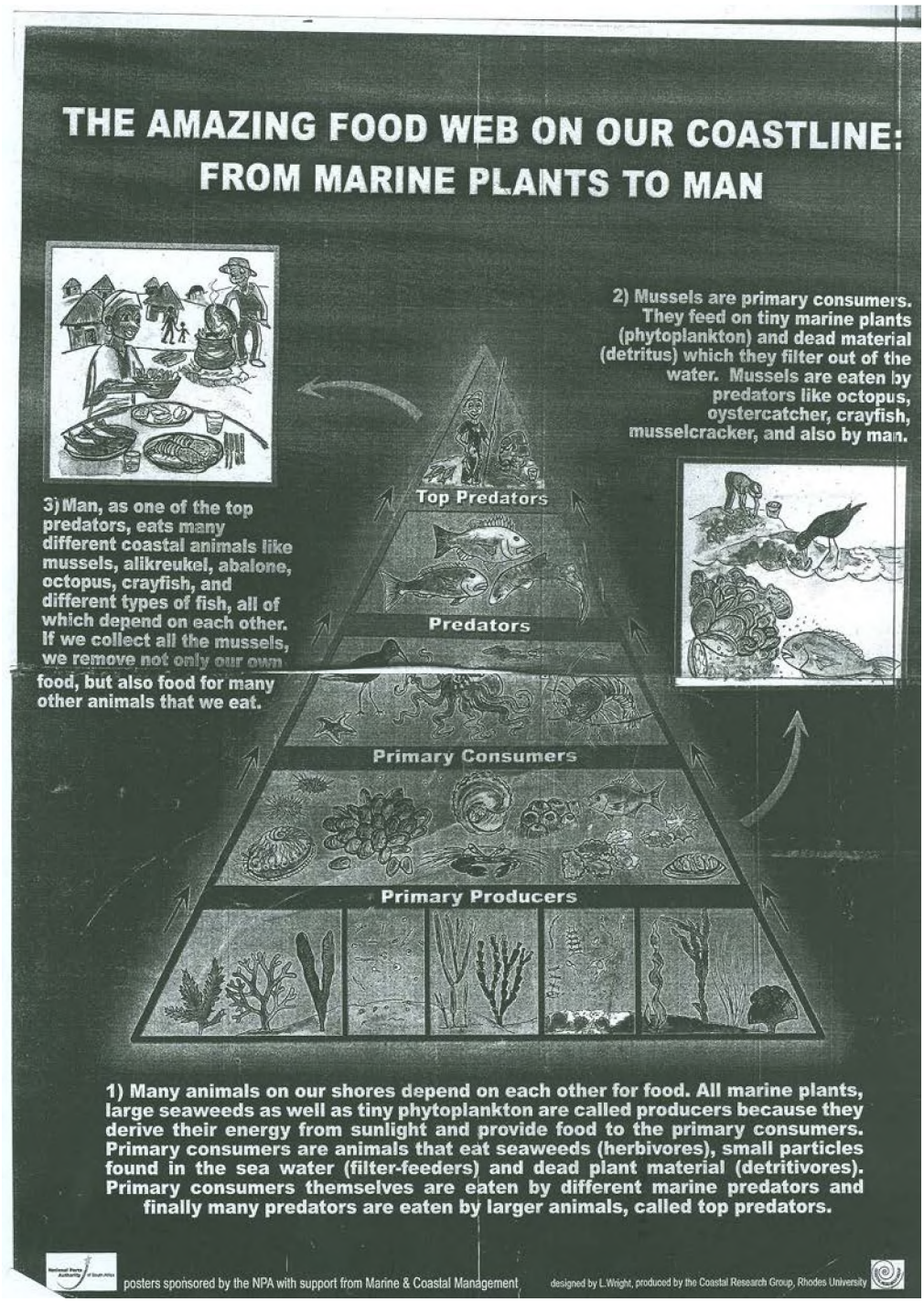
5. Second animals is the chan is called ~~consumers~~ consu

Partially achieved

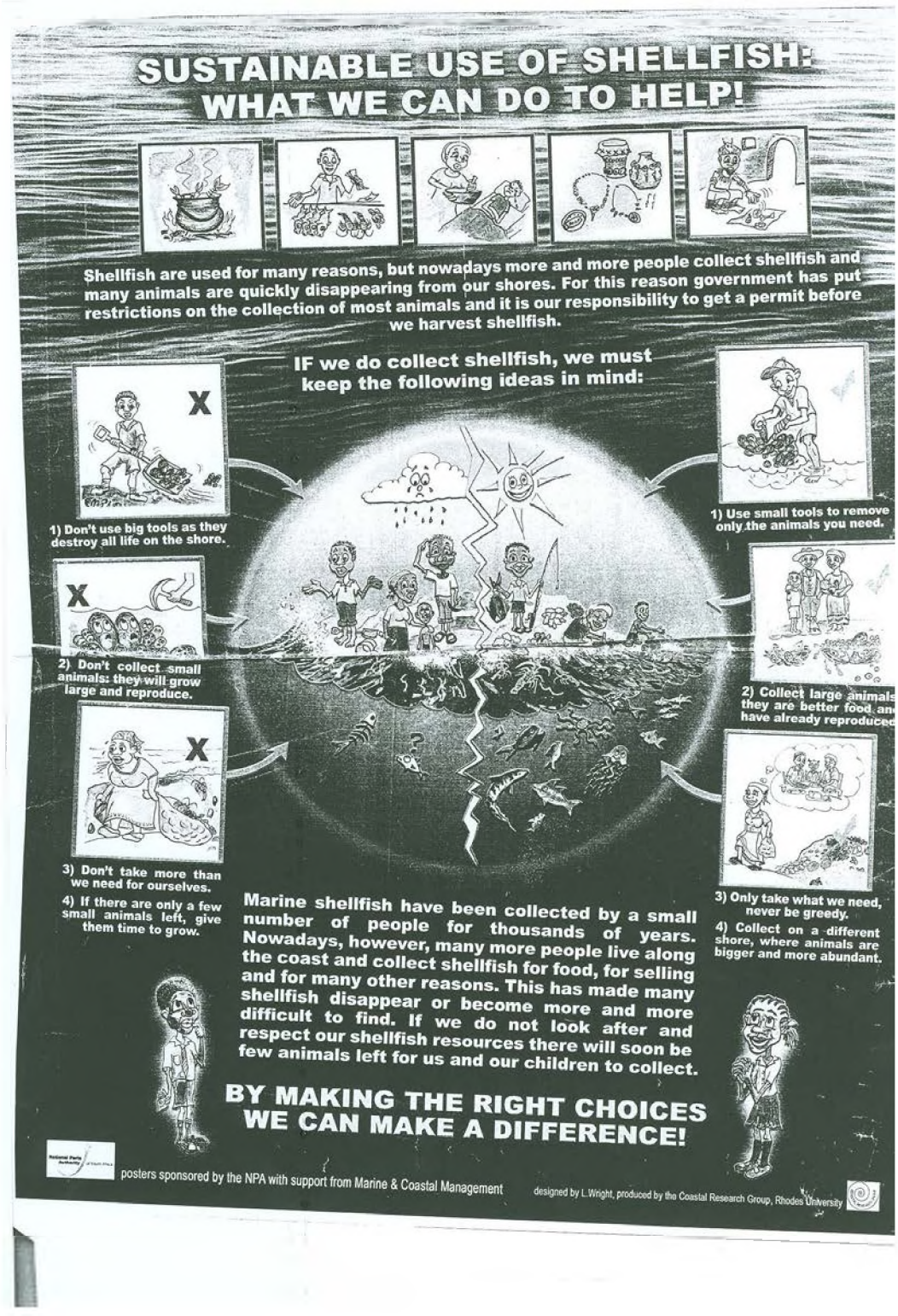
APPENDIX 11a –MATERIALS USED

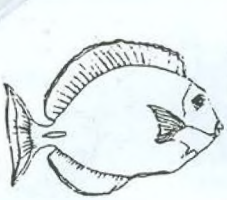


APPENDIX 11b



APPENDIX 11c





What is Ecology?

Before you start looking at the Rocky Shore ecosystem, there are a few new terms you should know:

ROCKY SHORE: A stretch of shore lined by rocks rather than sand.
INTERTIDAL ZONE: The area stretching from the Spring High Tide mark to the Spring Low Tide mark.
GRAZERS: Animals (eg. limpets, winkles and sea slugs) which crop seaweed growing on the rocks, keeping it short like moss.
FILTER FEEDERS: Animals which are permanently attached to the rocks and must therefore feed by straining tiny particles of food out of the seawater. They include sponges, tube worms, mussels, oysters and barnacles.

Use your senses to describe the ABIOTIC CONDITIONS on the rocky shore NOW (_____tide):

... and as you imagine they will be in six hours time (_____TIDE):

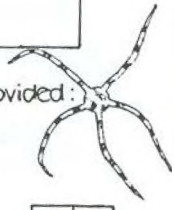
APPENDIX 11d

ADAPTATIONS TO PHYSICAL (ABIOTIC) CONDITIONS ON THE ROCKY SHORE:

Select a rock pool and choose ONE interesting-looking plant or animal.

Draw it in the space below:

Sea-urchin



Identify it using the I.D. sheet provided:

Name: Sea-urchin

Is it exposed to:

- the force of the waves at high tide? Yes / No
- drying out at low tide? Yes / No

Examine the plant or animal closely.
How is it PHYSICALLY ADAPTED to living on the rocky shore?

Its mainly found on the rock pool, in gullies, where there is shade