

**SECONDARY SCHOOL TEACHERS' PERCEPTIONS  
OF THE IMPORTANCE OF PRACTICAL WORK IN  
BIOLOGY IN OSHANA EDUCATION REGION.**

**A THESIS SUBMITTED IN PARTIAL FULFILMENT  
OF THE REQUIREMENTS FOR THE DEGREE OF**

**MASTER OF EDUCATION**

**OF**

**THE UNIVERSITY OF NAMIBIA**

**BY**

**LEENA LAHYA TILENI NGHIPANDULWA**

**NOVEMBER 2011**

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**NOVEMBER 2011**

**APPROVAL PAGE**

This research has been examined and is approved as meeting the required standards for partial fulfillment of the requirements of the degree of Master of Education.

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Date

## **DECLARATION**

I, Leena Lahja Tileni Nghipandulwa declare hereby that this study, Secondary School Teachers' perceptions of the importance of practical work in Biology in Oshana Education Region is a true reflection of my own research, and that this work, or part thereof has not been submitted for a degree in any other institution of higher learning.

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**DATE** -----

**Ms Leena Lahja Tileni Nghipandulwa**

## **DEDICATION**

This work is devotedly dedicated to my Daughter, Tuapewa Memory Shoombe for her patience; she was young and still in need of my full love, support and care during the time of this study and also in memory of my late mother, Saara Selma Simon who did not live long to witness this special day in my life.

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Finally, I am indebted to all persons whose names cannot be individually mentioned here due to lack of space for their prayers, encouragements and moral support.

May God bless you all!

## **ABSTRACT**

The aim of this study was to investigate the Biology teachers' perceptions of the importance of practical work in selected secondary schools in the Oshana Education Region. The study also sought to find out whether the selected secondary schools in the OER had all the necessary resources needed to conduct meaningful practical lessons in Biology.

This study sought to answer the following research questions:

1. What are the Secondary School teachers' perceptions of the importance of practical work in Biology in Oshana Education Region?
2. How do Biology teachers in Oshana Education Region perceive the use of practical work during instruction?
3. To what extent is practical work done in Biology classrooms in the Oshana Education Region?
4. Do Secondary Schools in Oshana education region have all the necessary resources for conducting practical lessons in Biology?

This study was situated in both the qualitative and quantitative research paradigms. The population of this study consisted of all 13 Secondary Schools in the OER which offer Biology as a subject at Grade 11 and 12 levels. Eight Secondary Schools in the OER were randomly selected to take part in this study. A sample comprising of 23 Biology teachers was then chosen purposively from the 8 Secondary Schools. A questionnaire and an observation schedule were used to collect the data for this study. Descriptive statistics were used to analyze quantitative data and included frequency tables, graphs and pie charts. Qualitative data were categorised into themes that emerged from the data.

The findings showed that the 69.9% of the Biology teachers did not have a laboratory specifically for conducting Biology practicals and carried out their practicals in a common laboratory, used for both Physical Science and Biology or in their classrooms. Two (two out of nine teachers) of the observed teachers did not bother to carry out practical work and taught Biology as a completely theoretical subject, which disadvantaged learners on Paper 3, alternative to course work paper.

The findings also showed that 66.6 % of the teachers in the Oshana Education Region were not carrying out practicals in Biology. They claimed to be doing so, but in actual sense there were not much practical work taking place in those schools as four out of six of the observed teachers were doing demonstrations only. The findings also showed that the materials necessary for carrying out practical work were not available in the Biology classrooms or laboratories. This was evident from the non-availability of practical manuals for both teachers and learners resulting in the use of teacher made hand-outs.

This situation needs to be seriously addressed if practical work is to become popular among the learners and the teachers in the Oshana Education Region in Namibia. The Ministry of Education through Biology Advisory Teachers should seriously address the problems of both lack of laboratory space for the conduct of Biology practicals and the laboratory resources to ensure the conduct of practicals in schools in the Oshana Education Region. Biology Teachers should be encouraged to borrow materials necessary for conducting practicals from neighbouring schools in cases where their schools do not have the necessary resources for conducting practicals in Biology.

# CONTENTS

Approval page	i
Declaration	ii
Dedication	iii
Acknowledgement	iv
Abstract	vi
List of Tables	xii
List of figures	xiv
Acronyms	xv
<b>CHAPTER 1: INTRODUCTION</b>	<b>1</b>
1.1 Background of the study	1
1.2 Theoretical framework	2
1.3 Statement of the problem	4
1.4 Research questions	5
1.5 Significance of the study	5
1.6 Limitations of the study	6
1.7 Delimitations of the study	6
1.8 Definition of terms	6
1.9 Summary	8
<b>CHAPTER 2: LITERATURE REVIEW</b>	<b>9</b>
2.1 History of practical work in Science subjects	9

2.2 What is practical work?	11
2.3 Goals and aims of practical work in Science subjects	13
2.4 Benefits of practical work in Science subjects	15
2.5 Teachers' perceptions of the importance of practical work	18
2.6 Availability of resources for conducting practicals	20
2.7 Importance of Laboratory space in the conduct of practical work	22
2.8 Summary	22
<b>CHAPTER 3: METHODOLOGY</b>	<b>23</b>
3.1 Research design	23
3.2 Population	24
3.3 Sample and Sampling procedure	24
3.4 The Research instrument	25
3.5 Pilot study	26
3.6 Data collection procedure	26
3.7 Data Analysis	27
3.8 Ethical consideration	27
3.9 Summary	28
<b>CHAPTER 4: PRESENTATION AND DISCUSSION OF THE RESULTS</b>	<b>29</b>
4.1 Introduction	29

<b>4.2 Results from the questionnaires</b>	<b>29</b>
4.2.1. The extent to which Practical work is conducted in the Oshana Education Region	30
4.2.2. Practical work environment	38
(a) Resources for conducting practical lessons in Biology	38
(b) Availability of teacher resources for conducting practicals in Biology	44
4.3. 3. Perceptions of the Biology teachers of the importance of practical work in Biology in Oshana Education Region	50
4.4. 4. Perceptions of Biology teachers regarding the use of practical work.	67
<b>4.4. Results from the Observation Guide</b>	<b>79</b>
4.4.1. Introduction	79
4.4.2. Classroom organization	80
4.4.3. Resources to support the practical lesson	82
4.4.4. Introduction of the practical lesson	84
4.4.5. Teacher to learner interaction	87
4.4.6. Role of the teacher during the practical lesson	88
4.4.7. Conclusion of the practical lesson	90
4.4.8. Summary	92

<b>CHAPTER 5: Summary, Conclusion and Recommendations</b>	<b>93</b>
5.1. Summary	93
5.2 Conclusion of the Study	95
5.3 Recommendations	96
<b>REFERENCES</b>	<b>99</b>
<b>APPENDIX 1:</b> Teachers' questionnaire	105
<b>APPENDIX 2:</b> Practical lesson observation schedule	115
<b>APPENDIX 3:</b> Consent letter for the school Principals	120
<b>APPENDIX 4:</b> Consent letter for the teachers	121
<b>APPENDIX 5:</b> Permission letter from the main supervisor	122
<b>APPENDIX 6:</b> Permission letter from the Permanent Secretary	123
<b>APPENDIX 7:</b> Permission letter from the Regional Director	124

## LIST OF TABLES

<b>TABLE</b>	<b>TITLE</b>	<b>PAGE</b>
Table 1	Frequency of conducting practicals in Biology by teachers	30
Table 2	Duration of Biology Lessons	32
Table 3	Availability of a dedicated laboratory	39
Table 4	Places where practical work was conducted in Secondary Schools	40
Table 5	How well stocked were the Biology laboratories	41
Table 6	What teachers used as a guide for conducting practical work in Biology	44
Table 7	How learners were assessed at the end of the practical lesson	46
Table 8	How teachers made sure all learners were involved during the practical	49
Table 9	Why practicals are necessary in the teaching of Biology	51
Table 10	What Biology teachers do if schools do not have equipment for Biology practicals	54
Table 11	Reasons why teachers allowed their learners to use the materials and equipment	56
Table 12	Why teachers enjoyed doing practical work lessons	59
Table 13	Reasons why some Biology teachers did not enjoy doing practical work	61

Table 14	How practicals contributed to the learners' understanding of Biology	62
Table 15	Benefits from doing practical lessons by Biology teachers	63
Table 16	Importance of knowing the names and functions of the apparatus and equipment	65
Table 17	Reasons why the time allocated for practicals was not enough	68
Table 18	Teachers' suggestions in the time that they thought would be sufficient to allow them to conduct practical lessons	69
Table 19	Importance of carrying out practical work in advance	70
Table 20	How learners benefited maximally from practical lessons in Biology	74
Table 21	Factors hindering teachers from carrying out practical work in Biology	75
Table 22	The conditions of Biology laboratories	84
Table 23	How teachers introduced the practical lessons	85
Table 24	Action by teachers to involve learners in doing the practical	89
Table 25	What learners handed in at the end of the practical lesson	91
Table 26	How teachers concluded their practical lessons	92

## LIST OF FIGURES

<b>FIGURE</b>	<b>TITLE</b>	<b>PAGE</b>
Figure 1	Equipment for teachers' or for learners' use?	42
Figure 2	Components of Biology enjoyed most by Biology teachers	58
Figure 3	Who should be doing the practical work during the Biology practical lesson?	64
Figure 4	What learners did at the end of each practical lesson	71

## **LIST OF ABBREVIATIONS AND ACRONYMS**

NSSC-O LEVEL	Namibian Senior Secondary Certificate for Ordinary Level
MEC	Ministry of Education and Culture
OER	Oshana Education Region

# CHAPTER 1: INTRODUCTION

## 1.1 Background of the study

After Namibian independence in 1990, the Ministry of Education and Culture (MEC) introduced a new education system, aimed at “reviewing inequality and inequity within the education system” (MEC, 1993, p.5). The mission of the educational system was to equip students with the necessary knowledge, skills and attitudes that could enable them to enter institutions of higher learning in and outside Namibia and meet the social demands without fear.

At present, the assessment objectives of Biology in Namibia are summarised in the syllabi (Ministry of Education, 2009a, p.26) under the following three domains:

**Domain A** : Cognitive domain (knowledge with understanding).

**Domain B** : Handling information and solving problems, and

**Domain C** : Practical skills and investigations.

The cognitive **domain (A)** focuses on subject matter content while **domain (B)** stresses the importance of handling information and solving problems and **domain (C)** focuses on the importance of practical work for the development of skills and investigations. For this study, Domain B and C are very important. It is through practical work that students may be involved in different activities that may enhance their abilities to handle information and solve problems and/or develop experimental skills and learn how to plan investigations.

In Grade 12, Biology has three examination papers which are written by learners at the end of the year. Paper 1 is multiple choice, Paper 2 is structured questions and Paper 3 is the Alternative to Practical Work. According to Sneyder (1998), Science teaching in Namibia is basically theoretical and the teaching of practical work is still neglected in most Namibian secondary

schools. The teaching of Science is still dominated by theory driven instructions that rely very much on rote learning as a way for students to acquire scientific knowledge. In most schools, coursework is not conducted because of the inadequacy of the teachers' professional teaching skills that they bring to the classrooms (Sneyder, 1998).

## **1.2 Theoretical Framework**

This study is based on the theory of constructivism. Constructivists view learning as an active process whereby learners should learn to discover principles, concepts and facts for themselves. The instructor and the learners are equally involved in learning from each other (Woolfolk, 2004).

Crawford (1996) indicated that social constructivists, such as Vygotsky, emphasize the importance of learners being actively involved in the learning process so that they can construct their own understanding. It is believed that learners with different skills and backgrounds need to collaborate on tasks, such as when they are doing practical work together in order to arrive at a shared understanding of the truth in a specific field.

The term "constructionist teaching" is commonly used in the teaching and learning environments (Ritchie and Rigano, 1996, p .220). The teacher according to the constructivist theory is not seen as a person who is responsible for constructing knowledge for the learners but rather is denoted by the many responsibilities given to him\her during instruction in mediating meaning at the inter-mental plane in the classrooms. Thus, the teacher's role becomes that of a guide provocateur, creator of opportunity and co-developer of understanding with learners. The instructional practices of the Biology teachers should therefore assist learners to acquire the process skills (Ritchie and Rigano, 1996).

According to Woolfolk (2004, p. 330), “Learners should constantly be challenged with tasks that refer to skills and knowledge just beyond their current level of mastery. This will capture their motivation and build on previous success, in order to enhance the confidence of the learners”.

Learners need to do practical work so that they can be given activities that would challenge them during the practical lessons. When learners are doing practical lessons, they will be motivated to learn better by doing, because learners learn better by doing rather than just being taught theoretically.

In the constructivist view, learning is a constructive process in which the learner builds an internal illustration of knowledge, a personal interpretation of experience. Learning is an active process in which meaning is accomplished on the basis of experience. Thus, educators must consider students’ levels of cognitive development when planning topics and methods of instruction (Ritchie and Rigano, 1996).

According to Driscoll (1994, p. 313), “A social constructivist, Jean *Piaget* (1953), believed that: learning should be authentic and real. Learners construct their own reality or at least interpret it based upon their perceptions of experiences. Learning should be situated in a realistic setting. A laboratory is a realistic setting, with the instruments for practical work that are found in the laboratory, they make it real life experiences”.

Laboratories allow learners to experience reality. Learners do not forget easily what they have seen with their own eyes, and during practicals they can observe with their own eyes and thus experience reality (Driscoll, 1994).

Driscoll (1994, p. 314) further added that “many schools have traditionally held a transmission of instruction’s model in which a teacher or lecturer transmits information to students”. In contrast, Vygotsky’s (1978) theory promotes learning contexts in which students play an active role in learning. The roles of the teachers and the students are therefore shifted, as a teacher collaborates with his/her students in order to help facilitate meaning construction in students. “Constructivism is a process in which knowledge is both built and tested. Individuals are not free to construct any knowledge, their knowledge must be viable, and it must work. Empirical evidence obtained from laboratory experiments, for example, can be used to test new knowledge” (Ritchie and Rigano, 1996, p. 799).

### **1.3 Statement of the problem**

According to the Ministry of Education (2008 and 2009), the Examiners’ Reports on Biology Paper 3 shows that the learners have continued performing poorly in Paper 3 countrywide in comparison to Paper 1 and 2. The Examiners’ Reports further pointed out that it is clear from Candidates’ answers that only a few schools follow a practical approach to the teaching of Biology.

Lubben (1998) noted that eight years after Namibia’s independence, practical work in Science education, in most Namibian schools, is still a pipeline dream as few teachers are capable of teaching Science by practical work and many Science teachers still need assistance on how to involve students in meaningful practical activities.

It is against this background that a qualitative and quantitative study was carried out in order to investigate the perceptions of the importance of practical work by Biology teachers in selected secondary schools in the Oshana Education Region.

The study also investigated whether the selected secondary schools had all the necessary resources needed to conduct meaningful practical lessons in Biology.

#### **1.4 Research questions**

This study sought to answer the following questions.

1. What are the secondary school teachers' perceptions of the importance of practical work in Biology in the Oshana Education Region?
2. How do Biology teachers in the Oshana Education Region perceive the use of practical work during instruction?
3. To what extent is practical work done in Biology classrooms in the Oshana Education Region?
4. Do secondary schools in Oshana education region have all the necessary resources for conducting practical lessons in Biology?

#### **1.5 Significance of the study**

The findings from this study might assist the Biology teachers in understanding how to teach practical work. The results of this study might also help Biology teachers to change their attitudes towards practical work in the teaching and learning of Biology. The findings of this study might also contribute to new knowledge that might help Biology teachers to find solutions to the problems of learners who are not performing well in the practical examination Paper in Biology. Biology teachers might also benefit from this study by finding out whether the practical work that they do at their schools is adequate to make their learners ready for the Biology final examination.

## **1.6 Limitations of the study**

Few studies on practical work have been carried out in Namibia. This has been a limitation in this study because most of literature reviewed was from outside Namibia. Another limitation was that the teachers might just do practicals when the researcher was present to give the impression that they do carry out practicals.

## **1.7 Delimitations of the study**

Given the limitations above, this study was limited to the Oshana Education Region only because that is where the researcher resides. The study was conducted in 8 secondary schools in the Oshana Education Region and the study focused on 23 teachers who taught Biology in Grade 11 and 12.

## **1.8 Definition of key terms**

**Practical work (laboratory work):** In this paper, Practical work is defined as the component of Science subjects that focuses on investigating phenomenon through hands and minds inquiry. It is seen as a hands - on, or minds - on practical learning opportunity by students or learners (Stoffel, 2005). Practical work is referred to by the researcher as an activity that promotes active learner participation in learning. This definition does not only mean hands-on activity involving equipment, but also encompasses a range of other ways of working, including teacher demonstration, group discussion of problems and their solutions, interaction between students, and between students and teachers. It may involve individual activity such as measurement, observation and investigation. Thus practical work can take different forms from experiments to pencil and paper activity and may take place in the laboratory, classes or elsewhere (Stoffels, 2005).

**Teachers' perceptions of practical work.** In this paper, teachers' perceptions are defined as how teachers see and understand practicals in the context of teaching Biology (Hornby, 2005).

**Cognitive domain.** In this paper, cognitive domain is defined as the concept that involves knowledge and the development of intellectual skills. This includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills (Krathwohl, Bloom & Masia, 1973).

**Meaningful learning.** In this paper meaningful learning is defined as the concept that the learned knowledge (let's say a fact) is fully understood by the individual and that the individual knows how that specific fact relates to other stored facts (stored in your brain that is) (Douglas & Jaquith, 2009).

**Student-centred learning.** In this study, student centred learning is defined as an approach to education that focuses on the needs of the students, that is, putting students first, Student-centred learning is focusing on the student's needs, abilities, interests, and learning styles with the teacher as a facilitator of learning. This classroom teaching method acknowledges student voice as central to the learning experience for every learner (Deci & Ryan, 1985).

**Active learning.** In this paper, active learning is defined as a technique where students do more than simply listen to a lecture; students discover, process, and apply information because the responsibility of learning is placed on the students themselves (Douglas & Jaquith, 2009).

**Constructivism.** In this paper constructivism is defined as the term that refers to the idea that learners construct knowledge for themselves, each learner individually (and socially) constructs meaning as he or she learns (Driscoll, 1994).

## **1.9 Summary**

This chapter focused on the introduction, describing the background information as well as the statement of the problem under study, the research questions were also given and the significance of the problem. The chapter also described the theories underpinning this study. The next chapter presents the review of the literature.

## **CHAPTER 2: LITERATURE REVIEW**

In this chapter the researcher reviewed the literature related to practical work. The literature that was reviewed was divided into seven subheadings, namely:

1. History of practical work in Science Subjects.
2. What is practical work?
3. Goals and aims of Practical work in Science teaching.
4. Benefits of practical work.
5. Teachers' perceptions of the importance of practical work.
6. Availability of resources for conducting practicals.
7. Importance of laboratory space in the conduct of practical work.

### **2.1 History of practical work in Science subjects**

Ever since experimental Science was advocated in the sixteenth century (Klainin, 1995), it has been well accepted that practical or empirical work is the major task of scientists. Thus, in order to educate our future leaders in science, there is a widespread belief that students should learn science by doing what scientists do (Klainin, 1995). Learning of Science therefore is seen by most Science educators as likely to be more effective if the child is involved in practical activities and takes an active part in the learning process. Practical work has been a prominent feature of school Science teaching from the late nineteenth century when Science was established as part of the curriculum of schooling in a number of countries (Klainin, 1995).

The curriculum innovation of the 1950s which started in the United States of America and Europe rapidly spread throughout the world and greatly changed the way science was taught. At the international science conference, funds were made available to develop courses that would allow students to work like practicing scientists, by allowing pupils to interact with the learning environment and this is one of the reasons why practical work has become a unique feature of science education. (Tamir, 1991, p. 14).

Namibia has included a practical work component in the teaching and learning of science. Learners in Grades 11 and 12 in Namibia are expected to do practical work in all the two Science subjects (Biology and Physical Science). In Grade 12, learners are assessed on practical skills in Paper 3 which is an Alternative to practical work. The inclusion of practical work is clearly stipulated in the Namibian Biology syllabus (Ministry of Education, 2009a).

Just as scientists need laboratories to carry out their investigations, schools also need laboratories or special rooms in which students can carry out experiments. The school science laboratory provides an environment where students can test how valid their intuitions, hunches and ideas are with respect to the scientific viewpoints learned (Tamir, 1991). Practical work can only be taught properly if schools are equipped with laboratories where teachers could engage in practicals with their students. The uniqueness of the laboratory lies principally in providing students with opportunities to engage in the processes of investigation and inquiry (Hofstein, 1998).

According to Dillon and Dillon (1995), since the science curriculum reform of the 1960s in the United Kingdom and 1970s in the United States of America, the nature and value of practical work have been examined and evaluated greatly. That is why the current curricula innovations in Science in many countries in the world now focus more on explorations and investigations (Dillon and Dillon, 1995).

Today practical work is seen as having a dual role of facilitating the learning and understanding of science concepts and of developing the skills and procedures of scientific inquiry (Millar, 1989).

If practical work is aimed at developing cognitive processes such as handling information and solving problems as well as scientific skills and procedures, students' performance will be high in the practical work assessment.

George (1995) emphasized that, since the inclusion of laboratory work into school sciences in many developed and developing countries, practical work has become an integral part of many school Science curricula of many countries both in developed and the developing world. The importance of practical work cannot be over-emphasized, but what is of great concern within this past decade is the way practical work has been practised and assessed.

## **2.2 What is practical work?**

Practical work is used to refer to laboratory activities that include lectures, group experiments, and teacher demonstrations where learners are involved in handling and observing real objects and materials (Millar, Le Marechals, & Tibergnien, 1999). Teachers should therefore provide opportunities for learners to handle materials, observe events, handle observation results and be able to draw conclusions. The aims of practical work are often related to the nature of learning outcomes including investigative and practical skills (Ritchie and Rigano, 1996). The development of these skills will be meaningful when teachers provide opportunities to learners to handle materials, observe events, handle observation results and be able to draw conclusions. In this way, practical work can be described as a means of acquiring process skills to promote meaningful learning (Ritchie and Rigano, 1996).

In a study carried out in Ethiopia, Bekalo, and Wellford (2000), indicated that there was an assumption among Ethiopian Science educators, including teachers that practical work in science means only laboratory work involving relatively sophisticated and imported expensive apparatus.

Alternative practical activities such as those that can be done outside the laboratory or with locally available materials are not only considered to be practical work, but also are perceived by teachers as low status activities.

Furthermore, Bekalo and Wellford's study revealed that the majority of educators thought the purpose of practical work was only to confirm scientific facts. These educators reflected the traditional aphorism, "I hear and I forget, I see and I remember, I do and I understand" as the only justification for doing practical work in Science (Bekalo and Wellford, 2000).

In this paper, Practical work is referred to by the researcher as an activity that promotes active learner participation in learning. This definition does not only mean hands-on activity involving equipment, but also encompasses a range of other ways of working, including teacher demonstration, group discussion of problems and their solutions, interaction between students, and between students and teachers. It may involve individual activity such as measurement, observation and investigation. Thus practical work can take different forms from experiments to pencil and paper activity and may take place in the laboratory, classes or elsewhere.

For many decades now, science has been taught as an inquiry. Schools have built laboratories as places where students learn their Science by doing things. Practical work forms an important part of inquiry learning. It is assumed to provide concrete props to help students comprehend the complex and obstacle concepts of science. (Tamir, 1991, p. 73).

Practical work is therefore used to clarify concepts, elucidate theory, illustrate phenomena, and verify facts and principles and confirm theory. It is by doing experiments and creating concepts at first hand in the laboratory that this understanding of science is to be achieved.

## **2.3 Goals and aims of Practical work in Science teaching**

According to Hodson (1992, p. 65), “It is sometimes convenient to think of education in science as having three major aspects.

- 1) Learning science: Acquiring a range of scientific concepts and becoming familiar with some of the major scientific theories.
- 2) Learning about science: Gaining some understanding of the nature of science and scientific practice and an appreciation of the complex relationship between science, technology and society. Practical work/laboratory work is the logical consequences of the scientific method; it should be seen and dealt with in this context as part of the process.
- 3) Doing science: Acquiring the knowledge and skills necessary for engaging in scientific inquiry and using that expertise to conduct real enquiries sometimes self-directed, sometimes under teacher guidance.

Practical work can be placed under both, learning science, doing science and learning about science. This is because students use their hands to do practical work. This they do, so that they can acquire skills and knowledge that will allow them to be involved in scientific inquiry. Students also use their understanding in order to arrive at their conclusions during practical work. Also, in learning science; learners do practical work in order to acquire scientific concepts that will allow them to understand science in general.

In a review of the literature on the place of practical work, Schulman and Tamir (1973, p. 343) proposed a classification of goals for laboratory instruction in science education as to:

- (i) arouse and maintain interest, attitudes satisfaction, open mindedness and curiosity in science.
- (ii) develop creative thinking and problem solving ability.
- (iii) promote aspects of scientific thinking and the scientific method e.g. formulating hypotheses and making assumptions.
- (iv) develop conceptual understanding and intellectual ability.
- (v) develop practical abilities, for example, designing and executing investigations, observations, recording data, and analysing and interpreting data.

Swain, Monk, & Johnson (1999) explored students' attitudes towards the aims of practical work in science education in three different countries, Egypt, Korea and United Kingdom (UK). It was found that all three groups of students expressed a common attitude towards the aims of practical work, and in particular, to "the methods by which scientists produce new knowledge" (p. 235). Swain et al. further reported that the three groups of students agreed that empirical work should be considered the defining feature of science. All three groups according to Swain et al. ranked the aims of practical work as 'to encourage accurate observation and description' the highest. This aim was followed by "to practice seeing problems and seeking ways to solve them", "to arouse and maintain interest", "to make phenomena more real" and "to find facts and arrive at new principles" (p. 234).

Practical work should therefore allow students to use all their four sense organs which will allow them to learn science with understanding. Practical work will also improve students' observational skills, so that they can become good observers in future.

## **2.4 Benefits of practical work in the teaching of science subjects**

According to Gott and Duggan (2003, p. 95), “Practical work is seen as the teaching and learning approach that develops procedural understanding as well as substantive understanding. Practical work allows learning by doing and is an important experience of own productivity and provides opportunities for significant learning about oneself and the world.”

Practical work allows learners to learn with understanding. Learners understand better what they have seen rather than what they were taught theoretically. During practical works, learners touch and hold the equipment themselves and as such learn better by doing.

The value of practical work has long been recognized at the secondary school level. Many teachers acknowledge the value of learning by doing rather than just being shown or told (Driver and Braund, 2002; p .222). If students can be allowed to do practical work in Biology, then this could help them understand the content better, because students learn better by doing. They will remember better something that they have done with their own hands. This was further emphasized by Hodson (1990) who said that practical work is an essential component of science and vocational subjects teaching. It is therefore advisable that students should be prepared with mastery of the skills required for practical work so that they will be ready for assessment. Hodson (1990) further added that in practical work the candidate performs certain activities in order to discover something as yet unknown, to test a hypothesis or to check an already known fact. In order to perform these activities, the candidate has to learn the skills required for practical work, which includes preparing and performing experiments and processing the results obtained.

According to Ottander and Grelsson (2006, p. 113), “The purpose of laboratory work in science education includes helping students learn science through the acquisition of conceptual and theoretical knowledge, and helping them learn about science by developing an understanding of the nature and methods of science”. Laboratory work would thus enable students to do science using the ways of scientific inquiry. The increased support for purposeful learning complements scientific theories and how to apply them. Furthermore, laboratory work is meant to stimulate the development of analytical and critical skills and create interest in science (Ottander and Grelsson, 2006). For the interests of students in science to be increased and for them to become motivated to want to do science, there is a need for teachers to do practical work with them.

A large proportion of both primary and secondary pupils thought that practical work would contribute positively to general learning in science. They believe that practical work provided a usefully independent experience that supports learning. By doing practical work in science at school, students can find things out for themselves rather than the teacher telling them; it is more fun than just the teacher showing them. (Krathwohl, 1998, p. 210).

The statement above by Krathwohl (1998) is true. From the researcher’s experience, usually when it is time for practical work, most of the students are happy, and they usually pay more attention than during the normal lecture lesson. In other words students find it fun when they are doing practical work, because they discover things for themselves.

We know that students enjoy practical work and that students are more likely to engage with science if they can see its relevance by doing experiments. Experiments sharpen students’ powers of observation, stimulate questions and help develop new understanding and their vocabulary. Practical work will also help all teachers of science subjects to share their skills and experiences of making experiments work in their classrooms. (Hodson, 1990, p. 33).

Practical work with real objects and materials help teachers and learners to communicate information and ideas about the natural world, and also provides opportunities to develop students’ understanding of the scientific approach to enquiry (Leach and Paulsen, 1999).

Practical skills in science education are important in their own right. Practical work is useful and essential for the teaching of Science in schools that aim to train students to become scientists or technicians and is helpful in assisting concept learning, development of attitudes and interests in learners in Science. Students, whether they go on to study science further or not, should benefit from the practical experiences of their science education, skills and hands-on confidence that will be useful in their future lives as citizens.

According to Ausubel and Novak (1968), the laboratory gives the students appreciation of the spirit and method of science, promotes problem-solving, analytical and generalization ability and provides students with some understanding of the nature of science.

“Science is about, ‘seeing is believing’ (Ausubel et al. 1968, p. 234)’. So learners should see, for them to believe, not only learn facts without any supporting evidence. That is why practical work is essential in understanding science. Students for that matter need proper training and guidance in doing practical work. Furthermore, at the end of the year learners in Namibia will be assessed practically.

It is therefore important that learners should be allowed to do practical work in Biology in order for them to benefit from those practicals and be able to understand Biology better. Teachers should organize practicals for the learners to do, and then teachers should help learners to do the practicals themselves if learners are to benefit from doing the practicals.

## **2.5 Teachers' perceptions of the importance of practical work**

The development of teachers' favourable attitudes towards science has often been listed as one of the important goals of science teaching. Students enjoy laboratory work in some courses and that it generally results in positive and improved attitudes towards science, and interest in the sciences (Hofstein, 1998).

Newman (undated, p .2) wrote: "We observed classes who studied chemistry and found that with few exceptions pupils enjoyed what they are doing in the laboratory even if difficulties arose in the procedures or even if students became aware that they didn't understand what was happening, it didn't seem to matter". On the other hand, Woolnough and Allsop (1985, p. 201) noted that, "Many science teachers recognized the importance of practical work. They believed that pupils should have first-hand practical experience in laboratories in order to acquire skills in handling apparatus, to measure and to illustrate concepts and principles". Having first hand information will allow students to apply the skills acquired during practical work when they become scientists in future.

Ramorogo (1998) explored teachers' perceptions of practical work in Biology in Botswana secondary schools. He found that in large classes, the shortage of laboratories and the lack of laboratory assistants were serious impediments to teachers in involving students in meaningful practical activities.

On the other hand, Leach et al. (1999) reviewed the use of practical work in science education in different countries. They found that in many countries, teachers spent or claimed that they spent considerable amounts of time in supervising laboratory work. However, they found that the bulk of science assessment was traditionally non-practical.

In other words, the assessment of students' performance in the Science laboratory was by and large neglected in most countries and by most teachers.

It should also be noted that during practical work the teachers interact with their students which develops closeness and trust between them. The students feel that their teachers care about them as much as they care about themselves. In an atmosphere of care and trust, learning is fostered. According to Psillos and Niedderer (2002, p. 232), "Practical work has long been a feature of school Science but the role and intended learning outcomes of practical work have been the subject of considerable debates. With regard to practical work, it is difficult for a teacher to plan systematically without having a clear understanding of the aims of the practical tasks being set. If learners are to cope with the demand of such tasks, they must possess appropriate conceptual and procedural understandings of practical work." In short, teachers need to be able to select practical activities that match intended learning outcomes. Such learning should extend beyond substantive facts and concepts to gaining an understanding of how to collect evidence from practical activities and how to analyse validate and use this as a basis for decision making (Gott and Duggan, 2003).

Thompson (1975) investigated the value of practical work at the upper secondary school level in England and Wales. The aim was to determine the value that teachers placed on laboratory work and to find out the constraints that prevented teachers from putting theory into practice. The finding revealed that teachers provided opportunities for students to be involved in a variety of practical work such as standardized exercises, discovery experiments, and taught those aims that they considered important.

Thompson (1975) further reported that the teachers were in agreement with the principle aims of practical work, i.e. : “to encourage accurate observation and description”, “to make phenomena more real through experience” and “to promote a logical reasoning method of thought”.

However, he found that Biology and Physics teachers placed greater emphasis on the development of critical attitudes. Thompson (1975) also noted that teachers placed more emphasis on practical work as a means of making phenomena more real through experiences.

Practical examinations are used in some countries as part of the external and terminal assessment of students’ learning (Kalinin, 1995). In the case of external practical examinations, the teacher usually has little involvement during the examination although he/she might be required to do assessment with the marking scheme, the end products of the practical work (Klainin, 1995). Teachers are not attracted to this type of practical examination (Klainin, 1995), because of the diminished role they have to play in assessing their students’ work. This is also the case in Namibia. Grade 12 students have to write an Alternative to Practical Work examination at the end of the year. This paper is not set by the teachers themselves; as such they have no control over the contents of the practical paper that their students are required to write.

## **2.6 Availability of resources for conducting practicals**

Klainin (1988) identified some problems of practical work in school science as experienced by the teachers and students in both developed and developing countries. These problems are associated with curriculum implementation, change of emphasis in school curriculum, and problems of incentives and the problems that are associated with goals that could be attained by practical work.

The problems associated with curriculum implementation include the lack of equipment, enough time for practical work, safety precautions in the laboratory, and students' participation. Those associated with incentives include the value of practical work held by students, teachers and curriculum developers, and the lack of reward for the students.

Practical work for school Science classes might be very expensive in money and time and human resources. Third world countries have not been reluctant in designing their science curricula to accept the challenge of using practical-based approaches to science learning. However, many problems then arise. How can equipment be obtained? Can the teachers make use of it? How can it be stored? How can large classes experience activities when only one set of equipment is available? (Klainin, 1995, p. 174).

Given the importance of practical work in enhancing understanding, ample time and resources should be made available to schools. This will enable Science teachers to ensure the attainment of Science content and processes

There was a significant difference between the teachers who have science laboratories and those who have not. The teachers who found their laboratories well-equipped wanted to do practicals more and more in comparison with those whose labs were inadequate. Having no science laboratories or inadequate equipment in science laboratories in schools affect teachers' attitudes towards the aims of science experiments. The teachers' opinions related to the non-existence of laboratories and inadequate equipment in laboratories may prevent them from the idea of doing simple experiments even under the current skimpy circumstances. Thus, the teachers may tend towards an idea that only when there is a well-equipped lab they can perform science experiments and reach their goals. (Gayford, 1988, p. 123).

Lack of resources for the conduct of practical work such as laboratories might prevent teachers from carrying out practical work in Biology. This will in return disadvantage learners especially in answering questions in Paper 3, the alternative to practical work, which will then negatively affect their performance in Biology as the whole subject.

## **2.7 Importance of laboratory space in the conduct of practical work**

Roth (1993) sees a science laboratory as a construction site. In a science laboratory from a constructivist's perspective, students are expected to work more independently, choose their own paths of investigation, determine their own research agendas and set up and conduct their experiments to make discoveries for themselves.

According to Roth, the students in this situation should not be provided with cookbook recipes for the experiment, but rather be given "a chance to discuss the meaning of the problem in the question and the appropriate experimental design for it" (p. 343).

Good laboratory facilities do not guarantee good practical and favourable learning outcomes. They can certainly facilitate better learning outcomes. Too often, because of poor laboratory design, inadequate facilities, lack of technical support and insufficient curriculum time, teachers are unable to operationalize practical work as they wish (Hodson, 1992). The lack of technicians, adequate laboratory space for the large number of students doing Biology and inadequate equipment and consumables may be impacting negatively on the conduct of practical work in Namibian secondary schools.

## **2.8 Summary**

This chapter looked at the literature review on the history of practical work and how scholars have defined practical work. The chapter also discussed literature on the goals and aims of practical work as well as the importance of practical work in science subjects. The chapter also focused at the literature on teachers' perceptions of the availability of resources for conducting practicals. The next chapter describes the methodology that was used in which this study was framed.

## **CHAPTER 3: METHODOLOGY**

In this chapter, the plan that was used in carrying out this study is described. The research design, the population, the sample, the sampling procedure, the research instruments, the data collection procedures and how the data were analyzed are also described.

### **3.1 Research design**

This research was situated in both the qualitative and quantitative research paradigms.

Qualitative inquiry aids the researchers to find out the views of individuals experiencing a particular phenomenon from their point of view (Patton, 1990). One of the strengths of the qualitative inquiry is the active role of the researcher with the subjects of the study (Straus and Corbin, 1998). Patton (1990) asserts that qualitative methods typically produce a wealth of detailed information about a much smaller number of people. According to Patton, this increases understanding of the cases and situations being studied but reduces generalization of the results.

Part of the data in this study was gathered by means of observations. This according Strauss and Corbin (1998) is a technique normally associated with qualitative methods which involves close contact between the researcher and the research participants.

The quantitative inquiry on the other hand relies on the collection of numerical data. It relies on collecting data based on precise measurement using structured and validated data collection instruments (Johnson and Christensen, 2008). In this study the frequency of use of practical work and facilities in schools were quantified to find out to what extent these hindered the use of practical work in Namibian secondary schools in Biology.

The researcher combined the two research designs (quantitative and qualitative) in this study because; she was concerned with understanding the social phenomenon from the participants' perspectives, by being a non participant observer during practical lessons. The researcher also tried to understand the problem from a quantitative view point, by finding out about the availability of practical resources such as the apparatus and available laboratories at the selected secondary schools.

### **3.2 Population**

Henning, Van Rensburg and Smith (2004), defined population as a group of individuals who have one or more characteristics in common that are of interest to the study. The population of this study consisted of all Biology teachers at Grade 11 and 12 levels in the Oshana Education Region.

### **3.3 Sample and sampling procedures**

De Vos and Strydom (2005) defined a sample as the elements of the population considered for actual inclusion in the study. Eight secondary schools in the Oshana Education Region were purposively selected to take part in this study. A sample comprising of 23 Biology teachers was then chosen purposively from the 8 secondary schools (each school has at least 3 Biology teachers for Grade 11 and 12). The 8 secondary schools were: Gabriel Taapopi Secondary School, Andimba Toivo yaToivo Secondary School, Oshakati Secondary School, Iipumbu Secondary School, Oshakati Combined School, Erundu Secondary School, Meshipandeka High School, Evululuko Secondary School, and Nangolo Junior Secondary.

### **3.4 The research instruments**

There were two types of research instruments for collecting data in this study, questionnaires, and observations.

#### **3.4.1 Questionnaires**

Johnson and Christensen (2008, p. 170) defined a questionnaire as a “self-report data collection instrument that each research participant fills out as part of a research study”. They further indicated that researchers use questionnaires so that they can obtain information about the thoughts, feelings, attitudes, beliefs, values, perceptions, personality and behavioural intentions of the research participants

In this study, the researcher set up a questionnaire for the Grade 11 and 12 Biology teachers. The questionnaires had both closed and open ended questions and had 3 sections. Section 1 had questions on the attitudes of the teachers towards the use of practical work in the teaching of Biology; Section 2 had questions on how teachers use practical work in the teaching of Biology, and Section 3 had questions on the views of teachers on the importance of practical work in the teaching of Biology.

#### **3.4.2 Observation Schedule (non participant observer)**

Johnson and Christensen (2008) defined observation as the watching of behavioural patterns of people in certain situations to obtain information about the phenomenon of interest. In this study, the researcher observed nine practical lessons by six teachers in six secondary schools. Two practical lessons each were observed from three teachers and one practical lesson each from the other three teachers. The researcher did not take part in the procedures of the Biology practical lessons that was being observed to avoid influencing the outcome of the practical classes.

### **3.5 Pilot study**

A pilot or feasibility study is a small version of a full scale study. It also refers to specific pre-testing of a particular research instrument such as a questionnaire or an interview (Patton, 1990). An advantage of a pilot study is that it can give advance warnings of possible failure of the main project, indicate where research protocols might not be followed or whether proposed methods and instruments are inappropriate or too complicated (Patton, 1990).

A pilot study was conducted for this study. One school with 3 Biology teachers was used for this purpose. The main aim was to test whether the instruments were giving the information that was expected. The three Biology teachers were chosen purposefully from one of the secondary schools. These three Biology teachers were given questionnaires to fill in and the researcher managed to observe one practical lesson per teacher. The piloting process was completed within a week and the findings were analysed thereafter. Questions were refined, biased and ambiguous questions were revised. The observation schedule was also rectified by adding the necessary questions and by removing the unnecessary questions.

### **3.6 Data collection procedure**

Permission to carry out this study was sought from the Ministry of Education through the Permanent Secretary and the Oshana Regional Director of Education. Letters were written to the Principals and the teachers of the 8 selected secondary schools to seek permission to do the research at the selected schools. Twenty three questionnaires were distributed to the 23 Biology teachers and were collected after two weeks. The researcher then observed nine practical lessons (after the questionnaires were collected) by six teachers in six Secondary Schools.

Two practical lessons each were observed from three teachers and one practical lesson each from the other three teachers was observed.

### **3.7 Data analysis**

The data was analysed using descriptive statistics. Frequency tables, graphs and pie charts were used in analyzing the extent to which practical work was done in Biology classrooms in the Oshana Education Region. The data that were collected about the availability of practical resources such as, laboratories and apparatuses in secondary schools was quantified and presented in tables, graphs and charts. Themes were used to analyse the data from the transcripts of the class observations. This analysis helped in answering the questions about the teachers' use and perceptions of the importance of practical work in Biology. The researcher also wrote reflective memos in order to record what the researcher was learning from the data collected during the observations. Memos are helpful for recording ideas generated during data analysis, according to Johnson and Christensen (2008).

### **3.8 Ethical considerations**

The researcher informed the participants about the nature of the research. Participants were also informed that they were free to withdraw from the research at any time. According to Best and Kahn (2003: p .47), "ethical choices involve the fundamental rights, dignity and worth of all people". The researcher received informed consent from the participants when they signed the consent form. Participants were also assured that they were to remain anonymous. This the researcher did by making sure that the respondents did not give their names when answering the questionnaire and that the researcher did not write down the names of the teachers when she was observing the practical lessons.

### **3.9 Summary**

This chapter focused on the research design, the population, and the procedure that were used to select the sample. The research instruments, data collection procedures and analysis procedures were discussed. The next chapter presents the findings and the discussion of these findings.

## **CHAPTER 4: PRESENTATION AND DISCUSSION OF THE RESULTS**

### **4.1 Introduction**

This chapter presents the results of the study. It also describes the approaches and strategies employed by the researcher to analyse the data that were collected. Miles and Huberman (1994) regards data analysis as a process of categorizing, ordering, manipulating and summarising of the data to obtain answers to the research questions. In data analysis the data is reduced to an intelligible and interpretable form so that the relationships of research problems can be studied tested and conclusions drawn (Miles et al., 1994). Lastly this chapter presents the discussions of the results.

### **4.2 Results from the questionnaires.**

The data collected using questionnaires were placed into the four main categories or headings as shown in 4.2.1.

#### **4.2.1 Data from the questionnaires were placed into four categories or headings, namely:**

- 1.** The extent to which practical work is conducted in the Biology classroom in the Oshana Education Region
- 2.** Resources for conducting practical work lessons in Biology
- 3.** Secondary school teacher's perceptions of the importance of practical work in Biology in Oshana Education Region
- 4.** Perceptions of Biology teachers regarding the use of practical work in Biology.

#### **4.2.2 The Extent to which Practical work is conducted in the Biology classroom in the Oshana education region.**

Under this heading, the researcher looked at the extent to which practical work was done in Biology classrooms in the Oshana Education Region. Seven questions from the questionnaires were answered under this theme.

When asked if teachers were conducting practical work lessons in Biology, all 23 Biology teachers responded that they carried out practical work in Biology. The Ministry of Education (2009a) expects all Biology teachers to teach by the prescribed syllabi and includes directions and guidelines for the teaching of practical work in Namibian schools. The practicals that are supposed to be done are stated in the Namibian Senior Secondary Certificate for Ordinary Level Biology syllabus for each topic. That is why all teachers were supposed to do practical work because practicals have been prescribed in the Biology syllabus.

The teachers were also asked to state how often they conducted practicals in Biology. Table 1 presents the teachers' responses on how often they conducted practicals in Biology at their schools.

**Table 1: Frequency of conducting practicals in Biology by teachers (N=23).**

<b>Number of times practical work is conducted</b>	<b>Frequency</b>	<b>Percentage</b>
Two to three times per chapter, according to the syllabus.	3	13.04
Sometimes only when necessary.	5	21.73
Depends on the materials available and the topic.	9	39.13
Not many times.	4	17.39
Once per topic.	2	8.7
<b>Total</b>	<b>23</b>	<b>100</b>

From Table 1 it is obvious that most (39.13%) of the teachers carried out practicals depending on the availability of materials and also on the topic that they were doing. About 21.73% of the teachers responded that they did practicals sometimes only when necessary. Seventeen point three nine percent of the teachers responded that they did not do practicals many times, while 13.04% of the teachers responded that they did practicals two to three times per chapter according to the syllabus. Very few teachers (9%) responded that they did practicals once per every topic.

The researcher analyzed the Namibian Senior Secondary Certificate for Ordinary Level Biology syllabus for 2009 (Ministry of Education, 2009a) in order to find out whether there were practicals that had been identified per topic. The researcher found that for all the topics in the syllabus, there were more than one suggested practical works or demonstrations which were supposed to be carried out in Grade 11 and 12. The teachers' responses seemed to suggest that they did not follow what was written in the syllabus because every topic in the syllabus had suggested practicals. Accordingly, Biology teachers were supposed to do practicals for every topic taught.

The National Subject Policy Guide for natural sciences also states that, "in the Biology and life Science syllabuses, the suggested practical activities, approaches or demonstrations required for each topic are included in the syllabus. These are considered basic and all learners should be exposed to them as a minimum requirement" (Ministry of Education, 2009b, p. 6).

Therefore, Biology teachers are required to do practicals with their learners on every topic as prescribed in the syllabus. However, from their responses, they were not following what was prescribed in the syllabus because not all of them did practicals on every topic.

Teachers were further asked to state the number of hours allocated per week to the practical lessons. Table 2 shows the teachers' responses on the number of hours allocated to the practical lessons.

**Table 2: Duration of Biology practical Lessons (N=23).**

<b>Duration of practical lessons</b>	<b>Frequency</b>	<b>Percentage</b>
45 minutes	7	30.4
1 hour(double lessons)	2	8.7
40 minutes	9	39.1
90 minutes(double lessons)	5	21.7
<b>Total</b>	<b>23</b>	<b>99.9*</b>

\*Does not equal to 100% due to rounding off.

Table 2 indicates that practical lessons were not allocated the same minutes in all the eight secondary schools. Nine teachers responded that practical lessons were allocated 40 minutes, seven teachers responded that practical lessons were allocated 45 minutes, five teachers, however, responded that practical work were allocated 90 minutes, while two teachers responded that practical work were allocated one hour.

In Namibian secondary schools, the time table for Grade 11 and 12 had single lessons and double lessons throughout the whole week. According to the National Subject Policy Guide for Natural Sciences (Ministry of Education, 2009b, p. 3), "It is stated clearly in the curriculum for formal education that different ways of organizing teaching and learning will need flexible time-tabling, using different periods. Since Biology, Life Science and Natural Science and Health Education (NSHE) are subjects that require practical work; consecutive periods (a double period) on the school time-table could provide enough time for practical activities". Single lessons were supposed to be for theoretical lessons.

The double periods (Consecutive periods) were supposed to be for practical lessons for those subjects that carry out practical work. The teachers' responses seemed to show that they did not know why their science time tables had double periods (Consecutive periods). In other words, Biology teachers were not utilizing the double periods (consecutive periods) for carrying out practical lessons, but were using double lessons for theoretical teaching, because their time tables does have double lessons(consecutive periods) and if they were not using them for practical work, they should be using them for theoretical lessons.

To the question of whether learners were taught to carry out practical work from lower grades (Grades eight to ten), all 23 teachers said that learners were not taught to carry out practical work on their own from lower grades (Grades eight to ten).

The reasons that teachers gave as to why they said learners had not been taught how to do practicals at lower grades included statements such as: "that those learners did not know how to hold most of the apparatus, they use to break them usually" (given by 10 teachers). Four teachers said that "learners did not know the names of most of the apparatus". Five teachers said that, "Lower grades were not having laboratories for conducting practicals and young learners might cause accidents and mess up the laboratories", while the remaining four teachers said that, "Lower grade syllabus did not require learners to do practicals, and young learners were not able to follow instructions properly because they were naughty". From the responses given by the teachers it was clear that learners were not taught to do practical work from lower grades.

According to the Life Science syllabus for Grades 8 – 10 (Ministry of Education, 2007, p. 39), it has been recommended that, "a minimum of five practical investigations should be assessed and

recorded (two investigations during the first, two during the second and one during the third trimester).

One of these investigations during the second trimester should be a project or a practical investigation that will allow all major skills to be demonstrated by learners”. The Life Science syllabus further states that “Grades 8 to 10 continuous assessments (CA) should have four components, namely:

1. Topic task,
2. Topic test,
3. Practical investigations/projects,
4. End of Term test” (Ministry of Education, 2007, p. 38).

One can see that learners were supposed to be taught practicals from Grades 8-10 because it forms part of their Continuous Assessment mark. But, from the teachers’ responses, the teachers in this study were not aware of this and that is why they were not carrying out practicals. This might contribute to learners having poor background knowledge in practical work from the lower grades. When learners reach the grades where practical work is compulsory, they might suffer as a result of not doing practical work from the lower grades.

The Biology teachers were further asked whether they gave their learners practical tests during the course of the year. All 23 Biology teachers responded that they never gave their learners practical tests because it was not required of them to do so by the Biology syllabus.

According to the Ministry of Education (2009, p. 47), the examiners' report on Paper 3 indicated that the candidates showed lack of analytical and comparative skills, and they did not follow instructions properly. The candidates had problems with:

- designing of experiments;
- drawings;
- Recording of data;
- proper reading of questions;
- relationships shown by graphs; and
- magnification shown by graphs.

Haambokoma (2007) conducted a study on errors that students made when answering questions in Biology practical tests in schools certificate examination in Zambia. The findings of the study showed that the students made different mistakes with respect to drawings, labelling, measuring, recording, calculating, magnifications, comparing and contrasting specimens as well as carrying out food tests. The following errors were reported with reference to food testing: most of the students failed to specify the quantity of the reagent used; students used inappropriate methods of heating or failed to specify the method of heating; giving wrong colour change; heating after the addition of iodine solution; inaccurate description of observation; making incorrect deductions from observations; and using wrong testing procedure.

Haambokoma (2007) concluded that the above-mentioned errors were indications that the students had low understanding of practical work and mastery of experimental skills. He further remarked that teachers were sometimes a contributing factor as they seemed not to provide students with enough opportunities to practice and develop the necessary understanding of practical work and mastery of experimental skills.

He further observed that the lack of adequate feedback to students on their practical work could also contribute to the lack of improvement in the errors mentioned above.

It is clear that learners have difficulties in answering questions in Paper 3 as none of the 23 teachers gave their learners tests on practical work, to enable them to write Paper 3 which is the alternative to practical work at the end of the year. The teachers were supposed to familiarize the learners with how questions in Paper 3 were to be answered by giving them feedback after they have written a practical test. Not writing practical tests during the course of the year could be one of the reasons why the learners displayed the difficulties reported by the examiners.

To the question of how often the Advisory Teachers visited their schools to determine the effectiveness of practical lessons, all the 23 Biology teachers responded that the Advisory Teachers never visited their schools since the beginning of the year in connection with the conduct of practical work. It can be concluded that Biology Advisory Teachers had not been doing any regular visits to schools in order to help teachers with practical work in Biology.

Teachers were also asked the type of help they got from the Advisory Teachers when it came to practical work. The majority of the teachers (91%) responded that they did not receive any help from the Advisory Teachers while the remaining 9% of the teachers responded that the Advisory Teachers used to send them chemicals upon request. The responses from the teachers' seemed to indicate that the Advisory Teachers did not offer any help to the teachers when it came to Biology practicals.

Walczyk & Ramsey (2003) indicated that, further exploration of the teachers' views and beliefs about their instructional strategies, especially those concerned with preparing students for practical examinations, suggests that such views and beliefs are rooted in the type of training

they (teachers) receive as well as the environment that sustains their instructional styles. In this study, the Biology teachers seemed to have received inadequate assistance from the Advisory Teachers and this in turn, tended to limit the way in which they conducted practical work in their classes.

According to the Ministry of Education (2006, p. 5) “the following are the core duties and responsibilities of Advisory Teachers:

- To assist and support teachers in teaching methodology on subjects in the region;
- To train, support, motivate and guide teachers through school visits;
- To observe classroom teaching for the purpose of improving teaching standards;
- To advise on orders of textbooks, equipments and learning materials; and
- To build capacity in planning, coordinating and facilitating workshops for teachers”.

In other words, it should be the responsibility of the Advisory Teachers to help teachers in doing their practical work effectively and competently by ensuring that teachers had enough chemicals, apparatus at their schools in order to carry out the suggested practicals. They were also expected to help teachers order the apparatus, chemicals and/or plan together with the classroom teachers on how to get the equipment for doing practicals.

The Advisory Teachers needed to visit schools regularly in order to find out the problems that teachers in the schools had with respect to the condition of laboratories, chemicals, equipment, or the difficulties the teachers had in carrying out practical work. The Biology Advisory Teachers could only do this if they visited schools regularly.

The results in this study seem to suggest that the Biology Advisory Teachers were not fulfilling their mandate as prescribed by the Ministry of Education (Ministry of Education, 2006).

In summary, Biology teachers were not doing practicals in the Oshana Education Region. All teachers were not using the double lessons for doing practical work.

Instead they were using single lessons for practical work. Further the learners were not taught how to do practicals from Grades 8-10. In addition, the teachers did not give their learners tests on practicals during the course of the year. It also came out from the study that Biology Advisory Teachers had not been visiting secondary schools in order to assist teachers with the conduct of practical work, and they did not offer any help to the Biology teachers when it came to doing practical work.

### **4.2.3. Practical work environment**

This heading is divided into 2 sub-headings. First, resources for conducting practical lessons and second the availability of teacher resources for conducting practical lessons in Biology.

#### **4.2.3.1 Resources for conducting practical lessons in Biology**

Teachers were asked whether their schools had a laboratory dedicated for conducting practical work in Biology. Their responses are presented in Table 3.

**Table 3: Availability of a dedicated laboratory for carrying out practical work in Biology (N=23).**

<b>Availability of a laboratory for Biology practicals.</b>	<b>Frequency</b>	<b>Percentage</b>
Yes	7	30.4
No	16	69.6
<b>Total</b>	<b>23</b>	<b>100</b>

From Table 3, 69.6% of the teachers responded that their schools did not have a laboratory specifically for conducting Biology practicals, while the remaining 30.4% responded that their schools had a laboratory specifically for conducting Biology practicals.

From these responses, one can say that most secondary Schools in Oshana Education Region did not have a laboratory specifically for conducting Biology practicals.

Lack of a dedicated laboratory, might be used as an excuse for not carrying out practicals in Biology by teachers who might not find it comfortable to carry out practicals in ordinary classrooms or in the open. All secondary schools offering Biology should therefore have a laboratory, because Biology is an experimental subject as stated in the Namibian Senior Secondary Certificate for Ordinary Level Biology syllabus (Ministry of Education, 2006) that scientific subjects are by their nature experimental. The teaching of Biology cannot be done theoretically only; there should be a practical component.

Teachers were further asked to state the place where they usually conducted practical lessons in Biology if they did not have a dedicated Biology laboratory. Their responses are presented in Table 4.

**Table 4: Places where practical work was conducted in Secondary Schools (N=7).**

<b>Place</b>	<b>Frequency</b>
Classes	2
Common laboratory	3
Rossing Foundation laboratory	2
<b>Total</b>	<b>7</b>

In Table 4, the seven teachers who responded that there was no laboratory for conducting Biology practicals at their schools were asked where they carried out Biology Practical. Three of the teachers responded that they conducted practicals in the common laboratory where all science subjects had their practicals; two teachers responded that they used the normal classes; while the remaining two teachers said they used the Rossing Foundation laboratory, which was about ten kilometres from the school. The use of the Rossing Foundation laboratory required teachers and their learners to leave the school premises because Rossing Foundation was not in the vicinity of the school. However going to the Rossing Foundation premises every week was not possible according to these teachers because there was lack of transport and the distance that they had to travel to the Rossing premises was too long.

Teachers were also asked to state how well stocked their laboratories were. Table 5 shows their responses.

**Table 5: How well stocked were the Biology laboratories (N=21).**

<b>How stocked was your Biology Laboratory?</b>	<b>Frequency</b>	<b>Percentage</b>
It does not have enough equipment and apparatus.	13	61.9
No laboratory at school.	2	9.5
It has expired chemicals.	6	28.6
<b>Total</b>	<b>21</b>	<b>100</b>

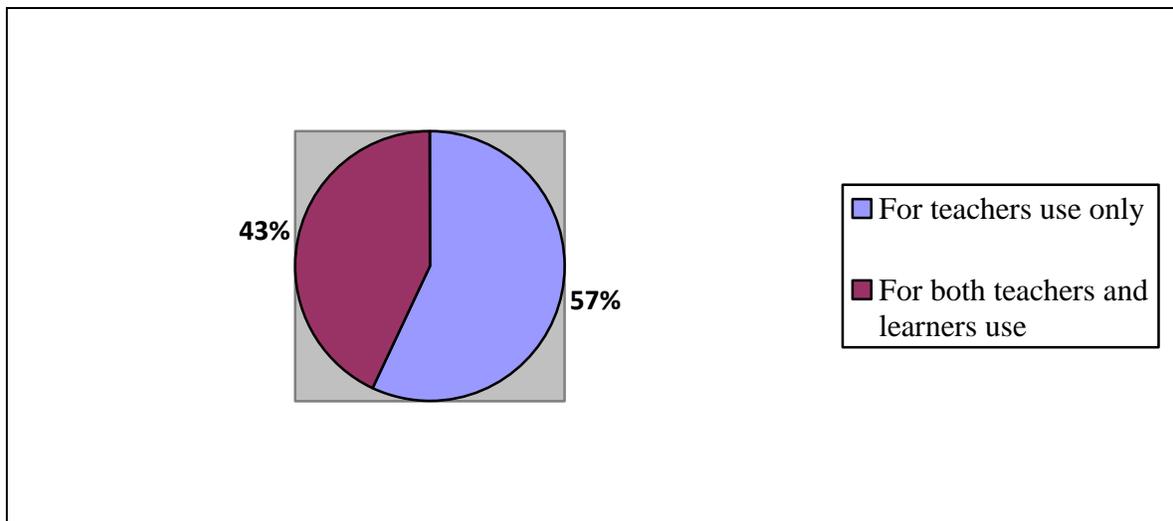
It can be seen from Table 5 that most of the laboratories used by the Biology did not have enough apparatus and equipment as indicated by 61.9% of the respondents. Some of the laboratories had expired chemicals and thus could not be used for practicals as indicated by 28.6% of the teachers. It is apparent from these results that the lack of laboratories, equipment, apparatus and chemicals made it difficult for Biology teachers to conduct practicals.

Teachers were further asked to state whether their schools had sufficient materials for conducting practicals in Biology. All the 23 Biology teachers indicated that their schools did not have sufficient materials for conducting practicals in Biology. According to Crawford (2000, p. 916), “increasing costs of equipments and consumables for laboratories have put science laboratories in universities and schools in a pathetic condition”. The high cost of scientific equipment and infrastructure facilities required for science laboratories have resulted in several educational institutions being hesitant to put basic science subjects on their priority list (Crawford, 2000). This might also be the case in most of the Namibian schools from the teachers’ responses.

Insufficiency of materials for conducting practicals, prevent teachers from allowing all their learners from doing the practicals themselves.

In other words, teachers might be forced to do demonstrations only, instead of allowing their learners to do practicals on their own. Furthermore this might also prevent teachers from carrying out all the practicals that were stipulated in the syllabus which in turn will disadvantage the learners on the Alternative to Practical Work examination paper.

To the question of whether the equipment were for teachers use only or enough to be used by the learners as well, the responses by the 23 teachers are shown in Figure 1.



**Fig 1: Whether the equipment was for teachers' or for learners' use (N=23).**

In Figure 1, ten (43%) of the teachers indicated that the equipment were for both teachers and learners while the remaining 13 teachers (57%) responded that there was only enough equipment for teachers to do practical work.

If the schools do not have equipment for conducting practical work, for both the teachers and the learners, teachers might be forced to do demonstrations only and might not allow learners to handle the equipment themselves.

If teachers do demonstrations only, this will prevent learners from being actively involved during the practical lesson and as such will not benefit from doing the practicals (Crawford, 2000).

On the question whether there were enough equipment for all learners to carry out practical work in Biology, all 23 teachers responded that the equipment was not enough for all the learners to use during the practical lessons. All learners were supposed to be active participants during the practical lesson, Learners were supposed to be handling the apparatus themselves, during the practical lessons, if equipment are not enough for all learners, this will prevent some learners from participating during the practical lesson.

The Namibian Senior Secondary Certificate for Ordinary Level Biology Syllabus (Ministry of Education, 2009a, p. 27), states that, “Learners should get practical (experimental and investigative) skills and abilities that will allow them to be able to follow a sequence of instructions; use appropriate techniques; handle apparatus/materials competently and have due regard for safety”. Learners can only learn how to handle the apparatus or the materials if there are materials to be handled at their schools. If the apparatus are not enough, teachers might be forced to do demonstrations and learners will be forced to observe only. As such they might not be able to learn how to handle the apparatus when doing practicals.

There is also a need for a different approach to timetabling in Secondary Schools where not everyone (teachers and learners) is in the laboratory at the same time, or a project based assisted learning where learners liaise with their teachers when they are available.

The results in this section show that most secondary schools in the Oshana Education Region did not have well stocked laboratories. Furthermore, the laboratories did not have enough resources for conducting practicals.

These findings are similar to those by Maboyi and Dekkers (2003) who found that almost all the Natural Science teachers in their study in South Africa preferred teacher demonstrations because of the lack of laboratories and laboratory equipment among others.

#### **4.2.3.2 Availability of teacher resources for conducting practicals in Biology.**

When asked whether learners had a practical manual, all 23 Biology teachers responded “no”. From the teachers’ responses, it was clear that learners did not use a practical manual when conducting practicals in Biology. The practical manual was supposed to be compiled by the teachers themselves for the learners to use as a guide during practical lessons.

Teachers were then asked to state what they used as a practical guide when carrying out practicals in Biology. Their responses are presented in Table 6.

**Table 6: What teachers used as a practical guide for conducting practical work in Biology (N=23).**

<b>Guide for conducting practicals</b>	<b>Frequency</b>	<b>Percentage</b>
Prepared handouts (prepared by the teachers) for the specific experiments	9	39.13
Procedures were written on the chalkboard	5	21.74
The teacher explained and demonstrated to the learners how to do the experiments	2	8.7
Used the textbook	7	30.43
<b>Total</b>	<b>23</b>	<b>100</b>

From Table 6, 39.13% of the teachers responded that they prepared handouts for the specific experiments as a guide during the practicals, while 30.43% of the teachers said that they used a textbook as a guide when conducting practical work. Twenty two percent of the teachers on the other hand responded that they wrote procedures on the chalkboard for their learners to copy and

follow them. The remaining 8.7% said that they just explained verbally and demonstrated to their learners in order to show them how to do the experiments.

If learners are not given a practical manual, they might not consider practicals to be important in the learning of Science. Preparing practical manuals might save teachers a lot of time and effort, instead of preparing a separate handout for each practical lesson. It might take time for the teacher to write the procedures on the chalkboard, the time that they are supposed to use in order to do the practicals with their learners. For those that were using the textbook as a guide for the practical lesson, textbooks might not have clear instructions, and some of the prescribed practicals in the syllabus might not be in those text books. The other problem with using the textbooks might be that the text books might not be enough for all learners, as most secondary schools do not usually have enough textbooks for all the learners to use as a guide during the practical lesson.

On the question of what effect the class size had on doing practicals, seven (30.4%) of the teachers said that their classes were too large. “Since the classes had too many learners, a teacher was not able to control all of them and one could not allow all of them to use the apparatus”. Ten (43.5%) of the teachers said that, “materials were in a short supply and therefore was not enough for every learner, forcing the teacher to demonstrate only”. Three (13.1%) of the teachers on the other hand said that, “teachers were not able to reach to all the learners which made some learners not to participate”. The remaining three (13.1%) of the teachers said that, “some learners were not able to observe when the teacher was demonstrating because they were sitting far”.

If classes are overcrowded, this might prevent teachers from carrying out practicals with their learners.

Teachers might be forced to demonstrate only instead of allowing all learners to use the apparatus during the practical lesson. If classes are overcrowded, materials for conducting practicals might not be enough and this might have a negative effect on the performance of learners in Paper 3.

Learners were supposed to be assessed at the end of the practical lessons in order to determine whether they had understood the practicals. The Biology teachers were asked how they assessed their learners at the end of the practical lesson. Their responses are shown in Table 7.

**Table 7: How learners were assessed at the end of the practical lesson (N=23).**

<b>Type of assessment</b>	<b>Frequency</b>	<b>Percentage</b>
They handed in post laboratory answers and i marked those	10	43.47
Gave them a quiz based on the practical done	4	17.39
I did not do assessment on practicals	6	26.09
Marked their laboratory reports and post laboratory answers	3	13.04
<b>Total</b>	<b>23</b>	<b>99*</b>

\*Does not equal to 100 due to rounding off

Table 7 shows that 10 (43.47%) of the teachers allowed their learners to hand in post laboratory answers for assessment at the end of the practical, while four (26.09%) of the teachers responded that they did not do any assessment of their learners when it came to practicals. Six (17.39%) of the teachers said that they just gave quizzes to their learners which were based on the practicals done at the end of the practical, while the remaining three (13.04%) indicated that they allowed their learners to hand in a laboratory report and post laboratory answers and then marked those at the end of the practicals.

It is clear from table 7 that that most (43.5%) of the teachers allowed their learners to answer post laboratory questions, and then hand them in for marking at the end of the practicals. On the other hand, 26.1% of the teachers did not assess their learners at all after they had done a practical. These learners will write Paper 3 at the end of the year. The question is, how do teachers prepare their learners to answer questions in Paper 3 if they do not assess them during or at the end of the practical lessons? Assessing practical work ensures that it remains an important part of the science curriculum, and it also ensures that practical work remained at the heart of the science curriculum (Millar and Osborne, 1998).

Learners should be assessed during the practical lessons. This is the only way that teachers could find out whether their learners have understood what was being done during the practical lessons. Assessing learners during the practical lesson will also make learners put in more effort in doing the practicals because they know that they are going to hand in something for marking.

Practical assessment gives students an opportunity to carry out a range of experiments with varying degrees of difficulty in order to allow discrimination between candidates, to analyze and evaluate given results, to demonstrate their (students) knowledge and understanding of the processes of scientific enquiry and also to demonstrate how to sensibly plan an investigation with due consideration for safety and reliability (Millar and Osborne, 1998). If learners know that they are not going to hand in anything for marking at the end of the practical lesson, they might not put in any effort in doing the practical which in turn will prevent them from participating fully in that particular practical lesson.

On the question of whether learners were ready to answer examination questions in Paper 3 at the end of the year, 12 teachers indicated that their learners were ready because: “They will be able to cover the whole syllabus and thus do the practicals which were suggested in the syllabus” (5 teachers) and they felt that “their learners had the skills that they had acquired during the practicals” (3 teachers). Teachers also felt that “their learners were ready because the learners used to give correct answers when asked in class during the practical lesson” (4 teachers).

The remaining 11 teachers responded “no”, because; “They usually did not assess their learners on practicals in order to familiarize the learners on what kind of questions to expect in Paper 3” (7 teachers), “the questions on the question paper were not based on practicals that were prescribed in the syllabus” (4 teachers). None of the teachers mentioned anything on whether they gave practical tests in order to see if the learners were able to answer questions on the practicals. The researcher is of the view that in order for learners to be able to answer examination questions in Paper 3, they should be taught first on how to answer such questions through tests and assignments given to them by their teachers.

It is important to note that all the learners were supposed to be involved in doing the practicals. The teachers were asked how they made sure that all learners were involved in doing the. The teachers freely indicated their responses as presented in Table 8.

**Table 8: How teachers made sure all learners were involved in the practical lessons (N=23).**

<b>Action</b>	<b>Frequency</b>	<b>Percentage</b>
By assessing them and observing them during the practical	4	<b>17.4</b>
Divided them into small groups and allocate a group leader to lead the group	9	<b>39.1</b>
Made sure that everyone was doing something by walking from group to group of learners, asking questions	10	<b>43.5</b>
<b>Total</b>	<b>23</b>	<b>100</b>

From Table 8, ten (43.5%) of the teachers indicated that they made sure that every learner was doing something by “walking from group to group of learners asking them questions”, nine (39.1%) of the teachers said that “they divided their learners into smaller groups with a group leader in order to supervise that particular group” while the remaining ten (17.4%) of the teachers said that they made sure that all their learners were involved in the practical lesson by “assessing them and observing them during the practical lesson”.

For all learners to benefit from doing the practicals, they should be actively involved in the practical lesson. Teachers should make sure that all learners are involved during the practical lesson. The teacher can do this if learners were sitting in groups, having the manual that stipulates the steps involved in carrying out the activity.

Learners in this case would then be able to follow the steps which are written in the manual in order to do the practical themselves. Teachers should guide their learners by walking from one group of learners to the other, discussing with them while keeping an eye on the learners who are

not putting in any effort in doing the practical work. Most importantly, learners should hand in practical report or answers to laboratory questions to be assessed by the teacher immediately after the practical lesson. This might encourage all of them to do the practical because they know that they are working for marks or for learning meaningfully the concepts linking theory with practicals.

#### **4.2.4 Perceptions of the Biology teachers of the importance of practical work.**

This theme addressed the perceptions of the Biology teachers on the importance of doing practical work in Biology

Teachers were asked whether practicals were necessary in the teaching of Biology. All 23 teachers agreed. Table 9 presents the reasons that the teachers gave as to why practicals were important in the teaching of Biology.

**Table 9: Why practicals are important in the teaching of Biology (N=23).**

<b>Statement</b>	<b>Frequency</b>	<b>Percentage</b>
Practicals prove theory in Biology, and make Biology an interesting subject	6	26.1
Practicals promote learners understanding of the topics better, and stimulate interest in the subject	5	21.7
Learners develop skills on handling and organizing apparatus and materials and following instructions	3	13.1
Learners learn better when they see and touch objects, they don't forget what they saw, and this reinforces the content	4	17.4
Slow learners understand the content better; master the content through investigations and observations	3	13.1
Practicals yield better results in Biology and prepare learners to answer questions in Paper 3 at the national level	2	8.6
<b>Total</b>	<b>23</b>	<b>100</b>

From Table 9, six (26.1%) of the teachers felt that practicals were necessary in the teaching of Biology because practicals proved theory in Biology and made Biology an interesting subject. Five (21.7%) of the teachers felt that practicals promoted learners' understanding of the topics better, and also stimulated students' interest in Biology. Three (13.1%) of the teachers felt that practicals developed learners' skills on handling and organizing apparatus and materials and in following given instructions, while four (17.4%) of the teachers felt that practicals allowed learners to learn better when they saw and touched objects, they do not forget what they have seen and this reinforces their content grasp.

Three (13.1%) of the teachers indicated that practicals allowed slow learners to understand the content better, master the content through investigations and observations while two (8.6%) of the teachers said that practicals yielded better results in Biology and prepared learners to answer questions in Paper 3 at the national level.

From the teachers' responses, it was clear that all 23 (100%) of the teachers were aware what practical work was all about and why it was necessary in the teaching of Biology. As indicated by Clackson & Wright (1992), Gott & Duggan (1995), and Leach (1999), a teacher's belief or conception of practical work can impact directly on the way she/he arranges practical work. Teachers should therefore have a clear understanding of what practical work entails and the purposes it serves. Having a clear understanding about the nature of practical work might help the teachers to plan teachable practical activities.

Teachers were also asked whether lack of a Biology laboratory would prevent them from doing practical work in Biology. Eighteen (78.3%) of the teachers indicated that not having a laboratory could not prevent them from carrying out practicals in Biology, while the remaining five (22.7%) of the teachers said that if there was no laboratory at school then they would not be able to carry out practical work in Biology and thus were not carrying out the practicals.

The five teachers, who indicated that if the school did not have a Biology laboratory, then they would not carry out practical work with their learners, explained that "classrooms were not conducive for conducting practicals, as some practicals were dangerous to be carried out in the classrooms". The 18 teachers who indicated that lack of a laboratory would not prevent them from carrying out practicals in Biology explained that "if there was no laboratory at school, then one should use the classroom or the outside to conduct the practicals"

Whether the school has a laboratory or not, learners will still write Paper 3 examinations at the end of the year. Accordingly, teachers need to expose learners to practical work if they are to do better in Paper 3. The Namibian Senior Secondary Certificate for Ordinary Level Biology Syllabus (Ministry of Education, 2009a) states that, “Paper 3 is Applied Practical Skills Paper which is a written paper of compulsory questions designed to test familiarity with laboratory practical procedures and will test skills mainly in assessment objective C, but may include the assessment objectives A and B”. This implies that learners must be exposed to practical work and demonstrations. If learners are not exposed to practical work, due to the lack of a laboratory for example, they might not be able to answer questions on Paper 3 and this in return might affect their final performance in Biology.

Teachers were also asked what they thought they should do in cases where the school did not have all the necessary equipment and apparatus to conduct Biology practicals. The teachers freely indicated their responses as presented in Table 10.

**Table 10: What Biology teachers do if schools do not have equipment for Biology practicals (N=23).**

<b>Action</b>	<b>Frequency</b>	<b>Percentage</b>
Learners should just sit in large groups and use the one's available	3	13.1
Borrow from neighbouring schools and notify the necessary authority such as Advisory Teachers	10	43.5
Teachers should just demonstrate in front of the classroom for learners to observe	5	21.7
Teachers should ask learners to contribute money to buy equipment for practicals	2	8.7
Ask the school to buy the apparatus and equipment	2	8.7
Teachers to organize Bazaars to solicit funds and ask for donations	1	4.3
<b>Total</b>	<b>23</b>	<b>100</b>

Table 10 shows that ten (43.5%) of the Biology teachers responded that, they (teachers) should borrow equipment, apparatus and chemicals from neighbouring schools and notify the necessary authority such as the Advisory Teachers on the need to buy the apparatus and chemicals for the school.

Five (21.7%) of the Biology teachers said that teachers should do the practicals in front of the classroom for learners to observe if the resources were not enough. Two (8.7%) of the Biology teachers said that if resources were not enough then teachers should ask learners to contribute money from their own pockets in order to buy equipment for their practicals.

Furthermore, two (8.7%) of the teachers suggested that school authorities should be asked to buy the apparatus and equipment for practicals, while three (13.1%) of the teachers suggested that learners should just sit in large groups and use the equipment and apparatus available. One (4.3%) of the teachers indicated that the teachers should organize Bazaars to get funds and ask for donations from private companies in order to buy equipment, apparatus and chemicals for their schools.

Tlala's (2006) study revealed that the use of low cost materials might contribute to meaningful learning and positive change in the students' attitudes toward practical work in Biology. Teachers in the Oshana Education Region should be encouraged to use low cost materials, in the conduct of the Biology practicals. Teachers should also ask learners to bring local materials from their houses, to be used for practicals. Biology teachers need to be creative in the use of local materials for carrying out practicals. Teachers do not need to use sophisticated equipment/apparatus and materials in order to carry out Biology practicals

On the question of whether teachers allowed learners to touch and use the equipment themselves during practical lessons, 18 (78.3%) of the teachers indicated that they allowed learners to do so while the remaining five (21.7%) of the teachers responded that they did not allow their learners to do so. The reasons given by the five teachers as to why they did not allow learners to use the equipment for conducting practicals in Biology were:

“Equipment was not enough and the learners will break those”.

“Learners misused the equipments and some equipment was dangerous and might cause accidents”.

Assessment objective C in the Namibian Senior Secondary Certificate for Ordinary Level

Biology syllabus requires learners to be able to:

- “handle and process experimental observations and data, including dealing with anomalous or inconsistent results;
- apply scientific knowledge and understanding to make interpretations and to draw appropriate conclusions from practical observations and data;
- plan, design and carry out investigations (based on concepts familiar to learners) and suggest modifications in the light of experience” (Ministry of Education, 2009a, p. 27).

In other words, learners should handle the apparatus themselves if they are to meet the assessment objectives stipulated in the Biology syllabus. Teachers should therefore allow learners to use the apparatus and the equipment during practical lessons.

The 18 teachers who agreed that they allowed their learners to use the materials and equipment in practicals gave the following reasons presented in Table 11.

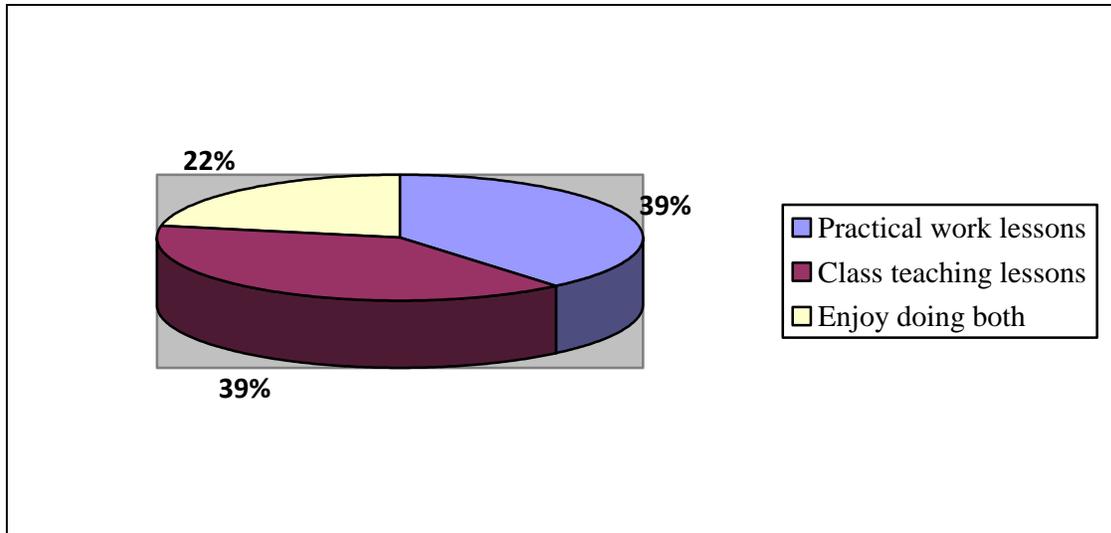
**Table 11: Reasons why teachers allowed their learners to use the materials and equipment (N=18).**

<b>Reasons</b>	<b>Frequency</b>
Learners can learn the names of the equipment easily and their functions also (become familiar with the equipment).	6
Learners can learn how to use them and become confident in using these; it is learners who should do the practicals.	7
Learners observed their own results better and were motivated to do practicals.	5
<b>Total</b>	<b>18</b>

Table 11 show that, six of the teachers indicated that it was important to allow learners to use the equipment and apparatus during practicals because this allowed them to learn the names of the apparatus and equipments easily and their functions also. Seven of the teachers said that learners became familiar with the equipment and learned how to use them and become confident in using the apparatus. The remaining five of the Biology teachers were of the view that allowing learners to use the equipment and materials during practicals allowed the learners to be able to observe their own results better and usually got motivated to do practicals.

Learners should be allowed to use the equipment and the apparatus during the practicals because practical work provides the necessary opportunity for the learners to participate in a scientific social endeavour in which the teacher plays the role of guide and supporter. Furthermore, practical work enables students to acquire knowledge and skills in various ways with the assistance of an expert, the science teacher. As active participants, the students acquire new knowledge by using societal tools, personal meaning making and by talking to other knowledgeable individuals in their immediate environment. Learners can only be active participants during practicals if they are allowed to touch and hold the materials themselves (Millar et al., 1999). Teachers need to allow their learners to use the equipment during practical lessons because it is learners who are supposed to do the practicals themselves, by handling the equipment in conducting the practicals. If learners are the ones handling the apparatus themselves, they will be confident that the results that they get at the end of the practical are a result of their hard work, not because the teacher did the practical work on their behalf (Millar et al., 1999).

Teachers were further asked to indicate which component of Biology teaching they enjoyed most. Their responses are presented in Figure 2.



**Fig 2: Components of Biology enjoyed most by Biology teachers (N=23).**

Figure 2 shows that 39% of the teachers said that they enjoyed doing practical work lessons, another 39% said that they enjoyed doing theoretical lessons while the remaining 22% said that they enjoyed doing both class teaching and practical work lessons.

The results seem to suggest that not all teachers enjoyed doing Biology practical work. Some might be doing practical work just because it was stipulated in the Biology syllabus. Teachers need to understand the fundamental aims of practical work and the role that teachers play in organizing a range of practical activities to be aligned with the aims and purposes of education. Biology teachers need to be sensitized in providing more opportunities for practical work and biological investigations (Thompson, 1975). Biology teachers should be encouraged to create opportunities for the students to be engaged in critical thinking, evaluation of ideas and ability to negotiate and reach a consensus about what they are doing in practical work (Ramorogo, 1998).

Five (39%) of the teachers who responded that they enjoyed doing practicals were further asked to state the reasons why they said they enjoyed doing practicals. Their responses are presented in Table 12.

**Table 12: Reasons given by teachers as to why they enjoyed doing practical work lessons (N=9).**

<b>Reasons</b>	<b>Frequency</b>
It was part of their work and teachers can integrate knowledge for learners to master the content better.	2
It was less work for the teacher as learners were doing the practicals.	2
Practicals allowed learners to explore more on their own, and it is fun.	2
Teachers and learners got to know each other better through interacting during the practical.	2
Teachers found it interesting to see the results after the experiment and to see learners being actively involved.	1
<b>Total</b>	<b>9</b>

Table 12 shows that, two of the teachers indicated that they enjoyed doing practical work lessons because it was less work for them as learners did the practicals, two of the teachers said that doing practical work was enjoyable because practicals allowed learners to explore more on their own and it was fun for both teachers and learners. Another two of the teachers said they enjoyed doing practicals because practicals were part of their work and that they integrated knowledge for learners to master the content better during practicals.

Two other teachers said that they enjoyed practicals because during the practicals, the teachers and the learners got to know each other better through interactions while the remaining teacher stated that she enjoyed doing practicals because she found it interesting to see the results after the experiment and to see learners being actively involved in the practical lesson.

These findings are similar to those by Woolnough, and Allsop (1985, p. 201) who concluded that, “Many science teachers recognized the importance of practical work. They believed that pupils should have first-hand practical experiences in laboratories in order to acquire skills in handling apparatus, to measure and to illustrate concepts and principles”. This will then allow them to apply the skills acquired during practical work in future.

But, two of the teachers indicated that they liked doing practicals because it was less work for them. They did not seem to realise that both learners and teachers should work together during the practical lessons. The teachers did not seem to realise that practical work needed a lot of prior planning for it to be successful. It cannot therefore be less work for the teacher during the practical lesson.

Five of the teachers (39%) who indicated that they did not enjoy doing practicals, were also asked to state the reasons why they said they did not enjoy doing practicals. Their reasons are presented in Table 13.

**Table 13: Reasons why some Biology teachers did not enjoy doing practical work (N=5).**

<b>Reasons</b>	<b>Frequency</b>
It was time consuming to prepare practicals than teaching lessons.	<b>3</b>
Practicals prescribed in the syllabus were not familiar to the teachers.	<b>1</b>
Practicals were frustrating especially if equipment were not enough.	<b>1</b>
<b>Total</b>	<b>5</b>

In Table 13, the reasons given by the teachers as to why they did not enjoy doing practicals included: practicals prescribed in the syllabus were not familiar to the teachers; practicals were frustrating due to inadequate equipment; and practicals were time consuming to prepare than the theoretical lessons.

If practicals that are prescribed in the syllabus were not familiar with the teacher as indicated by one of the teachers, the teachers should consider working with other teachers who might be familiar with those practicals. Teachers should practice ‘co-teaching, whereby teachers plan and teach together in order to help each other in teaching the topics that they might be having problems with. For the sake of the learners teachers should not neglect practicals and thus disadvantaging the learners in the Paper 3 examinations just because they did not understand the practicals in the syllabus. They can always replace the practicals that they do not understand with simple ones that teachers can get from the internet or elsewhere.

To say that it was time consuming to prepare practicals than the theoretical lessons, teachers seemed to forget that practicals were not done on the daily basis. Teachers were therefore supposed to prepare the practicals on the days when they were not having practical work lessons.

To the question of how practicals contributed to the learners' understanding of Biology, teachers gave the following responses (see Table 14).

**Table 14: How practicals contributed to the learners' understanding of Biology (N=23).**

<b>Ways in Which practicals contribute to learners understanding of Biology.</b>	<b>Frequency</b>
Learners were able to compare theory to practice and develop problem solving skills.	5
Practicals stimulated thinking and interests in Biology and allowed learners to answer questions in Paper 3.	4
Learners understood theory better and were able to solve real life problems.	10
Doing practicals promoted good learning relationships between learners.	4

From Table 14, the majority of the teachers (43.48%) felt that if learners did practical work then they would understand theory in Biology better and therefore be able to solve real life problems.

Students do enjoy doing practical work, because they are actively involved in doing the practicals. By doing practicals, learners might feel confident that they know what they were doing. Getting the results themselves during practical lessons might boost their self esteem which might motivate them to like Biology as a science subject.

Teachers were also asked to state how they thought they benefited from doing practicals. Their responses are given in Table 15.

**Table 15: Benefits from doing practical lessons by Biology teachers (N=23).**

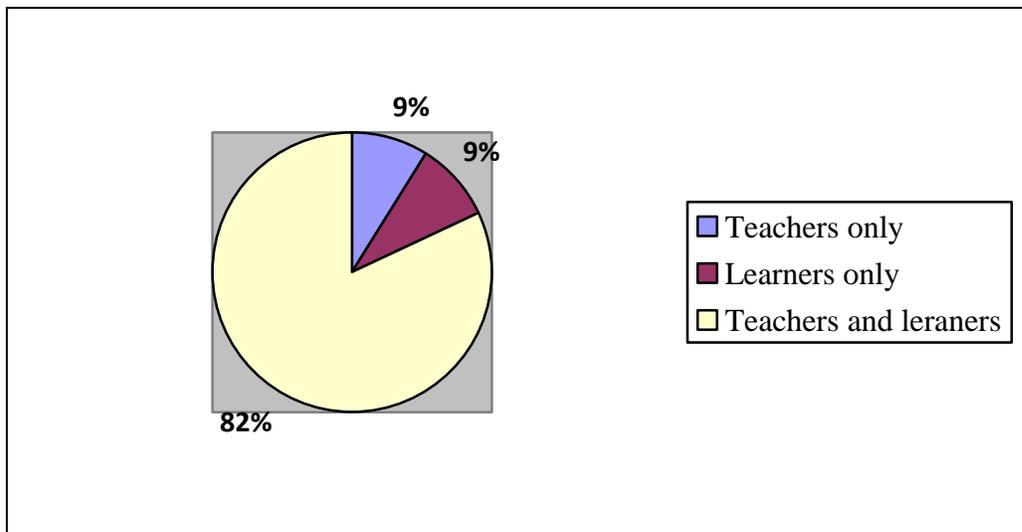
<b>How teachers benefited from doing practical work</b>	<b>Frequency</b>	<b>Percentage</b>
Increased understanding of Biology, master skills and became more competent in carrying out practicals	10	43.5
Teachers are able to prove theory in class through practicals and develop different teaching skills.	5	21.4
Teachers make learners understand better the content through practicals and so increase the pass rates in Biology	4	17.4
Practicals broadened teachers' knowledge and skills in Biology	3	13
Teachers do not benefit from practicals	1	4.3
<b>Total</b>	<b>23</b>	<b>100</b>

Table 15 shows that ten (43.5%) of the teachers indicated that doing practicals increased their understanding of Biology and helped them to master skills and become more competent in carrying out practicals in Biology. Five (21.7%) of the teachers responded that doing practicals helped teachers to prove theory in class through practicals and to develop different teaching skills. Four (17.4%) of the teachers on the other hand stated that doing practicals helped teachers to make learners understand better the subject content which increased their pass rates in Biology.

The results in Table 15 show that, most of the teachers felt that they were benefiting from doing the practicals. If teachers understand that they are benefitting from doing the practicals, then they are likely to do practicals more often. But, if teachers feel that they do not benefit from doing practicals then they might not like to do practicals. According to Mortimer & Scott (2003, p. 17), "Teaching science involves introducing the learner to the social language of school science.

The teacher is central to this process, as they take the role of an interpreter, or a mediator, of the school science social language”. The more the teachers did the practicals the more efficient they become in doing the practicals. During practicals, teachers interact with their learners, and through that interaction, teachers and learners will develop positive relationships which are necessary during the teaching process.

Teachers were also asked who they thought should do the practical work during practical lessons. Their responses are shown in Figure 3.



**Figure 3: Who should be doing the practical work during the Biology practical lesson (N=23).**

Figure 3 indicates that 82% of the teachers responded that both the teachers and the learners were supposed to do the practical work if there were sufficient materials and equipment available. Nine percent of the teachers on the other hand said that it was the teacher who was supposed to do the practicals while the remaining nine percent indicated that it was only the learners who were supposed to do the practical work.

The Namibian education system requires the teachers to teach in a student centred manner (MEC, 1993). Students are seen as active participants during the learning process and both the teacher and the students should be involved in discussions to negotiate meaning from what has been taught. If the learners are to be actively involved in the learning process, they should be involved in practical activities in Biology (MEC, 1993). From the findings, in Figure 3 there are still some teachers who feel that the teacher should be the only one to do the practicals.

Crawford (1996) indicated that social constructivists, such as Vygotsky emphasize the importance of the learner being actively involved in the learning process so that he/she can construct his/her own understanding. Vygotsky believed that learners with different skills and backgrounds need to collaborate on tasks, such as when they are doing practical work in order to arrive at a shared understanding of the truth in a specific field (Crawford, 1996).

Teachers were then asked whether they needed to know the names and the functions of all the apparatus and equipment to be used during the practical lesson. All 23 teachers answered “yes” and gave the following reasons presented in Table 16 as to why it was important to know the names and functions of all the apparatus and the equipment to be used during the practical.

**Table 16: Importance of knowing the names and functions of the apparatus and equipment (N=23).**

<b>Reasons</b>	<b>Frequency</b>	<b>Percentage</b>
To be able to use them properly and be able to answer practical questions.	2	8.7
To avoid using wrong materials in order to obtain the anticipated results and avoid accidents.	8	34.8
For the teacher to teach the name and functions of those apparatus and equipments to the learner.	6	26.1
To be able to state them all by names when demonstrating during practicals.	7	30.4
<b>Total</b>	<b>23</b>	<b>100</b>

The majority of the teachers (34.8%) felt that teachers should know the names of all apparatus and equipment to be used during the practicals in order to avoid using wrong materials, obtain the anticipated results and avoid accidents during the practicals. Another 30.4% of the teachers felt that teachers should know the names and functions of all apparatus and equipment to be used during the practical lessons in order to be able to state them all by names when demonstrating during practicals, for the learners to learn their names as being stated by the teacher. Twenty six point one percent of the teachers indicated that it was important to know the names and functions of the apparatuses to be used during the practicals in order to teach the names and functions of those apparatus and equipment to the learners, so that the learners will be able to use them correctly when doing the practicals themselves. The remaining 8.7% of the teachers said that it was important to know the names and functions of the apparatus to be used during the practicals in order to be able to use them properly and be able to answer practical questions when asked by the learners.

During the practical lesson, the teacher is a role model for the learners. In order for the learners to learn the names of the apparatus that are being used during the practical lesson, they have to hear their teacher stating them. Teachers should also know which apparatus to use when doing different experiments. If teachers do not know the names and functions of the apparatus and the equipments, they might use wrong apparatus and thus may not get the required results.

Teachers were further asked whether they thought they had sufficient training to teach practical work in Biology during their pre-service training. Eight (34.8%) of the teachers said “yes they had sufficient training to teach practicals in Biology during their pre-service training”, while the remaining 15 (65.2%) said “no they did not have sufficient training to teach practicals in Biology during their pre-service training”.

The results show that most of the teachers had received insufficient training in the teaching of Biology practicals. Without sufficient training there is no way that the Biology teachers could carry out practicals properly with their learners. The 15 teachers who said that they had not received sufficient training during their pre-service teacher training suggested that, “in-service training and workshops should be organized by the Advisory Teachers and the Ministry of Education in order to train teachers on how to conduct practicals in Biology and to encourage them to do practicals with their learners”. Hodson (1996a) notes that practical work is difficult to teach, that is why both in-service and pre-service training need to be conducted in order to provide science teachers with the special skills they may need in order to organize practical work effectively.

#### **4.2.5: Perceptions of Biology teachers regarding the use of practical work**

Under this heading, the researcher looked at how the Biology teachers in the Oshana Education Region perceived the use of practical work during instruction

The 23 Biology teachers were asked whether the time allocated for practicals was enough. Four (17.4%) of the teachers said “yes” while the remaining 19 (82.6%) said that it was not enough. The results show that most teachers felt that the time allocated for doing practicals at their schools was not enough for them to conduct meaningful practicals in Biology.

Table 17 shows the reasons given by teachers as to why they thought the time was not enough to carry out meaningful practical work.

**Table 17: Reasons why the time allocated for practicals was not enough (N=23).**

<b>Reasons</b>	<b>Frequency</b>	<b>Percentage</b>
One period was too short to finish the practical and to allow all learners to do it themselves thus teachers were the ones who did it in order to save time.	6	26.09
The time was not enough to allow all learners to be involved as classrooms were overcrowded.	7	30.43
It took time to set up the practical and to get clear results	5	21.74
Some practicals took more than 2 hours before they yielded the expected results.	5	21.74
<b>Total</b>	<b>23</b>	<b>100</b>

From Table 17, most ( 30.43%) of the teachers felt that the time allocated for practicals was not enough because classrooms were overcrowded to allow all learners to be involved in the practical. Twenty six point zero nine percent of the teachers indicated that one period was too short to finish the practical and to allow all learners to do it themselves thus teachers were the ones who did practicals in order to save time.

One period of 45 minutes is not enough to complete a practical, as some practicals took longer before they yielded the expected results. Single periods are expected to be used for theoretical lessons while double periods (90 minutes) are meant for practical lessons (Ministry of Education, 2009). The teachers' seemed not to know why the single and double periods were on the timetables because most of the teachers responded that they used the single lessons for conducting practicals in Biology.

Teachers were further asked to suggest the time that they thought was sufficient to allow them to conduct practical lessons. Their responses are presented in Table 18.

**Table 18: Time that teachers thought would be sufficient to allow them to conduct practical lessons (N=19).**

<b>Suggested time</b>	<b>Frequency</b>	<b>Percentage</b>
More than 2 hours	3	15.8
After school for two hours	7	36.8
One hour and 40 minutes	2	10.5
One hour	3	15.8
90minutes	2	10.5
80 minutes	2	10.5
<b>Total</b>	<b>19</b>	<b>99*</b>

\*Does not equal to 100 due to rounding off

From Table 18, 36.8% of the Biology teachers suggested that practicals were supposed to take place after school for two hours, i.e. from 14 hours to 16 hours, 15.8% of the teachers suggested that they needed one hour, while the other 15.8% of the teachers suggested that they needed more than 2 hours in order to do practical work. The other teachers (10.5%) suggested that they needed 90 minutes which was equivalent to a double lesson, while another 10.5% of the teachers suggested that they needed 1 hour and 40 minutes, and the remaining 10.5% of the teachers suggested that they needed 80 minutes (equivalent to a double lesson for schools with periods of 40 minutes duration) for them to do their practical lessons.

In conclusion, most of the teachers (36.8 %) suggested that they needed two hours after school in order to do practical work. The problem in this case could be that not all teachers might be happy to do practicals after school. In addition the learners might not be happy to do practicals after school because some might be travelling long distances back home for those who do not reside in the school hostels. These are some of the things that might prevent practicals from being carried out after school.

For the teachers who suggested more than two hours, this might not fit in the School timetable (because schools has made provision for practicals in their timetables, by putting in double or consecutive lessons) and might force them to do practicals after school.

Teachers were further asked whether they performed practical work before their learners came to class for a practical lesson. Six (26.1%) of the teachers said “yes”, while 15 (65.2%) of the teachers said “no”. Two (8.7%) of the teachers said that they only did that sometimes. Teachers need to do practicals in advance in order to see whether the practicals will work before they do them with the learners and also to see whether the apparatus and equipments were available and working.

When teachers were asked about the importance of carrying out practical work in advance before the actual practical lesson, they gave the following responses as shown in Table 19.

**Table 19: Importance of carrying out practical work in advance (N=23).**

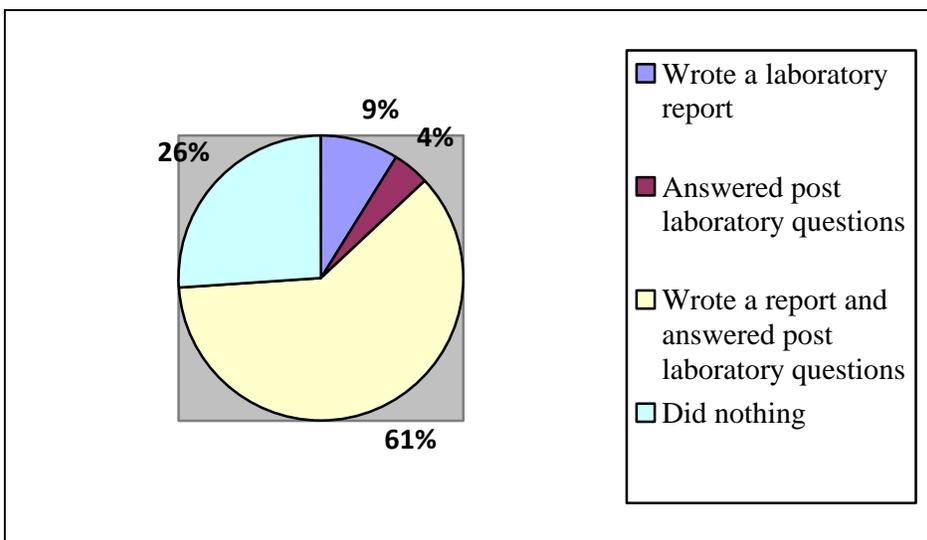
<b>Importance</b>	<b>Frequency</b>	<b>Percentage</b>
To see the results before hand and see whether the experiment will work	11	47.8
To see whether all equipment are available, working and that chemicals are not expired.	6	26.1
To familiarize oneself with the apparatus and the procedures to be used during the practical lesson.	4	17.4
Confidence that you know what you are doing to your learners and to manage your time well.	2	8.7
<b>Total</b>	<b>23</b>	<b>100</b>

From Table 19, eleven teachers (47.8%) felt that doing practicals in advance by the teacher before the actual practical lesson allowed them to see the results before hand and also to see whether the experiment worked before doing it with their learners.

Six (26.1%) of the teachers said that doing practical work in advance allowed them to see whether all the equipment and apparatus were available, working and the chemicals were not outdated.

The teachers' responses appear to be in line with The National Subject Policy Guide for natural sciences which states that, "in lessons where the teacher intends to conduct some practical work tasks must be tried out before hand" (Ministry of Education, 2009b, p. 20). Practical work needs thorough planning by the teacher. Teachers are therefore expected to carry out practical work in advance so that they can rectify any problems that might prevent the actual practical from being successful.

Teachers were also asked about what their learners did at the end of the practical lesson. Figure 4 presents their responses.



**Fig 4: What learners did at the end of each practical lesson (N=23).**

From Figure 4, 14 (61%) of the Biology teachers responded that their learners answered post laboratory questions at the end of the practical lesson. Two ( 9%) of the teachers said that their learners wrote a practical report, one (4%) of the teachers said learners answered post laboratory

questions and also wrote a practical report. Six (26%) of the teachers however, said that their learners did not write anything at the end of the practical lesson.

Six teachers (26%) as shown in Figure 4 did not give their learners any type of work at the end of the practical lessons. The Ministry of Education (2006; 2007), Examiners' Reports showed that practical examinations remained the biggest challenge within the Namibian education system. Learners continued to have problems in performing successfully in practical examinations due to lack of high-level procedural and conceptual skills. The lack of practical assessment of learners after practical lessons could be one of the reasons.

It should be pointed out that 16 (69.5%) of the teachers indicated that the practicals prescribed in the Biology syllabus were relevant to the learners' experience, or background knowledge, while six (26.1%) of the teachers were of the view that they were not relevant to their learners' knowledge and experience for the following reasons:

“Most learners did not understand these practicals”.

“Teachers usually had to find other examples similar to the experiments to make learners understand”.

“They did not have background knowledge on practicals from lower grades”.

If practicals were not relevant to the learners' experiences or background knowledge, learners might not be able to understand them and thus they might not learn anything from them. To say that the practicals that were prescribed in the syllabus were not relevant to the learners' experiences might be just an excuse for teachers not to do practicals because the Namibian Senior Secondary Certificate for Ordinary Level Biology syllabus is a localized one reflecting the local Namibian experiences and learners' knowledge.

Teachers were further asked to indicate what should be the role of the learners during the practical lesson. Six (26.1%) of the teachers said that it was “to handle the materials, observe and record their findings”. Eleven (47.8%) of the teachers said the role of the learners was to carry out the practicals themselves following the right procedures and then answering post laboratory questions. Two (8.7%) of the teachers on the other hand indicated that it was “to observe teachers demonstrating for them in order to answer the questions, and ask for clarity from the teacher.” The remaining 4 (17.4%) of the teachers said that “it was to follow the instructions carefully, write down the results and draw conclusions”. Students need to be involved in practical activities that will enhance their acquisition of higher-order process skills rather than the lower-order thinking skills (Lake, 2004; Savage, 1998).

Sometimes some form of data-handling that was never used in class is examined extensively in the end of year practical examinations (Keiler & Woolnough, 2002). Therefore, learners should be active participants during practical lessons. They should do the practicals themselves under the teachers’ supervision and they should be the ones handling the apparatus during the practicals if they are to be successful on the practical examinations.

When asked how learners benefited maximally from practical lessons in Biology, the teachers gave the following responses as presented in Table 20.

**Table 20: How learners benefited maximally from practical lessons in Biology (N=23).**

<b>How learners benefited</b>	<b>Frequency</b>	<b>Percentage</b>
By doing the practical themselves and be able to apply them to real life situations	6	26.1
If they were motivated by teachers, and if they understood all steps and procedures to be followed during the practical	6	26.1
If practicals were well set up, well formulated, equipment were all available, instructions were clear	6	26.1
If practicals were a true reflection of real life situations and when learners were in smaller groups	5	21.7
<b>Total</b>	<b>23</b>	<b>100</b>

From the teachers' responses, 26.1% of the teachers suggested that learners could benefit from doing practicals, if they understood what they were doing during the practical lesson; learners could also benefit from doing practicals if they were the ones doing the practicals, and handling the equipments. Mere observations of the teacher demonstrations will not instill the intended practical skills in the learners.

#### **4.2.5.1 Factors that hinder teachers from carrying out practical work in Biology**

Teachers were asked to identify the factors that hindered them from carrying out practical work in Biology. Their responses are presented in Table 21.

**Table 21: Factors hindering teachers from carrying out practical work in Biology (N=23).**

<b>Factors.</b>	<b>Frequency</b>	<b>Percentage</b>
Lack of chemicals, apparatus and materials (resources).	10	<b>43.5</b>
Classes overcrowded and time not enough for a practical lesson	3	<b>13</b>
Lack of experience and knowledge due to lack of support from Advisory Teachers	4	<b>17.4</b>
No laboratory for Biology at school.	3	<b>13</b>
Lack of teacher training in conducting practical work.	3	<b>13</b>
<b>Total</b>	<b>23</b>	<b>99*</b>

**\*Does not equal to 100% due to rounding off.**

Table 21 shows that ten (43.5%) of the teachers felt that lack of chemicals, apparatus and materials prevented them from carrying out practicals in Biology. Four (17.4%) of the teachers felt that they lacked experience and knowledge in carrying out practicals due to the lack of support from the Advisory Teachers.

The findings from Table 21 show that lack of chemicals, apparatus and materials, lack of experience, crowded classrooms, lack of laboratory space and lack of training in conducting practicals during pre-service training were hindering teachers from carrying out practical work in Biology in the Oshana Education Region. These findings are similar to those by Kandjeo-Marenga (2008) who found out financial constraints as well as overcrowded classrooms hindered Biology teachers from carrying out practical work.

#### **4.2.5.2. Different stakeholders' role in Science teaching**

Several stake holders play an important role in ensuring that effective teaching and learning takes place in Science classrooms. Some of these include: School management, Advisory Teachers, Teacher Training Institutions and the Ministry of Education (Keiler & Woolnough, 2002). Accordingly, this study sought to find out what these stakeholders should do to encourage teachers to do practical work in Biology. The teachers' responses are given in this section.

##### **4.2.5.2.1 School Management**

Sixteen (69.57%) of the teachers felt that the School Management should avail funds for buying equipment and chemicals for practicals. The remaining seven (30.43%) of the teachers said that the school management should make sure that there was a laboratory that was fully equipped with materials for practicals.

The learning environment needs to improve considerably if Biology teachers are to do meaningful practicals with their learners. School Management should improve the condition of school laboratories at the secondary school level ((Keiler & Woolnough, 2002) for the teachers not to have excuses for not conducting the practical work with their learners.

##### **4.2.5.2.2 Advisory Teachers**

Twelve (52.2%) of the teachers felt that Advisory Teachers should organize workshops on practicals for secondary school teachers in order to advise them and encourage them to do practicals. Six (26.1%) of the teachers said that Advisory Teachers were supposed to ensure that laboratories were fully equipped to carry out practical work by paying regular visits to schools.

Five (21.7%) of the teachers said that Advisory Teachers were expected to visit secondary schools regularly (which they never did according to the teachers) in order to see if practicals were being done and to work with teachers also.

The Advisory Teachers' core duties and responsibilities according to the Ministry of Education (2006) include:

- “To ensure quality subject management in every school.
- To assist teachers to teach and assess the basic competencies according to the set standards.
- To evaluate performance of subordinates.
- To train, support, motivate and guide teachers through school visits” (p. 4).

The Advisory Teachers should work together with the teachers in order to assist them in doing practicals at the secondary school level. If teachers do not have the necessary training in doing the practicals, the Advisory Teachers through the Ministry of Education should plan in-service-training for the teachers. From the teachers' responses, it was obvious that the Advisory Teachers were not fulfilling their mandate.

#### **4.2.5.2.3 Teacher Training Institutions**

Fourteen (60.9%) of the teachers indicated that Teacher Training Institutions were expected to train teachers on how to conduct practicals. The other six (26.1%) of the teachers felt that the Teacher Training institutions were supposed to do practicals that were relevant for trainee teachers to apply in schools after they completed with their training. The remaining three (13%) of the teachers indicated that the Colleges of Education and the University should assess teachers on practical work as well before graduation.

The teachers' responses seemed to point to the need for teachers to be trained in doing practical work before they graduate and start teaching. This can only happen if the curriculum for teacher training consists of a compulsory practical work component for all Science teachers. In this way there will be no excuse for not doing practical work when student teachers start teaching.

#### **4.2.5.2.4 Ministry of Education**

Ten (43.5%) of the teachers indicated that, “the Ministry of Education was supposed to provide money to build laboratories and buy equipment and chemicals”, while nine (39.1%) of the teachers on the other hand felt that “the Ministry of Education was supposed to send teachers for in-service training on practicals in order to keep them updated”. Two (8.7%) of the teachers said that “the Ministry of Education was supposed to make practical tests compulsory for grade 11 and 12” and another two (8.7%) of the teachers said that “the Ministry of Education was supposed to make it compulsory to do practicals in lower grades for learners to become familiar with the doing of the practicals”. Nonetheless, Angula (1993) noted that, teachers had expectations of what the Ministry of Education should do to facilitate their tasks in preparing their students for the practical examinations but which the latter failed to do. Teachers usually do what the Ministry of Education wants them to do, but if the Ministry of Education declares that all teachers should undergo in-service training on the conduct of practical work, teachers should adhere to this.

The National Subject Policy guidelines for Natural Sciences (Ministry of Education, 2009, p. 6) stipulate that “the supply of suitable teaching aids that will ensure an effective teaching of Natural Sciences must be seen as a joint responsibility between the Ministry of Education and the school”.

The Ministry of Education should build the laboratories at the secondary schools, while the schools should ensure that these are adequately stocked and utilized by the teachers. Without such partnership, little practical work will take place.

#### **4.4. Results from the Observation guide**

##### **4.4.1. Introduction**

The researcher had planned to observe 24 practical lessons, but only managed to observe nine practical lessons by six teachers, in six secondary schools. The researcher also only managed to observe two practical lessons each observed from three teachers and one practical lesson each from the other three teachers. The reason for the low number of practical lessons observed practical lessons was because the teachers informed the researcher that they did not do practicals that often, because they “did not have enough equipment and apparatus to carry out the practicals”. Three of the Grade 12 teachers told the researcher that they “had passed the topics which require practicals already, which is why they were not going to do practicals anymore”. Three teachers at one school told the researcher that they “did not have a laboratory at the school because Grade 11 and 12 was just introduced that year, and thus they did not carry out practicals at all”. At another school, the researcher was told that their, “laboratory had no apparatus; no chemicals because it was just built since it is a new school and thus do not carry out practicals”.

There were fewer practicals taking place in schools in the Oshana Education Region, during the conduct of this study. All 23 teachers had indicated in the questionnaires that they carried out practical work in Biology but the observation indicated otherwise. The results from the Observation Guide are presented and discussed in this section.

As indicated earlier the researcher managed to observe seven Grade 11 classes and two Grade 12 classes. Most (7 out of 9) of the practical lessons took place in Grade 11. But, Paper 3 is written by Grade 12 learners at the end of the year. Accordingly, they were supposed to continue with practical work from Grade 11 through to Grade 12. As noted earlier, the Namibian Senior Secondary Certificate for Ordinary Level Biology syllabus for Grade 11 and 12 suggests a practical for almost all topics (Ministry of Education, 2009a). This is an indication that practicals were supposed to be carried out at Grade 12 as well. Learners who were in Grade 12 were most likely to be disadvantaged answering questions on Paper 3, if no practicals were conducted, in Grade 12.

Out of the nine practical lessons observed, six (66.7%) lasted for 40 minutes while the remaining three (33.3%) lasted for 45 minutes. These observations seem to suggest that most of the practical lessons (at least those observed) only lasted for one period instead of a double period (or two periods following each other). Grade 11 and 12 timetables have both single lessons and double lessons. The single lessons are intended for teaching theoretical lessons, while the double lessons are intended for practical lessons because practical lessons need more time (Ministry of Education, 2009b). The observed Biology teachers did not make use of the double lessons to conduct practical work; instead they made use of the single lessons. This made it difficult for the teachers to allow all learners to be actively involved during the practical lessons.

#### **4.4.2 Classroom organization**

During the practical lessons observations, it was found that, in three of the lessons, learners were seated in groups while in the other six lessons observed; learners were sitting in rows and columns as they sat during theoretical lessons.

This latter sitting arrangement might prevent learners from interacting with each other. Interactions are better facilitated in smaller groups and smaller groups allow all learners to handle the apparatus during the practical lessons. Smaller groups also make it easier for the teacher to control learners, keep order in the laboratory during the practical lesson and easily identify non-participating learners and thus encourage them to participate actively during the practical lesson.

The number of learners in the observed practical lessons varied in seven of the observed practical lessons, there were over 40 learners in class while in the remaining two practical lessons observed, there were 35 learners who attended the practical lesson accordingly.

Seven practical lessons observed, were overcrowded. As such, it was not easy for the teacher to divide learners into smaller groups for carrying out practical work. Also, overcrowded classes make it difficult for all learners to handle the apparatus during the practical lessons and teachers' control of the lesson might be adversely affected. Another hindrance to effective practical lessons in overcrowded classes could be a shortage of materials, apparatus, equipment, and chemicals for learners' use if classes are overcrowded. This will in turn restrict the handling of materials and apparatus by learners, the experience required to do better on Paper 3. It is interesting to note that during two practical lesson observations, the researcher counted a total of 20 learners per group, and in another four observations, a total of 10 learners per group. In such cases many of the learners were passengers only and did not take an active part in the practical activities.

### **4.4.3 Resources to support the practical lessons**

Out of the nine practical lessons observed, two teachers used the syllabus as a guide for their practicals; another two used a handout that they also gave to their learners as a guide for their practical lessons, while the other two used the textbooks as a guide for their practical lessons and the remaining three teachers used nothing to guide their practical lessons.

These findings show that there was an absence of practical manuals to guide the teachers in conducting practicals in the observed lessons. Practical need to be planned in advance, if learners are to benefit from them. Even though the Ministry of Education has suggested practical activities to be carried out by Grade 11 and 12 teachers (Ministry of Education, 2009a), the preparation of laboratory manuals is the responsibility of the teachers. The teachers should be pro- active and prepare such manuals to guide them and their learners during practical lessons.

It was also observed that in all the nine practical lessons, there were not enough apparatus and equipment for all the learners to use. Learners shared the apparatus and equipment in three practical lessons observed. In the other two, the laboratory apparatus were for the teachers' use only, while in the remaining four practical lessons, there were no apparatus at all. For those schools that had apparatus, the researcher observed that most of the apparatus were in good working condition, a few were old and dusty indicating that they have not been used for a long time and some chemicals had long expired and thus could not be used during practicals.

The lack of essential laboratory resources tended to limit how much practical work could be done in secondary schools (Kandjeo- Marenga, 2008). Lack of resources can limit the number of practicals that can be carried out in Biology, in secondary schools.

The researcher is of the view that the Ministry of Education and the Biology teachers should work together in order to ensure that there are enough practical resources at all secondary schools offering Biology. Improvising should be encouraged among Biology teachers in the conduct of practical work.

During observations, the researcher found that six (66.7%) of the practical work took place in laboratories while three (33.3%) were carried out in ordinary classrooms. None of the practical lessons took place in the field or school yard.

The classrooms were not conducive for carrying out practicals, they were not build for that purpose. Furthermore, the classrooms were not large enough for the overcrowded classes. According to Ausubel et al. (1968), the laboratory gives the students appreciation of the spirit and method of science, promotes problem-solving, analytical and generalization ability and provides students with some understanding of the nature of science. If practicals are conducted in the classrooms, learners might not see them as real practicals, but as an extension of the usual theoretical lessons. As such learners will not take practicals seriously.

The condition of the laboratory plays an important role in popularizing practical work among learners. Accordingly, the researcher observed/checked at the conditions of the laboratories. The findings are given in Table 22.

**Table 22: The conditions of Biology laboratories (N=6).**

<b>Condition</b>	<b>Frequency</b>	<b>Percentage</b>
Laboratory is old without posters to support the practicals	3	50
Big but empty, it does not have stools for learners to sit on, tables and benches not enough, learners standing.	2	33.3
Laboratory is in good condition, with enough benches and chairs for learners.	1	17.7
<b>Total</b>	<b>6</b>	<b>100</b>

Table 22 shows that three laboratories were too old, and they did not have any supporting materials. The other two laboratories were big but the chairs and the tables were not enough for all the learners, some of whom were standing during the practical lessons. The remaining two laboratories were in good condition with enough chairs and benches for all learners to use during the practical lesson.

Most of the laboratories that were observed needed to be renovated. The condition in which they were was not conducive for learning. Poor conditions of the laboratories might reduce the learners' interest in doing Biology practical work; five were big enough to accommodate all the learners. Big laboratories allow learners to move freely and interact with each other during the practical lesson as compared to small laboratories. Big laboratories also allow teachers to divide learners into groups during the practical lessons and thus allowing learners to work in groups, helping each other during the conduct of practical work.

#### **4.4.4 Introduction of the practical lessons**

The researcher also observed how Biology teachers introduced the practical lessons in their classes. This information is presented in Table 23.

**Table 23: How teachers introduced the practical lessons (N=9).**

<b>How teachers introduced the practical lessons</b>	<b>Frequency</b>	<b>Percentage</b>
The teacher explained what they were going to do during that practical lesson at the same time preparing apparatus	3	33.3
The teacher revised what they talked about yesterday	2	22.2
The teacher went through steps as stipulated in the handout	4	44.4
<b>Total</b>	<b>9</b>	<b>99*</b>

\*Does not equal to 100% due to rounding off.

Table 23 shows that three teachers introduced their practical lessons by explaining what they were going to do during the practical lesson as they prepared the apparatus for the practical lesson. Two teachers revised what they had talked about the previous day before introducing the practical lesson, while the remaining four teachers went through the steps of the practical lessons as stipulated in the hand out before letting the learners carry out the practical.

The teachers need to provide meaningful and extended explanations before engaging students in practical work. Meaningful discussions can take place as complementary to the practical work (Westbrook & Marek, 1992). Teachers need to provide learners with some background information on the practical before they start with the actual practical lesson. This might allow learners to understand the practical better if they had some background information. It is not enough for teachers to just go through the steps of the practical lesson, without giving learners some supporting information on the practical. Giving learners' background information on the practical might also increase the interest of learners towards that particular practical lesson.

It was observed in this study that eight of the nine teachers gave clear instructions to their learners before they started the practical. Nonetheless one teacher just told the learners to do the practical without giving them clear instructions on what they were really supposed to do.

Learners who have been given clear instructions before they start with the actual lesson are in a better position of not making a lot of errors. Six of the teachers gave verbal instructions to their learners while three teachers gave written instructions.

Learners need instructions that are written so that they do not forget the steps that they were supposed to follow during the practical lesson. If the instructions are written down then learners might avoid making a lot of errors during the practical lessons. Also, if the instructions were written down learners might be able to understand them better. Some learners might not understand what the teacher was saying, if the instructions were given verbally. It is therefore important to give written instructions for practical lessons which are open ended in order to promote scientific inquiry.

It is interesting to note that five (55.6%) of the nine teachers made sure that the instructions were clear and understood by the learners before they started the practical. The remaining four (44.4%) just started the practicals. For learners to do their practicals properly, they need to understand the instructions that they had to follow in order to achieve the anticipated results. The teachers should make sure that all learners understood all the instructions before they start doing their experiments.

It was also observed that for the first 10 minutes of the practical lessons, five teachers demonstrated the practical to be carried out to familiarize their learners with the practical. The remaining four teachers did not do any demonstration.

In my view, teachers should have all started the practical lessons with a demonstration of that practical in order to allow learners to observe how to do that particular practical, to be at ease with it, and also to be sure that the practical will yield the expected results. Nonetheless, press of time might have forced some teachers not to carry out the demonstration first.

The teachers needed to ‘model’, the process before they allowed learners to do the practical. In the laboratory setting, the teacher might demonstrate a task to the whole class or to a small group and thereafter, the student is asked to perform a similar task in the presence of the teacher (Hodson and Hodson, 1998b). Modeling is necessary to help learners carry out the practicals successfully. As indicated earlier, four out of nine of the teachers that were observed in this study failed to model the practicals.

#### **4.4.5 Teacher - learner interactions**

Interactions between the teacher and the learners and between the learners themselves are a hallmark of a successful lesson or practical and learner centred teaching (Lubben, 1998). Accordingly, the researcher sought to find out whether there was any interaction between the teacher and the learners and between the learners themselves during the practical lessons. It was noted that in all the nine practical lessons that were observed, there was some interactions between the teacher and the learners. Nonetheless, in five lessons the teacher initiated this interaction by asking questions and the learners responding to them. In four practical lessons observed, the teachers walked from group to group of learners, explaining what needed to be done and also talking to individual learners in those particular groups. Nonetheless, little exchange took place between the learners themselves.

Dialogue among learners and/ or with the teacher is necessary because a dialogue tends to help learners to appropriate scientific knowledge in order to internalize the new information at a personal level. That is why teachers should assist students in unlocking the meaning embedded within what is being observed (Nakhleh et al., 2002, Staver, 1998).

It is interesting to note that, the teachers did not allow learners to do practicals on their own. In six practical lessons observed, the teachers were doing the practicals themselves. In three other cases the teachers used two learners to demonstrate the practical work, while other learners observed. Most of the learners were not actively involved during the observed practical lessons.

Hofstein et al. (2005) noted that students involved in carrying out a task may perform better than those that were not involved in carrying out a task. Therefore, it is important that all learners take an active role during the practical lessons so that they can acquire practical skills. In a country where many learners may not have a scientific background that will help them develop the skill and knowledge of the scientific world, it must be seen as a serious opportunity lost if this experience is not provided in the school environment (Ministry of Education, 2009b).

The findings above are similar to those by Ramorogo (1998) who noted that, “most of the practical lessons in Biology were dominated by laboratory activities that required the students to make accurate observations and measurements, use scientific apparatus correctly and confirm and verify facts and principles” (p. 85).

#### **4.4.6 Role of the teacher during the practical lesson**

To be able to use the apparatus and equipment correctly during the practical lessons, learners need to know the names and functions of those apparatus and materials. In five practical lessons observed, the teachers mentioned the names and functions of all the apparatus that were used

while in the remaining four practical lessons, the teachers did not mention the names and functions of all the apparatus that were being used during the practical lessons. Since teachers are expected to be role models during practical lessons, they were expected to state the names of the apparatus for learners to be able to know them. Stating the names of the apparatus by the teachers might show the learners that the teacher knows what he/she is doing, hence build up learners' confidence in the teacher's grasp of the subject content.

As it was mentioned earlier, the learners in six of the practical lessons observed did not actually carry out the practical work themselves but their teachers did. The teachers on the other hand did not try to involve all the learners in the practical work. Table 24 shows the methods that the teachers used during the practical lessons.

**Table 24: Action by teachers to involve learners in doing the practical (N=9).**

<b>Ensuring involvement of learners</b>	<b>Frequency</b>
Teacher asked learners questions when they were observing what the teacher was demonstrating	2
Teacher did not mind those learners who were not doing the practical	2
Teacher made use of one learner only	1
Teacher was moving from group to group of learners making sure that they are all doing something.	1
Teacher asked two learners to do the practical work and then others to observe	3
<b>Total</b>	<b>9</b>

Table 24 shows that in two of the observed practical lessons, the teachers did nothing to involve the learners who were not actively involved in doing the practical. In one practical lesson, the teacher made use of one learner to do the practical while the rest of the class was observing.

In another practical lesson, the teacher moved from one group to the other making sure that they were all doing practical work. In the remaining three practical lessons, the teachers asked two learners to do the practical while the rest of the class was observing. The teachers need to make sure that all learners are involved in doing the practicals. They can only do this if they allow learners to do the practicals themselves. Using one or two learners to do the practical for other learners will not allow other learners to do the practical.

#### **4.4.7 Conclusion of the practical lessons by the teachers.**

Recording of results is important in practical work. In this research, only in four of the practicals did learners record their findings. Accordingly, in five of the cases learners did not keep a record of what they did and this might have negative impact on their performance on Paper 3 examination. Learners were supposed to record their findings during the practical lessons.

As far as teachers' assessment of the learners' practical work was concerned at the end of the practical lessons, it was found that only in three practical lessons that the learners handed in work to the teacher for assessment while in the remaining six practical lessons the learners did not hand in any work to the teachers for assessment after the practical lessons. Learners need to be assessed after they have done a practical lesson so that the teacher would know if they have understood what they did in the practical lesson. Table 25 shows what learners handed in at the end of the practical lesson.

**Table 25: What learners handed in at the end of the practical lesson (N=9).**

<b>What learners handed in at the end of the practical lesson</b>	<b>Frequency</b>	<b>Percentage</b>
Wrote a practical report	0	0
Answered post laboratory questions	3	33
Handed in nothing	6	67
<b>Total</b>	<b>9</b>	<b>100</b>

Table 25 shows that in the six practical lessons observed, the learners did not hand in anything to their teachers at the end of the practical lessons for marking. While in three other practical lessons, the learners answered questions (post laboratory questions) on the practicals that they did and then handed them in for marking. After learners had done a practical, they should be assessed in order to find out their level of understanding of the work they have done.

Assessment is necessary in order to find out whether the students have learned anything from the practical lesson. Without assessment, there is no way teachers will know if learners have understood the practical or not. According to the Ministry of Education (2007; 2008; 2009) Examiners' Reports, comparative language was one of the aspects of practical work that most learners in Namibia found difficult. Through assessment, teachers might find out whether learners had a problem with the language in practical work and rectify this. Without such assessment this problem remains unsolved resulting in poor performance on Paper 3.

Like any lesson, conclusion of the practical lesson is an important component and often revisits what has been covered in that particular lesson. In this study, the researcher also sought to find

out how practicals were concluded by the Biology teachers. This information is presented in Table 26.

**Table 26: How teachers concluded their practical lessons (N=9).**

<b>How teachers concluded practical lessons</b>	<b>Frequency</b>
Teacher went through the results of the experiment	4
The teacher told the learner to answer post laboratory questions	3
Told the learners what they will be doing tomorrow	1
Teacher and learners went through questions in the textbook and answered them together	1
<b>Total</b>	<b>9</b>

The findings in Table 26 show that, four teachers went through the results of the experiment when they were concluding the experiment. Three teachers told the learners to answer post laboratory questions and then said nothing else in order to conclude the lesson. One teacher on the other hand told the learners what they were going to do the following day and then said nothing on the practical that they had just completed. Another teacher went through the questions in the textbook with the learners and answered them together. All the observed teachers did not allow learners to talk about how the practical went, about what worked or didn't work, asked questions at the end of the practical lesson, or talked about the difficulties that the learners had, and how they could improve them next time. At the end of the practicals, learners should talk about their experiences on that particular practical with their teachers, to ensure better understanding of the practical lesson.

#### **4. 4. 8 Summary**

In this chapter, the findings of the study were presented and discussed. The next chapter will present the summary, conclusions and recommendations of this study.

## **CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

In this chapter the summary of the major findings of the study highlighting their implications for policy, curriculum development, instructional practices and research are provided. The conclusions, recommendations and suggestions for further research are also presented.

### **5.1 Summary**

According to the Ministry of Education (2008 and 2009), Biology Examiners' Reports show that Grade 12 learners have continued to perform poorly on Paper 3 countrywide. The Examiners' Reports further point out that from the candidates' answers it is evident that only a few schools followed a practical approach to the teaching of Biology. It is against this background that this study was carried out in order to find out the Biology teachers' perceptions of the importance of practical work in secondary schools in the Oshana Education Region. The study also sought to find out whether the secondary schools in the Oshana Education Region had all the resources needed to conduct meaningful practical lessons in Biology.

#### **Research questions**

This study sought to answer the following questions:

1. What are the secondary school teachers' perceptions of the importance of practical work in Biology in the Oshana Education Region?
2. How do Biology teachers in the Oshana Education Region perceive the use of practical work during instruction?
3. To what extent is practical work done in Biology classrooms in the Oshana Education Region?
4. Do secondary schools in Oshana education region have all the necessary resources for conducting practical lessons in Biology?

The study was both qualitative and quantitative in nature. The population of this study consisted of all 13 secondary schools in the Oshana Education Region offering Biology at Grade 11 and 12. Eight secondary schools were randomly selected to take part in this study. A sample comprising 23 Biology teachers was then chosen purposively from the eight secondary schools.

Two research instruments were used to collect the data for this study, a questionnaire and an observation schedule. Questionnaires were completed by the 23 Grade 11 and 12 Biology teachers consisting of both closed and open ended questions. Nine Biology practical lessons were observed from six Biology teachers at the selected secondary schools. The researcher was a non-participant observer during the practical work to avoid influencing the outcome of the practical classes. Descriptive statistics including frequency tables were used to analyze quantitative data, while qualitative data was placed under headings from both the questionnaires and the observation schedule.

All 23 teachers were aware of what practical work entailed and why it was necessary in the teaching of Biology. But, from the observations it was clear that, not all the teachers did practical work. Only nine practical lessons were observed.

The three teachers out of the six that were observed conducted demonstrations and did not allow their learners to use the apparatus during practical lessons. Further, four out of six of the observed teachers did not involve all the learners in the practical lesson and they did not make sure that all the learners were following the right procedures in order to get the anticipated results.

Fifteen out of 23 teachers had not received sufficient training to teach practical work during their teacher training. They suggested in-service training and workshops be organized by the Advisory Teachers and the Ministry of Education for the teachers to receive some training on conducting practicals work.

## **5.2 CONCLUSIONS**

This study found that all the Biology teachers were not doing practicals in Biology even though they said they did. The teachers did not allow their learners to do the practicals themselves even though they were expected to do practicals under the teachers' supervision. This might be one of the reasons why learners performed poorly on Paper 3.

The study also found that both teachers and learners did not have Biology practical manuals to guide the conduct of practicals. Without a practical guide for both the teachers and the learners, learners might not take practicals seriously and this might affect their performance on Paper 3. Furthermore, the study found that learners were not assessed at the end of the practical lessons, to determine whether they had understood the practical and to familiarise the learners with the questions format in Paper 3. This might have adverse impact on learners' performance on Paper 3.

In conclusion not all schools in the Oshana Education Region had laboratories for conducting practical work in Biology. Some laboratories were too old while some did not have tables and chairs for learners to sit on during practical lessons. Without a laboratory for conducting practicals in Biology, teachers might not do practicals with their learners which will contribute to poor performance on Paper 3. Further, the secondary schools in the Oshana Education region did not have the necessary resources, apparatus and equipment for both the teachers and the learners to use during the Biology practical lessons.

## **5.3 RECCOMENDATIONS**

In light of the findings of this study, the following recommendations are made:

### **5.3.1 Ministry of Education**

5.3.1.1 There is a need for the Ministry of Education to budget money for building Biology laboratories at secondary schools. If the Ministry builds new secondary schools or transforms Combined Schools into secondary schools, laboratories for conducting practicals in Biology should also be built at the same time.

5.3.1.2 The Ministry of Education should also budget money for buying the apparatus and the equipment that will be used by both teachers and learners during practical lessons. Laboratories which are empty and do not have the necessary chemicals, apparatus and materials for conducting Biology practicals serve no purpose in the conduct of practical work in Biology.

5.3.1.3 The Ministry of Education should renovate laboratories that are old so that they can become conducive for conducting practical work.

5.3.1.4 The Ministry of Education should, through curriculum development make practical tests compulsory for Grade 11 and 12, so that learners could be prepared to answer questions in Paper 3.

### **5.3.2 Advisory Teachers**

5.3.2.1 The Biology Advisory teachers should visit secondary schools regularly in order to identify the problems that teachers are facing in conducting practical work. In this way they will be able to assist Biology teachers in conducting practicals and in ordering required consumables and equipment.

5.3.2.2 The Advisory Teachers should together with the Ministry of Education organise workshops and in-service training for Biology teachers in order to train them on how to conduct practicals in Biology.

### **5.3.3 Teacher Training Institutions**

Teacher Training institutions should train teachers on how to conduct practical work in Biology.

### **5.3.4 Biology teachers**

5.3.4.1 The Biology teachers should borrow materials from neighbouring schools for conducting practicals in Biology if they lack these at their schools.

5.3.4.2 Biology Teachers should inform the Biology Advisory Teachers where their schools do not have the necessary resources for conducting the practicals in Biology. In this way the Advisory Teachers might organise the needed resources for conducting practicals.

5.3.4.3 Biology teachers should be afforded the chance to attend Workshops dealing with conducting practicals so that they could get the skills on how to conduct practical work in Biology organized by the Ministry of Education and the Advisory Teachers.

### **5.3.5 School Management**

5.3.5.1 School Management should organise bazaars, fundraising activities and any other money raising events in order to generate funds for buying equipment and chemicals that will help teachers to carry out practicals in Biology.

5.3.5.2 School Management should be proactive and inform the Advisory Teachers if their schools do not have the necessary resources for conducting practicals in Biology.

### **5.3.6 Suggestion for further research**

5.3.6.1 A longitudinal study should be carried out that would shed more light on the nature of Biology practical work in Namibian secondary school classes.

5.3.6.2 There is need to conduct a countrywide study that will shed more light on why Biology teachers are not conducting practical work at the secondary school level.

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## **APPENDIX 1: TEACHERS' QUESTIONNAIRE**

### **Instructions**

This questionnaire is designed with the aim of investigating the views and attitudes of Biology teachers to practical work in selected Secondary Schools in the Oshana Education Region. The information to be collected from these questions will be used to understand the way in which practical work is conducted in selected Secondary Schools in the Oshana education region and how such practices may affect students' performance in Biology. Your honest responses will help in improving the way in which practical work is conducted in our secondary schools. Please do not write your name on any part of this questionnaire. The information collected from this questionnaire will be kept confidential and will not be given to anyone. It will be used for this study only.

Thank you for your answers which will contribute to making our schools offer effective instructions to our learners in Biology.

Ms L. L. T Nghipandulwa

1. Name of school..... 2. Grade.....

3. Do you do practical work lessons in Biology? (Please tick) Yes ( ) No ( )

4. If yes how often do you do practical work lessons in Biology?

.....

5. (a) How long are the practical lessons?

(i) 40 min .....

(ii) 80 min .....

(ii) Others (specify).....

(b) Is the time sufficient enough for carrying out practical lessons?

Yes ( ) No ( )

(c) If not sufficient suggest the time that you think will be sufficient to allow you to conduct practical lessons?

.....

(d) Give reasons for your answers in (b)

.....

.....

.....

6. How many hours are allocated to the following Biology Lesson components?

(a) Practical work lessons.....

(b) Teaching theoretical lessons.....

7. Do you think practicals are necessary in the teaching of Biology? Yes ( ) No ( )

Explain why?

.....

.....

.....

.....

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8. Does your school have a laboratory specifically for conducting Biology practical work?

Yes ( ) No ( )

(i) If not, where do you conduct practical work lessons?

.....

(ii) How well-stocked is your Biology laboratory?

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.....

(iii) If the school does not have the Biology Laboratory, should this prevent teachers from carrying out practical work with their learners? Yes ( ) No ( )

(iv) Explain your choice

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9. Do you have sufficient materials and equipments to teach Biology practicals? Yes ( ) No ( )

(i) Are the materials and equipments for teacher's use only? Yes ( ) No ( )

(ii) Are there enough materials and equipments for each learner to carry out practical work in Biology?

Yes ( ) No ( )

(iii) In your view, what should teachers do in cases where the school does not have all the necessary Equipments and apparatus to conduct Biology practicals?

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10. Do you allow learners to use the materials and equipments in practicals? Yes ( )

No ( )

(i) If yes what is the importance of allowing learners to use the equipments during practical lessons?

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(ii) If no why don't you allow them to use the equipments during practical lessons?

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11. Are learners taught to carry out practical work on their own from lower grades?

Yes ( ) No ( )

Explain your answer.

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12. Do you carry out (perform) practical work before class or in advance? Yes ( ) No ( )

13. What is the importance of carrying out practical work in advance before the actual practical lesson?

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14. Do your learners have a practical lab manual? Yes ( ) No ( )

(i) If not, what do they use as a guide when they are conducting practical work in Biology?

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15. How many learners do you have in your class?

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(i) What effect does your class size have on doing practicals?

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16. Do your students write a practical laboratory report or answer post laboratory questions or both at the end of each practical lesson? Choose your response by ticking in the appropriate box.

- (i) Write a lab report ( )
- (ii) Answer post lab report questions ( )
- (iii) Do both ( )

17. How do you assess your learners at the end of the practical lesson?

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18. Are the practicals prescribed in the Biology text book relevant to the learners' experiences and background knowledge?

(i) If no why?

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19. Which one do you enjoy most between the following?

- (i) Doing practical work lessons ( )
- (ii) Class teaching lessons ( )
- (ii) Explain the reason for your choice.

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20. Do you enjoy doing practical work with your students? Yes ( ) No ( )

(i) If yes, what do you enjoy in the practical lesson?

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(ii) If not, why don't you enjoy doing practical lessons?

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21. What should be the role of the learner during the practical lesson?

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22. How can learners benefit maximally from practical lessons in Biology?

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23. In your view how do practicals contribute to the learners understanding of Biology?

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24. In your view how do teachers benefit from doing practical lessons in Biology?

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25. Do you give your learners tests on practical work during the course of the year?

Yes ( ) No ( )

26. Do you think that your learners will be ready to answer examination questions in paper 3

(alternative to practical work) at the end of the year? Yes ( ) No ( )

( i) Explain your choice in 26.

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27. How do you make sure that all learners all involved in doing the practical?

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28. How do you make sure that all learners will get the anticipated results at the end of the Biology practical lesson?

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29. In your view, who should be doing the practical work, during the Biology practical lesson?

- (i) Learners only ( )
- (ii) The teacher only ( )
- (ii) Both the teacher and the learners ( )
- ( iii) Others( specify) .....

30. What do you keep yourself busy with when learners are doing the practical work in the laboratory?

- (a) Walk from learner to learner ( )
- (b) Sit in front and do your work ( )
- (c) Walk from group to group of learners ( )
- (d) Others (specify) .....

31. In your view, do you think that teachers should know the names and the functions of all the apparatus and equipments to be used during the practical lesson? Yes ( ) No ( )

(i) Explain your choice

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32. How often do advisory teachers visit your school to determine the effectiveness of practical lessons?

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33. What type of help do you get from advisory teachers when it comes to practical work in Biology?

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34. In your view, what factors hinder teachers from carrying out practical work in Biology?

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35. Do you think you had sufficient training to teach practicals in Biology during your teacher training? Yes ( ) No ( )

(i) If not suggest what should be done in order to help those teachers that did not receive sufficient training during their tertiary education?

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36. What can the following stake holders do to encourage teachers to do practical work in Biology?

(i) School management

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(ii) Advisory teachers

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(iii) Teacher training Institutions

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(iv) Ministry of Education

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(v) Others (specify)

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37. Any other general comments you would like to make about the teaching of practical work in Biology?

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**Thank you for your help.**

## APPENDIX 2: PRACTICAL LESSON OBSERVATION SCHEDULE

### GENERAL INFORMATION

Date: \_\_\_\_\_ Name of School: \_\_\_\_\_ Grade: \_\_\_\_\_

Number of learners attending the practical lesson \_\_\_\_\_

Duration of the practical lesson: \_\_\_\_\_

#### 1. Classroom setting

Descriptor	Yes	No
(a) Are learners sitting in groups?		
(b) If yes in how many groups?		

(c) Number of learners per group \_\_\_\_\_

(d) If they are not seated in groups, how are they seated?

\_\_\_\_\_

#### 2. Resources to support the practical lesson

Descriptor	Yes	No	comments
(a) Does the teacher have a guide for the practical lesson?			
(b) Do the learners have a lab manual?			
(c) If yes are they using it for the practical lesson?			
(d) If yes is the instruction in the lab manual clear?			
(e) Are there enough apparatus and equipment for all the learners to use during the practical lesson?			
(f) Are the apparatus in a good condition( not too old)			
(g) Are learners stating the names of all the apparatuses and equipment during the practical (as they talk to each other?)			

(h) If learners do not have a laboratory manual, what are they using as a guide for the practical?

\_\_\_\_\_

(i) (a) Are they using a laboratory or a classroom for the practical lesson?

Laboratory ( )

Classroom ( )

(b) If they are using the laboratory, in which condition is the laboratory?

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(c) Is the laboratory big enough to accommodate all the learners during the practical lesson?

Yes ( ) No ( )

### 3. Introduction

(a) How did the teacher introduce the practical lesson?

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Descriptor	Yes	no	comments
(b) Did the teacher give clear instructions on what is going to be done during that practical lesson?			

(c) Is the instruction verbal or is it written?

(i) Verbal ( )

(ii) Written ( )

(d) How did the teacher make sure that all the learners got the instructions clear before they started the practical?

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(e) Did the teacher do any demonstration to familiarize learners with the practical before they started with the practical lesson? Yes ( ) No ( ).

#### 4. Teacher/ learner interaction

Descriptor	Yes	no	comments
(a) Is there any interaction between the teacher and the learners during the practical lesson?			
(b) Is the teacher walking from group to group of learners?			
(b) Is the teacher doing some explanations as he/she walks from one learner to the next?			
(a) Are learners doing the practical themselves, are they handling the equipment themselves?			
(e) Did the teacher make sure that all learners are handling the practical equipment during the practical lesson?			
(f) Are the learners interacting with each other during the practical lesson?			

#### 5. Presentation of classroom activities during the practical lesson

Descriptor	Yes	no	comments
(a) Did learners ask questions on what they did not understand?			
(b) Did the teacher provide feedback?			
(c) Was the feedback helpful to the learners?			
(d) Did the teacher briefly explain all the steps involved in the practical lesson?			
(e) Are all learners involved/ participating in the practical lesson?			
(f) Are the learners recording their results during the practical lesson?			
(g) Were all learners following the steps as stipulated by the teacher?			
(h) Did most of the learners get the same results after the experiment?			

(i) If some learners did not get the anticipated results, what did the teacher do in order to help them get the results?

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### 6. Role of the teacher during the practical lesson

Descriptor	Yes	no	comments
(a) How Did the teacher make sure that learners were involved in the practical lesson?			
(b) Is the teacher mentioning the names of all the apparatus and equipments to be used during the practical?			
(c) Is the teacher mentioning the functions of all the apparatus to be used during the practical?			
(d) Did the teacher remind the students about the remaining time before the practical lesson ends?			
(e) Did the teacher make sure most of the learners were following the right procedures in order to get the results that were anticipated?			

(f) If yes, how did he\she made sure that most of the learners were following the right procedures to get results?

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(g) How did the teacher make sure that most of the learners were involved?

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### 7. Conclusion

Descriptor	Yes	no	comments
(a) Did the experiment yield the expected results?			
(b) Did most of the students get similar results at the end of the experiment?			
(c) Did Learners hand in any work to the teacher for assessment after the practical			
(d) Did they finish the practical lesson on time before the lesson ends?			



**APPENDIX 3: CONSENT LETTER FOR THE  
SCHOOL PRINCIPALS**

I.....a school principal, fully agreed to support Leena Lahja Nghipandulwa a Master Degree student at The University of Namibia in her investigation into the Biology teachers perceptions of the importance of practical work in secondary schools in the Oshana Education Region.

.....

Signature

**APPENDIX 4: CONSENT LETTER FOR TEACHERS (BLANK)**

I.....a teacher, fully agreed to support Leena Lahja Nghipandulwa a Master Degree student at The University of Namibia in her investigation into the Biology teachers perceptions of the importance of practical work in secondary schools in the Oshana Education Region.

.....

Signature

## APPENDIX 5: LETTER FROM THE MAIN SUPERVISOR

### UNIVERSITY OF NAMIBIA

Private Bag 13301, 340 Mandume Ndemufayo Avenue, Pioneerspark, Windhoek, Namibia



18<sup>th</sup> June 2010

**TO WHOM IT MAY CONCERN: MS LEENA L. T. NGHIPANDULWA**

Dear Sir/Madam,

This is to confirm that the above indicated is a bona fide Master of Education student at the university of Namibia.

In order to satisfy the requirements for her degree, she is required to carry out an original study in the field. She has identified the Oshana region for her study on Teachers perceptions and attitudes towards practical work in Biology.

I should be most grateful if you could kindly assist her in this respect by granting her permission to carry out her study in schools in the Oshana Education Region.

I thank you,

A handwritten signature in cursive script, appearing to read 'C. Kasanda', followed by a dotted line.

**Prof. C. Kasanda**  
**Deputy Dean, Education**  
**Tel 065- 061 2063726**

**APPENDIX 6: PERMISSION LETTER FROM THE PERMANENT SECRETARY**



REPUBLIC OF NAMIBIA

**MINISTRY OF EDUCATION**

Tel: 264 61 2933200  
Fax: 264 61 2933922  
E-mail: [mshimho@mec.gov.na](mailto:mshimho@mec.gov.na)  
Enquiries: MN Shimhopileni

Private Bag 13186  
Windhoek  
NAMIBIA  
25 June 2010

File: 11/2/1

Ms Nghipandulwa L. Lahja T.  
P. O. Box 2654  
OSHAKATI

Dear Ms Nghipandulwa

**RE: REQUEST TO CONDUCT RESEARCH IN SCHOOLS IN OSHANA EDUCATION REGION**

Your letter dated 23 June 2010 requesting permission to conduct a research in certain schools in Oshana Region, has reference.

Kindly be informed that the Ministry does not have any objection to your request to carry out a research project in the schools concerned.

However, you are advised to contact the Regional Education Office for permission and authorization to carry out your study project.

Kindly take also note that your research activities should not interfere with the normal school programmes. It would be highly appreciated, if you could share your research findings with the Ministry.

By copy of this letter the regional director is made aware of your request.

Yours faithfully

*A Ilukena*

A Ilukena

PERMANENT SECRETARY

cc: Regional Director, Oshana Education Region



**APPENDIX 7: PERMISSION LETTER FROM REGIONAL DIRECTOR**



**REPUBLIC OF NAMIBIA  
MINISTRY OF EDUCATION  
OSHANA REGION**

**Tel: (0650 2230057  
Fax: (065)230035**

**Private Bag 5518  
Oshakati  
Namibia  
06 July 2010**

**Enq. Albertina Mwandingi**

**TO: Ms. L.L. T. Nghipandulwa  
P.O. Box 2654 Oshakati**

**REQUEST TO DO RESEARCH IN THE SCHOOLS IN OSHANA 28 June -23<sup>rd</sup>  
July 2010**

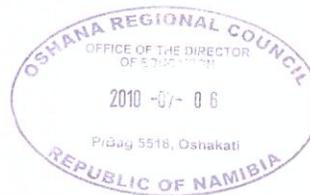
Dear Madam

We hereby grant you permission to conduct research in our schools on the topic: *Secondary School Teachers Perception and Attitudes towards Practical work in Biology.....* . We would like to learn from your findings, so a copy of the report will be highly appreciated. May we also request that the research activities may not interrupt the normal school program.

Please take a copy of this letter to the school as proof of permission granted.

Yours truly

7. *Dutte N. Shinyemba* 26.07.10  
**MRS. DUTTE N. SHINYEMBA  
REGIONAL DIRECTOR**



cc. The Inspectors of Education: Eheke, Oshakati, Oluno, Ompundja