RHODES UNIVERSITY

DEPARTMENT OF EDUCATION

THE IMPLEMENTATION OF PROJECT WORK BY SELECTED GRADE 10 LIFE SCIENCE TEACHERS IN NAMIBIA

Submitted by

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ABSTRACT

Prior to independence in Namibia in 1990 the education system of the day did not encourage the majority of Namibian learners to explore and investigate the wonder of the natural and physical world. The post independence education system has nurtured the study of the sciences and has emphasized participation, problem solving and independent studies. The inclusion of projects and other independent studies has been regarded as a key vehicle to develop scientific understanding and competencies related to this understanding. However, very few studies have hitherto investigated the teachers' understanding and implementation of projects in the Namibian context.

This study investigates how Grade 10 Life Science teachers understand and implement projects in selected schools in Namibia. The study focused on two teachers in two schools, a combined and a senior secondary school in the Oshikoto educational region of Namibia. The research was conducted through an interpretive case study aiming to gain a better understanding about the implementation of projects in schools. Data were collected through semi-structured interviews, classroom observation and document analysis.

The findings indicate that despite the focus on projects in the Life Science syllabus and broad curriculum, policy documents do not give detailed guidelines on how projects should be planned, organized and assessed. The results revealed that knowledge about projects and their implementation is primarily informed by practical activities rather than the critical enquiries or investigations required by the Life Science curriculum policy. The study also revealed that despite the in-service training received by the two teachers participating in this study on syllabus interpretation, it is apparent from the findings that project work in these in-service programmes was neglected. This has further hampered teachers' understanding and implementation of projects.

The findings of this study point to a need for project guidelines as well as in-service programmes in this area if the stated nature and role of projects in the context of Namibian education policy is to be achieved.

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ACRONYMS USED IN THIS STUDY

BETD	Basic Education Teachers Diploma
CA	Continuous Assessment
CS	Combined school
EMIS	Education Management Information System
HS	High school
MASTEP	Mathematics and Science Teachers Extension Programme
MBEC	Ministry of Basic Education and Culture
MBESC	Ministry of Basic Education Sport and Culture
MEC	Ministry of Education and Culture
MoE	Ministry of Education

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Projects in the context of the formal school curriculum are synonymous with critical inquiries, investigations and thus by inference with problem solving. Projects as an approach to teaching and learning are regarded as a powerful tool to develop the learner as an autonomous thinker and are viewed as a means to enhance a range of cognitive skills, values and attitudes as well as to develop conceptual understanding. The Namibian curriculum follows this current thinking and has incorporated projects in all school curricula with a particular focus on critical inquiry and investigations. This study is an attempt to explore how projects are perceived and implemented through the particular case in which this study is situated, which is the Life Science curriculum of Namibia.

This study investigates the understanding of Grade 10 Life Science teachers of project work and how they implement it in their classroom practices. This chapter gives an overview of the context of the study and the research sites. It also provides the research goal and questions that frame this study. Finally, this chapter gives an overview of the structure of the whole thesis.

1.2 CONTEXT OF THE STUDY

Before independence, education in Namibia was based on a traditional teacher centered approach with little attention paid to learners, their background and interests. Seventeen years ago, the Namibian government committed to shift away from this teacher centered approach to education and to adopt a learner centered approach focusing on learning with understanding (Namibia. Ministry of Education [MOE], 2005a). The shift has characterized the reform process and shaped education policy. Group work, demonstration lessons, debates, communications and project work are activities encouraged to ensure learners' "active participation" in the learning process (Namibia. Ministry of Education and Culture [MEC], 1993a: 26).

Projects in the formal curriculum have a long history but became particularly important since their emphasis by John Dewey in 1916 (Fried-Booth, 2002). Fried-Booth also suggests that projects reflect the search for ways to make learning as meaningful as possible. Projects are viewed as means through which learners become active participants in an experiential learning method and to assist them in developing independent and co-operative learning skills (Fried-Booth (2002)). Waters (1982: 1) in his research on primary school projects defends projects as being 'child-centered' and 'activity-based' work. He defined a project as "a complete piece of work in which the children have made individual and group contributions towards the whole". Postholm (2005: 520) conducted a study that aimed to "describe and show how the project work method and the teacher can facilitate conversation throughout the work process". His research showed that the "teachers are acting and function as facilitators or guides for the learners within project-directed teaching" (2005: 519).

Van Harmelen (1991) suggests that because learning is enhanced when learners are able to relate to real issues and problems, teachers need to look beyond the textbook and develop activities that will provide learners with the necessary opportunities to explore and investigate problems they

are facing in their own environment**.** In line with this Schallies, Wellensiek and Lembens (1999: 2) see projects as a method of researching individual processes involved in the construction of knowledge and the development of understanding that requires "the analysis of interactions in the learners' local environment". Therefore, learners are more likely to feel personally involved in the learning process and motivated by a tangible end product (Fried-Booth, 2002).

The Namibian reformed curriculum encourages learner involvement in small scale investigations through projects with the claim that: "With project work, learners work independently of the teacher for certain periods and are responsible for identifying the topic or problem and for decision making during the process" (Namibia. Ministry of Basic Education and Culture [MBEC], 1995: 62). A study carried out by Chin and Ligek (2004) on implementing project work in Biology indicated that learners in this study implemented project work through problem-based learning, where learners themselves generated the problems and questions that they investigated. Therefore in implementing project work of this nature these authors claim that learners have the "possibility to develop qualities like curiosity, creativity and resourcefulness and interpersonal skills" (Chin & Ligek, 2004: 1).

The Life Science curriculum following the policy of the Broad Curriculum for Basic Education emphasizes the role of the natural sciences as a means to create opportunities for learners to acquire conceptual understanding, practical and investigative skills, as well as the values and attitudes needed by the learners (van Harmelen, 1999: 80). Further to this according to Fried-Booth (2002), projects give teachers a means to involve the whole child in the learning process by involving the full range of skills and talents available.

Project work creates opportunities for extensive cross-curricular teaching and skills integration (Namibia. Ministry of Education [MoE], 2005b: 116). According to Freeman and Gatfield as cited in Mills (2003: 527), project work is part of group work whereby "group learning places

responsibility for learning on the student to promote understanding through expecting learners to be able to describe, explain and apply the knowledge and provides socialization skills that are necessary to survive the real world". The research which was conducted by van Harmelen, (1991) showed that project work is an integral part of independent study topics within a learner centered approach.

I have been involved in the professional development of many teachers during the 17 years of Namibian independence in my role as a Junior Secondary phase Life Science advisory teacher specializing in Natural Sciences. The discipline includes science subjects such as: Agriculture, Biology, Natural Science and Health Education and Physical Science. Based on my experience as an advisory teacher, I first became personally interested in this research topic when I was monitoring the implementation of Continuous Assessment (CA) in schools. I learned that Life Science teachers appear to have problems with the implementation of projects and other approaches to independent studies. This was evidenced by the fact that no project work was recorded in the CA form. From the sixty teachers observed during monitoring, only two recorded a project. However, I did not come across any research in the Namibian context on project work other than in the context of continuous assessment. The results of the survey prompted me to carry out research to investigate how teachers understand and implement projects in schools. Hence, my research question: How do Grade 10 Life Science teachers understand and implement project work in their classroom practice?

My purpose in this study is not to criticize the Life Science documents such as the subject policy, syllabus or the broad curriculum**,** but rather to analyze how they are interpreted. I argue that unless we know how these documents are implemented and interpreted, we cannot meaningfully criticize them. I hope that this study will help me to have a better understanding of the difficulties teachers experience in implementing project work in the curriculum. Furthermore, I hope that this study will reveal whether there are authentic reasons for teachers not implementing project as per curriculum requirements. It will also inform the advisory teachers and curriculum

developers on how to help teachers to broaden their views on projects and to implement project work in an appropriate way.

1.3 RESEARCH SITES

The study was conducted in two selected schools, a combined and secondary school in the Oshikoto Education Region in Namibia. Oshikoto Region is situated in the far north central region of the country. It shares borders with Ohangwena Region to the north, Otjozondjupa Region to the south, Kavango Region to the east and Oshana Region to the west

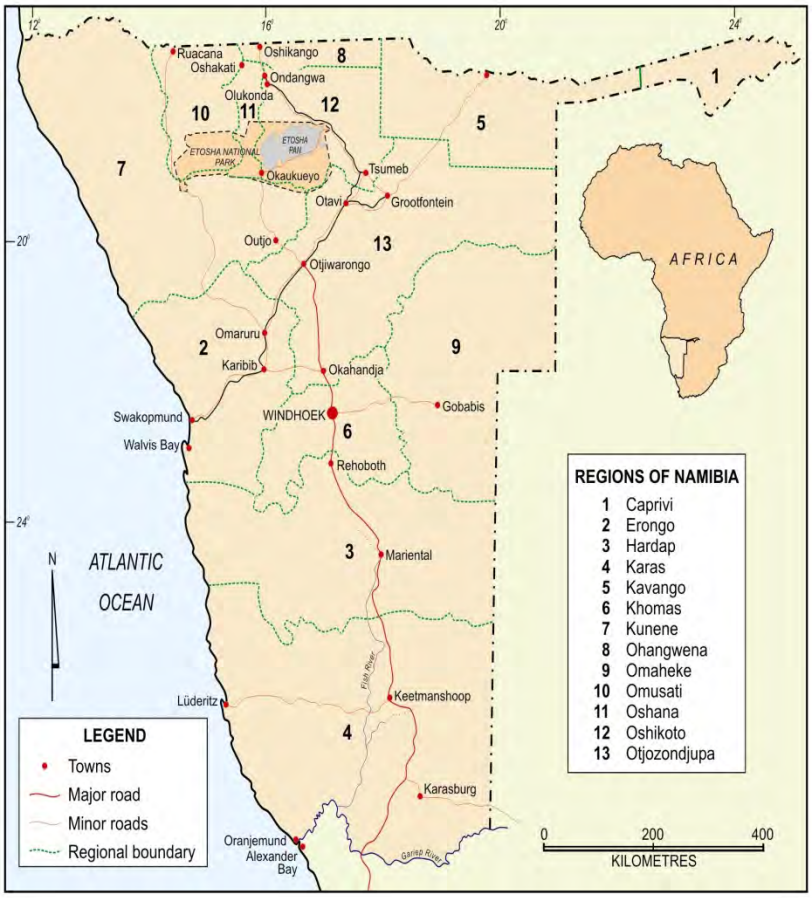

Figure 1. Map of the regions of Namibia. (Sue Abrahams (2006). Graphics Unit, Rhodes University, Grahamstown.)

Oshikoto Region encompasses 38653 square kilometres and has a population of 161007 of which 84620 are female and 76387 male (Namibia. Ministry of Regional, Local Government and Housing, 2003). According to (Namibia. MoE, 2008a: 1); Namibia. MoE, 2008b) education in the region is organised as follows:

- The region has a total of 178 schools of which 115 are primary (1-7), 49 combined/junior secondary (1-10) and 14 secondary schools (8-12).
- There are 58178 learners of which 40983 are primary, 13511 are combined/junior secondary, 3664 are senior secondary and 20 are in special schools
- There are 2006 teachers in the region of which 1812 teachers have teacher training and 194 are without teacher training.
- The region has one Education Director and a Deputy Director, seven Inspectors of Education and twelve Advisory Teachers.

1.4 RESEARCH GOAL

The goal of this research is to investigate selected grade 10 Life Science teachers' understanding and implementation of project work.

1.5 RESEARCH QUESTION

In order to achieve the goal of this research, the study attempts to answer the following research question:

- How do teachers understand and implement projects in Life Science?

1.6 STRUCTURE OF THE THESIS

The structure of this thesis is as follow:

Chapter one gives an introduction and the background to the study. It outlines the research questions and goal of the study. This chapter ends by providing a brief overview of each chapter.

Chapter two provides an overview of the literature that shaped and informed this research. It highlights the theoretical framework of the research.

Chapter three presents my research design. It discusses the approach, methods and tools used to collect data. It also highlights the procedures for analysis and interpretation of the data. This research uses a case study method to investigate the research problem. Validity, limitation and ethical procedures of this study are highlighted in this chapter.

Chapter four presents and analyses the data collected from interviews, lessons observation and documents. It presents the four categories that emerged from the study, which include the profile of the schools and teachers; teachers' understanding of projects in Life Science; teachers' implementation of projects in Life Science and the data collected from the documents.

Chapter five presents the discussion of the main findings reported in chapter four. It discusses the findings by interpreting the views of participants in relation to my research goal and questions and links them with other studies on the implementation of project work.

Chapter six presents a conclusion to the study. It reflects on the research process and design. It highlights the key findings and reflects on the lessons learnt from this study. It considers the limitations of this study and provides tentative suggestions about issues to be addressed. Finally, this chapter ends with possible suggestions for further research.

CHAPTER 2

LITERATURE REVIEW

> Learning can, and does occur in many places and many situations. Learning occurs in school, at home and on the trip between home and school. Activities that are done in a classroom or in a home will provide adults and children with increased opportunities to explore natural phenomena in an engaging and exciting way. A project, experiments, activities, crafts and games allow teachers or parents to learn Science along with learners. (Stine; Gillespie; Stanbury; Greenberg; Harms; Maves, et al., 1988: 7).

2.1. INTRODUCTION

My research goal is to investigate the Grade 10 Life Science teachers' understanding and implementation of project work in schools. The Namibian policy and syllabus require and expect project work to be carried out in the Life Science curriculum. My argument is that if project work is seen to be a vital component of the Life Science curriculum and of the Broad Curriculum, then a teacher needs to have a clear understanding of the theory, principles and strategies as well as assessment of this particular approach to learning. Secondly, I argue that the status of the project in the curriculum has to be clearly identified and that sufficient attention must be given to project work in assessment. Thirdly, the syllabus content must be sufficiently open and flexible to allow time for project work to be done efficiently.

The literature explored in this chapter provides a theoretical framework for the principles and strategies and assessment of project work which have informed this research by providing key indicators that I have used in my data collection. In order to provide an answer to my research question I critically analyze and review the literature that shaped and informed this research.

This chapter gives a brief overview about project work and the curriculum. I look at a brief history of project work in teaching, and its definition; how different authors view and define projects, their perceived importance and the role of projects in teaching. I also discuss when and how projects can be done and where they can be used. I also focus on the kinds of projects used particularly in Science. I also look at the reasons for implementing project work in the Namibian Life Science curriculum and how it is perceived to benefit learners. I attempt to uncover the challenges teachers face in carrying out projects in Science teaching. The last part of the chapter looks at the assessment of project work.

2.2 PROJECTS AND THE LIFE SCIENCE CURRICULUM

"Before Namibian independence in 1990, the understanding of Science related phenomena was regarded as being low and a large number of school goers were not given an opportunity to explore and investigate the 'wonder' of nature" (Mushelenga, 2007: 1). The education system prior to independence did not encourage participation, much less problem solving and independent studies. Project work was consequently a foreign concept in the existing system.

A group of educators and political leaders including those from Namibia met in Jomtien, Thailand, in March, 1990 to discuss the transition from elite education to education for all and how to make a shift from teacher-centered to learner-centered education (Namibia. MBEC, 1997). Much of the discussion at this conference revolved around the inclusion of practical investigations and other independent studies in science subjects. This group emphasized the

importance of developing an understanding and appreciation of science in the lives of children (Stine, et al., 1988). Science subjects therefore became a focal point in the post independence Namibian curriculum.

The many deficiencies of the South African Apartheid education system which was imposed on Namibia resulted in a reform policy designed to bring Namibian education in line with current global educational trends. One subject in particular was designed to model and to capture the spirit of the reform, namely Life Science. Key tenets that underpinned this subject included:

- Participation in learning through activities that were intended to develop learners' critical and creative capacity and their ability to make informed decisions as responsible members of their community
- Learning to be self sufficient through the acquisition of practical skills
- Enabling learners to make careful observations and analysis, to be able to think scientifically and solve problems
- Promotion of equal participation for males and females learners in all spheres of society
- Development of personal and communication skills in all learners that increases their participation in planning and evaluating their own projects (Namibia. MoE, 2006a: 1-2)

These ideals framed the inclusion of projects in the Life Science curriculum as a key vehicle to promote the ideals of the reform. What follows is the discussion of how the subject Life Science came into existence in the curriculum.

In 1991, through the restructuring and transformation of the education system, the subject Life Science was introduced in schools for the first time in Grade 8 replacing the subject General Science. The basic competencies for teaching Life Science are that learners are expected to demonstrate the scientific skills such as observations and investigation as well as values and

attitudes. One of the approaches in which learners should practice the identified competencies was through the introduction of project based learning. In 1993, all Life Science teachers were trained in the implementation of projects as part of the newly introduced Grade 10 syllabus (Namibia. MEC, 1993b).

The Life Science syllabus was compiled in such a way that it was to be taught in a learner-centered manner combining theory and practice and aimed at giving learners opportunities to be actively involved in the teaching and learning situation by doing what were termed as practical investigations (Namibia. MBEC, 1997). Practical investigations and projects in the Life Science curriculum were designed to promote scientific knowledge and skills among teachers as well as to encourage learners to study and understand Science and Technology related subjects (Mushelenga, 2007).

Despite the fact that projects were part of continuous assessment in the revised syllabus (Namibia. MBEC, 1997), the syllabus itself did not give precise instruction on the implementation of project work; what sort of projects to do and how to do them. Projects were seen by some as an initiative of the teachers who are brave and energetic enough to conduct projects for assessment. The syllabus (Namibia. MBEC, 1997) design is very different to the newly developed (Namibia. MoE, 2006a) Life Science syllabus, which indicates the practical activities, approaches and demonstrations that are required for the topic at the end of each theme. The Life Science curriculum makes projects and other approaches to independent studies a minimum requirement of fulfilling the demands of the syllabus.

The Life Science subject policy has made it compulsory for learners to be exposed to hands-on practical activities, which in the long run will lead to the necessary scientific literacy, critical thinking, attitudes and motivation of learners (Namibia. MoE, 2006a). It further explains that more time should be devoted to hands-on activities, the type of activities such as ‘projects’ where children are involved in inquiry-based learning and can acquire knowledge through activities that

focus on observing, exploring, analyzing and drawing conclusion from experimental data. Learners need to design and build models and think about science using concrete materials. When learners are provided with appropriate experiences, they can use these skills and behavior to construct their own knowledge bases. Therefore, the Life Science syllabus recommends a minimum of five practical investigations; one of them a project to be carried out, assessed and recorded. Similarly, the (Namibia. MoE, 2006a: 37) Life Science syllabus indentified projects as one of the examples of assessment tasks that "give learners an opportunity to complete an investigation into one of the themes/topics" but does not provide adequate guidelines of topics suited to project based studies (Namibia. MoE, 2006a; Namibia. MBEC, 1997).

The project, as one of the investigations stipulated in the (Namibia. MoE, 2006a) Life Science syllabus, should be carried out during the second term. Projects enable learners to demonstrate the following skills according to this syllabus (2006a: 39):

- Practical techniques
- Observing, measuring and recording
- Handling, processing and evaluating data
- Planning and carrying out investigations

With regard to practical techniques, the activities should include experiments, handling and organizing apparatus and materials. The skills of observing, measuring and recording includes collecting and processing quantitative and qualitative data, reading scales and tabulating results. The scientific skills of handling, processing and evaluating data include inferring conclusions from data, processing numerical data drawing graphs and charts etc, while the skills of planning and carrying out investigations includes analyzing a practical problem systematically and producing a logical plan for an investigation (Namibia. MoE, 2006a: 39).

2.3. AN OVERVIEW OF PROJECTS

In this section, I draw on the relevant literature to discuss projects in a general way, not focusing on a specific discipline.

According to the Concise Oxford dictionary, 8th edition, (1990: 954), a project is referred to as

> … a long-term task undertaken a by student to be submitted for assessment.

Adderley (1975) as cited in Henry, (1994: 13) points out that:

> … projects involve a variety of educational activities, generally involve the solution of the problem and offer the chance of tackling interdisciplinary areas.

Henry (1994) views projects differently as he feels that there is no universally agreed definition of the term project, rather he uses six criteria to define a project. These involve the role of the student and the teacher; the student selects the project topic, locates their own sources, presents an end product and conducts an independent piece of work which lasts over an extended period. The teacher plays the role of adviser during the implementation of projects (Henry, 1994: 12). Isai (2007: 4) adds to these criteria suggesting that the project involves "studies, research, observation, measurements and record keeping". Mushelenga, (2007) views projects as assigned self-studies in which learners carry out independent investigations, while Solomon (2003: n.p) emphasized that:

> ...in project-based learning students work in groups to solve challenging problems that are authentic, curriculum-based, and often interdisciplinary.

Viewing projects in the context of science Henry (1994: 13) referred to a project as:

> …an investigation carried out by the student in an area he or she selects and plans using scientific methods to discover the answer and presents a report.

The Natural and Social Sciences curriculum of Namibia defines a project as a:

> …longer assignment than a practical exercise and gives learners an opportunity to complete an investigation into one of the themes/topics outlined in the syllabus (Namibia. MoE, 2006a: 37; Namibia. 2006b: 14).

This type of investigation will 'enable the teachers and learners to pursue a topic in greater depth and in a more lively and creative way than with short discrete topic tasks or practical exercises or investigations (2006a: 37; 2006b: 14).

Given the nature and role of projects, I am going to adopt the following criteria for the purpose of this study as a means to frame my analysis.

- A project is a task that focuses on and includes investigation, problem identification and problem solving, decision making, creativity and innovation;
- A project is designed and developed to help to develop learners as autonomous thinkers and self-reliant learners and as critical thinkers;
- A project focuses on learners' conceptual development in the context of the enquiry by providing opportunities for learners to describe what they are investigating, to explain processes to give reasons and above all to apply relevant knowledge to the situation being investigated;
- A project needs a week or longer to complete;
- Learners are encouraged to choose their own topics;
- Learners are expected to work independently;
- Learners are encouraged to select their own material;
- Learners are expected to produce a product and to present their own work;
- Teachers are required to act as advisors;
- Feedback is required from both teacher and learners;
- There should be an involvement of learners in peer assessment and;

- General feedback is required from the teacher.

The argument is if learners are trained at an early age to do project work and are offered a chance to examine other's work during feedback, they will learn important "principles of quality" and improve their critical thinking skills (Solomon, 2003: 4).

Fried-Booth (2002) defines projects as a process of inquiry based learning that will pass through three stages. The first stage is classroom planning, where students together with the teacher plan the content and scope of the project and discuss the way to gather the materials and the information together before carrying out the project. This is what Henry (1994: 14) referred to as a structured project. During planning, the teacher and the learners discuss how to implement the activity and which assessment strategies should be used. Learners are informed about what to prepare for the assessment and how it will be conducted (Solomon, 2003; Powell, 2004). The second stage is the execution of the project. According to Fried-Booth (2002) the activities can be done outside the classroom in the laboratory, library or in the field. He further elaborates that during stage two, the students are required to use all four skills: reading, writing, speaking and listening. In this stage learners are required to read from different sources, take notes that are useful for the study and compile them so they can use them during their presentation. They also discuss how to design and develop the product and how to present their final product.

The last stage concerns reviewing and monitoring the work done during stage two. This stage helps learners to check if anything is lacking and to prepare the presentation. During the presentation, discussion and feedback play the most important role (Solomon, 2003). Assessment is part of stage three and is often done concurrently with the presentation. Comments from both the teacher and students are made known to give the students a chance for self monitoring and self reflection. This process of inquiry generates the argument that if teachers are carrying out projects using Fried-Booth's ideas, then learners are in a position to carry out projects and

investigations that will enhance the development of skills, values and attitudes. Next I discuss the reasons for teaching through projects.

2.3.1. Reasons for teaching through projects

Teaching projects in the Science curriculum has many purposes. Henry (1994: 45) identifies five major reasons for using projects in teaching and learning:

- to ensure that students are able to apply their knowledge;
- to teach higher cognitive skills;
- to motivate students through activities that are of greater relevance to them;
- as a means to offer students greater autonomy and
- for assessment, which Beaumont and Williams in van Harmelen (1991) described as a method that enables students to be measured with regard to higher-order skills of organizing, synthesizing, analyzing, problem solving and evaluating. These aspects are also emphasized by the Life Science curriculum (Namibia. MoE, 2006a).

Henry (1994: 46) claims that it is necessary for teachers to teach through projects because students have more control of the learning process and that projects take a "greater account of learners' interests". Adding to this (Millar, 2004) emphasizes that teaching through projects provides every student with sufficient understanding of science to take part confidently and effectively in the modern world with its technology based society. He elaborates that as societies advance they require a steady supply of new recruits to jobs that require detailed scientific knowledge and expertise.

According to Solomon (2003), projects engage students through hands-on and authentic experiences, which Henry (1994: 46) views as "providing preparation for working life". Solomon (2003) adds that in doing small projects students are getting the basic skills which give them the necessary knowledge to do longer and bigger projects which can be submitted for

competitions such as those run by Science fairs. Henry (1994) supports the point by elaborating that in the case where the project is designed for Science competitions, it opens the doors for academic opportunities. These opportunities develop students' self confidence.

Henry (1994) identifies the application of knowledge as the most common reason for teaching through projects because it enables learners to apply the knowledge they have learned in class to the real world. He argues that the ability to apply knowledge through projects is a very different skill from understanding theory in the abstract. The Society for Science & the Public (2008), adds to this by claiming that teaching through projects is the ultimate answer to the asked question; it can be self-validating and exciting because it is not just practice, but involves real discovery of little known or unknown information. In addition, Waters (1982: 2) describes the use of projects in teaching as an approach which makes good use of students' interests and curiosity, and helps to "minimize the notion of subject matter being rigidly compartmentalized" and allows teachers to "adopt a way of consultation, guiding and stimulating than a purely didactic one".

Chin and Ligek (2004) discuss the major aim of project work in teaching as helping students acquire competence in identifying, accessing and processing relevant information in order to solve authentic problems and construct new knowledge. They further emphasize that by doing projects students will have the opportunity to generate their own questions and seek answers to their questions. They stress that carrying out projects will create a sense of ownership in students as they get the opportunity to carry out field activities and laboratory investigations and surveys which enable students to learn interesting things outside the classroom. Therefore teaching through projects provides an ideal educational vehicle for offering and assessing learning in a real environment (Henry, 1994). Millar (2004) adds to this by saying that the practical aspect of project work allows the students who are involved to observe or manipulate the objects and materials they study. He further emphasizes that in project based learning, students are not only given a chance to collect data but also to organize, analyze, synthesize and evaluate them. According to him, project activities do not normally take place only in a school laboratory, but

could also occur in an out-of-school setting, such as at home or in the field. This helps learners to acquaint themselves with the milieu in which they live.

Van Harmelen (1991) sees problem solving as a key feature of the project approach, because students are involved in critical analysis and evaluation of evidence in order to reach conclusions. She further argues that students need to be able to structure arguments on what they have researched and be in a position to come to some conclusion. Henry (1994: 47) supports the idea by arguing that students need to be equipped with the practical skills for doing research and the evaluative skills that are necessary to "critically assess literature". Fried-Booth (2002) emphasized that in doing projects students' motivation comes from within not from outside and the students own their projects, therefore they make all their own decisions. Based on these reasons, project work is a teaching tool that demands the active involvement of learners and offers them opportunity to learn different scientific skills.

Henry (1994: 53) summarizes reasons for offering project work as follows:

- Relevance – what is learnt is directly relevant to the task performed
- Intrinsic motivation –allowing the child to learn what and when they want to learn, thus avoiding cramping their natural inclinations and helping to turn them into self-motivated healthy adults
- Autonomy –the method used in approaching the project should reflect the desired end - an autonomous interested learner who knows how to learn and communicate
- Metacompetences – given databases with their 'knowledge on tap', the skills of problem solving, learning to learn, decision making and communication cultivated through projects are more relevant to today's needs

- Learner management – if we are to create a society of responsible individuals able to use initiative appropriately, sensitively and efficiently, then we must teach them to take control of the learning process so they are able to develop their initiative skillfully.

This indicates that if learners are given a project which is interesting and relevant to the topic studied, then they will be motivated to learn and therefore develop a sense of ownership of the project. On the other hand Adderley cited in van Harmelen (1991: 21) sees the following as the purpose of conducting project work, which to some extent differs from Henry's.

- To encourage students to make their own choice of a subject of study and thus encourage a sense of commitment and personal responsibility for the task;
- To give students practice in learning to learn by undertaking a piece of personal research involving activities such as: planning the work, hunting out sources, collecting material, selecting from it and deciding on presentation;
- To enable students to experience the satisfaction of working on a complex task over a period of time with the possibility of producing a result of permanent value and interest to themselves and others;
- To provide opportunities for practice of communication skills in a framework where language is used in a number of ways;
- Communication, seeking information, oral and written reporting, discussing, synthesizing, revising and editing (van Harmelen, 1991: 21).

In addition to the above purposes, Coombs (1995) and Collis and Lacey (1996) identify the following project-work criteria that are essential to motivate students which Arends (1998) as cited in Tessema (2005: 23) calls principles of project work. These principles are as follows:

1. Tasks are organized around socially important problems and questions that are personally important for students
2. Students should conduct authentic investigations that find real solutions to real problems

3. Students should investigate many subjects, such as politics, history and science among others
4. Tasks should require students to create artifacts and exhibits that represent or explain solutions to a problem
5. Tasks are characterized by students collaborating with each other in pairs and small groups

Among the principles of project work identified by Arends (1998) as cited in Tessema (2005), he stresses the inclusion of all the four skills of reading, writing, speaking and listening as important in carrying out projects. These principles show how projects are carried out (what to do, how to do it and why one is doing it). Using these strategy and tools teachers can implement a successful project.

2.3.2. A brief history of projects in education

> The use of projects in the classroom is not a new one, and reflects the search for ways to make the learning … as meaningful an experience as possible. Projects are a means by which learners become active participants …, and assists in the development of independent and co-operative learning skills. It gives teachers a means by which to involve the whole child in the learning process … (Fried-Booth, 2002: 1).

The implementation of science projects in education is not something new. Projects as part of education have been seen as important since 1916 when John Dewey emphasized the project approach in his text *Democracy and Education*. Dewey, as cited in Henry (1994: 41) stresses "passiveness of the student through rote teaching". He also favored the "active approach of the problem-based method" where students are fully involved in an unstructured project which leads to "collaborative possibilities of group projects". Like Dewey, Adderley (1975) as cited in Henry (1994) stresses the use of the project method by some American vocational schools as an important tool for learning with understanding.

According to Fried-Booth (2002: 5), project work in a 'foreign language' was originally published in 1986. The publisher was trying to provide meaningful activities for language students and give them the confidence to use English in the world outside the classroom. Therefore, project work can be seen as a link between the school, home and the environment. Henry (1994) adds to this indicating that projects started to be more common in schools in the United Kingdom (UK) and by the 1930s were used by many schools as a common form of active learning in the United States of America. He further states that during the late 1960s and 1970s, projects were vital to preschooler education in the UK, while in the 1950s and 1960s the use of projects moved into the secondary schools and by the 1970s and 1980s it was finally introduced to higher education. This differs from the Namibian education system as in the Namibian context project work is significant in the upper primary and senior secondary level, Grade 5-12 in all disciplines. The lower primary phase (Grade 1-4) curriculum does not emphasize the use of projects.

Henry (1994: 44) indicated that in the 1970s and 1980s, educators in the UK emphasized the importance of projects for developing the student's "autonomy, capacity for self direction and independent study". As noted above, Namibia also shared these ideals by emphasizing project work in the curriculum. This move was spearheaded by the two science projects; the INSTANT and Life Science projects and the implementation of projects has been strengthened and given greater focus since 1997 when the Life Science syllabus was revised.

2.3.3. Types of science projects

In carrying out a science project there should always be a question that intrigues the researcher. Therefore the type of project to be carried out will be determined by the interests of the students and the teacher and how they respond to an identified problem or issue. In the case of projects developed for learners the teacher should ensure that they are relevant to the teaching syllabus and appropriate to the level of knowledge and understanding of a specific grade (Namibia. MoE, 2006a).

Scientists (van Cleave, 1997; Isai, 2007) have identified three basic types of Science projects which are; collection/study projects, investigative projects and constructive projects. Isai (2007) describes the collection/study type as a project that normally involves observation, classification and recording such as investigating the feeding habits of birds. The collection/study type of project requires learners to collect the data that reveals evidence of a fact or situation of scientific interest. This type of project is usually carried out over a longer period of time. He describes the investigative project as a type of project that is normally undertaken to test a scientific hypothesis using a scientific method. Isai (2007) further suggests that the investigative type of project must be original, topical and must also relate to the existing and prior experience of the learner. The last type of project identified by Isai (2007) is the construction type which normally comprises some form of construction, such as a model. This type of project should demonstrate an understandings of the scientific principles involved through which a learner acquires technical knowledge and skills.

According to Isai (2007) all these types of projects allow learners to demonstrate all major skills such as the skills of practical techniques; observing, measuring and recording; handling, processing and evaluating data and planning and carrying out investigation. These are also the skills identified by the Life Science curriculum (Namibia. MoE, 2006a).

On the other hand Henry (1994) has used a different approach to identify projects. Unlike van Cleave (1997) and Isai (2007), Henry (1994) sorts projects into four types of inquiry. These are; literature review, information research, empirical research and design project. In a literature review the research takes place in a library, the information search projects use a primary source (original data) and secondary (pre-digested materials) data; empirical research projects involves a survey, a case study and experiment and the design projects involve specifications and construction (Henry, 1994). Waters (1982) points out that these types of inquiry include all the disciplines rather than sciences only, which helps a child to reach many goals of understanding and investigation.

In traditional schooling much teaching was done by the teacher and students played a relatively passive role. This is what Henry (1994: 23) called "spoon feeding" which he believes does little to develop the student's higher cognitive skills. Therefore the literature review type of project will encourage and enable the students to gather information from a variety of sources, such as newspapers and from the reference materials. Henry sees the information research type as very close to empirical research; as they both use original data. The only difference Henry observes is that in the information research students undertake a project based on data collected from records, documents and archives as well as from reference texts in the library, while in empirical research students base their project on the analysis of the original data which they have collected themselves. In both information and empirical search, learners develop their ideas from the gathered information. In empirical research students are required to do surveys, case studies or interviews. According to Waters (1982) the three types of enquiries used by Henry (1994) help learners to acquire the necessary skills such as information gathering, problem solving and decision making; knowledge and attitudes towards others. They also enhance learners' personal and social growth and development. Exploring the different types of projects identified by the literature reviewed here, will help me to focus on what sort of projects are used by teachers and the sort of skills, values and attitudes projects are designed to address. Next I look at the implementation of projects in teaching.

2.4. IMPLEMENTATION OF PROJECTS

Implementation means put ‘into practice’ or put ‘into action’. This section looks at ways Science researchers implement project work, which could possibly provide the Grade 10 Life Science curriculum with guidelines on how to implement project work effectively. Fried-Booth (1990: 6) states that carrying out a project involves three stages namely: “planning, carrying out the project and reviewing and monitoring the work”. He suggests that planning begins in the classroom, then moves outside to carry out the activity and returns to the classroom to review and monitor the work. Fried-Booth (1990) emphasizes that the teacher in collaboration with the learners should discuss the content and scope of their project and should ensure they are clear about the purpose of the project. This is supported by Waters (1982) saying that teachers and learners can complement each other in selecting a topic for a project. Henry (1994) adds that learners own the topic while the teacher plays the role of facilitator and adviser. During the planning stage, the teacher and learners decide on how to carry out the project, what materials are to be used and how to access them. They should also discuss how to present their product and agree on the assessment strategy to be used.

Despite the absence of a continuous assessment manual for Life Science, the continuous assessment manual for History (Namibia. MoE, 2006b: 14-15) provides an outline of the main features of the project to be attempted. The outline should consist of the following:

- Theme
- Topic
- Title
- Basic competencies or competencies
- Teacher instruction to learners
- Class organization – group activities/individual responsibilities
- Sources of data
- Techniques for data collection/presentation

- Skills to be assessed
- Length of the project
- Date of submission of project

The History manual emphasizes that the teachers must provide learners with a clear outline of the stages within a project. The following stages can be seen as guidelines for the project, and can be adapted to the Life Science curriculum.

Table 2.1 Stages within a project (Namibia. MoE, 2006b: 16 slightly adapted)

A	Choice of project
B	The design of the work
C	Collecting of data
D	Selection and collation of data collected
E	Representation and recording of data
F	Analysis and interpretation of the data
G	Making conclusions

In terms of the execution phase of the project Fried-Booth (1990: 6) explains this as the stage when learners move out of the classroom to perform the tasks that have been planned. He points out that during this stage learners are using all four skills of “reading, writing, speaking and listening”. There is the suggestion that for longer projects, periods are set aside to monitor the progress of the projects and for teachers to help learners to keep on track and /or to sort out any problems that may arise.

When the project has been completed it needs to be reviewed and monitored. At the presentation stage discussions take place and feedback is given by both the teacher and learners. According to Powell (2004), assessment is done concurrently with the report back. During feedback the learners analyze their work and do self monitoring. Since my research is to explore the Life Science teachers understanding and implementation of projects in the next section I discuss the challenges faced in carrying out projects.

2.4.1. Challenges in carrying projects

Despite the advantages and benefits of the implementation of projects discussed in the previous section, there are also some challenges that inhibit the implementation of projects in the curriculum. In order for a project to be successful, it needs thorough planning. Thorough planning needs an experienced person, because inexperience can lead to ineffectiveness (Millar, 2004). In addition, the research done by Millar (2004) indicates that because of the inexperience of learners, the quality of the equipment provided and the limited amount of time allocated to projects problems arise related to observations or measurements which may be incomplete and/or insufficient. This according to Millar (2004) results in inconsistencies of results with the intended aims.

Henry (1994); Chin and Ligek (2004) see time constraints as a major challenge to the implementation of projects. They suggest that a project needs to be allocated a fair amount of time in order to give students the chance to organize, analyze and synthesize their materials. They further argue that in order for a project to succeed, students need access to all the desired information for the research, but this exercise may involve expenses in travelling to and from the sites such as libraries, monuments as well as buying the materials that cannot be found at school or home (Henry, 1994). This is a major challenge to most schools because not all of them possess libraries and if there are any, they are often not well equipped with the necessary

resources. The other challenge is that in a country such as Namibia not all learners can afford to buy materials.

Elton, (1987); Henry, (1994); Chin and Ligek, (2004) and Powell, (2004) showed that most projects are carried out in groups. The problem experienced in group projects is that sometimes groups fall apart due to misunderstandings among team members. The authors claimed that some students dominate in the group, which results in the withdrawal of some of the group members from the activity. Therefore Henry (1994) maintained that it is the responsibility of teachers to make sure the groups are maintained and co-operate.

As indicated in my working definition projects are meant for assessment. This can prove to be a major challenge during the implementation of projects. Isai (2007) suggests that one of the reasons teachers find it difficult to assess group projects is because of the copying of work by students and another is that the contributions of students are not always equivalent (Elton, 1987). This gives teachers problems in identifying individual contributions in group projects.

In the modern world of technology, some teachers give projects that require information from the Internet. According to Henry (1994) this exercise demands a lot of time as students have to research and sift through a large number of web sites to select the relevant information. On the other hand, many schools do not have Internet access so cannot do research on the Internet, which results in insufficient information and a shallow exploration of the topic.

Difficulties in obtaining information were another challenge observed by authors which resulted in students changing the project topics due to their inexperience. Therefore (Henry, 1994) felt that the teacher can lend assistance and give the students advice that will help them to come up with researchable, workable and doable projects. Waters (1982) adds to this saying that the

teacher should make sure students have chosen a topic that does not demand more than they are capable of and that the topic reflects their own interests.

2.4.2. Assessment of project work

Prior to Namibia's education reform process assessment was predominantly formal and examination oriented. However, with the introduction of a learner centered approach, the idea was to reduce the emphasis on examinations and give emphasis to formal and informal Continuous Assessment (CA) strategies (Amakali, 2007). Since the introduction of Life Science as a subject, projects were part of CA as part of course work. The assessment of projects as course work assists in the evaluation of the skills and abilities of learners that are essential to the Life Science course that are not necessarily suitably measured by written examinations (Namibia.MEC, 1993b; MBEC, 1999). In addition the reason for assessing projects is to assess what Powell (2004: 224) calls "soft competencies that are difficult to assess in a formal examination such as presentation skills and team work". Some learners do better when it comes to practical activities but perform badly in written examination.

Learners are assessed formally and informally in order to evaluate their progress throughout the whole year. This is supported by Coombs (1995) who sees the importance of CA as the acknowledgement of results as the student progress. Powell (2004: 224) adds to this saying that the core reason for assessing projects is to test whether groups or individuals have mastered the learning objectives of the project as well as providing an evaluation measure of the project.

The skills and abilities to be assessed as course work include (Namibia. MoE, 2006a: 36):

- using and organizing simple tools, techniques and procedures, apparatus and materials
- observing, measuring and recording

- handling simple observations and data, and drawing conclusions from them
- planning simple investigations and working together with others

The assessment of project work is also based on the principle of positive achievement, that is opportunities should be given to learners to demonstrate what they can do and understand (Namibia. MEC, 1993b) and not on what they have not achieved. However when assessment of project work is carried out in groups, a teacher should ensure that the individual contribution of each learner is assessed and recorded as evidence for both the learner and parents on the progress and achievements of the learner (Namibia. MBESC, 1996). As learners develop positive attitudes towards the practical activities, this improves their achievement.

The Life Science curriculum emphasizes the assessment of project work to be done individually or in groups. Freeman and Gatfield as cited in Mills (2003) see group learning as placing the responsibility for learning on students in order to promote deep learning and to provide socialization skills that are necessary to survive the real world. In addition Solomon (2003) emphasizes that peer assessment helps students to learn from each other.

2.5. CONCLUSION

This chapter explored the concept of projects. It discussed the overview of projects and the challenges they present. Benefits as well as assessment were highlighted. Relevant literature has been analyzed and reviewed to inform this research and to provide an important foundation and framework for the study.

The literature indicates the challenges that teachers face in implementing projects, it appears that group work in project work is a global challenge. As indicated in Chapter one, the fact that

teachers do not show an interest in project work or its implementation in the Life Science curriculum is a real challenge. While recognizing that the project approach has its challenges, it would seem that the value of projects continues to outweigh the problems. In the next chapter I discuss the research methodology and methods that I used to investigate teachers' understanding of projects

CHAPTER 3

RESEARCH METHODOLOGY

3.1. INTRODUCTION

This chapter presents my research design. The approach to the study was informed by my research questions and research goal. It discusses the following elements:

- Research orientation
- Research approach
- Selection of the sample
- Data collection instruments
- Data analysis procedures
- Data management
- Validity in my study
- Ethical procedures
- Research issues, problems and limitations
- Conclusion

3.2. RESEARCH ORIENTATION

For my research orientation, I adopted the interpretive paradigm as the orientation most appropriate for the intended research. Babbie and Mouton (2001) describe the purpose of interpretive research as that of giving a researcher an understanding of meanings made by the research participants of the problem studied. In addition, Cantrell (1993: 84) and Bassey (1999: 44) argue that this paradigm allows a researcher to understand the situation and to make meaning of the phenomena within its "social and cultural context". Therefore the interpretive approach seemed most appropriate in helping me make meaning of how the Grade 10 Life Science teachers understand and implement project work.

3.3. RESEARCH APPROACH

I used a qualitative interpretive case study approach for this study. According to Patton (1990) and Bell (1994) a case study allows the researcher to concentrate on a specific area of interest while Bogdan and Biklen (1993: 58) define a case study as an in-depth assessment of one setting, a single subject; be it a school or a teacher. As Bell (1994) and Merriam (2001) maintained, using a case study allowed me to obtain a thorough picture and in-depth information of the professional context of my two participants within a limited time scale. This approach gives the researcher an opportunity to analyse the evidence gained from the participants while retaining their voices. I have included direct quotations from the participants where they highlight particulars. Therefore in order to practice what Cohen, Manion and Morrison (2000: 78) called a 'sense of being there', I reported what I observed, read and heard from interviews, lesson observation and documents.

3.4. SELECTION OF THE SAMPLE

This research was conducted in Oshikoto Region, Namibia. There are 54 schools offering Life Science both at the Combined and Secondary schools. There are about 100 teachers teaching Life Science in Oshikoto Region. Due to the geographical vastness of the region and the nature of the research problem and of the study, a half thesis, the study was conducted in two schools, one Combined School and one Senior Secondary School that offers Life Science in Grade 10. Since I wanted an in depth study of my research topic in the selected schools, this was considered to be an appropriate sample size.

I used purposive sampling to select two teachers to participate in the study. I know they are experienced in teaching Life Science at Grade 10 and have attempted to implement project work in their classrooms. This was done in order to create a sample that was suitable to my particular need, Patton (1990) in Polkinghorne (2005: 140) referred to this as an "information rich" sample. This sample size was based on the belief that a smaller number of participants will generate depth of data that will provide the desired illumination of the situation being studied (Bell, 1994) within the time constraints for a half thesis research.

Further to this, I selected my participants using convenience sampling. McMillan and Schumacher (1997: 169) perceive convenience sampling as a "group of subjects selected on the basis of being accessible and suitable". Therefore I selected the two schools which I had easy access (Cohen, et al., 2000). These teachers were a male and a female and the schools and the participating teachers were coded as 'Magano' at 'Shiingulu High School' and 'Tulonga' at 'Kuthenga Combined School'. These pseudonyms were given in accordance with the ethical protocol and for the sake of confidentiality, privacy and anonymity.

3.5. DATA COLLECTION INSTRUMENTS

Before I embarked on my data collection, I first decided on what kind of data I needed and the tools that would be most useful. I adopted Polkinghorne's (2005) idea that in qualitative research, data are gathered in the form of oral or written language rather than numbers. Therefore I elected to include interviews, lesson observation and document analysis. I prepared the interview schedule and the data lists (Appendix 1A) containing the semi-structured questions that were designed to provide answers to my research questions. Following Polkinghorne (2005) these data collection tools were used in order to get as rich data as possible and they were selected to complement each other through triangulation. They also helped to address some of the issues perceived as inherent limitations of a small scale qualitative study. I also used a stimulated recall interview to follow up on certain aspects of the lesson, took notes and recorded the voice of the teachers as evidence of the collected data for my research. Polkinghorne (2005: 137) describes the purpose of qualitative research aiming at "describing and clarifying human experiences as it appears in human lives". In supporting Polkinghorne's notion, I allowed teachers to speak for themselves during interviews with my role being only to pose the questions and to probe where necessary. What follows is discussion of each of these tools pertaining to their use in collecting data.

3.5.1. Interviews

According to Polkinghorne (2005), the interview is the most widely used approach for the production of qualitative data. Potter (1996) cited in Polkinghorne (2005) defines interviews as a method of gathering data through asking questions and getting verbal reactions. He further explains the purpose of interviews as to gain a "full detailed explanation from the informer of the knowledge under study" (2005: 142). In my study I conducted semi-structured interviews. Semi-

structured interviews contain open-ended questions and allow for in-depth probing for further information (Cohen & Manion, 1994) so best suited my study.

I conducted the interviews at the end May and at the beginning of June. I drafted my interview time-table when I made appointments with teachers after introducing my research topic to them. By then I had my interview schedule and data list. Following Denzin and Lincoln (1994), I piloted the interview questions in one of the combined schools coded as 'Okakwiyu Combined School'. The reason for piloting the questions was to see whether they would not only provide the needed richness of data but would also maintain the ideals of the selected research orientation and approach. I selected Okakwiyu Combined School as my pilot because 'Natangwe', the Life Science teacher was willing to assist me when I introduced my research problem to him. He also serves as a Science Fair co-ordinator in Oshikoto Region where this study was conducted. The annual Science Fair is based on learners' individual or group projects and consequently Natangwe falls in the category of people able to provide information rich data.

When I conducted my pilot interview and transcribed the recorded interview, I sent them to my tutor for comments. I made some changes in my data lists that assisted me to get the information I needed from the participants. I used the edited version for the actual interviews **(**Appendix 1B**).**

I conducted the interviews with the two teachers in English. I interviewed each teacher twice. All the interviews took place from two o'clock, after school hours in a quiet room at the schools, except for the pilot interview which took place from twelve o'clock because the school closed earlier due to examination sessions. From the interview, I collected information on the teachers' biography, their knowledge and understanding of the subject with regard to the implementation and assessment of projects. The interview was used to illuminate the connection between what the teacher says and what actually happens in the classroom and to better gauge teachers' understanding of project work. I asked more probing questions to allow participants to express their feelings as honestly and openly as possible. The respondents were free to express

themselves and to air their views and thoughts as I gave them more time to think about their answers. During the interviews, I used a voice recorder and took some notes with the teachers' permission. I used a voice recorder to capture the interview and it assisted me in transcribing the interviews and lesson observation that helped to ensure that the participants' voices were not lost. Note taking assisted me to capture the interviewee's facial expression and body language that cannot be captured by the voice recorder.

3.5.2. Class observation

Patton (1990) in Cohen, Manion and Morrison (2000) states that observation enables the researcher to enter and understand the situation that is to be described, this was a very important aspect in the collection of my data, because it enabled me to monitor, describe and understand the implementation and assessment of project work. This research tool allowed me to observe what was taking place in the classrooms. I observed four lessons in total, two of them were about the topic "respiratory system" and the other two were about the topic "human skeleton".

I did not get time to pilot the observation tool, but I manage to get as much relevant information as possible and the observation went as expected. The main aim of carrying out classroom observation was because it focused on the practical aspects of the teachers' classroom practice (Patton, 1990). During the class observation, I used a voice recorder to capture the "live data from live situations" (Cohen, et al., 2000: 305) and took notes in case the voice recorder failed. A stimulated recall interview (Murray & Nhlapo, 2001) was done informally soon after the lesson presentation to clarify issues that arose during observation. I transcribed each lesson presentation in order to analyze the data.

3.5.3. Document analysis

Analysis of documents is one of the strategies I used to collect my data. I decided to use this strategy because it provided me with supporting evidence about how teachers implement project work based on the requirements of the Life Science curriculum. The documents I referred in this study include: the Grade 10 Life Science syllabus, the teachers' lesson plans, learners' work on projects and the Continuous assessment (CA) record form. For the lesson plan, I focused on the objectives and the basic competencies designed for the projects, to check whether there is a correlation with those from the syllabus. For the learners' work I checked the evidence of activities done on projects, how they relate to the syllabus and the lesson plan. I also observed the teachers' assessment and the recording of the marks in the CA form. The most important aspect of this strategy was to see how teachers interpret the suggestions from the syllabus and what problems they have with the requirements of the syllabus. I was also interested to see whether they are able to move beyond the basic requirements of the syllabus in relation to the implementation of project work.

3.6. MANAGING DATA

It was not easy to organise the data I had collected, because I had used different sources. To organise my data well, I read the transcriptions of the interviews and lesson observations and went through the documents to develop a case study of each teacher.

The case study was compiled in the form of a narrative describing in as much detail as possible what transpired in the course of the data collection process (Patton, 1990) (Appendix 2A & 2B). The case record for each teacher consisted of a file containing interview transcripts and classroom observation and information from documents. These data enhanced the final data analysis.

3.7 PROCESSING AND ANALYSING THE DATA

I transcribed the data that I collected in this case study from the interviews, class observation and documents analysis. Thereafter I read through the transcription using the source questions (Patton, 1990) to guide my analysis. I used a form of coding using colours and noted the key areas such as information about the teacher, teachers' understanding that includes planning, preparation and roles; implementation that includes execution and assessment; feedback from both teacher and learners, and problems experienced in implementing and assessing projects.

Using this approach greatly enhanced the development of case study of each teacher. (Patton, 1990). This helped me to remain focused on the kind of information that I needed in the light of my data lists. The last step of the data analysis was to make what Patton (1990) refers to as 'cross case analyses', which means grouping together the responses from the two teachers and coming up with patterns, commonalities and inconsistencies. This helped identify the themes for my presentation chapter. However, Polkinghorne (2005: 139) raises the question that there is a need for qualitative data collectors to understand that "translation may distort meaning or data are lost during transcription". Being aware of this I tried to ensure that this did not happen by carefully interpreting and analysing my data.

I then went on to the next level of analysis. Each source was analysed separately. For example, I presented the information from the documents under the heading "data collected from the documents". I did the same with other sources. I identified categories, patterns and themes for my study and used them to write my discussion chapter where I discuss the findings by interpreting data in relation to my research goal and questions and link this to the literature concerning project work and its implementation.

3.8 VALIDITY IN MY CASE STUDY RESEARCH

In order to increase validity and ensure the trustworthiness of the study, I employed the following strategies as suggested by Merriam (2001):

- **Triangulation**

I had collected data using triangulation, using a multiple data approach. This approach to triangulation (Patton, 1990: 245) is done to 'increase both the validity and the reliability of data'. Anderson and Arsenault (1998: 131) state that triangulation helps "eliminate bias and detect errors in the findings". Therefore, I interviewed two teachers, visited their classes and reviewed their syllabus, lesson plans and learners' work (Cohen, et al., 2000).

- **Member checking**

To enhance validity I gave the interviews and lesson observation transcripts to the participants for verification and justification. By doing this, participants are given the opportunity to confirm or insert omitted information.

- **Stimulated recall interview**

I used a stimulated recall interview to follow up on certain aspects of the lesson. The main aim of this method is to clarify issues that arose during observation.

- **Primary data**

I included the voice of the participants in my report through direct quotes from interviews and lesson observations where these are deemed relevant.

- **Case record**

I compiled a case record for each participant (Bassey, 1999) as evidence that the findings are based on the collected data.

3.9 ETHICS IN INTERPRETIVE RESEARCH

When I conducted this qualitative research, I was aware of the need to follow certain ethical procedures in research of this nature. Before I embarked on my data collection, I went through all the necessary steps of obtaining permission from my Regional Education Director, the principals and teachers (Appendix 3). I used a permission letter from my Director for both principals and teachers, introduced myself to them and explained the purpose of the research as suggested by Bell (1993). After these arrangements, I made my appointments with the teachers concerned. I assured them of their right to participation, privacy and anonymity. To ensure that I adhered to this agreement, I promised all the participants and their respective schools that pseudonyms would be used during the whole process.

I informed the teachers of the methods and tools I intended to use to collect data such as interviews, lesson observation and document analysis and the use of voice recorder during interview and lesson observation. No one objected to the idea. For confidential purposes, (Bless & Higson-Smith, 1995), all documents and data collected were handled with a high degree of confidentiality. All participants were assured that they would receive the draft of the report for validation and were invited to provide corrections if necessary and to ensure that the details were accurately recorded and reported.

3.10. RESEARCH ISSUES AND PROBLEMS

The following issues, problems and limitations affected my study in one way or another:

- **Withdrawal:** My initial idea was to invite three Grade 10 Life Science teachers to take part in the study. In the end I only worked with two teachers, the third one withdrew from the study as he was transferred to an Upper Primary school that does not offer Life Science.

- **Piloting:** I piloted the instruments used to collect data to ensure they are accurately designed to serve the intended purpose. However this did not go the way I planned because the appointment with my first pilot teacher did not materialise as she had to attend to other commitments, instead I had to look for a replacement.

- **Post observation:** As a way of increasing the validity of the findings, some aspects from the observation are clarified. The stimulated recall interview, however, happened informally on the way to the staff room, because there was not enough time to do it as planned. I feel it was done in a rush as teachers are very busy.

3.11 LIMITATIONS

- A possible limitation I found in this study was the time constraints and the small scale of the research study, thus the results cannot be generalized.
- Another limitation that I found crucial to my study was that I conducted the research as a novice researcher because it was the first time I have ever embarked on research of this kind.

3.12 CONCLUSION

In this chapter, I have shown and discussed my research methodology and procedures that I used to collect data which are relevant to my research question. I also discussed how I analysed the data and the strategies that enhanced my findings. I have discussed and outlined how I dealt with ethical issues during the data collection process.

In the next chapter, I give details on my findings from the semi-structured interviews, lesson observations and document analysis. This is done by identifying patterns, trend and themes as recommended by Rossman and Rallis (as cited in Creswell, 2003).

CHAPTER 4

DATA PRESENTATION AND ANALYSIS

4.1 INTRODUCTION

This chapter reports on the findings gained from the semi-structured interviews, observations and document analysis. As indicated in chapter three, I discuss the findings from the collected data by identifying patterns, trends and themes (Rossman & Rallis as quoted in Creswell, 2003). The discussion is influenced by my research question "How do Grade 10 Life Science teachers understand and implement project work"? I have identified six categories that emerged from the data that best describes the teachers understanding and implementation of projects. The framework of this chapter is as follows.

In the first section, I present the results taken primarily from the interviews. I include the profile of the schools and teachers; the teachers' understanding of projects in Life Science; the views about the roles and the benefits of projects in Science as well as the challenges they experience in implementing projects.

In the second section, I describe the implementation of the projects in Life Science. I use the data compiled primarily from the observation although it is also informed by my analysis of various documents. In the final section, I discuss specific data collected from the documents.

4.2. THE PROFILE OF THE SCHOOLS AND TEACHERS

This section presents a contextual analysis of the two schools and the two teachers who participated in this research. The schools and the participating teachers have pseudonyms for the sake of confidentiality, privacy and anonymity. In the table below, I present the information on the profile of the two teachers including their qualification and their teaching experience.

Table 4.1 Profile of teachers including their qualification and teaching experiences

Teacher	**School**	**Sex**	**Qualification**	**Subject taught & grade**	**Teaching experience**
Magano (pseudonym)	Shiingulu High school (pseudonym)	F	Diploma in Biology	Life Science 8-10 Agriculture 8 Art 10	24 years and 14 years (Life Science)
Tulonga (pseudonym)	Kuthenga Combined school (pseudonym)	M	Basic Education Teachers Diploma (BETD) and Mathematics and Science Teachers Extension Programme (MASTEP)	Life Science 9-10; Agriculture 9-10	11 years

Table 4.1 shows that the two teachers I worked with in my study are one male and one female. The first teacher is Magano, a teacher at Shiingulu High school (HS) a semi-urban school about 20 km north of Ondangwa town. This is one of the older high schools in Oshikoto Region and is a boarding school. There are 374 learners and two Grade 10 classes comprising 75 learners. Each grade 10A and B have a total of 38 and 37 learners respectively. The school has five laboratories

for Biology, Life Science and Agriculture, Physical Science, Languages and Computer study. All the laboratories are well equipped.

Magano started teaching in 1984 and she has taught Life Science for fourteen years. She specializes in Natural Sciences as she possesses a Diploma in Biology through the University of Namibia obtained in 2006; therefore she is qualified to teach Life Science. However it is interesting to note that, despite teaching Life Science, Magano did not study to become a Life Science teacher. During her initial teacher training she wanted to specialize in Languages. She was motivated and inspired to love the subject by her Life Science teacher in the college. Currently Magano is teaching Life Science at the Junior Secondary phase (Grade 8-10) and at the same time serves as a Life Science facilitator in her circuit. The subject Life Science has four lessons per week with forty minutes a period. It is worth noting that Magano also teaches Agriculture in Grade 8 and Art in Grade 10.

The second teacher is Tulonga, a teacher at Kuthenga Combined School (CS). The school is about 25 kilometers east of the town of Ondangwa. There are 372 learners and 23 teachers. Though the school offers computer studies it was interesting to note that none of the six computers is functioning. The Science equipment is kept in a store room which is used by the teacher only; as there is no Science laboratory. Experiments take place in the classroom, which can be dangerous and present a risk to learners. At Kuthenga Combined school there are two Grade 10 classes with 63 learners of which each class (A and B) has 31 and 32 learners respectively.

Tulonga is a qualified teacher as he specialized in Sciences. He possesses the Basic Education Teacher Diploma and attended in-service training in the Mathematics and Science Teachers Extension Programme (MASTEP) He obtained this qualification in 2006. He has eleven years of teaching experience and teaches Life Science and Agriculture Grade 9-10. Tulonga transferred to Kuthenga CS in January 2008. He also taught Life Science at his previous school. Tulonga likes teaching Life Science topics such as ‘Human biology and Ecology’ where he sees himself as a co-

learner, learning many things he regards as being important in life. He indicated: *"I learn the symptoms of certain disease, how to treat and overcome the disease and also learn the relationship between living and non-living things"*. Life Science has four lessons a week with forty minutes a period.

4.3 TEACHERS UNDERSTANDING OF PROJECTS IN LIFE SCIENCE

In this section, I first present an analysis of how teachers view and understand projects. The data from this section is generated from the interviews with the two teachers. The findings include the ways these teachers interpret the policy relating to projects and how they articulate their conceptual understanding of projects.

4.3.1 The definition of a project

Both teachers have a shared view or a similar understanding of what a project is. Responding to the question of the difference between a project and an investigation, Tulonga responded as follows: "*a project is referred to an activity given to learners that can take many days to complete and counts thirty marks",* while an investigation *"can only take one or two days to complete and counts ten or twenty marks"*. Magano on the other hand sees both a project and an investigation as a practical investigation but the difference is that a project is a "*longer assignment which can take from a week to a month and counts twenty marks* while an investigation *can be carried out within a day or two and counts fifteen marks"*. She adds that in a project all the four assessment skills such as planning, practical techniques, observation and conclusion are assessed; while in investigation only three skills are to be assessed. Tulonga did not mention assessment skills. It is interesting to note while neither teacher gave a broad definition of a project, they showed an understanding of its meaning in the context of the description in the syllabus. Magano added to the shared definition of a project saying:

> *In carrying out a project, the teacher acts as somebody who assists learners when they are doing the project while the learners' roles are to do the project on their own, collect data and come up with their product.*

She further emphasized that in project work "*learners work on their own most of the time, unlike an investigation where the teacher should always be closer to the learners"*. It was noted that both teachers indicated that carrying out a project is a requirement of the syllabus and should be undertaken in the second term of each year.

4.3.2 Planning and selection of the project

When asked to explain how they plan projects both indicated that they intend to use the syllabus to plan the topic, because they teach according to the basic competencies from the syllabus to reach the syllabus objectives. Both teachers indicated that projects are completed by the learners outside of normal lesson times and take about a week to complete. Tulonga explains how he plans a project as follows:

> *I am going to choose the topic Human skeleton under the theme Human Body from the syllabus which I see is easy for learners to get materials. I also prepare the worksheet with instruction.*

He further adds:

> *I will give learners instructions and let them work on their own, collecting materials such as a 30cm to 60cm piece of box/poster, a knife/scissor, an eraser, a pencil and a pen and bring them to school.*

Similarly, Magano explained:

> *I'll plan the project in the way that I choose a topic Respiratory system under the theme Human Body from the syllabus, and then prepare a worksheet which learners use during the execution.*

She added that:

> *I'll give learners a project task to make a lung model. I choose that topic because the model that learners are going to construct assists the learners to understand how things really happen compared with models.*

Both teachers indicated that they planned the activity in a manner which gives the learners an opportunity to work mostly on their own and that the learners are responsible for collecting their own materials from various sources in their environment. The teachers' choice of project topics are not selected from those listed in the Life Science textbook but from the syllabus. Magano also indicated that she would tell her learners *"to use different books especially the Biology books to search for the relevant information for the project in question"* while Tulonga stated: *"I will tell my learners to look at the picture and follow the instruction given on the worksheet to be provided"*. Both Tulonga and Magano indicated that learners worked on their projects in groups. Tulonga's approach was to have the learners do the set task individually and do their presentation in groups. Magano expects his learners to work collaboratively throughout the project process.

4.3.3 Preparing learners for a project

The two teachers did not see that there is a big difference between the two terms; planning and preparation indicating that the "*two go hand in hand*". According to them, planning takes place before the lesson presentation while preparation takes place within the lesson presentation in the

classroom. The two teachers indicated that after planning they prepared their learners for carrying out the project. Both teachers indicated that they first tell their learners what is expected from them when carrying out the project. Tulonga said that he told the learners that the activity that they did contributes to their continuous assessment; therefore they need to be serious about their work. In the same vein, Magano claimed:

> *If they are not serious with their work, then they will not score good marks for their assessment therefore I will urge everybody to be active involve in doing a project.*

She indicated that she asks all learners to put in as much effort as possible and "*come up with something that is conveying good information and that gives clear message"*. Both teachers indicated that they went through the instructions with learners and clarified things that were not clear. Tulonga indicated that:

> *When giving project work to learners I make sure the instructions given are clear and understandable to all learners. I also make sure that learners have used the correct equipment for example to observe the insects.*

Learners at both schools were requested to follow the instructions as per given worksheet.

Tulonga indicated he gave explicit instructions about the materials that the learners would need to construct the proposed model while Magano indicated that she asked *"the learners to consult the necessary materials by referring to the diagram in the worksheet"*. Both teachers indicated that they invite learners to ask questions for clarification. This took place at the end of the lesson. Neither school indicated that money is allocated for implementing projects

4.3.4 Assessment of projects

Both teachers confirmed that they assessed the learners' projects, however, each teacher interpreted the assessment criteria provided by the syllabus differently. Magano indicated that she followed the mark allocation for projects as set out in the syllabus, but given there are no performance criteria indicated specifically for projects in the syllabus, she used the performance criteria for practical work which includes "*planning, practical techniques, observation and conclusion"* (Namibia. MoE, 2006a). Tulonga on the other hand uses a rubric which he considers a good reflection of the task provided and allocates marks for the construction of the proposed model as follows: *"drawing (10 marks), using of tools (10 marks), labeling (7 marks), punctuality (1 mark), creativity (1 mark) and neatness (1 mark)"*. It is important to note first, that the mark allocation for projects in the syllabus as well as the marks allocated by the teachers does not exceed thirty marks, and second that the range of performance criteria is limited given the much broader range identified in the broad curriculum and in the Life Science curriculum preamble.

4.3.5 Benefits of projects in science

In the following section, I present the teachers' responses to the question regarding their views about the benefits of projects. It is interesting to follow their responses in the light of their explanation of how they plan and prepare for projects.

Magano responded to the question relating to how learners benefit from doing projects, that "*learners can touch and do rather than just listening and copy information from the chalkboard"*. In addition, Tulonga emphasized that a learner doing "*hands on activities when touching and sees the real things, one will always remember what she or he saw, touches and does"*. Both teachers have identified investigation as an important tool for learners in project based learning. Though Tulonga and Magano were from different schools it is interesting to note that they both indicated "*handling of apparatus"* and "*observation"* as skills that developed in

learners through carrying project work. Magano adds "*learners will develop the skill of drawing and able to follow instructions on their own"*.

Furthermore, Magano said:

> *Learners have developed positive attitudes of carrying out activities and the love of doing it"* and *"the activity has strengthened the learners' spirit of working together as a group; help each other and share ideas which in turn make things easier for them.*

These responses focused primarily on practical applications related to carrying out particular sets of instructions. This focus is understandable given the nature of the projects, which is constructing models. Both teachers also mentioned the role these tasks have as group activities in developing social and interactive skills and values. Although the notion of investigation is mentioned neither teacher elaborated on this aspect relating to projects.

4.3.6 Problems experienced in carrying out projects

Responding to the question of the problems experienced in carrying out projects both teachers indicated that apparatus such as microscopes were insufficient and that insufficient time hampered the observation for every learner within a forty minute period. In this instance teachers once more reflected that they perceive "projects" as closely related to practical work notwithstanding that projects were identified as "longer tasks" In addition Magano emphasizes that lack of enough apparatus encourages copying as "*some learners do not want to do things on their own; they wait for others to finish and then copied from them"*. This they said placed a limitation on the sorts of projects that are possible.

The other problem experienced by Tulonga in conducting projects was that "*learners do not comply with due dates"*. He further indicated that "*some learners always rush on the last day to finish their tasks; therefore I decided to allocate one mark for punctuality"*. In addition Tulonga

stated that some learners end up not handing their projects to the teacher and as a result, it has an effect on their assessment as well as their performance.

Both teachers mentioned group assessment as problematic. According to Tulonga "*there was no need to assess in groups, because even if you allocate marks to the whole group you have to give individual marks"*, while Magano explained that "*I found it difficult to assess group work because I felt that I was not doing justice to all learners because of the large classes"*. She said she finds it difficult to walk around and see what is happening in all the groups. It is interesting to note that Magano did not only experience difficult in assessing large classes but also that of group work as "*some learners tend to dominate others and some are just sitting in groups and doing nothing"*.

The challenges and difficulties identified by the teachers are those that are common to all tasks that require learners to work independently and that are dependent on having an adequate supply of equipment and materials. These responses are another reflection of how these teachers perceive the nature and role of projects in the context of Life Science.

4.4 TEACHERS IMPLEMENTATION OF PROJECTS IN LIFE SCIENCE

In this section, I present how the two teachers implemented project work in the Life Science programmes I observed. Accomplishing a project such as an investigation involves five stages namely planning and preparation, execution, presentation, feedback and assessment. I discuss how each stage is carried out by Tulonga at Kuthenga CS and by Magano at Shiingulu HS preceded by a general description of the lessons that I observed.

4.4.1 General description of the lessons

The observations I discuss are based on two lessons in each of the teacher's classes. The lessons are not concurrent, but refer to the lesson used to prepare the learners for the task and the lesson set aside for the presentation and feedback. There was a week between the preparation and the feedback lessons, because teachers gave learners a week in which to do the project. It was impossible for me to come to the class in that intervening week and the teachers said that they did not really intend to spend time on projects until the feedback and presentation lesson.

The project task at Shiingulu HS was to "make a model of the human lungs" under the topic "respiratory system" and the project task at Kuthenga CS was to "make a model of the human skeleton" under the topic "human skeleton". Both teachers started by explaining the details of the task, rules, materials and assessment criteria. Learners at both schools based the projects on the pre-prepared worksheets. The projects at both schools are carried out outside the classroom and it takes learners about a week to complete their task. It is interesting to note that learners at both schools collected their own materials using waste materials from the environment and were encouraged to get support from teachers and parents.

4.4.2 Detailed description of teachers' lessons

A detailed description follows of both lessons under each phase, e.g. planning and preparation, execution, presentation, feedback and assessment.

4.4.2.1 Planning and preparation

The Respiratory System Project

The observed lesson at Shiingulu HS took place in Grade 10A with 38 learners. Magano, the teacher, followed the syllabus when planning her lessons. She was teaching the topic "*Respiratory system"* under the theme "*The Human Body"*. The lesson objective indicated in the syllabus under this topic requires learners to be able to "*discuss the significance of the features of gaseous exchange for the maintenance of life".* It must be noted that Magano's selection for the task was taken from the practical activities, approaches and demonstrations that are listed in the syllabus under the topic respiratory system which states "*make a model of a respiratory system using a two litre bottle"* (Namibia. MoE, 2006a: 32), rather than from the suggested investigations and issues–based activities identified in the Life Science textbook.

She constructed the project in three parts: In the first 40 minute period, based in the classroom, she prepared the learners for executing the project. The second part was devoted to the learners carrying out the project by working in their own time outside the classroom, for example in the library, and were given a week to complete it. In the third phase, the learners returned to the classroom for another 40 minute period for the group presentations of the projects and for feedback and assessment.

In the first period, she started the lesson by reminding the learners that they had discussed "breathing" in the previous lesson. She then related the previous lesson to the model that they were to construct. Learners are told that the project they do is a requirement of the Life Science syllabus.

She had prepared a worksheet on "Making a lung model" and asked learners to do the activity guided by the worksheet (Appendix 4A). Learners are asked to consult relevant resources including those from the library. She told them that the project would take a week to complete. She also told them that the worksheet would be distributed after the lesson. The reason for this was because the power was off at the time so the photocopier was not operating. She informed

the learners that by doing the project they would be learning different scientific skills such as observation, analysis and problem solving.

Learners were divided into six groups and the teacher urged everybody to be actively involved in the project and put a lot of effort into coming up with something that conveyed good information and gave a clear message. She also requested the group leaders to make sure all their team members had a role to play when carrying out the project. The teacher told the learners that all the relevant parts noted in the worksheet, such as windpipe, lungs, diaphragm, bronchi and chest cavity should be presented as part of a model.

Lastly, she told the learners to follow the instructions carefully and come up with conclusions which read "*in your conclusion, state the shortcomings of your model which makes it different from the real part of the body"*. The teacher also informed the learners about the assessment strategy used and wrote down the assessment skills on the chalkboard. The four skills for practical assessment assessed within the given project at Shiingulu HS are:

- Planning: This was explained as the need to include the way learners planned to collect information, execute it and present the completed model
- Observation: The explanation here focused on the need for the learners to show their ability to observe "*what is happening*" and during demonstration learners should be able to explain "*what is happening*".
- Practical techniques: Here, the learners were expected to show and explain how they organized their materials and apparatus they had collected.
- Data evaluation: Magano explained that learners were expected to come up with the purpose of the model, be able to show how the system works, be able to explain the similarities and differences between the model and the real organ and were expected to draw conclusions from their findings.

Magano's assessment scheme followed that of the syllabus (Namibia. MoE, 2006a: 39). Following the completion of these instructions, still in the same period, Magano's learners discussed how to approach the task and were invited to ask questions of the teacher relating to

the task before its execution. One example of a learner's question was: *"Miss, are we going to include the chest as part of our model?"* The teacher made it clear to the learners that "*I provided you with the picture of a lung model in the worksheet and only the parts that are in the picture should be part of the model"*. At the end of the lesson, the teacher and learners agreed on the due dates for the submission of the project. Magano requested learners to comply with the due date and be ready for the presentation a week later.

The Human Skeleton Project

Tulonga taught the Grades 10 (A and B) with a total number of 63 learners. Tulonga at Kuthenga CS taught the same theme "*Human Biology"* as Magano but a different topic. His topic was also taken from the syllabus and it was based on the topic "*Skeleton and muscles"*. Its objective reads as follows in the syllabus: "*discuss how the skeleton and muscles are organized to support, protect and move the body*" (Namibia. MoE, 2006a: 30). As can be seen from the topic and objective the two aspects – skeleton and muscles - are coupled and can be taught together, Tulonga however preferred to deal with the *skeleton* first. He decided to teach the topic through constructing a model although the syllabus did not specifically indicate the practical activities, or approaches for the topic under study. He prepared a worksheet as a guide for the learners for the activity (Appendix 4B).

In the first period, he informed the learners that they had finished with the last topic and they were to begin with the next one. Tulonga wrote down the topic "*HUMAN SKELETON"* on the chalkboard in big letters. He asked learners to give their understanding of the term skeleton and its functions. The learners responded with answers such as "it *supports and gives shape; for protection, for movement"* and the teacher wrote the responses on the chalkboard and told them that they are going to discuss the functions in detail once the project is completed.

He distributed the worksheet to each learner telling them that they are going to do a project on the topic '*make a model of a human skeleton*" as specified in the worksheet and that it would take a week to complete. The learners would do the project individually. The worksheet was compiled in a way that specified the materials needed and gave precise instructions to learners on what to do. Tulonga also told the learners exactly what materials they would need, identifying the following "*a 30cm x 60cm box or flipchart, a pair of scissors/knife, a rubber, and a pen/pencil"* for their project.

He demonstrated step two of the worksheet upon the learners' request, which read "*use a knife and a pair of scissors to carefully cut off the drawing lines from the rest of the bones"*. He asked the learners to use letters to indicate the body parts on the model instead of writing the name of the parts; for example "*letter A is for the skull, letter B is for the knee joint, ribs is letter C, vertebrate is letter D"* and so on, as it was indicated in the worksheet (See Figure 4.2 & 4.3). There was not much that learners did during the preparation period, instead the teacher read the whole worksheet to them and invited questions for clarification. The only questions asked were for the teacher to repeat the steps and to clarify them.

He then requested learners to come up with "*nice models that are really like a human skeleton*". Learners were told that the project contributed to their continuous assessment and they were assessed according to their performance, but he did not give them the criteria for the assessment. He asked the learners to hand in their project the day before the due date in order for the teacher to see the progress of individual learners. Near the end of the period, learners were given a chance to ask questions for clarification.

During the preparation stage, the teacher did not indicate to the learners whether the project was to be presented. I asked him, during an informal discussion after the period, what he did with the projects when the learners handed them in. He then indicated that he would tell the learners the next morning.

I noted that both teachers selected, designed and developed the tasks with no involvement from the learners at all. All learners in each class observed are expected to do the same task so no choices are provided. The prescriptive approach adopted meant that the learners' role was limited to executing the given task by:

- Obtaining suitable materials and the necessary equipment to construct the model
- Organizing the task as individuals and as a group
- Managing their time according to the allocated time frame given
- Interpreting the instructions
- Applying the instructions to the construction of the models
- Applying the textbook information on the lung function and the composition of the skeleton to the model
- Manipulating the materials
- Making decisions related to the construction process and to the presentation
- Keeping a record of the process

4.4.2.2 Execution

This part of the section was devoted to the learners who worked on their own. The learners completed their project task outside the classroom. The teachers informed me that during this stage the learners worked on their own, deciding on how to carry out the activities, how to collect materials, how to come up with the final product and how to conduct their presentation. Both teachers indicated that they were available to assist the learners.

Even though the learners were scattered outside the classroom around the school environment searching for the relevant materials for their projects, it is worth noting that both teachers indicated that they made sure that the learners were on task and did the projects. They said they did this by going to where the learners were working to see how the learners were doing with the help of the group leaders. This made it easy for the two teachers to control and supervise the learners.

4.4.2.3 Presentation and feedback

This was the third phase of the task where the learners returned to the classroom for the presentations, feedback and assessment of the projects. I mentioned earlier in the preparation stage that Magano requested her learners to be ready for the presentation, but Tulonga informed his the next day.

Magano's groups

The six groups presented their project titled "lung model" within the one week time frame. The teacher together with the learners agreed on the time (seven minutes) for each group to cover their presentation. The learners were reminded that after each presentation they could comment and ask questions. Magano then listed the four assessment criteria on the chalkboard and asked the learners to base their assessment on the planning, practical techniques used, the explanation given and the reflection provided by the presenters.

All the groups were asked to bring their models to the front of the class before presenting them. The teacher indicated that the reason for having the projects displayed in front of the classroom was a strategy to ensure that learners paid attention to the presentations. She instructed the

learners to listen closely to the presentations, as everybody was required to take part in the feedback session which was to follow after each presentation.

The groups used a variety of different materials such as straws, plastic sheets, balloons, 2 litre bottles, cello tape, bottle tops and a glue stick, which they collected themselves to construct their models guided by the picture in the worksheet. Both groups used straws to represent the trachea and the bronchi. Four groups used the following materials to make the lung model: The indented figure of eight plastic 2 litre bottle to represent the rib cage or chest cavity; medium sized balloons to represent the lungs; a plastic container to represent the diaphragm; bottle tops and a glue stick to seal the opening of the 2 litre bottle. The other two groups used an oval shaped 2 litre bottle representing the rib cage or chest cavity; small balloons representing the lungs, a plastic book cover to represent the diaphragm and the glue stick to cover the opening of the 2 litre bottle. Both groups used cello tape to fasten the plastic cover to the 2 litre bottle.

FIG.4.1: Examples of the lung models constructed

Two female learners representing one group went in front of the classroom to present their model; one was holding their model while the other one presented their findings. The presenter started by introducing the group and the project by indicating that it was an "*assignment from the teacher"* They then explained the construction of the model describing how they had followed the worksheet instructions. After which the presenter explained how the model represented the actual organs. The learner who was holding the model demonstrated how the model worked. After the presentation, the presenter invited questions and comments.

Four of the groups gave a detailed explanation of the models. They described the planning, the construction and how the model worked, while two groups restricted their presentation to a short explanation of the models. One group's demonstrator confused the contraction of the plastic sheet (diaphragm) and the deflation of balloons (lungs) and vice versa. I also observed that one group did not conclude the presentation as required by the worksheet. Three of the groups did not include the required reflection on the process. I noted that the four models that used small balloons did not give as good a result as the one with the bigger balloons, because it was difficult to see the deflation and inflation of the balloons.

Feedback on the models in Magano's groups

After each presentation, Magano asked the groups not presenting to ask for clarification or to add anything important was omitted during the presentation. When there was no response, she asked the presenter to conclude their presentation. The one presenter's conclusion was this, "*because it is impossible for us to cut a human being and show how such system works we decided to make a model to demonstrate how the breathing system works"*.

In the absence of responses from the learners, Magano asked them to give the differences and similarities observed between their models and the real respiratory system. One learner responded "*one shortcoming of our model was that some parts like a heart, pleural membrane and an abdominal cavity were not present in their model"*. The teacher again invited questions from the other groups, but with no responses. She then invited learners to assess each other's

work after each presentation and to provide positive and negative comments (See the detailed assessment at 4.6.2.4 of this chapter).

In each group in Magano's class there was one spokesperson and one to manipulate the model, while the other learners were allowed to contribute if they so wished. The groups read from their notes when presenting their projects and demonstrated how their models worked.

The detailed presentation of Tulonga's lessons in each class (A and B) is as follow:

On the day that I returned to Tulonga's classes to observe the presentations and feedback six groups in the first class were ready to present their models. Tulonga had organized the presentations by allocating each learner to a group. The group had to choose one of the individually executed models for the presentation. Each presenter was allocated 4 minutes to explain how they obtained their materials, whether they received any assistance from somebody either from home or at school and how they had constructed their models. The following is an example of one of the presentations.

> *We were given a project. We go home ask materials from parents, fortunately materials are available. Apart from parent assistance our teacher assists us also. We want to thank our parents and the teacher who help us do our project. This is how it looks like (show it to the other groups).*

FIG.4. 2 shows the model of the skeleton constructed by group 1 learner for 10B

The rest of the presentations in Grade 10 B followed a similar pattern.

Presentation in grade 10A

After Tulonga greeted the learners in the second class he asked them if they were ready to present their work. He asked for volunteers and when he got no response, he called on the groups to send their chosen presenter forward.

The following is an example of how the groups presented in grade 10A

> *I come here to say something about the project that we are given on 02 June 2008 by our Life Science teacher. It is a project of a human skeleton. He gives us to make a skeleton even to make it with box, wires and also sheet. Some were using box that we get from cuca shop free of charge, some materials were borrowed from the teacher. In our group no one used a wire. First we start to cut a piece of box the length of 60cm and width of 30cm. we start to draw a skeleton compare with what we were given start from the skull, vertebrate and going to pectoral girdle, ribs, elbow joint, pelvic girdle up to knee joint and we finish the skeleton. The problem we experienced was to cut out the ribs. Here is the skeleton (show their model to the whole class).*

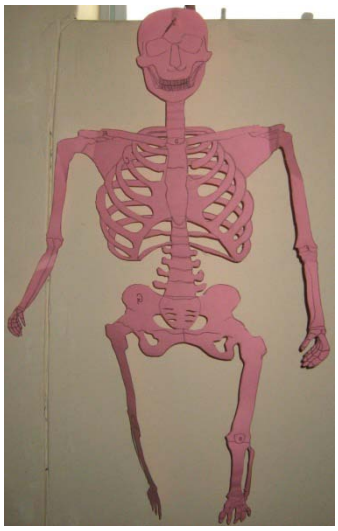

FIG 4.3 shows the model of the skeleton constructed by group 1 learner for 10A

There were twelve groups in the entire grade 10A and B. Seven of them used hard cardboard to make the project of a human skeleton and a pair of scissors to cut the lines while five groups used flipcharts and knives. Both groups drew the skeleton parts first and later used 'Koki' pens to draw big lines which made it easy for them to cut (Fig. 4.3 & 4.4).

Having looked at these projects, both grades did the sketch on a poster or box, cut out the skeleton and then mounted it. The final product was not really a model but a two dimensional poster. The observation showed that, from the twelve groups who took part in making the model of a human skeleton, only one of them gave a detailed explanation and showed an understanding of how projects should be presented. Eight of them revealed a limited understanding of the task while three of the presenters had very little understanding of either the task or how to do the presentation. This was evident in the example given of the Grade 10B presentation. Both groups read from their notes but provided no additional information from the presenters. The final product of the model varied considerably because three of them were not cut out carefully. Instead of cutting the ribs the group shaded the parts that were not needed. Two of them did not use the measurements as indicated in the worksheet, which skewed the scale. Seven groups could be regarded as satisfactory because they used their material well and constructed a good poster as shown by the sample of the photograph in fig 4.3 and 4.4. I however observed that most of the learners did sketches rather than a model.

In Tulonga's classes, not all learners were able to present as one presenter was selected in each group and as the models were constructed individually there were no opportunities for any form of collaboration in the course of the process.

Feedback in Tulonga's Grade 10 A & B

After all the Grade 10B groups presented, the teacher asked the whole class if they wanted to say something about the presentation. After a long silence, the teacher asked the members of the group this question: "*Did anybody get hurt by the sharp objects when carrying out the project?"* After a no response from the group members, he asked the learners to write their names on their models and give them to him for assessment.

After all the group presentations in Grade 10A the teacher asked learners if they wanted to say something about the presentations. One learner asked "*why did group 2 not tell us where they start with their project?"* and one asked *"Why they don't cut out ribs?"*

The Group 2 presenter then explained in detail how he started from the skull to all the parts of the skeleton and clarified that there is no space to cut out ribs, therefore "*I shaded with a pencil to show that the shaded part is not part of the model"*. The teacher then asked learners to also give positive responses not only questions. He asked all learners to bring their model with their names on. He took the models with him to the staff room for assessment. In this part of the lesson, the observation showed that there was little involvement in giving feedback by either the teacher or the learners.

4.4.2.4 Assessment

Magano's Group

In Magano's class, assessment was done after all the groups had presented. The assessment was based on the four areas identified. The peer assessment occurred through an open discussion between the teacher and the groups. Groups were invited to indicate their assessment of their peers and the teacher contributed to the discussion. The final marks for each group were finalized

through the discussion. It was noted that at times the teacher concurred with the allocation of marks and at other times mediated mark allocation.

The learners were asked to justify their mark allocations. The justification provided by the learners regarding the actual presentations revealed that they were aware of the conventions pertaining to presentations relating to audience contact and in general to public speaking. They also revealed that they were able and willing to make judgements based on evaluating the quality and accuracy of the models.

Based on the discussions an example of the mark distribution for one of the good presentations was as follows:

Table 4.2: Distribution of assessment marks

Assessment skills	**Marks**
Planning and presentation	4
Practical technique	5
Observation	4
Conclusion	3
Total	**16**

Tulonga's lesson in grades 10 A & B

Tulonga did not give clear assessment strategies for the presentation and no assessment was done during the feedback session. Tulonga, however, indicated to me that he awarded 5 marks to learners for their presentation skills. Learners were not aware that assessment took place and what was assessed. For the final assessment marks that he recorded in the CA record form, he indicated that he used the rubrics to award marks to individual learners as follows.

Table 4.3: Rubrics used for assessment

Assessment Skills	Marks
Use and organizing techniques, apparatus and materials (including presentation)	10
Observe, measure and record	10
Handle, process and evaluate experimental observation and data	5
Plan investigation	5

Tulonga did not provide the learners with the assessment criteria or the rubric at any time during the process and only drew up the rubric when I asked for it because I wanted to know how he awarded marks. From the observation, the two teachers differed in the assessment strategies. Magano used peer assessment where she involved learners in giving marks to others, while Tulonga's learners did not take part in assessing each other's work. Even though both Tulonga and Magano teach the same subject, their approach to assessment differs when it comes to the use of the skills that are listed in the syllabus. The Life Science syllabus (Namibia. MoE, 2006a) clearly stipulates that a total of fifteen or thirty marks is awarded to the project. Magano awarded twenty marks to the project, which she later scaled down to fifteen so that it corresponds with the Continuous assessment record form and Tulonga awarded thirty marks for his project.

4.4.2.5 General Feedback

This section presents how Magano and Tulonga provided their learners with general feedback after the project presentations.

Magano's general feedback to her class

Magano began her feedback on a positive note by thanking all the groups for an '*excellent job done'*. She then referred to the following aspects, saying the learners should:

- always follow instructions whenever they do a project
- always keep eye contact when presenting
- rehearse their presentation
- work together and help each other during presentations
- find out whether the model functions
- make their conclusions short and to the point
- check whether the aim was reached

She emphasized that drawing conclusions in a project is very important explaining, "*you are required to just repeat in short summary of what was done, why and say the shortcoming?*" She then requested them to leave their worksheets and their product behind for final assessment.

Tulonga's feedback in Grades 10 A and B

This was not observed during the presentation stage; however Tulonga indicated that he gave an overall feedback the next day for both Grades 10 A and B. Learners copied the following points down into their project books. The teacher indicated that he urged all learners to keep the points in mind when doing future projects. They are as follow:

- Models should be clear and big enough
- Be serious about your work
- Project marks contributed to the Continuous assessment

- Be well prepared
- Share and agree on what to say before the presentation
- Choose somebody who is confident to present.

4.5 DATA COLLECTED FROM THE DOCUMENTS

4.5.1 Links with syllabus and project implementation

As indicated in Chapter two, the syllabus is the official document which outlines the intended learning outcomes and assessment practice for both the subject and the grade (Namibia. MoE, 2006a). Furthermore, the syllabus identifies the themes, topics, aims, learning objectives and competencies for the Life Science curriculum. This study shows that both teachers who participated were in possession of the current Life Science syllabus. Tulonga and Magano used the syllabus to plan their projects by selecting the topics. They used the syllabus to identify the objectives and basic competencies when developing their projects, an extract from the syllabus is included in Appendix 5A & 5B.

However, as indicated in Chapter two, the Life Science syllabus also requires learners to understand and make sense of specific terms in science such as: analyze, compare, distinguish, interpret, list, suggest, predict, sketch, outline, evaluate, discuss, investigate, explain, study and describe. It is through these scientific terms a learner develops the life skills competencies of investigating, interpreting, applying knowledge and skills, communicating and participating. As the study showed, the key words related to problem solving were not used as teachers asked learners to organize tools, construct a model, observe and measure.

4.5.2 Lesson preparation

The findings from the study indicate that both Tulonga and Magano plan their lessons daily. They use the same lesson plan format (Appendix 6A & 6B) which they normally use for other lessons topics, because there was no a specific lesson plan format designed for projects and other practical activities. However as indicated earlier these lesson plans did use the syllabus to identify the objectives. Further, these lesson plans indicate the resources and materials used as well as the assessment strategies used when carrying out the tasks, tests, assignments, investigations and projects.

As indicated in the previous section, the assessment strategies relate more to practical assessment than project assessment. Therefore, the nature of these lesson plans inhibits the development of projects. The lesson plans however do include an expectation from the teachers that learners will provide some form of critical analysis linked to the project in that they have to explain to their peers what they had done when presenting their work.

4.5.3 Learners' work

When doing a project, it is important that the project topic is of interest to the learners enabling them to demonstrate application of knowledge, understanding, and inquiry skills. It is possible to develop these skills through learners' activities. As indicated in Chapter two, the syllabus requires learners to do two practical investigations, two topic tasks, two topic tests during the first and second terms and only one project in a year. My observation of the learners' work at the time of the study revealed that they had completed the required two practical investigations, two topics tasks and tests. Both teachers set a project for learners to do during Term two as stipulated by the syllabus. I looked at the learners' work with the view to comparing the tasks referred to as project work.

The topic tests focused on the learners being able to recall facts in detail. There was very little focus in these tests on explanation and almost no marks allocated to application, discovery and problem solving. The topic tasks however focused on learners having to explain and describe particular processes. However, there was neither application nor evaluation included. The practical investigations were based on science experiments that the learners had done in class. Although these were linear, they provide learners with the opportunity to describe, observe and to explain scientific phenomena.

4.5.4 CA record form

The CA record form (Appendix 7A & 7B) is one of the necessary official documents that teachers use to record the marks for formal assessment. Formal assessment includes a variety of tasks that include short tests, quizzes, projects and examinations. The CA record form ensures the easy accessibility of recorded marks for both formative and summative continuous assessment. Teachers are implementing the assessment policy successfully if they carry out the number of tasks required. However, the current CA form does not include any particular assessment criteria. Although, quality tasks are those that require learners to demonstrate their mastery of learning objectives and competencies in the syllabus, there are no records kept of the learners' performance criteria in projects that are assessed during the academic year. These criteria only appear on the learners' assessment sheet. In the study, Magano did however use a rubric of the performance criteria while Tulonga did not. Therefore, unless teachers choose to use these performance criteria, there is no evidence of how the competencies are actually being developed.

In Chapter two I explain how the syllabus requires the teachers to record four practical investigations, one project, six topic tasks, six topic tests and three end of term tests in the CA

form each year. At the time of this study, each teacher recorded two practical activities, two topic tasks, two topic tests, a project and one end of term test on the official CA record form. I noticed that the mark recorded in the CA form corresponds to the marks in the learners' worksheets. It is also interesting to note that Tulonga recorded individual marks while Magano gave group marks for the project.

4.6 CONLUSION

In this chapter, I have presented the findings from the data gathered from the semi-structured interviews, lesson observation and document analysis. The findings that I reported link to the research question of how teachers understand and implement projects in Life Science. In the next chapter, I discuss the findings under the themes that emerged from the presentation. These themes were framed by the key indicators from my literature review chapter.

CHAPTER 5

DISCUSSION OF FINDINGS

5.1 INTRODUCTION

In this chapter I discuss the findings arising from the themes that emerged from the data analysis. These themes were influenced by the topic studied. In the discussion I link the findings to my literature review. The analysis of the data is done in two parts: the first part relates to the teachers' understanding of projects – the meaning they make of them, their perception of their role and value, and their views about the challenges. This section will also provide a platform from which to look at implementation.

The second part of this chapter will look at the implementation of projects. In this section I will explore the following dimensions: the preparation and planning of projects, the execution of projects, the presentation of projects and the feedback and assessment of projects. My discussion will be guided and informed by the indicators identified in Chapter two by Fried Booth (1990); van Harmelen (1991); Henry (1994); Solomon (2003); Powell (2004); Mills (2004) and Namibia. MoE, (2006a).

These are:

- A project is a task that focuses on and includes investigation, problem identification and problem solving, decision making, creativity and innovation;
- A project is designed and developed to help to develop learners as autonomous thinkers, self-reliant learners and critical thinkers;
- A project focuses on learners' conceptual development in the context of the enquiry by providing opportunities for learners to describe what they are investigating, to explain

processes, to give reasons, and above all to apply relevant knowledge to the situation being investigated;

- A project needs a week or longer to complete;
- Learners are encouraged to choose their own topics;
- Learners are expected to work independently;
- Learners are encouraged to select their own material;
- Learners are expected to produce a product and to present their own work;
- Teachers are required to act as advisors;
- Feedback is required from both teacher and learners;
- There should be an involvement of learners in peer assessment, and
- General summative feedback is required from the teacher.

While it may be argued that the term project is open to a wide variety of interpretations and applications, in the context of formal education and in particular in relation to projects in Life Science, the above indicators encapsulate the characteristics that identify projects as a unique approach to learning.

5.2 UNDERSTANDING OF PROJECTS

In this section, I first discuss the teachers' theoretical understanding of project work, what teachers understand by the term "project" and how they see it as different from other practical activities. I also look at how teachers perceive the role and value of projects. Finally, I examine the challenges teachers face in carrying out projects. The findings from the documents, lesson observation and interviews showed that teachers' understanding of projects varies with regard to both the concept of a project, and the planning and preparation of projects.

5.2.1 Meaning of a project and roles of projects

The literature identifies a project as a particular type of activity which focuses on planning, investigation, problem solving, participation, observation and analysis, development of personal and communication skills, and of scientific knowledge and skills (Fried-Booth, 2002; Millar, 2004; Namibia. MoE, 2006a; Isai, 2007). Henry (1994), views a project as an investigation where scientific methods are applied. He maintains that learners' interests must be taken into account. Solomon (2003) focuses on the idea of hands-on and authentic experiences, while van Harmelen (1991) sees the project as an inquiry-based form of learning that involves the critical analysis and evaluation of evidence.

When teachers were asked in the interviews to describe their understanding of projects they identified these as tasks that take a longer period of time to complete than other practical activities. As was seen in Chapter four, their view of projects was strongly linked to their understanding of practical work – to the extent that Magano based her assessment of models on the competencies identified in the syllabus for these particular tasks.

Both teachers identified project work as occasions when learners were expected to work independently of the teacher. It might therefore be argued that model making includes many of the characteristics associated with project work. The analysis of the projects in terms of their design and development and execution, however, revealed considerable limitations in their achievement of desired outcomes. This was so despite the teachers' belief in the value of projects, which ostensibly confer the following benefits:

- Firstly, projects allow learners to apply knowledge that they have learned from the curriculum and the real world.
- Secondly, projects permit social interaction and allow learners to learn from this social interaction.

- Thirdly, projects help to motivate both teachers and learners.
- Fourthly, the way in which projects are identified and developed helps to enhance learners' understanding, cognitive skills and values
- Lastly, projects help learners to enhance each other's learning through debating, questioning and other participation strategies, which strengthen their interpersonal and collaborative skills.

An analysis of the learners' actual roles and involvement, as reiterated below, reveals a marked discrepancy. Learners' roles were largely limited to the following:

- Obtaining suitable materials and the necessary equipment to construct the model
- Organizing the task as individuals and as a group
- Managing their time according to the allocated time frame given
- Interpreting the instructions
- Applying the instructions to the construction of the models
- Applying the textbook information on the lung function and the composition of the skeleton to the model
- Manipulating the materials
- Making decisions related to the construction process and to the presentation
- Keeping a record of the process

The apparent mismatch between how the teachers viewed the role of projects and what was achieved in reality reveals the disjunctions that exist in the prevailing system between:

- the individual syllabus content and assessment guidelines, and the syllabus preamble and policy as identified by the Broad Curriculum
- the teachers' understanding of projects, and of more foregrounded and familiar practical work
- teachers' dependence on the syllabus with its lack of clear guidance, and their own instinctive understanding of the broader connotation of projects
- the status of projects given in the current system of assessment, and allocating marks and performance indicators that encapsulate the real worth of projects

What follows is more detailed analysis of the benefits that the teachers identified, in relation to the benefits as described by Waters (1982); van Harmelen (1991); Henry (1994); Collis and Lacey (1996); Millar (2004); Chin (2004) and Namibia. MoE (2006a).

Henry (1994) emphasized the role that projects have in terms of the application of knowledge, and in this way emphasized that projects enhance conceptual understanding. He also saw projects as the interface between the curriculum and the learner's own community and environment. When the teachers' ideas are compared with their implementation, the fact that the teachers did encourage learners to obtain their own materials from within their environment, and even – in the case of Magano's learners – encouraged them to move beyond the textbook to find information, was at least in part motivated by the idea of applying knowledge and of knowledge linking the curriculum and the learner's environment. However, the way in which this was done, partly because of the choice of topic and the nature of the task, meant that opportunities for real application of their knowledge to the task or to their environment was limited.

A related aspect is highlighted by the Namibian education policy on projects, in which knowledge is linked to the development of cognitive skills enabling learners to "organize, synthesize, analyze and evaluate own work" (Namibia. MoE, 2006a: 36). This was a benefit

mentioned by the teachers and seemingly achieved by allowing the learners time to give feedback to their peers, and by expecting them to organize and carry out the task. But analysis of the implementation revealed that peer feedback was superficial, and that the learners' opportunities to evaluate their own work were limited to the explanation they gave of how they had carried out the task.

The other benefit identified by the teachers was that when learners are involved in an independent activity and are able to give feedback they are motivated in terms of their learning (Henry, 1994). Though learners were given a chance to observe and manipulate their projects (in line with the recommendations of Millar, 2004), not everybody got the chance to present his or her product. This was because of the way teachers organized the projects. Although, in the case of Magano, the groups worked collaboratively, she could not clearly identify the contribution of each learner. And although Tulonga made each individual construct their own model, the opportunity to present them was limited to those selected by the groups. Therefore while each learner was given an individual mark for the model, they were unable to practise their presentation skills. According to Henry (1994), this would serve to reduce the motivation of learners to take part in future projects.

Collis and Lacey (1996) emphasize the importance of learning from social interaction in project work. That Magano encouraged her learners to work in groups throughout the process, thus affording them opportunities to share ideas with their teachers and other learners, and to solve problems through discussion, was a positive feature in her implementation of the project (van Harmelen, 1991). The strategy helped her learners to enhance each others' learning through negotiating their way through the project and planning the presentation (Waters, 1982). In the case of Tulonga's learners, working in isolation, the opportunities for interaction with other learners were very limited. The way in which Tulonga's learners operated in groups yielded none of the benefits that Magano's learners derived from the experience, while in the case of Tulonga the opportunities for group interaction were further limited by the way in which he organized the projects and their presentation.

Henry (1994), Millar (2004), and Chin and Ligek (2004), among others, have emphasized the importance of learner involvement in selecting, planning and developing projects as a means to motivate learners through their taking ownership of their own learning. This feature was noticeably absent in the project work covered by this study, where the teachers selected the topic and did not involve the learners in the matter. What is more, the selection of the topics by the teachers limited the learners' ability to think for themselves about how to design their projects. These learners therefore had less control over their learning and did not effectively own their projects, in the way advocated by Henry (1994). It is also argued that from the evidence, these models were not designed in a manner that would enhance problem identification and problem solving, decision making, creativity and innovation; nor was it possible for learners to develop as autonomous thinkers, self-reliant learners and critical thinkers (Henry, 1994; Namibia. MoE, 2006a). The factors detailed above also limited learners' ability to acquire the detailed scientific knowledge, skills and expertise that were emphasized by Fried-Booth (2002) and Millar (2004).

The study showed that the two teachers revealed a particular understanding of the benefits to be derived from carrying out projects. However, there were other values mentioned in the literature that were missing, such as the development of autonomy, meta-competencies, learner management, intrinsic motivation, all of which were emphasized by Henry (1994) and Arends (1998) as cited in Tessema (2005). Similarly limited were opportunities to develop competencies such as personal responsibility and good communication skills, as identified by van Harmelen (1991) and Coombs (1995). Had the projects been designed to include the inculcation of these skills and values, they would have better achieved the goals of Life Science.

5.2.2 Challenges in carrying out projects

In this section, I discuss the findings of the study in relation to the challenges associated with projects, particularly in the Life Science curriculum. The challenges revealed in this study were seen to inhibit the implementation of project work in the Life Science school curriculum. Many of the challenges revealed in this study are reflected in the literature reviewed in Chapter two.

One serious challenge faced by the two teachers who took part in my study was the syllabus design. The Life Science syllabus (Namibia. MoE, 2006a: 37) recommends and expects teachers to conduct projects, but fails to provide adequate guidelines concerning topics suited to project-based studies. The study showed that the teachers experienced difficulty in choosing relevant investigative topics for the projects. The interviews revealed that the teachers' choices of topics were determined by factors that had more to do with logistics and the perceived availability of materials than sound educational principles.

The study conducted by Millar (2004) revealed that many teachers do not do thorough project planning as a result of limited knowledge in this area. The two teachers, Tulonga and Magano, raised this concern in the interviews, claiming that the syllabus design, the low status given to projects in the curriculum, as well as the inadequate training received at college and from the in-service programme have all contributed to their lack of experience in this area.

Time constraints and lack of resources were discussed as challenges in this study. These issues were identified in the research carried out by Henry (1994), Gipps (1997), and Chin and Ligek (2004), as major challenges to the implementation of projects. Henry has also revealed that projects that require information from the Internet demand a lot of time (Henry, 1994). Magano said she had once planned a project that required the use of the Internet and that it took learners a month instead of two weeks to complete. She argued that the Internet is too slow, and that it

takes time for learners to find relevant information given their limited access to reliable computers.

As I indicated in Chapter two, research has revealed that most projects are carried out in groups. Researchers such as Liew (2008) and Poole (2001) have indicated that group work does not always function as planned. These authors have identified a number of problems associated with group work, one of which – the dominance of some students and consequent withdrawal of others – was also mentioned by Magano in her interview. Carlos (n.d), Poole (2001) and Liew (2008) emphasize the fact that successful group work is dependent on good organization and design. The results of this study have helped me to realize that one of the problems faced by these teachers was a lack of deep theoretical understanding of how projects should be developed and designed.

The other issue that emerged from this study as a challenge to teachers was assessment. Learners 'copying from one another (Isai, 2007) was seen as a problem in the way of the assessment of individual learners' projects. To give an example, one of the teachers indicated that some learners waited for others to come up with the answers and then copied from them. I think this tends to happen if the project is not well organized. The fact that all the learners are doing the same topic increases this particular temptation. Despite Magano alluding to copying as a challenge, she did not experience it during the implementation of the project. Assessing group projects also emerged as a challenge in this study. This was supported by the study conducted by Elton (1987), who pointed out that in group projects the contributions of students are not always equivalent. It is not easy for a teacher to assess the contribution of each learner in a group, and the award of the same marks to every learner in the group is seen as unfair. Thus Tulonga decided to give individual marks for his project and allocated tasks to learners individually.

Teachers also identified the inconsistencies in the syllabus relating to assessment as a challenge. I feel, however, that what teachers see as an inconsistency is the result of misinterpretation and

misunderstanding on their part about how to use the skills and the scale of assessment when assessing. I therefore suggest that the Continuous assessment manual for Life Science be made available and designed in a way that includes the assessment criteria. It should also give clear guidelines on how assessment is carried out; the allocation of marks to each criterion, calculation and the scaling down of marks. The following format could be used as an example of the project assessment sheet.

Table 4.4 Project assessment sheet (Namibia. MoE, 2006b: 17 slightly adapted)

Project assessment sheet

Name: _____ Grade: _____ Topic: _____

Project	**Marks (encircle)**
Introduction/problem statement	1 2 3 4 5
Methods/techniques of data collection	1 2 3 4 5
Ability to collect and record data/information	1 2 3 4 5
Presentation of data	1 2 3 4 5
Factual accuracy	1 2 3 4 5
Validity of interpretation of data	1 2 3 4 5
Validity of conclusions and solutions	1 2 3 4 5
Neatness	1 2 3 4 5
Originality	1 2 3 4 5
Overall impression of project	1 2 3 4 5
Bibliography	1 2 3 4 5
	Total: _____

Group member contributions:

Names:

_____	1 2 3 4 5
_____	1 2 3 4 5
_____	1 2 3 4 5
_____	1 2 3 4 5
_____	1 2 3 4 5
	Total: _____

With this structuring the teacher will be able to allocate marks to the work undertaken by learners in relation to each stage of the inquiry.

The Life Science syllabus (Namibia. MoE, 2006a) and the subject policy guide (2007) do not give clear instructions on how projects are to be assessed. This needs to be addressed, because it is one of the contributing factors to the poor understanding and implementation of projects in the Life Science curriculum. In the next section I discuss the findings on how these teachers implemented projects.

5.3 IMPLEMENTATION OF PROJECTS

This section discusses the findings from the interviews, documents and lesson observation, with a focus on the planning and preparation, execution, presentation, feedback and assessment of projects, as follows:

5.3.1 Planning and preparation of a project

Authors such as Waters (1982), Henry (1994), Solomon (2003) and the Namibian policy (Namibia. MoE, 2006b) identify in all seven stages in the planning of a project: choice of project, design of work, collection of data, selection and collation of data collected, representation and recording of data, analysis and interpretation of the data, and reaching conclusions. Although the two teachers broadly followed these stages, neither teacher involved the learners at any of the stages. It is claimed that if these stages within planning a project are clearly explained and well understood by both the teacher and learners, learners will be helped to develop confidence, to solve their own problems, and be equipped to take part in the learning activities (Namibia. MoE, 2006b: 16).

The findings from the interviews indicate that both teachers plan their project work some days before the actual activity, as recommended by Waters (1982). According to Solomon (2003: 6), the choice of topic should be guided by asking yourself "what you want your students to learn … and find out if the project description matches and addresses the needs of the learners". As was indicated in Chapter four, the topics selected for the projects in this study were focused on the syllabus rather than on the learners' identified interests. While these topics were therefore designed to develop particular aspects indicated in the syllabus, the choice of topic was limiting in the context of what was actually learned. Projects should of their very nature make it possible to develop a wide range of competencies and interrelated concepts, but this was not the case with these topics.

The evidence reveals that because of their design, the models – particularly that of the skeleton – had limited value in even achieving the syllabus objectives for those topics. In achieving the sorts of outcomes that make projects unique, their design limited the opportunities for learners to engage critically and deeply with the topic, thus limiting what they were able to learn from doing the projects – thus relegating them to the status of practical tasks rather than projects in the true sense of the concept. Thus despite the intentions of the teachers, the desired outcomes were not fully achieved. It was also noted that the teachers did not provide the learners with a rationale for their selection of the topic, or an explanation of exactly why that topic and not another was selected, even though this was indicated in the interview to the researcher. Thus while the reason for selecting their particular topics was understood and justified to the researcher by the teachers, the learners were not party to their thinking. Furthermore, because the design of these projects was linked to precise instructions, they provided only limited opportunities for learners to be creative other than in terms of how they constructed the models.

The collection, selection and collation of data in planning a project can be seen as important stages in its implementation. As indicated earlier, Waters (1982), Henry (1994), Solomon (2003) and Namibia. MoE (2006b) emphasized that data should be collected by the learners themselves who should also decide on which data is relevant to their project. The way that the data is

recorded should also be decided by the learners. This being so, teachers should consider letting learners make informed decisions about which kinds of data were relevant to their projects. This did not happen in the case of either teacher.

Waters (1982) suggests that through gathering information from a variety of sources, learners enhance their ability to critically review information. Further to this, Henry (1994) claims that the use of a variety of sources also avoids the duplication of projects and helps the learners to acquire new scientific skills (Namibia. MoE, 2006a). Once again the prescriptive nature of these projects limited learners' development in these areas.

The preparation, planning and design of the projects in this study revealed a lack of deep understanding about the nature and role of projects as a vehicle to develop the skills and competencies seen as an integral dimension of projects as an approach to teaching and learning.

5.3.2 Execution

As indicated in Chapter two, Fried-Booth (1990) recommends that a project due to its nature should be carried out in the learner's own time rather than during formal lesson periods. In this study learners had to collect their own materials and assemble them according to the instructions given on the worksheet. Therefore it would seem that through this, learners were being provided with an opportunity to connect with their environment, which is seen by Millar (2004) to be an important part of project work. However in this instance, their interaction with the real world and environment was very limited. Had the models been designed differently, learners could have used their environment in a more holistic way. Nevertheless, allowing the learners to work on their own in the construction and presentation of the model, gave them a chance to discuss and share ideas among themselves about how to interpret the instructions. This is seen as an important part of projects in the Life Science policy (Namibia. MoE, 2006b).

Another positive aspect of these projects was that learners were encouraged to obtain assistance in constructing their models. It was also noted that the teachers were prepared to help the learners where needed, an aspect seen as important by Mills (2003).

5.3.3 Presentation

Authors such as Fried-Booth (1990), Namibia. MoE, (2006b) and van Cleave (2008), among others, identify the importance of the presentation of project work for a number of reasons:

- First, the presentation allows learners to reflect on the process
- Second, learners are required to describe and explain the final product, and
- Third, presentation helps learners develop their communication skills in a formal setting.

In this study learners were given the opportunity to explain how they prepared the models, how they obtained the materials, and whether they got assistance in carrying out their projects. The findings indicate that the presentation was poorly done, especially by Tulonga's learners. As indicated in Chapter four, only one member of Tulonga's groups gave a presentation on the process. In this instance Magano's groups were provided with better opportunities for reflection and explanation.

Furthermore, the study revealed that learners at both schools were given the chance to explain and to demonstrate how their models work. The demonstration was more successful in Magano's class than in Tulonga's, primarily because of the differences in the project design.

With regard to the techniques most suitable for the presentation of data, it was clearly shown in the lesson observations of these teachers that apart from the models that the learners designed and constructed, they read from the worksheet when presenting. The type of projects proposed by the teachers did not give learners opportunities to analyze and to process data in ways that are encouraged by the various policy documents (Namibia. MoE, 2006b).

The study also revealed that while opportunities were given to learners to show their models to their peers, the presentations were limited in terms of their effectiveness with respect to the development of the sort of communication skills associated with this type of presentation.

5.3.4 Feedback and Assessment

It is recognized that feedback and assessment are important dimensions of project work. Van Harmelen (1991) sees feedback as important for the following reasons:

- It gives recognition to the learners' work and through this recognition helps to motivate them
- Feedback also serves to educate learners about the processes and the thinking associated with project
- It provides learners with an understanding of appropriate standards that are expected to be met in the doing of the project and whether they have achieved those standards.

In line with this, Powell (2004) suggests that feedback provides learners with affirmation for a task well done while at the same time provide constructive criticism. In addition, feedback should be not only the prerogative of the teacher: peer feedback ought also to be encouraged.

The study revealed that both teachers gave learners the opportunity to give comments on others' presentations, but it was noted that neither Tulonga's nor Magano's learners gave feedback on each other's work. This meant that opportunities were missed for learners to learn from each other, in the way envisaged in the assessment policy guide (Namibia. MoE, 2006b).

Roossink and Weenk as cited in Powell (2004: 224) argue that in assessing a project a teacher is testing the "soft competencies that are difficult to assess in a formal examination". As indicated in Chapter 4, Magano followed the syllabus and based her assessment on the skills for assessment (Namibia. MoE, 2006a). Tulonga, however, included aspects such neatness, creativity and punctuality as criteria to be assessed. The study indicates that neither of the teachers followed the assessment criteria for projects as stated by Namibia. MoE (2006b).

As indicated earlier, Magano's learners did not make comments on the other groups during the presentations, but it is worth noting that they were involved in assessing each others' work. This is "peer assessment" (Solomon, 2003; Powell, 2004: 226). It is a strategy that allows more "detailed questions which give learners a more detailed impression of competencies" (Powell, 2004: 226) and allows learners to gain first-hand feedback. Tulonga did not involve his learners in peer assessment, yet he indicated that he assessed them during the presentation, as recommended by Fried-Booth (2002). It was important to note that both teachers collected the learners' project for the final assessment. As indicated in Chapter four, although the learners awarded marks to their peers, Magano mediated the mark allocated to each group.

Both Tulonga and Magano provided general summative feedback, which is seen by Solomon (2003) as a means to help learners perform self evaluation and reflection. The comments made by both teachers indicate that they had a particular understanding of how the presentation of projects should be handled. In this instance, Magano urged learners to place emphasis on following the instructions, eye contact and project objectives. Tulonga emphasized the need to take the task seriously, to be well prepared and to share ideas. Once again this level of feedback

reveals a general lack of real understanding of the thinking underpinning the nature and role of projects.

5.4 CONCLUSION

In this chapter, I have discussed the results that emerged from the data analysis in Chapter four. I interpreted my findings and explained the views of the participants in relation to my research question. Much of what this study has discovered is also reflected in the literature reviewed in Chapter two. I have discussed the benefits that projects have for learners and the challenges associated with project work. The two teachers who participated in my study have shown some understanding of how projects should be carried out, but have employed different strategies to implement and assess them.

I have also discussed how the teachers conducted the assessment of the projects and the inconsistencies in this. The findings of this study indicate that there is a lot to be done in order to improve teachers' understanding of projects. In the next chapter, I will reflect on the main findings, on the research process and the research design. I will also highlight the lessons learnt from the study, identify of the limitations of the study, and, finally, put forward tentative suggestions for further research

CHAPTER 6

CONCLUSION

6.1 INTRODUCTION

This chapter provides a critical overview of the main findings that emerged from this study. First, I reflect on the research process and discuss the reasons why I selected the research design that I did. I also give an overview of the key findings of the study. Second, I focus on the lessons learnt from the findings. Third, I provide a brief discussion of the limitations of my study. Finally, I offer tentative suggestions for improvement on some issues and possible areas for future research.

6.2 OVERVIEW OF THE STUDY

This study aimed to investigate how Grade 10 Life Science teachers understand and implement project work in schools. I felt that it is important to provide an overview of my motivation to carry out this research. As I indicated in Chapter one, my interest in this study was prompted by my observation during the monitoring of the implementation of continuous assessment in schools. Life Science teachers appear to have problems with the implementation of projects. As an Advisory Teacher responsible for advising and guiding teachers on education related matters, my concern was to find out whether the poor implementation of projects was because teachers lack the necessary knowledge and skills to design and develop projects or are there other factors that militate against the implementation of project work.

This research focused on the understanding and implementation of project work by Grade 10 teachers in the context of Life Science, which enabled me to ground my research within a specific area. This research enabled me to understand the teachers' perception and practice of projects as I had the opportunity to observe their real life practice of project work in the classroom situation.

The findings from this research provided answers that can inform my own professional context. Therefore I feel better prepared to offer meaningful assistance to the teachers I serve. This study could also provide meaningful feedback to policy makers and curriculum developers as well as implementers in that they need to revisit their strategies and approaches to be in line with the findings and recommendations.

6.2.1 Overview of the research process

As I indicated in Chapter three, I adopted an interpretive orientation for this qualitative case study approach. The selected design and approach were appropriate for my study and helped to shape the success of this study. The interpretive case study approach provided me with opportunities to engage with my teachers and make sense of what they said and did. A qualitative case study approach helped me to critically examine the teachers' perceptions and views regarding issues concerning my research topic.

I used three methods for collecting the data; interviews, class observation and document analysis. The interviews allowed me to converse with the teachers about their views and perceptions about project work. To counter-act the limitations of interviews, other methods such as lesson observation and documents analysis were used. Class observation allowed me to observe what was taking place in the classroom. It also allowed me to illuminate the connection between what the teacher said in the interviews and what was happening in the classroom. Documents

consulted allowed me an opportunity to study the syllabus, lesson plans, continuous assessment record form and the learners' activities books. These documents helped me triangulate and crosscheck data from the other two sources. Holistic and rich descriptions of how teachers make sense of their experiences in project implementation were obtained and I believe that it increased the validity and reliability of the study.

Through the process of data collection, I encountered some difficulties that hampered the breadth of data for my study. It is worth mentioning that due to the withdrawal of one of the teacher from the study, I did not collect as much data as expected. The extent of the data I did gather is thanks to the willing participation of the two teachers who were involved in the study. I feel that the depth of data from these two participants compensated for the withdrawal of the third teacher.

6.2.2 Overview of the main findings

This section reflects on the main findings as presented in the previous chapter. The findings of this study are influenced by my two research questions. This study looked at how teachers understand and implement project work. Although it was not easy to measure the understanding of teachers, the study has shown that teachers have demonstrated a particular understanding of the implementation of project work. The teachers were not able to articulate the theory relating to practice as fully as would have been expected, however, their perception of project work was valuable for a number of reasons. The view these teachers have of projects being so closely linked to their particular syllabus, raised questions about their professional development opportunities and the role of the syllabus in terms of providing teachers with the necessary frameworks and guidance needed to achieve the policy goals.

A key finding consequently was that there is a problem between the syllabus and the broad curriculum. The broad curriculum and the key syllabus guidelines require projects to be implemented and assessed. The broad curriculum policy suggests a particular approach and competencies desirable for project based studies and the guidelines are expected to be accessible to all teachers. In fact, the syllabus does not do this and does not even give examples of topics from which to develop projects. This study revealed that the teachers lack of knowledge and understanding of how projects ought to be planned, organized and assessed are to a degree related to flaws in the syllabus.

Given that the syllabus does not provide guidelines either in terms of what a project is, how to carry it out or how to assess it, it has not helped the teachers in developing their skills. It was apparent from the teachers that the initial training and in-service workshops do not provide them with a deep understanding or knowledge of projects. The results also revealed that teachers are not in possession of the continuous assessment manual for Life Science; where the detailed assessment procedures are explained. The lack of explicit information in the syllabus and the subject policy and the absence of the continuous assessment manual hindered the effective implementation and assessment of project work. These factors raise questions about the real status given to projects in the context of this subject.

On a positive note, teachers follow the requirements of the syllabus and record the CA marks. Learners, too, have shown their willingness to carry out projects, and to do to what the teachers ask them to do. These findings have also contributed to the lessons I learned from this study that I discuss in the next section. I believe these findings will help future researchers and curriculum developers to find possible answers to the challenges that are facing the teachers.

6.3 LESSONS LEARNT

The lessons learnt from the research process include:

- How to choose appropriate literature for my research
- How important it is to design relevant questions in order to carry out effective research. The research questions will also determine the type of data collection instruments
- How to collect the data using the following methods; interviews, lesson observation and document analysis. The skills gained in this research will be used in assisting others in my work situation
- How to apply different approaches to conduct interviews; what to do and what not to do during the interviews and how to deal with the question of ethics and confidentiality

This study has developed my writing skills through data analysis, presentation and discussion in a logical way. During the course of this study, I became knowledgeable about the topic I researched and most importantly, I have grown as a researcher.

The lessons learnt from the study include the realization that:

- If we are serious about doing projects in line with the way literature identifies projects and in line with the way that the broad policy suggests that they should be done, that is as critical investigations and as problem solving, then we have to help teachers by giving them adequate support and provide them with adequate guidelines
- If we think that projects are important, then we have to raise their status in the curriculum

- We need to build on teachers' existing knowledge, give recognition for what they are doing in order to motivate them and provide them with incentives to develop beyond this
- Learners are capable of so much if we allow them scope and we need to build on this willingness to try things
- If we in fact do not follow these ideas, then we need to re-think the role and value of projects

As an Advisory Teacher I realize and recognize the value of the lesson learnt because it informs my professional context. Therefore, my role is to give teachers greater opportunities to interrogate theory and practice on projects and to understand it in their teaching and learning contexts. This study enabled me to gain a better understanding of the teachers' practices of projects in the Life Science curriculum. It also enabled me to realize what the needs of the teachers are and the kind of assistance that would benefit them.

6.4 LIMITATIONS OF THE STUDY

This study has limitations, due to the size of the sample and the length of the research study. Therefore, the results cannot be generalized. Only two teachers from the whole Oshikoto Region were involved in the study and the study was conducted within a limited time. Due to the vastness of the Region, time and resources constraints, the research had to be limited to only two schools that offer Junior Secondary education in Oshikoto Region. My inexperience in conducting a research was also a limitation in this study. The study also suffered from a lack of literature on the implementation of projects in the Namibian context.

6.5 TENTATIVE SUGGESTIONS ON ISSUES TO BE ADDRESSED

Looking at the findings that emerged from my study, I conclude that the syllabus does not equip teachers well to deal with projects, thus resulted in lack of planning, organizing and managing the projects. The following issues that emerged from the study need addressing:

- The syllabus should provide examples of topics from which to develop projects. These topics could be intended as examples and not a comprehensive or prescriptive list.
- Teachers need to be aware of how projects are planned, organized and assessed. Assessment of group projects should be made clear to the teachers in order for them to have a common understanding of how group projects are assessed
- The study revealed that the two teachers have not received any support from the colleagues at school, cluster and circuit. There is a need for teachers to come together in the departmental meetings, subject meetings and to attend in - service workshops in order to keep abreast with the changes in the implementation of projects in the curriculum and to get professional support
- Teachers need to be aware on the role projects play in the real life of children. They need explanations on the importance and the structure of continuous assessment to learners
- Teachers need training on how to involve learners in projects. This might motivate learners to take part in Science fair competitions

6.6 AREAS FOR FURTHER RESEARCH

Looking at how projects are understood and implemented by the teachers, the study revealed that there are some issues that need to be addressed. I therefore suggest the following areas as possible research areas:

- The impact of projects on learners' future performance
- Teachers understanding in assessing projects
- The difference between a practical activity and a project
- Teachers and learners' attitude towards project work

6.7 CONCLUSION

This study has revealed that if we are to take projects seriously and to see them in the light of appropriate vehicles to develop conceptual understanding, skills and values and to enhance autonomous learning, then we need to re-look at how we support our teachers and learners. For the successful implementation of projects in schools, teachers should give more attention to the teaching of projects. The research has shown that there is a need for both teachers and learners to understand the importance of projects in the curriculum. The pre-service and in-service programmes should give more emphasis on the teaching of projects. Schools should also establish and strengthen Science clubs in order to motivate learners to take part in project-related activities. These improved conditions for the teaching of projects will occur only if the Natural Sciences curriculum developers provide appropriate and relevant information on how projects are to be planned, organized and assessed.

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APPENDICES

Appendix 1A

Original data lists

When collecting the data for my research, what I would like to know from the teachers? (Original Data list)

Teachers understanding/ background knowledge

Definition of a project?
Types of scientific projects – Information

- Investigation
- Model
- Study

Involvement of a teacher in doing projects during his/her schooling
Sort of project s/he involved in
Roles/importance of projects in science teaching.
Advantages/benefits of carrying projects in science
Value of projects in science teaching – why doing projects?

Implementation

Whether a teacher gives project work to learners.
The sort of projects do teachers does with learners.
The type of projects that goes well and why
The type of projects that did not goes well and why
The purposes/ reasons for conducting projects? (link to the syllabus requirements)
How projects work are planned – any involvement of other teachers, learners or parents.
How planned projects are linked with the subject topics in the syllabus.
How learners are prepared for project work.
The role learners and parents play in the implementation of projects.
How projects are managed.
Time used for projects
Any support received from other teachers, learners and the management.
Resources used: – type of resources and how and where to get them
How learners are encouraged to do (love) projects?
Problems experienced in planning and implementing projects: a teacher and learners.
What was done to improve on the problems?

Assessment

How project work is assessed: individually/pair/group
Why assessment individually/pair/group
The assessment strategies used – look at specific skill using rubrics
Using a certain scale e.g.5 points scale
Problems experienced in assessing projects.
How the problem was dealt with.

Benefits

What benefits do teachers and learners have on projects?
What skills are developed in learners?

- decision making

- problem solving
- think critical
- communication
- better understanding
- self discovery
- learn from mistakes

What are the values set in learners?

- working together
- feel ownership
- respect others' views
- take responsibility
- achieve independence

Document analysis, observation and interview

CA record form
Learners work/activities Does all these documents corresponds
Teachers activities
Lesson plan

Look at what learners have done before (old projects)

Ask question like:

Why do they do this?
How do they do it?
When do they do it?
In which context they are doing it?
Is the report/feedback corresponds to the type of project?
Resources used:

- how and when they get them?
- why the type of resources?

Interview schedule questions

1. What experiences have you had in doing project?
2. What do you think are the advantages of carrying project work in the curriculum?
3. What do you understand the reasons for conducting project work in Life Science?
4. How do you usually plan and implement project work with your learners?
5. How do you prepare your learners for project work?
6. What support and motivation do you receive that helps you in the implementation of project work, and from whom?
7. How do you assess project work? What assessment strategies do you use?
8. What are the benefits of carrying project work for the learners and for you in terms of teaching Life Science?
9. What problems do you observe in planning and implementing project work in Life Science and how do you deal with the problems for improvement?
10. What is your planning to do projects this year? When, why and how?

Thanks for your time

Appendix 1B

Edited data lists

When collecting the data for my research, what I would like to know from the teachers? (Data list)

Teachers understanding/ background knowledge

Tell about self
Subject and grade taught
Subject specialization
How long s/he taught Life Science?
Why choose to teach Life Science?
The importance of the subject Life Science in the curriculum

Implementation

The types of activities given learners.
If one of, then ask the understanding of project
The difference between a project and an investigations (time and all skills)
Does the teacher give projects to learners
Give an example of the projects done with learners
From which topic/theme of the syllabus was (that) project taken
How that (specific) project planned i.e. how the project was choose; how are the learners prepared?
How the (specific) project implemented?
Resources used: – type of materials and apparatus used in that particular project
How and where to get the resources?
The role learners play in implementation of the specific project
The role a teacher plays in the implementation of the project
The benefits learners received from doing/carrying a specific project i.e. what skills developed in learners; what values project set in learners?
How learners are encouraged to do (love) projects?
Problems experienced in implementing that specific project.
What was done to improve on the specific problems?

Assessment

How that specific project is assessed .e.g. individually/pair/group
Why assessment individually/pair/group (depends on the answer given)
The assessment strategies used look at specific skill using rubrics (what is meant by rubrics)
Using a certain scale e.g.5 points scale
Problems experienced in assessing those projects.
How the problems were dealt with.

Benefits (see in the implementation part)

What educational benefits do learners have on projects?
What skills are developed in learners (skills for objective C in the L. Science Syllabus?)

- decision making
- problem solving
- think critical
- communication
- better understanding
- self discovery

- learn from mistakes

What are the values set in learners?

- working together
- feel ownership
- respect others' views
- take responsibility
- achieve independence

Document analysis, observation and interview

CA record form
Learners work/activities Does all these documents correspond?
Teachers activities
Lesson plan
Syllabus

Look at what learners have done before (old projects)

Ask question like:

Why choose this?
How do they do it?
When do they do it?
In which context they are doing it?
Is the report/feedback corresponds to the type of project?
Resources used:

- how and when they get them?
- why the type of resources?

Evidence on the link with the syllabus competencies

Interview schedule questions

1. What experiences have you had in doing project?
2. What are the reasons for doing projects in Life Science?
3. How do you usually plan and implement project work?
4. How do you prepare your learners for project work?
5. How do you implement projects?
6. How do you assess project work?
7. What assessment strategies do you use?
8. What support and motivation do you receive that helps you in the implementation of project work, and from whom?
9. What are the education benefits/learning outcomes for the learners in doing projects?
10. What problems do you experience in planning and implementing project work in Life Science and how do you deal with the problems for improvement?

Thanks for your time

Appendix 2A

Case history: Magano

CASE HISTORY: MAGANO for SHIINGULU HIGH SCHOOL

1. INTERVIEW

Magano is the name of a teacher
Shiingulu High school is the name of the school

On 27 May 2008, I held an interview with Ms Magano, a Life Science teacher at Shiingulu High school, a semi urban school for about twenty km from Ondangwa. There are 374 learners with two grade 10 classes with 75 learners; 38 and 37 learners in each class. It is one of the old High school in Oshikoto Region with five labs; Biology, Life Science and Agriculture, Physical Science, Languages and Computer labs. All the labs are well equipped. Magano started teaching in 1984, she taught Life Science for 14 years now. Life Science is a 4 lessons subject per week with 40 minutes a period. She specializes in Natural Sciences as she possesses the Diploma in Biology through University of Namibia in 2006. During her schooling, she was not studying to become a Life Science teacher, she wanted to specialize in Languages, but because there was a very good Life Science teacher at the College she was motivated and inspired by her Life Science teacher to love the subject Life Science. Currently, Magano is teaching Life Science from grade 8 - 10 and as well as some Biology.

When I asked her the importance of teaching Life Science in the curriculum she said it is important for learners to learn about themselves; how to take care of them and the environment around them. She told me that she gave different practical activities to the learners where they can touch, see and do rather than just listening and copy information from the chalkboard. To the question whether she gave a project as one of the practical activities, she said that a project can only done be done during Term 2 between May and August every year, therefore she only do shorter practical investigations this year during Term 1. Ms Magano seems to understand what a project is, because in our discussion she gave the difference between a project and an investigation. According to her, both are practical investigations but the difference is that a project is a longer assignment which can take from a week to a month and it count 20 marks for all the four skills assessed. An investigation can be carried and completed within a day or two, counting 15 marks for only three skills to be assessed, she said. She further gave the difference between an investigation and a project when it comes to teachers and learners' roles. To her response, as a teacher she only act as somebody who assists learners when they are doing or carrying out the activities while learners are doing the activity on their own, collect their own data and come up with their product, unlike in investigation where the teacher should always be closer to the learners.

I asked her an example of the investigations that she have done with the learners this year. The example she gave me was that of using a microscope taken from the syllabus topic 'Scientific processes' where she wanted learners to have knowledge and the know how to use apparatus. She told me that during planning she first prepared a specimen

and a worksheet with instructions that the learners have copied into their exercises books. As part of the preparation, she did the demonstration first and asked learners to do as instructed by the worksheet. Learners were informed on the skills to be assessed during that specific activity. The skills includes: the ability to follow instructions; handling apparatus and the ability to observe what they can see on the stage of the microscope.

During implementation, the teacher told me that she borrowed two microscopes from other department as she only had three in her lab to make five microscopes enough for the five groups. She then asked each groups to prepare a wet mount and during the execution of the activity the teacher was assessing learners on following instructions as indicated in the worksheet. After that learners were asked one by one to take the microscopes from their table to the teacher's table. During this exercise the teacher was assessing learners on handling apparatus. Learners were asked to draw what they can see through the microscope into their exercise books. During that time the learners were assessed on observation, whether they are drawing what they have observed.

When I asked her the materials she used, she told me that she provided the learners with onions, microscopes, a knife, an iodine solution, transparency as slides and learners brought their own books, pen, pencils and erasers.

I asked the teacher the learners' roles as well as hers during that specific activity. According to her, learners' role was to manipulate the microscope, prepare a specimen according to the given instruction, observe and draw what they could see. Her role was to walk around, assisted learners where they got stuck for example in adjusting the focus. To make sure the learners are following instruction, to check if they are handling apparatus in a correct way and to make sure all learners were actively involved and not copying from one another.

To the questions whether the learners have benefited anything from the activity and if there is any skill and values developed when carrying out the activity, the teacher responded that they (learners) have developed positive attitudes of carrying out activities and the love of doing it. She again said that the activity has strengthening the learners' spirit of working together as a group; help each other and share ideas which in turn make things easier for them. Learners do also understand the importance of using a microscope, she emphasized.

When I asked her how she encourages learners to love projects, she said that learners need to be informed at the beginning that they are doing the activity which contributes to their continuous assessment. The other thing she did, she always told learners that whenever they are doing an activity, they can learn something useful from what they are doing. One good thing she thought can work well in encouraging learners to love doing project and other investigations is to talk to learners in a professional way. She said she always talked to them in a manner that does not discourage them and they cannot develop a negative attitude towards doing projects or even hate handling laboratory apparatus. She gave an example that few groups from the grade 10 learners were passively involved in one of the investigations, she said she talk to them nicely and during assessment she asked the rest of the groups to contribute to the awarding of marks that groups got. She said that during assessment learners were requested to give constructive criticism as encouragement to the colleagues.

I asked her if she experienced any problems during the implementation of that specific investigation. Her responses was that few problems experienced was that of copying network as some learners do not want to do things on their own, they used to wait others to finish and then copied from them. One problem experienced was that of not having enough microscopes as all learners (six in a group) were required to observe through the microscope and draw what they have observed within the limited time of forty minutes. The way to improve on the problems she said she always encourage learners to do their own things and not to rely on others work and she make sure all learners are actively involved in the activity. On the microscope issue, she planned for the activity to be done in the afternoon (after school) where there is plenty of time.

I asked her whether she planned to give a project this year. She said that she planned to give two activities according to the instructions from the syllabus and one of them will be a project which is going to be part of continuous assessment. She explained all the details from the planning and preparation, implementation and presentation of the project she plan to do. First of all she said she planned the activity in a way that she chose a topic 'respiration' from the syllabus; then she prepare a worksheet that learners will be using during the execution of a project. She said that learners will be given a task to make a 'lung model' as part of a project from the topic respiration. The reason why she chooses that specific topic was because the lung model that learners are going to construct will assist learners to understand how really things happens when breathing in and out. She again said that a project will give them (learners) an opportunity to develop own materials She told me that when doing the project, the learners will choose any materials from the environment that they will use. They will be told to use different books especially the Biology books to search for the information that is relevant to the project they are carrying. The teacher said she will tell the learners to come up with the projects which are able to convey the message that is clear to the audience and they will be required to state the shortcoming of the model during the presentation.

She said that learners will be told of what is going to be assessed during that specific activity. The assessment is planned to take place concurrently with the presentation and all the group will be given a chance to take part in the awarding of marks. She explained that she will be using a rubric (criteria), which explains in details how the marks are awarded for each skill. She further explained that the practical investigations count 15 marks for three skills, unlike a project which count 20 marks for the four skills to be assessed, and each skill should count 5 marks. She referred to the current Life Science syllabus page 39, which indicated the skills to be assessed for practical activities, the general criteria and the scale used to evaluate the task which was performed. She told me that some skills could be assessed individually and some could be assessed as group, depending on how the investigation was carried out. She gave an example of an observation skill that it cannot be assessed as group, because each and every learners should make own observation as nobody could observe on behalf of the group. She said that follow instructions could be assessed as group but in some instance one has also to give individual marks as per the syllabus instruction (general criteria), because learners can perform a skill at a different pace, therefore in some groups the marks will be different.

When I asked her whether she experienced some problems when assessing the practical investigations she have carried out, she responded that she found it difficult to assess group work, she felt not doing fair and justice to all learners, because of the large classes. She found it difficult to walk around and see what is happening in all the groups. Some learners do not do the activities and some tend to dominate others, she emphasized. Lastly, she stated that when planning a lesson she always plan it in such a way that accommodate all learners of different abilities.

2. LESSON OBSERVATION: Magano for Shiingulu High school

Introduction: The lesson observation took place in grade 10A with 38 learners. It is a forty minutes lesson. The teacher started the lesson by reminding the learners what they discussed in the previous lesson about breathing. She then relates the previous lesson to the new activity by showing them different ready made models (heart and cell). In order to find out whether the learners know the name given to those models and with what they are made of, she asked them to share with others. After the responses from learners that they are models and are made from waste materials, she told them that the materials used to make different models are mostly found in the environment. She again told the learners that they are going to do a project because it is a requirement of the Life Science syllabus and the learners will learn different scientific skills by carrying out the project. The project was about 'Making a Lung model'. The learners were happy to hear that they are going to carry out a project on making a lung model because and the teacher has mentioned during the interview that most grade 10 learners love doing projects.

Preparation: Learners were divided into six groups and everybody was urged to be actively involved in a project. The teacher requested the group leaders to make sure all their team members are having a role to play when carrying out a project. Learners were told that because the project will count 20 marks, they must put a lot of efforts in coming up with something that is conveying good information, something that giving accurate information and give clear message.

The teacher told the learners that in this project they are going to work alone most of the time, they can only ask help from her whenever needed or when they got stuck. She told the learners that they are going to work in the library, consult relevant sources and work according to the instructions provided in the worksheet. The teacher told the learners that all the parts that are indicated in the worksheet should be presented as part of the model; parts are such as windpipe, lungs, diaphragm, bronchi and chest cavity. They were again told to follow the instructions as they appear in the worksheet and come up with the conclusion which reads 'in your conclusion, state the shortcomings of your model which makes it different from the real part of the body'. To make the learners understand what they are supposed to do in the conclusion, the teacher showed the heart model to the learners and asked them to give the differences of the model and the real heart. The learners gave many differences such as cross section, the cells are not real, no blood, it is not made out of muscles and cannot pump like the real one. Then the teacher tried to make sure that the instructions she gave was clear and if the learners understand the information

correctly by asking them whether they understand what they are supposed to do. There was an indication from learners that they got the information correctly as they nod and responded ‘yes miss, yes miss’.

The teacher prepares the learners on how the project is going to be assessed. She started by informing them that four skills will be assessed as stated by the syllabus and each skill should count five marks. She then write down the skills on the chalkboard and asked all learners to copy them down into their group work books. The skills to be assessed within the given project were as follow:

- Planning: This includes the way learners have collected information, carrying out a project and presentation of the information that was collected.
- Observation: The learners should show their ability to observe what is happening and during demonstration learners should be able to explain what is being happened.
- Practical techniques: In this skill learners were expected to show and explain how they organizing their materials and apparatus they’ve collected.
- Data evaluation: In this skill learners were expected to come up with the purpose of the model, be able to show how the system works, be able to explain the similarities and differences between the model and the real organ and can also draw conclusion from what they came up with.

Learners’ questions and responses: The teacher gave chances to learners to ask questions for clarification. One learner wanted to be clarified on how to do a project whether there are rules to be followed or they just do it their own way. To this question the teacher referred the learners to the instructions on the worksheet that they have to follow. She (the teacher) again reminded the learners that she will be available to assist if there is something they do not understand. The other question, a learner wanted to know the due date of the project, which to the teacher was a good question. The response from the teacher was that it is due by Wednesday, meaning that it took a week to complete the project, but before handing their project on Wednesday, learners were asked to bring their work to the teacher two days before the due date. The teacher wanted to see as to how far the learners have gone with their project and assist those in needs. The teacher emphasizes the re-use of materials when responding to the question if learners can use materials that are not wastes.

When the learners asked questions that are not part of the project, the teacher requested them to stick the questions which are relevant to the project. One learner asked whether the chest can be included as part of the model, while another one wanted to find out whether she can include parts that are not asked or shown in the picture. Responding to the two questions, the teacher told the learners that they will be provided with a picture of a lung model in the worksheet and only the parts that are in the picture should be part of the model. One learner wanted to know whether the model can be made in such a way that it show the breathing in and out. Responding to the question, the teacher requested the learners to use their own ideas through consultation with different sources and decide on how their

model be presented. The last question a learner wanted to find out was whether drawings are models. The teacher showed her understanding by saying that drawings are not models because they are not three dimensions like models. She again told learners that a model can be handled unlike the drawing.

She then told learners that she will give them their activity books after finished marking them.

The lesson ends after the bell has ringed.

Feedback or presentation: (after a week)

The presentation was done in one week from the date of execution. The teacher together with the learners agreed on the time (which is seven minutes) they will take for a group to cover their presentation. Lucky enough they used the next two periods after Life Science period, because the teacher who was supposed to teach the next periods was not at school. Before they start the teacher reminded the learners that they are going to do as usual that after each presentation, they use to give comments and questions. They (learners) were also reminded that they are going to base their assessment on the four skills of:

- Planning: which includes displaying of the materials, investigation and reporting
- Practical techniques: whereby the emphasis was put on the organizing the materials and on whether the product was giving accurate information or it is confusing and misleading.
- Observation: whether they are able to observe what is going on when the presenter is doing a demonstration. Whether the presenter explained how the model works?
- Conclusion: whether the group has come up with a nice conclusion, which stated the shortcomings of the model that make it different from the real lungs.

She then requested all the groups to bring their product in front of the class and give a chance to one group to present their product. All the groups were given a worksheet to follow the instructions and they all used the same materials such as straws, a sheet of plastic, balloons, 2 liter bottle, cello tape and a glue stick

Two female learners went in front of the classroom; one was holding their product while the other one is presenting their findings. The presenter started by presenting their names and told the audience why and how they came up with the product (because is an assignment from the teacher). They showed how they have followed the instructions when coming up with their design with all the parts that were supposed to be included in the model. She (the presenter) explained clearly that the parts of their product were representing the real organs e.g. the 2 liter bottle represented the chest cavity, the balloons represented the lungs, the straws represented the bronchi and the plastic sheet represented the diaphragm.

One learner who was holding the product demonstrated to show how the model works by pulling the sheet of plastic outwards (inhaling) and pushing it inside (exhaling). She explained that as she pulls down the plastic sheet, the balloons inflated which means in reality that the air goes into the lungs and they become bigger, but if the plastic sheet was pushed inwards, the balloons deflated, which in reality mean the air goes out of the lungs and they become smaller.

After the presentation, the presenter invited for questions and comments. The teacher asked other groups to ask for clarification or add where they see something important was omitted during the presentation. After a long silence, the teacher asked the presenter to conclude their presentation. The presenter then responded that because it is impossible for them to cut a human being and show how such system works they decided to make a model to demonstrate how the breathing system works.

Because the teacher wanted to find out whether the group has used the worksheet when carrying out their activity, she asked them to give the differences and similarities observed between their product and the real respiratory system. One learner from the group responded that one shortcoming of their model was that some parts like a heart, pleural membrane and an abdominal cavity were not present in their model. The teacher again invited questions from the other groups, but no responses. She then asked the groups to participate in giving marks to the first group.

Different groups got chances to say why they are giving such marks to the first group. The 2nd group gave 4 marks on planning and presentation skill, because according to them there was no eye contact from the presenters. Group 5 also gave 4 marks, because according to them the presenter did not give the detailed explanation. Then the teacher also gave 4 marks, because she sees that the presenter changed her tone of voice from clear to low and soft. When it comes to practical techniques, group 3 gave them 5 marks, because they see that everything was well planned. The teacher did not give another group a chance, instead she said 'that is also the marks I gave them, because to me everything for this skill was good and ok'. On observation, group 4 gave 5 marks with the reason that the presenter has explained everything clearly. Here the teacher also disagrees with group 4 as she gave 4 marks because she sees that the demonstration was a bit confusing between contraction of the diaphragm and the deflation of lungs. Then on the last skill which is conclusion, group 2 and 5 gave them 5 marks because they see that the presenter ahs covered almost everything needed for the conclusions and they also presents their shortcoming of their model. The teacher tends to disagree and she gave them 3 marks, because she said that even when the group came up with the shortcoming as was said by group 2 and 5, they only do it when asked to. According to the teacher, the group presenter did not also come up with conclusion while they were presenting.

The presentations continued with the rest of the group. The same procedures as for group 1 was followed and all the groups were awarded marks (details to be attached as appendix). In conclusions the teacher thanks all the groups for the excellent job done. She gave the feedback to all of them that they:

- should always follow instructions whenever they are doing an activity
- Keep eye contact
- Do pilot reporting
- Work together and help each other during presentation
- Find out whether the model is function
- Conclusions: short to the point; includes shortcomings; check whether the aim was reached

She emphasized that drawing conclusions in a project is a very important thing whereby 'you are required to just repeat in short summary of what was done, why and say the shortcoming?'. The teacher requested the learners to improve on the suggestions given by other colleagues as well as the feedback she gave. She then requested them to leave their worksheets and their product behind for the sake of final assessment. The learners hand in everything on the teacher's table and left for another class.

3. DOCUMENTS: Magano for Shiingulu High school

Syllabus, Lesson plan, learners' activities and Continuous assessment form: The Life Science syllabus is aiming at developing learners' knowledge and understanding, creativity as well as practical and experimental skills. It also

helps learners to develop self-confidence through meaningful scientific activities. The syllabus through its competencies and learning outcomes clearly highlighted the major skills that need to be practiced and demonstrated by all learners through hands on activities:

- practical techniques
- observing, measuring and recording
- handling, processing and evaluating data
- planning and carrying out investigations

Carrying out these skills learners enable the learners to posses the necessary skills after carrying out a particular investigations e.g. practical activities or project.

- Communication skills
- Information skills
- Competitive skills
- Problem solving skills
- Participation
- Physical skills

Most of the above skills should be acquired through effective group work, which is supported by the 'learner centred education' an approach to teaching and learning. The teacher should monitor the effective implementation of all the skills through teaching and through formal and informal assessment. The teacher has showed the connection of the syllabus and the lesson plan when planning her lessons. This was indicated in her lesson plan where she indicated the topic which was taught and the objectives which are used to assess the learners' understanding and demonstration of skills. The following are extracts from the syllabus which a teacher used to draw up the lesson plans (to be attached as appendix) which she used for the lesson she taught on the two practical investigations/activities.

Topic 2. Scientific processes (an investigation)

2.1. Process skills

Objectives: At the end of the lesson learners will be able to know and understand the importance and application of the basic process skills

Practical activities, approaches and demonstration: Collect specimens, measure draw and calculate magnification

Topic 7. Human Body (a project)

7.1. Respiratory system

Objectives: At the end of the lesson, learners will be able to discuss the significance of the features of gaseous exchange for the maintenance of life.

Practical activities, approaches and demonstration: Make a model of a respiratory system using two litre bottles

The Life Science syllabus does not clearly stated on which topics required for a project and how the project should be carried out, but the teacher has indicated in the interview as well as in her lesson plan how she is going to implement a project. The syllabus has only clearly indicated the number of practical investigation which should be assessed and recorded. From the five investigations, two of them should be done during Term 1 of every year, another two during Term 2, of which one be a project and the last one to be done during Term 3. The syllabus has clearly indicated the practical skills for practical assessment (on page 11), the scale and the criteria which to base the evaluation of the performance tasks as shown.

SCALE	GENERAL CRITERIA
5	The assessed skill is performed well above average, neatly and independently with little or no support or guidance
4	The assessed skill is performed above average with little or no support or guidance
3	The assessed skill is performed at an average level with some support or guidance
2	The assessed skill is performed below average with some support or guidance
1	The assessed skill is performed well below average, requiring pronounced support or guidance
0	This mark is only given when the learner is not assessed due to non participation without valid reason

(MoE, 2007: 39 slightly adapted)

The teacher planned and prepared the worksheets which the learners used when carrying out an activity. The lesson plan was drafted in a normal lesson plan format because there is no specific format for practical activities and project, and because the Life Science syllabus has clearly stated that activities such as field trips, project work investigations and observations should not be taught as separate entities. Therefore the teacher infuses investigations and project work in the topics that are specified by the syllabus. Depending on the type of the lesson plan format the teacher used, the teacher has also indicated the resources and materials used in that specific activities.

In the interview, the teacher indicated that she gave two practical investigations for assessment. I collected the lesson plans for those specific activities, learners' work, an extract from the syllabus for those specific activities and the Continuous Assessment form where the teacher used to record the marks the learners got. The reason for collecting all those documents is for evidence, and to see whether there is a link between the documents. The learners' work corresponds to the worksheet given and the marks allocated correspond to the recorded marks in the continuous assessment form. These evidence shows that the teacher understands and follows the assessment procedure.

Appendix 2B

Case history: Tulonga

CASE HISTORY: MR.TULONGA: KUTHENGA COMBINED SCHOOL

1. **INTERVIEW**

TULONGA is the name of the teacher
KUTHENGA COMBINED SCHOOL is the name of the school

On the 2nd of June 2008, I interviewed Mr. Tulonga, a teacher at Kuthenga Combined School. The school is about 25 km east of the Ondangwa town. Its enrolment is about 572 learners and 22 teachers. There is a computer lab and the Science equipments are kept in a storeroom that can only be used by the teacher. There is no Science lab. Experiments are mostly done in the class which is very dangerous to learners. There are two grade 10 classes with 63 learners, of which each has 31 and 32 learners. He is teaching Life Science and Agriculture grade 9-10. The subject Life Science is 4 lessons a week with 40 minutes a period. Mr. Tulonga is specialized in Agriculture and Life Science as he posses Mathematics and Science Teachers Extension Programme (MASTEP) which he obtained in 2006. His teaching experience is eleven years. He said he like teaching some of the topic in Life Science, e.g. Human biology and ecology, because he learns many things which are important in his life. He said he learned the symptoms of certain disease how treat and overcome the diseases and he also learns about the relationship between living and non-living things.

To the question of what types of activities he gave to learners, he said that he give assignments, projects and investigations. I asked him what learners do with homework and investigations, he said homework is a daily topic related task that learners do at home and an investigations learners are sent to do an observation and get information on how things are work or done. When I asked him to tell me what an investigation and a project is, he said there is a slight difference between the two. One difference, he said a project is an activity given to learners and can take many days to complete, too long to complete, while an investigation can only take one or two days to complete. She said that the project count thirty marks when it comes to assessment and an investigation count only ten or twenty marks.

When I ask him whether he gave project to learners this year, he said he planned to have it this term, because the syllabus do not give chance for a longer assignments (project) in the first term. He explains that in the first term the learners were only did and assessed in topic tasks, topic tests and practical investigation. I then asked him the type or example of investigations he have done with his learners during the first term. He said he send learners to collect some insects and observe their movement, food and everything they could see from the behavior of insects. The topic of the syllabus where he took that activity was “living organisms’ and the reason for choosing it he said was because it was during the rainy season where different insects are available and learners can easily find them. I ask him to explain for me how he prepares the learners for that specific activity. He said he told them first that they have to do the tasks, homework and practical investigations for their continuous assessment. He prepared a worksheet with instructions (steps) for the learners to follow and he used the chalkboard to write down some main point. When it comes to the assessment of that specific practical activity he said he gives marks according to the steps in the worksheet (to be attached as appendix).

I asked him the apparatus and materials used during that particular activity. He said they used flask (a transparent container), hand lens that they used to put in insects and observe them. I asked him the reason for using a hand lens and he said they used for magnification. He said learners’ role during the activity was to collect the insects observe

their external parts and draw their magnification. His role was to make sure the instructions given were clear and understandable and to see if the learners have used the hand lens to observe the insects. To the question of which skills assessed during the activity, his answer was observation and handling of apparatus skills and all these skills were assessed individually. When I asked him whether the learners have benefit anything from doing the activity. He said: 'Yes I think they did because they learn by doing'. I asked him the skills learners develop when learn by doing, and then he said they develop the skills of handling apparatus (flask and hand lens) with care and not to brake them. He emphasized the hands on activities when touching and sees the real things that one will always remember what she or he saw, touch and do.

To the question whether he experienced any problem in implementing the activity, Mr. Tulonga said that few apparatus hampered the observation skill, because not all learners are catered for in a forty minutes time. Therefore he suggested that in the future he will plan to do the activity in the afternoon where there is enough time for all the learners to get chance to complete their observation. Another problem, his experience was that some learners do not comply with the due date; they always rush on the last day to finish their tasks, therefore the teacher decided to award one mark for punctuality in the project as a way of encouragement.

Because he told me earlier that he planned to give project this year, I asked him to explain for me the planning and preparation of the project. He started by saying that he chose the theme human biology from the syllabus, topic human skeleton. He said he chose that topic because it is very easy for the learners to get the materials for making a human skeleton. He said he will give each learner instruction on a worksheet and the activity will take a week to be completed. He said the project will count thirty marks and he planned to assess learners on the following skills; drawing (10 marks), using of tools (10 marks), labeling (7 marks), punctuality (1 mark), creativity (1 mark), neatness (1 mark). He said the activity will be done individually and so as the assessment because he wanted to assess individual work and skill. He said that he would like everybody to participate actively in doing the activity. The materials they are planning to use he said they will need a piece of box/poster (30cm x 60cm or bigger), a knife/scissor, an eraser, a pencil and a pen. Most of the materials can be found from home and in the surrounding at no cost involved, he adds. He planned to give the instructions to learners and let them work on their own, collecting materials and bring them to school, and he will supervise them and help them when in need of assistance.

Lastly, I asked him to tell me the advantages and disadvantages of projects in learners; he started with the advantages by saying that learners are helping one another and share ideas in group work. To him, the disadvantages was that some learners become reluctant and relaxed when working with others, while on the other hand some become dominant and do not give chance to others to take part in discussions or in doing.

2. LESSON OBSERVATION 10A and B, TULONGA: KUTHENGA CS

I observed both grade 10s A and B, with a total number of 63 learners. It was a 40 minutes Life Science lesson in each class. In the introduction the teacher reminded the learners that they have finished with the last topic and they are going to start with the new topic. He wrote the topic 'Human skeleton' on the chalkboard and asks learners to give their understanding of the term skeleton and its functions. After the learners gave their opinions the teacher wrote the definition and the functions of skeleton on the chalkboard. He told the learners that they will discuss in details the functions in the next lessons instead he told them that they are going to do a project on human skeleton which will take the whole week. He distributed the worksheet to every learner and tells them that he expect individual learner to come up with his/her own project which is a model of human skeleton. He reads the instructions to learners while they are following. He asks them to do the activity following the given instructions. He

did the demonstration to clarify step 2 which learners showed not clear. It reads: ’use a knife and a scissor to carefully cut off the drawing lines from the rest of the bones.

The teacher told learners that the materials needed for the activity were; 30cm x 60cm box/flipchart, a scissor/knife, a rubber and a pen/pencil. Learners were requested to start collecting the materials as soon as they arrive home and bring them to school so that they can start their project as soon as possible to avoid delays. He again requested them to come up with a nice model that is really like a human skeleton and tells them that what they are doing will be contributed to their continuous assessment. Learners were given chances to ask question for clarification. They were also told that the teacher will assist them where they need help.

Feedback: After five days from the lesson observation. The teacher started with the grade 10B whereby he reminded the learners that they are going to present their project. It was an individual activity, and then the presentation was done per groups. He asked each group to select one representative to present their outcome. Each group was given only 4 minutes to tell about how they get their materials, whether they get any assistance from somebody either from home or at school and how they work.

The teacher did not follow orders of the group instead he mentions any group to give their feedback. Starting with group six, one learner comes in front. His presentations are as follows:

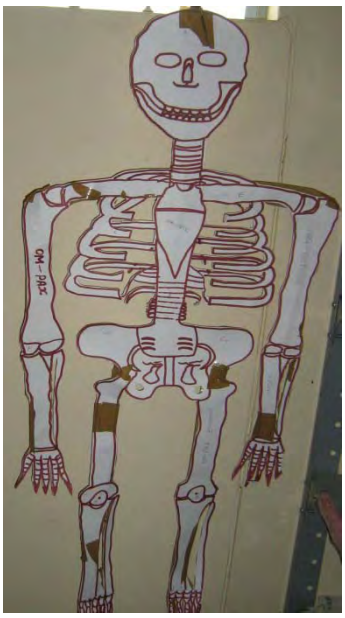
> *We were given a task to come a model of the skeleton. I first borrow materials and start with my skeleton. My parents give me materials like a knife and a scissor. I start to draw all part of the skeleton till I finish. I indicate part of the bone with letter. My skeleton look nice than others in the class.*

After the presentation the teacher asked the group whether they experienced problems when doing their activity. The group responded ‘no’. The teacher then asks group 1 to give their presentation. A group representative presents as follows:

> *It was Tuesday on 3rd June when our teacher gave us a task. We were wondering where to get the materials. One of our group members said ‘from the cuca shop’. My parents assist with scissor and knife and start drawing my skeleton, cut it and I was happy because I have everything. When I come to school my group said I am not the one who made it. I say is me.*

The teacher give chance to the other group and one boy come forward and say:

> *I am given a project, I go home ask materials from parents, fortunately materials are available. Apart from parent assistance our teacher assists us also. I want to thank my parent and teacher who help me do my project. This is how it looks like (show it).*



After the entire group presents the teacher asked the whole class if there is anybody who wants to say something from the presentation. After a long silence the teacher asked all learners to write their names on their models and give them to him.

The teacher then move to grade 10A

After greeting them he asked them if they are ready to present their work. He again reminded them that they are going to present in groups as agreed. After asking volunteer he call group 4 in front to present their work. A girl presents as follows:

> *My name is Hanga representing group 4 with my team members (she introduce them). The materials we used are scissors, knife; some we borrowed from parents and teacher. We start by drawing, start with vertebrate and all the parts. This is how we come up with our project.*

The teacher asked the group whether they experienced problems when using sharp objects. When the learners answered 'no' then he calls group 2 to present. A girl starts by saying:

> *My name is Lobi representing group 2. This skeleton is drawn by one of our group members, and one brought a Koki pen to draw big lines. One group member brought a scissor to cut. She shows all the parts of the bones and their functions. The problem we experienced was to cut lines.*

Then the teacher gives chance to the next group. A boy representing group 1 presents as follows:

> *I come here to say something about the project that we are given on 02 June 2008 by our Life Science teacher. It is a project of a human skeleton. He gives us to make a skeleton even to make it with box, wires and also sheet. Some were using box that we get from cuca shop free of charge, some were going to borrow*

at teacher. In our group no one who use a wire. First we start to cut a piece of box the length of 60cm and width of 30cm. we start to draw a skeleton compare with what we were given start from the skull, vertebrate and going to pectoral girdle, ribs, elbow joint, pelvic girdle up to knee joint and we finish the skeleton. The problem we experienced was to cut out the ribs, which is why we use a pen to show that this part is out. Here is the skeleton (show their model to the whole class).

After all the presentations the teacher asked learners if they want to say something on the presentations. One learner asked why group 2 did not tell them where they start with their project and one wanted to find out why they don't cut out ribs. Group 2 explained in details how they start from the skull to all the parts of the skeleton and clarified that there is no space to cut out ribs, therefore they shade with a pencil to show that the shaded part is not part of the model.

The teacher asked learners to give positive responses, then one learner got chance to thank group 1 for their nice presentation. After that the teacher gave an overall feedback to all learners on what to keep in mind when doing practical activities:

- Models should be clear and big enough
- Be serious with your work
- It is important to do practical work in order to gain more marks for Continuous assessment
- Presentation:
    - every group should be well prepared
    - group should share and agree on what to say

- choose somebody who is confident to present
- make sure you did it for your marks

He then asked all learners to bring their model with names on. He took the model with to the staff room for assessment. During presentation the teacher allocates five marks to each presentation. The assessment was done by done by the only teacher. He uses the rubrics and allocates marks to each skill as follows (MoE, 2006: 39):

Skills	Marks
Use and organize techniques, apparatus and materials (including presentation)	10
Observe, measure and record	10
Handle, process and evaluate experimental observation and data	5
Plan investigation	5

3. DOCUMENTS, TULONGA: KUTHENGA CS

Syllabus, Lesson plan, learners' activities and Continuous assessment form: The Life Science syllabus is aiming at developing learners' knowledge and understanding, creativity as well as practical and experimental skills. It also helps learners to develop self-confidence through meaningful scientific activities. The syllabus through its competencies and learning outcomes clearly highlighted the major skills that need to be practiced and demonstrated by all learners through hands on activities:

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Carrying out these skills learners enable the learners to posses the necessary skills after carrying out a particular investigations e.g. practical activities or project.

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- Information skills
- Competitive skills
- Problem solving skills
- Participation
- Physical skills

Most of the above skills should be acquired through effective group work, which is supported by the 'learner centred education' an approach to teaching and learning. The teacher should monitor the effective implementation of all the skills through teaching and through formal and informal assessment. The teacher has shown the connection of the syllabus and the lesson plan when planning his lessons. This was indicated in the lesson plan where he indicates the topic which was taught, the learning objectives and the basic competencies that are used to assess the learners' understanding and demonstration of skills. The following are extracts from the syllabus which a teacher use to draw up the lesson plans which he used for the lesson he taught on practical activities.

Topic 2. Scientific processes (an investigation)

2.1. Process skills

Objectives: At the end of the lesson learners will be able to know and understand the importance and application of the basic process skills

Practical activities, approaches and demonstration: Collect specimens, measure draw and calculate magnification

Topic 7. Human Body (a project)

7.5. Skeleton and muscles

Objectives: At the end of the lesson, learners will be able to discuss how skeleton are organized to support, protect and move the body.

Practical activities, approaches and demonstration: Make a model of a human skeleton (not stated in the syllabus).

The Life Science syllabus does not clearly stated on which topics required for a project and how the project should be carried out, but the teacher has indicated in the interview as well as in his lesson plan how he is going to implement a project. The syllabus has only clearly indicated the number of practical investigation which should be assessed and recorded. From the five investigations, two of them should be done during Term 1 of every year those count 15 marks, another two during Term 2, of which one is a project that count 30 marks and the last one to be done during Term 3 and count 10 marks. The syllabus has clearly indicated the practical skills for practical assessment (on page six), the scale and the criteria which to base the evaluation of the performance tasks as shown.

SCALE	GENERAL CRITERIA
5	The assessed skill is performed well above average, neatly and independently with little or no support or guidance
4	The assessed skill is performed above average with little or no support or guidance
3	The assessed skill is performed at an average level with some support or guidance
2	The assessed skill is performed below average with some support or guidance
1	The assessed skill is performed well below average, requiring pronounced support or guidance
0	This mark is only given when the learner is not assessed due to non participation without valid reason

(MoE, 2006: 39 slightly adapted)

The teacher planned and prepared the worksheets which the learners used when carrying out the activities. The lesson plan was drafted in a normal lesson plan format because there is no specific format for practical activities and project, and because the Life Science syllabus has clearly stated that activities such as field trips, project work/investigations and observations should not be taught as separate entities. Therefore the teacher infuses investigations and project work in the topics that are specified by the syllabus. Depending on the type of the lesson plan format used, the teacher has also indicated the resources and materials used in that specific activities.

In the interview, the teacher indicated that he gives two practical investigations for assessment. I collected the lesson plans for the specific activity, learners' work, an extract from the syllabus for that specific activities and the Continuous Assessment form where the teacher used to record the marks the learners got. The reason for collecting all those documents is for evidence, and to see whether there is a link between the documents. The learners' work corresponds to the worksheet given and the marks allocated correspond to the recorded marks in the continuous assessment form. These evident shows that the teacher understands and follows the assessment procedure.

Appendix 3

Permission letters

P.O.Box 1561
Ondangwa
25 June 2007

Enq. A. H, Angula

TO: Oshikoto Regional Director
Ministry of Education
P/Bag 2028
Ondangwa

Dear Madam

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN SCHOOLS

I am currently studying for a Master degree in Education (General Education Theory and Practice) at the Rhodes University. As part of my Master's degree I am required to carry out a research project on an aspect of the coursework of the Master programme.

The aim of my research project is to investigate how Grade 10 Life Science teachers understand and implement project work in Oshikoto region. I therefore kindly request your office to allow me to use two schools as my research sites for the research project.

I also request permission to observe lessons, to look at examples of project related activities and to interview Life Science teachers at these schools.

The schools and teachers are assured of anonymity in the final research report. They will receive drafts of the report and will be invited to provide corrections if necessary to ensure that details are accurately recorded and reported.

Your attention will be highly appreciated.

Yours faithfully

Alina H, Angula

cc. Senior Advisory Teacher
Mrs. Taimi Kamati
Oshikoto Region

REPUBLIC OF NAMIBIA

MINISTRY OF EDUCATION

OSHIKOTO REGION

Tel: (065) 281900/7
Fax: (065) 240315

P/Bag 2028
Ondangwa

29 June 2007

Enquiries: Mr Timoteus H. Ndakunda

To: Ms Alina H Angula
Ongwediva Teachers Resource Centre
Ongwediva

Dear Madam

Re: Request for Permission to conduct research in schools.

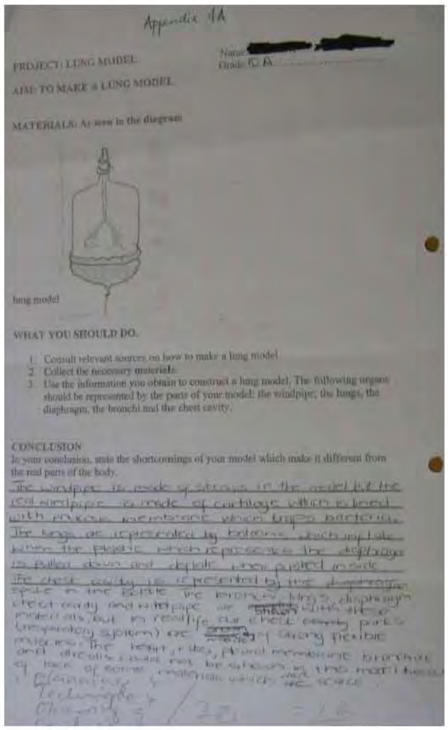
1. Your request on 25 June 2007 bears reference.
2. You are allowed to conduct research in the two schools of your choice, as long as the school programme is not interfered with.

Thank you,

Mrs Ester Anna Nghipondoka
Regional Director
Oshikoto

Appendix 4A

Worksheet: The lung model



Appendix 4A

PROJECT: LUNG MODEL

Name: [redacted]

Grade: 10 A

AIM: TO MAKE A LUNG MODEL

MATERIALS: As seen in the diagram

lung model

WHAT YOU SHOULD DO.

1. Consult relevant sources on how to make a lung model
2. Collect the necessary materials
3. Use the information you obtain to construct a lung model. The following organs should be represented by the parts of your model: the windpipe, the lungs, the diaphragm, the bronchi and the chest cavity.

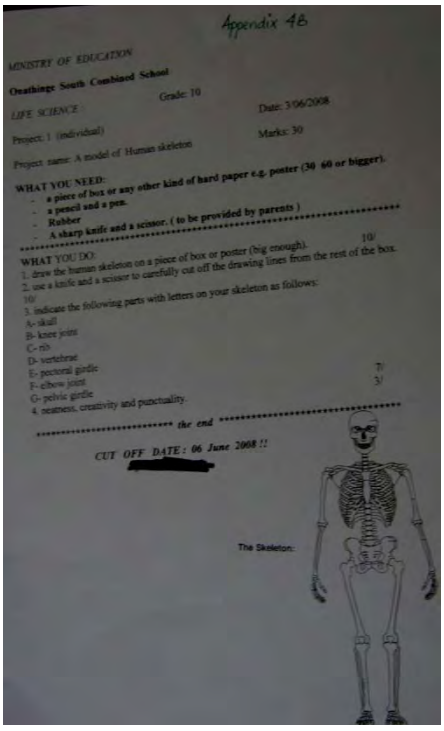
CONCLUSION

In your conclusion, state the shortcomings of your model which make it different from the real parts of the body.

The windpipe is made of straws in the model but the real windpipe is made of cartilage which is lined with mucous membrane which traps bacteria. The lungs are represented by balloons which inflate when the plastic which represents the diaphragm is pulled down and deflate when pushed inside. The chest cavity is represented by the [illegible] space in the bottle. The bronchi, lungs, diaphragm, chest cavity and windpipe are shown with these materials, but in real life our chest cavity parts (respiratory system) are [illegible] strong flexible muscles. The heart, ribs, pleural membrane, bronchioles and alveoli could not be shown in the model because of lack of some materials which are scarce.

Appendix 4B

Worksheet: The model of a human skeleton



Appendix 4B

MINISTRY OF EDUCATION

Onathinge South Combined School

LIFE SCIENCE Grade: 10

Project: 1 (individual) Date: 3/06/2008

Project name: A model of Human skeleton Marks: 30

WHAT YOU NEED:

- **a piece of box or any other kind of hard paper e.g. poster (30 60 or bigger).**
- **a pencil and a pen.**
- **Rubber**
- **A sharp knife and a scissor. (to be provided by parents)**

WHAT YOU DO: 10/

1. draw the human skeleton on a piece of box or poster (big enough).
2. use a knife and a scissor to carefully cut off the drawing lines from the rest of the box. 10/
3. indicate the following parts with letters on your skeleton as follows:

A- skull
B- knee joint
C- rib
D- vertebrae
E- pectoral girdle 7/
F- elbow joint 3/
G- pelvic girdle
4. neatness, creativity and punctuality.

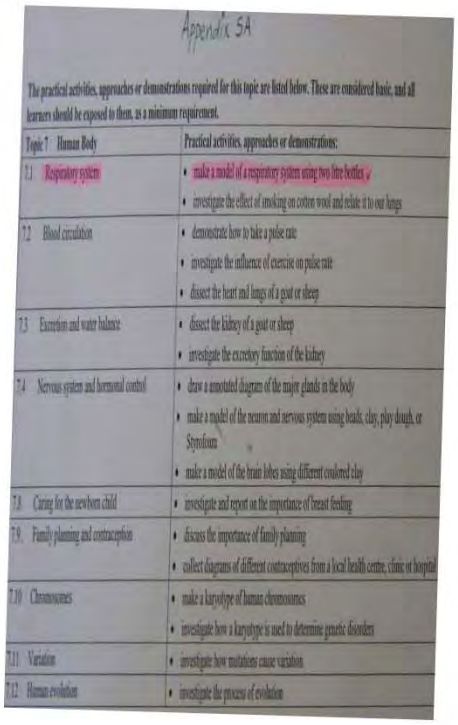
the end

CUT OFF DATE : 06 June 2008 !!

The Skeleton:

Appendix 5A

Syllabus extract: Lung model



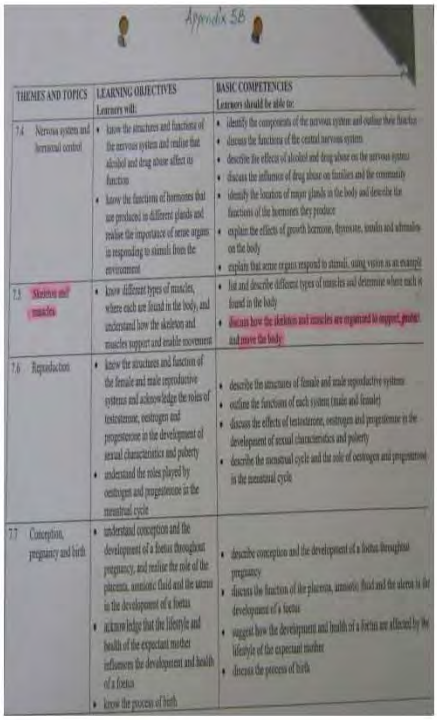
Appendix 5A

The practical activities, approaches or demonstrations required for this topic are listed below. These are considered basic, and all learners should be exposed to them, as a minimum requirement.

Topic 7 Human Body	Practical activities, approaches or demonstrations:
7.1 Respiratory system	• make a model of a respiratory system using two litre bottles • investigate the effect of smoking on cotton wool and relate it to our lungs
7.2 Blood circulation	• demonstrate how to take a pulse rate • investigate the influence of exercise on pulse rate • dissect the heart and lungs of a goat or sheep
7.3 Excretion and water balance	• dissect the kidney of a goat or sheep • investigate the excretory function of the kidney
7.4 Nervous system and hormonal control	• draw a annotated diagram of the major glands in the body • make a model of the neuron and nervous system using beads, clay, play dough, or Styrofoam • make a model of the brain lobes using different coulored clay
7.8 Caring for the newborn child	• investigate and report on the importance of breast feeding
7.9 Family planning and contraception	• discuss the importance of family planning • collect diagrams of different contraceptives from a local health centre, clinic or hospital
7.10 Chromosomes	• make a karyotype of human chromosomes • investigate how a karyotype is used to determine genetic disorders
7.11 Variation	• investigate how mutations cause variation
7.12 Human evolution	• investigate the process of evolution

Appendix 5B

Syllabus extract: The model of a human skeleton

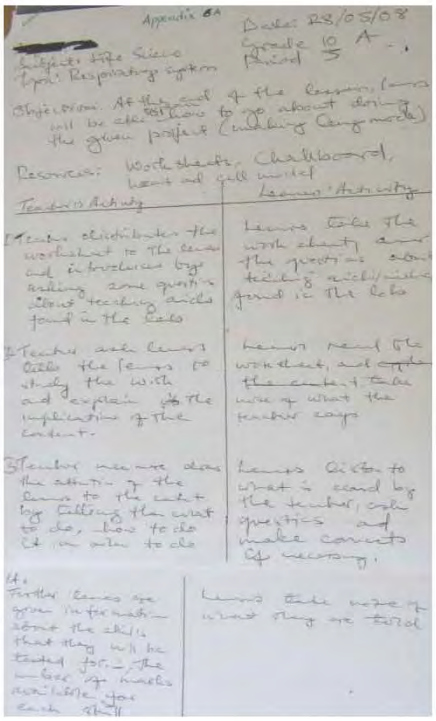


Appendix 5B

THEMES AND TOPICS	LEARNING OBJECTIVES Learners will:	BASIC COMPETENCIES Learners should be able to:
7.4 Nervous system and hormonal control	• know the structures and functions of the nervous system and realise that alcohol and drug abuse affect its function • know the functions of hormones that are produced in different glands and realise the importance of sense organs in responding to stimuli from the environment	• identify the components of the nervous system and outline their function • discuss the functions of the central nervous system • describe the effects of alcohol and drug abuse on the nervous system • discuss the influence of drug abuse on families and the community • identify the location of major glands in the body and describe the functions of the hormones they produce • explain the effects of growth hormone, thyroxine, insulin and adrenalin on the body • explain that sense organs respond to stimuli, using vision as an example
7.5 Skeleton and muscles	• know different types of muscles, where each are found in the body, and understand how the skeleton and muscles support and enable movement	• list and describe different types of muscles and determine where each is found in the body • discuss how the skeleton and muscles are organised to support, protect and move the body
7.6 Reproduction	• know the structures and function of the female and male reproductive systems and acknowledge the roles of testosterone, oestrogen and progesterone in the development of sexual characteristics and puberty • understand the roles played by oestrogen and progesterone in the menstrual cycle	• describe the structures of female and male reproductive systems • outline the functions of each system (male and female) • discuss the effects of testosterone, oestrogen and progesterone in the development of sexual characteristics and puberty • describe the menstrual cycle and the role of oestrogen and progesterone in the menstrual cycle
7.7 Conception, pregnancy and birth	• understand conception and the development of a foetus throughout pregnancy, and realise the role of the placenta, amniotic fluid and the uterus in the development of a foetus • acknowledge that the lifestyle and health of the expectant mother influences the development and health of a foetus • know the process of birth	• describe conception and the development of a foetus throughout pregnancy • discuss the function of the placenta, amniotic fluid and the uterus in the development of a foetus • suggest how the development and health of a foetus are affected by the lifestyle of the expectant mother • discuss the process of birth

Appendix 6A

Lesson preparation: The lung model



Appendix 6A

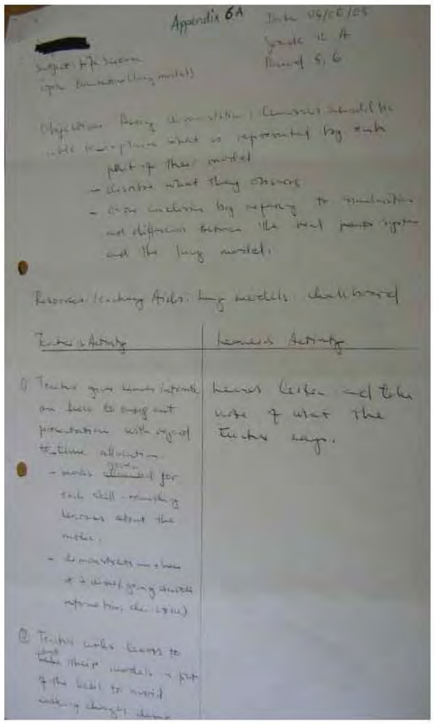
Date: 28/05/08
Grade 10 A - .
Period 5

Subject: Life Science
Topic: Respiratory system

Objectives: At the end of the lesson, learners will be able to go about doing the given project (making Lung model)

Resources: Worksheets, Chalkboard, heart and gall model

Teacher's Activity	Learner's Activity
1. Teacher distributes the worksheet to the learners and introduces topic by asking some questions about teaching aids found in the lab	Learners take the work sheets and answer the questions about teaching aids/models found in the lab
2. Teacher asks learners to study the work and explains on the implications of the content.	Learners read the worksheet, and explain the content, take note of what the teacher says
3. Teacher now draws the attention of the learners to the content by telling them what to do, how to do it and when to do	Learners listen to what is said by the teacher, ask questions and make corrects if necessary.
4. Further learners are given information about the skills that they will be tested for, the number of marks available for each skill	Learners take note of what they are told


Appendix 6A

[redacted]

Grade 11 A

Period 5, 6

Objectives:

part of their model

– describe what they observe

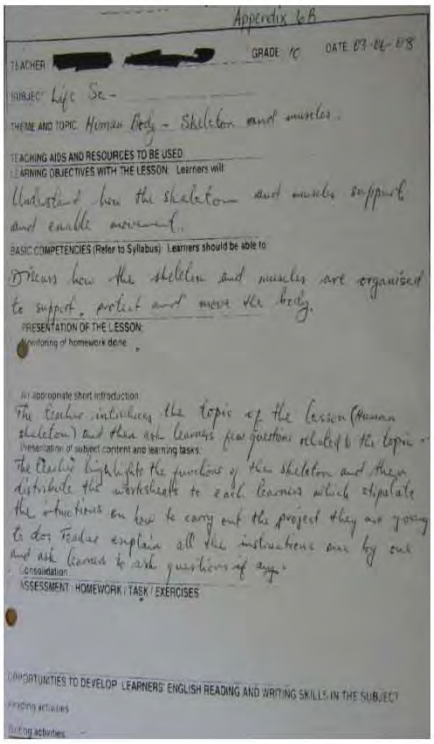
and the lung models.

Resources/Teaching Aids: lung models, chalkboard

Teacher's Activity	Learner's Activity
① Teacher gives learners ...	Learners listen and take note of what the teacher says.
② Teacher ... their models ...	

Appendix 6B

Lesson preparation: The model of a human skeleton



Appendix 6B

TEACHER [redacted] GRADE 7C DATE 03-06-18

SUBJECT Life Sc-

THEME AND TOPIC Human Body - Skeleton and muscles.

TEACHING AIDS AND RESOURCES TO BE USED

LEARNING OBJECTIVES WITH THE LESSON: Learners will

Understand how the skeleton and muscles support and enable movement.

BASIC COMPETENCIES (Refer to Syllabus): Learners should be able to

Discuss how the skeleton and muscles are organised to support, protect and move the body.

PRESENTATION OF THE LESSON:

Monitoring of homework done

An appropriate short introduction

The teacher introduces the topic of the lesson (Human skeleton) and then ask learners few questions related to the topic

Presentation of subject content and learning tasks

The teacher highlights the functions of the skeleton and then distribute the worksheets to each learners which stipulate the instructions on how to carry out the project they are going to do. Teacher explains all the instructions one by one and ask learners to ask questions if any.

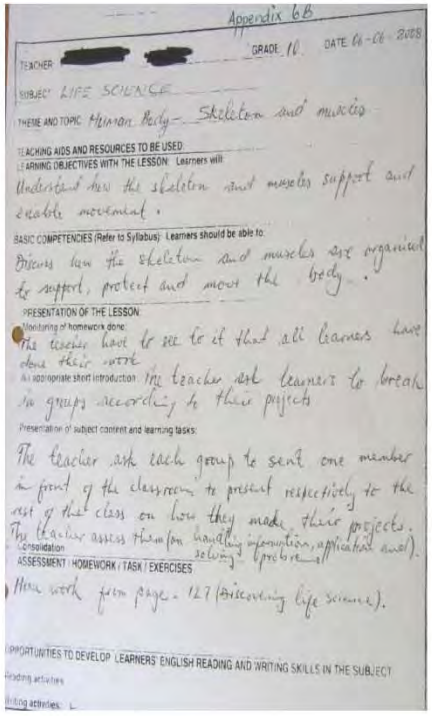
Consolidation

ASSESSMENT: HOMEWORK / TASK / EXERCISES

OPPORTUNITIES TO DEVELOP LEARNERS' ENGLISH READING AND WRITING SKILLS IN THE SUBJECT

Reading activities

During activities



Appendix 6B

TEACHER [redacted] GRADE 10. DATE 06-06-2018

SUBJECT LIFE SCIENCE

THEME AND TOPIC Human Body - Skeleton and muscles

TEACHING AIDS AND RESOURCES TO BE USED

LEARNING OBJECTIVES WITH THE LESSON: Learners will:

Understand how the skeleton and muscles support and enable movement.

BASIC COMPETENCIES (Refer to Syllabus): Learners should be able to:

Discuss how the skeleton and muscles are organised to support, protect and move the body.

PRESENTATION OF THE LESSON:

Monitoring of homework done:

The teacher have to see to it that all learners have done their work

An appropriate short introduction: The teacher ask learners to break in groups according to their projects

Presentation of subject content and learning tasks:

The teacher ask each group to sent one member in front of the classroom to present respectively to the rest of that class on how they made their projects. The teacher assess them on handling information, application and problem solving.

Consolidation

ASSESSMENT / HOMEWORK / TASK / EXERCISES

Home work from page - 127 (Discovering life science).

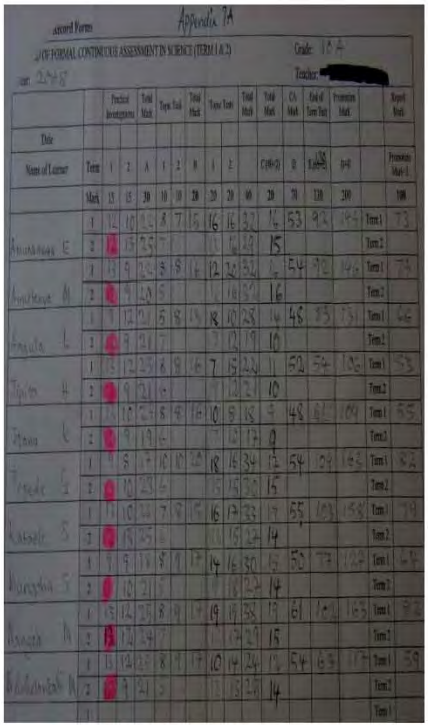
OPPORTUNITIES TO DEVELOP LEARNERS' ENGLISH READING AND WRITING SKILLS IN THE SUBJECT

Reading activities

Writing activities

Appendix 7A

Completed CA record form: Shiingulu High school



Appendix 7B

Completed CA record form: Kuthenga Combined School