

**GRADE 12 LEARNERS' PERCEPTIONS OF WRITING PRACTICAL REPORTS ON
HIGHER LEVEL PHYSICAL SCIENCE, IN OMUSATI EDUCATIONAL REGION**

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

JOHANNES I. SHIVUTE

200502140

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MAIN SUPERVISOR: DR. H. M. KAPENDA

CO-SUPERVISOR: PROF. C. D. KASANDA

APPROVAL PAGE

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

Internal Examiner

Date

Dean of Education Faculty

Date

External Examiner

Date

DECLARATIONS

I, Johannes I. Shivute, hereby declare that this thesis: *Grade 12 learners' perceptions of writing practical reports on Higher Level Physical Science, in Omusati Educational Region in Namibia* is my own work and is a true reflection of my research, and that this work, or any part thereof has not been submitted for a degree at any other institution.

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DEDICATION

I would like to dedicate this thesis to

My Two Families

For their love, care and thoughtfulness that enabled me to get through this demanding journey of completing my study.

My Friends

For their encouragement, generosity and inspirations that kept me strong, many of whom always acknowledging the little time I could sacrifice to stay with them since the beginning of my studies.

My colleagues

For their advice and careful reading part of the manuscript. Their inputs have really contributed to the successful completion of my thesis.

God bless you

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ABSTRACT

This study investigated the Grade 12 learners' perceptions of writing practical reports on Higher Level Physical Science, in Omusati Educational Region. The objectives of the study were: (a) to find out to what extent do Grade 12 Higher Level Physical Science learners carry out practicals and write practical reports; (b) to determine the level of the Grade 12 Higher Level Physical Science learners' knowledge of writing practical reports in Physical Science; (c) to devise strategies which can be used to improve Grade 12 Higher Level Physical Science learners' understanding of writing practical report. The population of this study included 320 Higher Level Physical Science learners in Grade 12 in the Omusati Educational Region. This study consisted of four Secondary schools offering Physical Science on higher level and all Higher Level Physical Science learners at the selected schools took part in the study. Simple random sampling was used to select four out of ten schools. Two research instruments were used to collect the data from the Grade 12 Higher Level Physical Science learners, a Questionnaire and an Observation Schedule. This study employed a sequential explanatory mixed methods design in order to seek responses to the stated three objectives. The study revealed that the Higher Level Physical Science learners in Omusati educational region were not prepared well on how to write practical reports before final examinations because resources for use during the practical sessions and time allocated to practical sessions were not enough for the learners to carry out practicals and write practical reports. In light of the findings discovered, the study recommends that the Ministry of Education, Arts and Culture considers incorporating practical slots in the school timetable and set aside funds for the provision of enough equipment to schools, for all the learners to be involved in carrying out of practical work.

LIST OF ABBREVIATIONS AND ACRONYMS

CA Continuous Assessment

DNEA Directorate of National Examinations and Assessment

ELT Experiential Learning Theory

HIGCSE Higher International General Certificate of Secondary Education

IGCSE International General Certificate of Secondary Education

MMoE Malaysia Ministry of Education

MoE Ministry of Education

MoEAC Ministry of Education, Arts and Culture

NIED National Institute for Educational Development

NSSCH Namibia Senior Secondary Certificate Higher Level

NSSCO Namibia Senior Secondary Certificate Ordinary Level

ORAS Omusati Regional Advisory Services

UNAM University of Namibia

UREC University of Namibia Research Ethics Committee

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CHAPTER 1

INTRODUCTION

1.1 ORIENTATION OF THE STUDY

Since 1995 Namibia has been offering the International General Certificate of Secondary Education (IGCSE) and Higher International General Certificate of Secondary Education (HIGCSE) curriculum in senior secondary schools (Ministry of Education, 2004). Physical Science is one of the subjects in the Natural Science field of study and according to the Ministry of Education [MoE] (2004), Physical Science is offered at three levels namely: Core, Extended and Higher.

In 2005 the secondary school curriculum was localised and as part of curriculum reform the three levels were reduced to two namely; Namibia Senior Secondary Certificate Ordinary Level (NSSCO) Physical Science and Namibia Senior Secondary Certificate Higher Level (NSSCH) Physical Science (Ministry of Education, 2005). NSSCH Physical Science was introduced to provide learners with the necessary knowledge, skills and attitudes that could enable them to pursue Science related courses at institutions of higher learning in and outside Namibia (Ministry of Education, 2005). In addition, to make sure that learners are equipped with necessary knowledge, skills and attitudes, the NSSCH Physical Science syllabus was described by topic content and assessment objectives for knowledge with understanding, handling information and problem solving and experimental skills and investigations (Ministry of Education, 2005). This seems to imply that NSSCH Physical Science syllabus is introduced to help learners to learn science through the study of a series of relevant topics. In this way it gives learners a lot of exposure to the science content. Learners learn science as a by-product of learning about real world content.

Therefore NSSCH Physical Science syllabus can facilitate the understanding of science by studying different content, which serves as the basis for teaching science skills.

The Grade 12 NSSCH Physical Science learners are assessed in three examination papers at the end of a two-year course of study (Grade 11-12). Paper 1 and 2 are all theory examinations while Paper 3 is a Practical Examination in which learners are expected to carry out a practical examination and answer questions related to the experiment they have carried out (Ministry of Education, 2013). The Paper 3 Examination requires learners to do practical work to internalise experimental skills and investigations during their course of study (Ministry of Education, 2013). However, a study by the Ministry of Education [MoE] (2014) indicates that practical work in some schools in Namibia is problematic because the schools lack basic science equipment. This situation has forced teachers in these schools to only demonstrate experiments to the learners instead of allowing the learners to carry out experiments themselves (Ministry of Education, 2014).

However, science is a natural subject for hands-on kinesthetic learning experiences that appeal to the visual and auditory senses. There are several factors leading to enquiries on the effectiveness of hands-on experiments in learning Science. Hands-on experiment is an active process of learner-centered learning whereby it encourages learners to discover and develop new concepts or ideas followed by spurring children's mind to be critical and creative (Jones & Wyse, 2004). As learners independently think critically and work through a subject matter, they develop a sense of independence and autonomy which will enhance their desire and ability to be self-motivated (Blandford & Knowles, 2009). There is thus a need for learners to carry out experiments themselves and report on what they have experimented on so that various details of experiment

including; apparatus, findings and other essential steps undertaken during the experiment in drawing conclusions are visible to all learners.

The study by the Ministry of Education (2014) also indicates that there are schools in Namibia where learners can carry out practical work throughout the year, but do not write practical reports after their practical sessions as required in Paper 3 examinations. The Ministry of Education through the Directorate of National Examinations and Assessment (Ministry of Education, 2016, p.16) examination report, therefore, stressed the need to write practical reports; “During practical sessions, similar conditions as those in examinations, should be set for the candidates in order to avoid stress during the examination of practical work. When data is collected it should be analyzed to identify possible errors.”

The examination report by the Ministry of Education referred to above emphasizes the fact that learners should be trained to do what they are expected to know before examinations. For example, if they are expected to record, analyze and interpret data during the examinations, then they should be trained on how to do so during their practical sessions rather than just observing a teacher carrying out an experiment for them. The Ministry of Education (2016) examination report points out that Physical Science syllabus also specifies all the practical skills which candidates need to be acquainted with. These skills include handling apparatus with due understanding of one’s own safety as well as care for the apparatus itself. These skills may minimize the stress which the learners might experience if not exposed to the environment of handling the apparatus, recording of data and writing of practical reports by analyzing, interpreting and explaining the results through

making conclusions and proper recommendations. It is for this reason that writing practical reports is one means through which learners can be taught how to handle apparatus, record data, draw graphs, analyze and interpret data, make appropriate conclusions as well as how to answer questions related to the experiment.

A study on the importance of writing practical reports by the Malaysia Ministry of Education (2005) recommends that science learners should always write practical reports after their practical sessions, in order for them to be able to apply their scientific knowledge to interpret experimental data and draw conclusions to communicate experimental results effectively in a scientific way. In so doing, learners are helped to answer questions related to the experiment correctly; hence improving their performance in a subject.

The Namibian Ministry of Education (2014) points out that most NSSCH Physical Science learners at some schools throughout the country fail to apply their scientific knowledge and understanding to make relevant interpretations and draw appropriate conclusions in Paper 3 examinations. Table 1 provides some of the Examiners' comments on Physical Science Higher Level examination Paper 3.

**Table 1: Examiners' Comments Provided for Physical Science Higher Level examination
Paper 3**

| Examination year | General Comments by Examiners |
|---------------------------|--|
| NSSC-H Level, 2013 | The tables drawn had to be as the instruction stated. Some candidates did not give correct headings and this would result in no marks as the listed data would not make sense. Often the units were repeated from the heading to the listed values; this is wrong (Ministry of Education, 2013, p.13). |
| NSSC-H Level, 2014 | At the point of conclusion regarding the aim of the experiment, many candidates missed the initial point of the investigation as examining the relationship between the contact friction and the total mass sliding. It is important that learners practice how to make relevant interpretations of data and draw appropriate conclusions (Ministry of Education, 2014, p.10). |
| NSSC-H Level, 2016 | It is important that candidates practice how to write down the observations made during experiments. Textbooks can assist in what words are to be used to describe an observation correctly. They also need to recognize the difference between heating gently compared to heating up to boiling point, which was not required in these tests (Ministry of Education, 2016, p.16). |

One may realize from analyzing the Examiners' comments that learners need training on how to handle apparatus, record data, draw graphs, analyze and interpret data, make appropriate conclusions as well as how to answer questions related to the experiment through writing practical reports. Examiners' comments also show that Grade 12 learners could not answer questions correctly in NSSCH Physical Science Paper 3, which might indicate that the learners were not exposed to carrying out practical investigations themselves and writing practical reports in Higher Level Physical Science, hence they performed poorly. Specifically, Omusati Region is one of the poorly performing regions in NSSCH Physical Science Paper 3 national examinations (Omusati Regional Advisory Services (ORAS), 2017). It is therefore against this background that this study investigated the Grade 12 learners' perceptions of writing practical reports on Higher Level Physical Science in Omusati Educational Region.

1.2 STATEMENT OF THE PROBLEM

The Physical Science examiners' report by the Ministry of Education (2014) indicates that Grade 12 Higher Level Physical Science learners in some Namibian schools could carry out Practical work with their teachers, but they could not apply their scientific knowledge and understanding to make relevant interpretations and draw appropriate conclusions in the examination. Applications of scientific knowledge with reference to interpretations and applicable conclusions are lacking in Namibian Grade 12 Higher Level Science learners. The 2014 National report seems to be confirmed by the Omusati Regional Advisory Services (ORAS) (2017), which reported that Omusati Educational Region is one of the poorly performing regions in NSSCH Physical Science Paper 3 national examinations. Reporting students' poor performance in NSSCH Physical Science Paper 3 is traceable to a number of factors, one of which is the ability of students to report practical.

Reporting the results of the experiment accurately is essential to enable learners apply knowledge and skills generated through experimentation in a creative and critical manner for problem solving and decision-making (Cooper, 1993). In NSSCH Physical Science Paper 3 learners are required to carry out a practical in the examination and report on the experiment they have carried out. The Examiners' comments in the examiners' report of the Ministry of Education (2014, p. 10) show that learners do not report procedures and results accurately. Training on how to handle apparatus, data, draw graphs, analyze, interpret and make appropriate conclusions would enhance Grade 12 learner's ability to answer questions correctly in NSSCH Physical Science Paper 3. Therefore, this study sought to investigate the perceptions of Grade 12 learners of writing practical reports in NSSCH Physical Science in four selected secondary schools in Omusati Educational Region.

1.3 RESEARCH OBJECTIVES

This study intended to achieve the following objectives to:

1. Find out the extent to which the Grade 12 Higher Level Physical Science learners in four selected secondary schools in the Omusati Educational Region carry out practicals and write reports.
2. Determine the level of the Grade 12 Higher Level Physical Science learners' knowledge of writing practical reports in Physical Science in four selected secondary schools in the Omusati educational region.
3. Device strategies that can be used to improve Grade 12 Higher Level Physical Science learners' understanding of writing practical reports in Omusati educational region.

1.4 SIGNIFICANCE OF THE STUDY

The results of this study might be important in assisting Physical Science learners in understanding how to write practical reports. The results of this study might also encourage learners to develop interest in conducting Physical Science Practical work at schools. The performance of the learners in NSSCH Physical Science examination might improve because when learners are allowed to write practical reports during practical sessions, they are more likely to prepare themselves for the final examination. The subsequent discussions with the learners during the writing of practical reports might allow the learners to improve their practical and social skills. Through data manipulation and drawing conclusions learners might gain insightful knowledge of the subject. The findings of this study might build a strong database for Namibian researchers who want to conduct research within the same field.

1.5 LIMITATIONS OF THE STUDY

This study had a number of limitations. Some learners were not willing to give relevant information because they did not take the study seriously; more encouragement from the researcher was needed. Due to time and financial constraints, not all learners in Omusati educational region were included in the study. The researcher's inexperience in carrying out research was another limitation as it was his first time to carry out a research of this nature at this level. This would prove to be a limitation because the researcher could not identify all the relevant literature on writing practical reports.

1.6 DELIMITATIONS OF THE STUDY

This study was limited to four selected secondary schools that were offering Grade 12 Higher Level Physical Science in Omusati Educational Region only. The study was limited to Grade 12 Higher Level Physical Science learners only because they are required to report on experiments they carry out during Paper 3 Examinations.

1.7 DEFINITION OF TERMS

The following terms are defined as they were used in the study:

Practical work (Laboratory work): In this study practical work is defined as tasks in which learners observe or manipulate real objects or materials or witness a teacher's demonstration (Aurora, 2010).

Practical reports (Laboratory reports): In this study practical reports are written to describe and analyze a laboratory experiment that explores a scientific concept. One of the reasons of writing laboratory reports is to communicate the laboratory work to other scientists (Aurora, 2010).

Perception: In this study perception is the way a person uniquely interprets a given situation (e.g. learners' views of writing practical reports in Physical Science) or information to come to a decision (Pickens, 2005).

1.8 SUMMARY

This Chapter provides the orientation of the study on Grade 12 learners' perceptions of writing practical reports on NSSCH Physical Science. The Chapter also defined and outlined the nature of the problem being researched; the research objectives that helped answer the research problem, and the significance of the study. The Chapter concludes by discussing the limitations and delimitations of the study, as well as definition of the key terms used. The next chapter presents the theoretical framework as well as the review of literature.

CHAPTER 2

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

The purpose of this Chapter is to provide a contextual background to the study by exploring the literature on the following three key sections: The first section of this chapter discusses the theoretical framework which informed this study. The second section focuses on the review of literature to determine what has already been conducted locally, nationally and internationally on learners' perceptions of writing practical reports in Physical Science. The third section discusses strategies that can be used to improve Grade 12 Physical Science learners' understanding of writing practical reports as cited from various literatures.

2.2 THEORETICAL FRAMEWORK

This study is based on Kolb's Experiential Learning Theory (ELT). Kolb (1984, p.41) defines ELT as "the process whereby knowledge is created through the transformation of experience, knowledge results from the combination of grasping and transforming experience". The foundation for Kolb's theory is based on the work of Dewey, Lewin, and Piaget (as cited in Kolb, 1984). Dewey, Lewin, and Piaget each focused much of their work on the experiential component of learning. Dewey stressed the significance of learning through experience, rather than textbooks and teachers (Kolb, 1984). This is supported by Ambrose (2010) who argues that experiential learning motivates learners in that it provides the conditions for optimally supporting learner learning. When learners are engaged in learning experiences whereby they see the relevance, then they might have increased motivation to learn. Learners are also motivated when they are provided

with opportunities for practice and feedback (Ambrose, 2010). Linn (2004) indicates that experiential learning creates self-directed learners and life-long learners. Through experiential learning, learners are confronted with unfamiliar situations and tasks in a real-world context (e.g. carrying out experiments and writing laboratory reports). To complete these tasks, learners need to figure out what they know, what they do not know, and how to learn it.

Much of Lewin's work focused on integrating theory into practice (Kolb, 1984). So learning should be situated in a realistic setting (Driscoll, 1994). This means that learners should experience reality on what they have learned in their theory class. This can be done by allowing learners to carry out experiments themselves and asking them to report on what they have experimented on. Through writing practical reports learners may have the chance to answer challenging questions. In so doing they are more likely to be equipped with knowledge with understanding, handling information and problem solving and experimental skills as well as investigative skills.

Piaget's work focused on how cognitive development is influenced by experience (Kolb, 1984). The work by Piaget concluded that the cognitive development of the learner may be affected by context in which a Physical Science lesson is given (Mji, & Makgato, 2006). This means that a learner who has experienced carrying out of practical work and writing experimental reports is more likely to learn better than one who did not. For example, Grade 12 Higher Level Physical Science learners who have carried out practical work and report on their practicals are more likely to be exposed to the subject content and can express themselves scientifically better than those who did not. This is because learners who have carried out practicals and written practical reports

are able to weigh up what they have read in their textbooks with what they have observed, to enhance their understanding.

Kolb (1984) explained Experiential Learning Theory further by creating a learning cycle, consisting of four phases that included: (a) concrete experience where the learner participates in an experience such as a simulation, (b) reflective observation where the learner reflects on the experience, (c) abstract conceptualization where the learner considers thoughts and reflections to identify the significance of the learning experience and considers what may have been done differently to enhance the outcome, and (d) active experimentation which involves using what was learned to direct future practice. The four phases of Experiential Learning cycle created by Kolb (1984) are summarized in Figure 1 below.

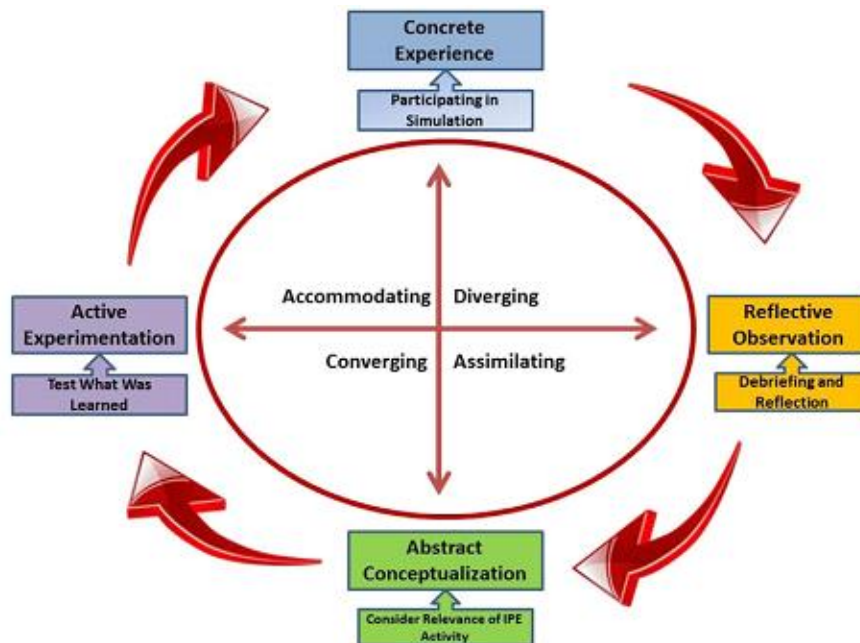


Figure 1: Kolb's Experiential Learning Theory (Source: Kolb, 1984, p.21)

From the Experiential Learning Cycle it appears that learners must experience each phase of Kolb's cycle to achieve optimal learning. This means learning is a four-stage integrated process where each stage mutually supports and feeds into the next. However, Kolb (2009) did not only provide a process for Experiential Learning Cycle, but he also recognized the importance of individual learning styles as well as an opportunity for each learner to acquire knowledge, based on their individual preferences. This means that learners do not always use all phases equally, usually showing a preference for one or two phases based on their individual learning styles (Lisko & O'Dell, 2010).

For example, in a Physical Science class, most of the learners learn better through active experimentation (fourth phase of experiential Learning). This is confirmed by Dunne, & Wragg (1997) who argued that most of the learners obtain genuine understanding of Physical Science through carrying out practical work and reflecting (reporting) on what they have experimented. The Namibian Ministry of Education (2009) also supported the argument by Dunne, & Wragg (1997) by pointing out that learners learn through self-discovery and through exploration and observation because they can observe what they were learning during practical work in the laboratory.

Experiential Learning Theory claims that learning is: 1) a process in which concepts are taken from and molded by experience (knowledge of the learner); 2) a continuous process which is tested by the experience of the learner; 3) a process which requires the resolution of conflicts between different ways of dealing with the world (finding new ways to solve problems); 4) involves connections between the person and the environment (learners find out the reality when carrying

out the experiments); and 5) is a process of creating knowledge (through writing practical reports) (Kolb, Boyatzis, & Mainemelis, 2000). This means in the experiential learning class, teaching and learning can take place through carrying out of experiments and writing of laboratory reports, demonstrations, observations, field work researches, tours and any other related activity in which learners and teachers learn from each other authentically (Southall, Nagel, LeGrande, & Han, 2003). Linn (2004) added that experiential learning requires learners to reflect on their prior knowledge and deepen it through reflection; transferring their previous learning to new contexts; mastering new concepts, principles, and skills; and being able to articulate how they developed this mastery.

For the purpose of this study, learners in the experimental groups were supported in applying their knowledge and conceptual understanding to real-world problems or situations (in this case by carrying out practicals and writing practical reports) directed and facilitated by the teacher (Wurdinger, 2010). Therefore they were active participants in the learning process by carrying out practical investigations and constructing knowledge. Learners may be guided by their teachers, to construct their knowledge actively during practical sessions through applying their scientific knowledge and understanding to make the relevant interpretation and draw appropriate conclusions when writing practical reports. Consequently the classroom or laboratory, can serve as a setting for experiential learning through embedded activities such as experiments (Wurdinger, 2010). This study therefore gave opportunities to the learners to acquire knowledge in authentic situations through writing practical reports on the practical investigations they carried out.

2.3 LITERATURE REVIEW

This section focuses on the review of literature to determine what has already been written locally, nationally and internationally on learners' perceptions of writing practical reports in Physical Science. This section also explores literatures on the concept of practical work, features of a good practical report and the importance of writing practical reports in Physical Science, and the strategies that could be used to improve learners' understanding of writing practical reports.

2.3.1 The concept of practical work

With the sole purpose of finding out something that had not been known previously, practical work was first introduced in schools in the Nineteenth Century in Britain (Black and Halliwell, 2000). Practical work is now considered to be an essential part of science teaching and learning activity, where the objectives are: (1) to allow the learners to work individually or in small groups, observe and manipulate the objects or materials they are studying (Millar, 2004); (2) to illustrate phenomena to give learners a feel for the phenomenon, and/or as exercises or steps to follow to develop a particular skill (Moeed, 2010); (3) to motivate learners by stimulating interest (Hodson, 1990); (4) to develop their understanding of laboratory skills; and (5) to enhance their understanding of scientific knowledge (Thair and Treagust, 1999). Practicals are also classified as exercises, investigations and experiences. Exercises are for skills development, including correct use of laboratory equipment while investigations involve writing practical reports and problem solving in open-ended tasks (Woolnough and Allsop, 1985). Therefore, practical work can be broadly defined as learning experiences in which learners are allowed to find out the reality by interacting with materials or with secondary sources of data to observe and understand the natural world (Millar, 2004). This means practical work can be considered as engaging the learner in observing or manipulating real or virtual objects and materials (Millar, 2004). Through

observations learners may have the opportunity to see what is happening in real life situations. Observing or manipulating of real objects might also enable the learners to think and act in a scientific manner. This is supported by Tamir (1991) who points out that practical work induces scientific attitudes, develops problem solving skills and improves conceptual understanding. Practical work in Physical Science helps develop familiarity with apparatus, instruments and equipment (Daramola, 2003). Learners need to carry out experiments themselves instead of a teacher demonstrating in front, for them to be familiar with the apparatus. Manipulative skills may be acquired by the learners if they are allowed to familiarize themselves with the apparatus. The observations made and results obtained might be used to gain understanding of Physical Science concepts.

2.3.2 Implications and limitations in conducting practical work

The teachers' aims and practices in conducting practical work might impact on the learners' learning experiences. The implemented practical work can lead to surface learning that only focuses on the development of conceptual and procedural knowledge if not planned well (Millar and Abraham, 2009)). For example, if the experiment is planned in such a way that learners are only expected to follow instructions and observe the end results without any knowledge of how the results came up, then learners are likely to gain shallow knowledge on the topic. The experiment should be planned in such a way that Physical Science learners experience authenticity and are able to discover things on their own through writing practical reports and answering questions related to the experiment (Jacobs, Vakalisa, & Gawe, 2004).

The learners' learning experiences can be extended to develop procedural understanding if the teachers explained the importance of following the steps, or asked the learners to reflect upon the reasons for choosing particular equipment or processes. For example, if a teacher wants learners to add anhydrous copper sulphate to a liquid and explain that, positive test will make the colour change to blue, this only leads to procedural knowledge. However, if the learners are told that the blue colour change means that the liquid is water, it leads to procedural understanding (Woodley, 2009)). Conceptual understanding may be developed if the learners have the opportunity to use the ideas that the teachers intend them to learn as they engage with the task at hand. For example, Woodley (2009) study showed that the learners' cognitive engagement could be maximized if the teachers include the questions related to the topic as the learners conducted the procedure and ask the learners to reflect on the experiment by asking them to write laboratory reports. In this way, learners are more likely to learn laboratory methods and equipment but also, to a limited extent, the application and reinforcement of theory. Hence, writing of practical reports may be deemed as the center stage for improved practical work.

2.3.3 Features of a good practical report

A scientific practical report is the primary means of communication among scientists and researchers world-wide (Davids, 2012). At school level practical reports can be written by the learners after their practical sessions to communicate their results to their teachers (Aurora, 2010). The University of Namibia (2012) points out that scientific experimental work is only complete when a resulting written report on it, has been compiled and marked. This means learners should write practical reports after every scientific experimental work they are doing. Experimental reports that learners submit after practical sessions' need evaluation by teachers to establish an

awareness of good communication skills that exist in the scientific community (University of Namibia, 2012). Teachers may need experimental guides when evaluating learners' reports. The experimental guide is meant to guide teachers with evaluating various sections of a practical report in Physical Science. It outlines the various aspects that are expected in the contents of a good laboratory report (Millar and Abraham, 2009). The sections of practical reports must be presented in order as suggested by Davids (2012) (see table 2):

Table 2: The sections of a good practical report

-
- 1. Date of the practical**
 - 2. Experimenter's Name**
 - 3. Title of the practical**
 - 4. Safety**
 - 5. Aim of the experiment**
 - 6. Introduction**
 - 7. Materials**
 - 8. Methods**
 - 9. Readings**
 - 10. Results and Data Interpretation**
 - 11. Conclusions and Discussions**
-

Source: UNAM Marking Scheme for First year Practical Reports (Davids, 2012)

Table 2 above shows that a good laboratory report does more than merely presenting data. It demonstrates the learners' comprehension of the concepts behind the experiment and the data obtained (Aurora, 2010). Aurora (2010) further points out that learners tend to record and reproduce expected results when writing practical reports. In doing so they are able to identify how and why differences occurred, and be able to explain how the data was affected by the experiment.

Learners are also able to show their understanding of the principles that the experiment is designed to examine, all of which require learners' organisation of thoughts and ideas. Being able to communicate the experiments results effectively in acceptable scientific style, is strongly recommended as it is a skill that learners must demonstrate (Aurora, 2010).

(a) Date of the practical, experimenter's Name and title of the practical

The learners need to write the date of the experiment on the report, alongside their details as well as the title of the experiment (Davids, 2012). This means the report should inform the reader of when the experiment was carried out. This is useful in determining the age of the report. The teacher would also like to know the name of the learner who compiled the report and which experiment was done for assessment purposes.

(b) Aim of the experiment

The aim of the experiment is the brief and concise sentence about why learners are conducting the experiment and what they hope to accomplish (University of Namibia, 2012). This means the learners must provide complete but concise statements that informs the reader of the purpose (objective) or mission of the experiment that was carried out. This notifies the reader of what the experiment was set to achieve.

(c) Introduction

The introduction of a laboratory report identifies the experiment to be undertaken, the importance of the experiment, and overall background for understanding the experiment (Davids, 2012). This means the introduction of a laboratory report should provide very brief background pertinent to the current experiment. Davids (2012) suggested that the description of definitions, concepts, theorems or laws should form part of the background information of the experiment. For example, any equation, theory, or law to be put in practice should be listed. If there are any key publications prior to the experiment that provide background information, this material should be referenced from the laboratory text as well as any other outside academic sources (University of Namibia, 2012).

(d) Materials and safety

Davids (2012) suggested that the learner should provide a list of the materials and equipment that were used for the successful completion of the experiment. A schematic diagram, if any, of the set-up must be provided. Photographs and diagrams can be used to describe the experimental setup. This means learners in a Physical Science practical session may list all the reagents and chemicals that they used during the experiment including name, concentration, and pH size, etc. They should also pay extra attention to the safety and handling guidelines for some chemicals and reagents if needed (for example, how to dispose of acids, keeping an ammonia covered when working with it on the bench to prevent diffusion, etc.) (University of Namibia, 2012). It is important that learners understand the risks involved with the chemicals used within the laboratory and how to safely

handle and work with them. Therefore, this section should contain pertinent information that is vital to learners' health, safety, and well-being.

(e) Methods

This part of the report discusses how the experiment occurred. It must be a brief yet complete outline of the procedures or steps carried out in order to complete the experiment. These include: What did the learners do, and how was it done? (Davids, 2012). He further suggested that this section needs to be written in the past passive tense, like “the cylinder was heated to 100 °C” instead of “Gilbert heated the cylinder to 100 °C” or instead of giving instructions like “heat the cylinder to 100 °C”. Therefore, the procedures of the laboratory experiment seems to be important because other learners can replicate the work later, if the need arises.

(f) Readings

Learners record their data in this section. Davids (2012) suggests that learners are expected to tabulate the readings in raw form in this section. This section therefore, seems to be the core of the experiment in terms of demonstrating practical skills such as the proper handling and usage of various laboratory equipment because learners will obtain and record the readings depending on how the learners have handled the equipment. For example, learners who do not know how to handle a protractor well to measure angles are more likely to get wrong readings compared to those who know how to use protractors. Each data in the table should be in the unit of the measurement without any unit conversion or calculation (University of Namibia, 2012). For example if the learners are measuring the length of a cylinder in cm then they should simply record it in cm. This data set may be important as it can be used to trace mistakes that may be seen in the later sections

of the report. Therefore, learners should try their best to organize the data into easy-to-follow tables, figures, or graphics.

(g) Results and Data Interpretation

The previously recorded data is then processed and tabulated in this section. These include amongst others unit conversions and subsequent calculations of additional required quantities, and indeed the calculation of the end result(s), and if possible the percentage error. Graphs, if any, belong to this section. Learners must correctly use the significant figures, scientific notations and SI units. Learners analyze and interpret the data in this section (Davids, 2012). Interpretation of data is crucial; it is a time of analytical reflection (University of Namibia, 2012). For example, did the data support the goal learners hoped to accomplish? If so, how? If not, why not? Do these unexpected results lead to additional questions? What might learners do differently if they were to repeat this experiment?

(h) Conclusions and Discussions

This is the wrap up of the report into a complete package. Davids (2012) suggests that the level of achievement of the set goals, in the Aim of the experiment, must be stated in this section. That is the learner should identify, state and discuss the observations that he or she made from this experiment. They summarize their findings and put it into context of what is in the literature in the area as appropriate as possible. Davids (2012) further suggests that in this section learners may also discuss what could possibly cause their data to be different than expected and how to improve their experiment if they are going to conduct it again. Therefore, possible sources of experimental

errors (wrong doings or blunders from the learners) must be listed here, with an explanation of how each error affects the data and the results. Wrong formula, and calculation errors are not part of sources of experimental errors etc.

2.3.4 Importance of writing practical reports in Physical Science

Practical (or Laboratory) report writing is an integral part of the scientific process (Kalaskas, 2013). This means writing laboratory reports help learners to develop or sharpen their skills associated with scientific inquiry, the scientific method, scientific thinking, and scientific communication, which are at the heart of the scientific process (Lerner, 2007). The findings by Kalaskas and Lerner (2013) are confirmed by the Malaysian Ministry of Education (2005, p. 2), which notes that “Practical reports enable learners to acquire scientific and thinking skills, as well as apply knowledge and skills in a creative and critical manner for problem solving and decision-making”. This seems to imply that writing practical reports might help learners to be critical thinkers, creative and be able to apply their knowledge. Meaningful learning, as advocated by many education theories, for example, Cognitivism and Constructivism, (Cooper, 1993) can be made possible in the laboratory as learners construct understanding based on the findings, critically evaluating data and supporting claims with evidence, when writing practical reports. Therefore, laboratory reports writing, may be a focal site of development of knowledge, skills and an empirical way of thinking for science learners.

Hodson (1990) notes that writing of laboratory reports enhances the learning of laboratory methods and equipment used in science laboratories. For example learners are likely to gain experiences in

following procedures when carrying out given experiments as well as experiences in reporting the findings from the experiments in Physical Science. Through writing practical reports, learners are also likely to be familiar with and to know the names of the equipment used in the school laboratory. Gaining more experiences in writing practical reports helps learners to be able to carry out experiments on their own and even to set up procedures to be followed on a given experiment. This is confirmed by Millar and Abraham (2009) who found that learners who only carry out experiments without explaining the results (through writing practical reports) obtained after the experiments were deficient in the simple skills needed to successfully carry out laboratory activity, such as using instruments to make measurements and collect accurate data. A study by Hofstein and Mamlok-Naaman (2007) also indicated that helping learners to develop relevant report writing skills in a controlled post laboratory activities can reduce the probability that important measurements in a laboratory experience will be compromised in future due to learners lack of expertise with the apparatus. Therefore, development of practical skills especially writing practical reports may achieve the probability that learners will always achieve the intended results in the laboratory experiments. Hence, achieving the intended results of a laboratory activity is a necessary, though not sufficient step towards the effectiveness in helping learners attain laboratory learning goals (De Jong, Linn, & Zacharias, 2013).

2.3.5 Learners' level of knowledge of writing practical reports in Physical Science

Learners' level of knowledge of writing practical report in Physical Science seems to affect their engagement in Physical Science. A study by Anderson (1976) found that learners often do not have clear ideas about the general or specific purpose of writing practical reports in their science laboratory. However Lunetta (1998) argued that when learners (learners) do not understand the

purpose of carrying out laboratory investigations and writing laboratory reports, negative consequences for learning occur. Lazarowitz and Tamir (1994) found that most learners perceive writing of practical reports to be a challenging activity because their understanding of the results of their experiments frequently do not match their teacher's expected results for the same experiment, so it becomes difficult for them to make proper conclusions. This implies that learners are likely to get different results from the expected result when they carry out experiments. This makes it difficult for them to interpret the data and draw concrete conclusions because they obtain a different result from what they have learned in the theory class. For example, if learners are taught in the theory class that a universal indicator will always form a red colour in an acidic solution and they obtain a different colour when they actually carry out an experiment, then they may struggle to make proper conclusions (Ministry of Education, 2009). Therefore, teachers need to set up experiments correctly, provide all the materials needed and explain the purpose (aim) of the experiment to the learners. Teachers should help the learners obtain genuine understanding of Physical Science, by relating what they have learned with what they have observed (Marx, Freeman, Krajcik, & Blumenfeld, 1998). If learners are able to relate and confirm what they have learned in the theory class with what they have observed during the practical investigation they are encouraged to learn through self-discovery and through exploration and observation (Marx, Freeman, Krajcik, & Blumenfeld, 1998).

Hofstein & Lunetta (2004) found that learners perceived writing of practical reports interesting, because through writing practical reports, learners discuss their findings with their peers, explain what they observed during the practical investigation and relate their findings to what they have learned from the teacher in the theory class. So, writing practical reports allows learners to interact

with their peers and the teacher, by asking questions based on what they were able to see, smell, feel, touch and hear. In so doing their higher order learning skills, such as, analysis, interpreting, problem solving, evaluating and concluding are improved (Hofstein & Lunetta, 2004). Learners are therefore, likely to learn from each other by asking their peers where they do not understand. In so doing they evaluate their own work and that of other learners. This prevents learners from directly copying from each other and therefore increases motivation and self-confidence of learners' individual abilities. For example, Linn (2003) found that learners who participated in writing of practical reports were able to interact with each other by discussing different sections of the report without copying directly from one another. These learners did not only always turn in their project reports more frequently but they were also able to turn in reports that were less identical to their research partners. This indicates that writing practical reports help learners to be more confident in their own answers than only copying from others.

Some learners report the writing of practical report to have changed their attitude towards learning Physical Science (Linn, 2003). Linn (2003) reported that learners preferred writing practical reports after practical sessions because it is more active learning than simply being told the correct answer by the teacher. During the same study, after completing the integrated unit on writing of practical reports, very few learners indicated that being good at science was a result of inherited traits, and very few learners indicated that boys tend to be naturally better at science than girls (Linn, 2003). Therefore it is plausible to argue that writing of practical reports change learners' beliefs towards performance in Physical Science.

2.3.6 Strategies that can be used to improve learners' understanding of importance of writing practical reports.

Directing writing of practical reports on clear goals requires that teachers understand assessment methods they would use in order for them to be able to measure and guide their learners' progress towards those goals (Gallagher, 1991). For the teachers to succeed in leading learners through experiments and writing practical reports, they must choose experiments that are appropriate at a given time (Duschl, 1983). For example, a teacher may choose to prepare an experiment which is related to the topic taught in the theory class rather than prepare an experiment on a topic which was taught two weeks ago. This might help the learners to reflect well on what was taught in the class when analyzing data and draw conclusions during practical report writing. However, Bell (2000) points out that whenever teachers are making choices of what experiments to be carried out, and when to complete practical reports they need to be aware of their own capabilities and that of their learners and their readiness to engage in various types of practical work:

Teachers must be aware not only of their own abilities but also of students' needs and readiness to engage in various types of laboratory experiences. Teacher awareness of students' science needs and capabilities may be enhanced through ongoing formative assessment. Formative assessment that is, continuously assessing student progress in order to guide further instruction, serves to enhance student attainment of the goals of laboratory education. Teachers need to use data drawn from conservation, observations and previous student work to make informed decisions about how to help them move towards desired goals (Bell, 200, p.11).

The above quote illustrates that to accurately measure learners' understanding requires teachers to assess learners effectively and they should know how to use data from these assessments, in order to reflect on learners' progress and make informed decisions about which laboratory activity and laboratory approaches to carry out or to change. Brown and Campione (1998) point out that laboratory assessment include systematically observing and evaluating learners' performances in specific laboratory tasks (such as answering questions related to the experiment and writing of reports) and longer term laboratory investigations. Teachers also need to know how to judge the quality of learners' oral presentations in the laboratory, laboratory note books, essays and portfolios (Bruner, 1996). For example, teachers can make use of the data from conversations, observations, and writing of practical reports and their previous work to make informed decisions about what type of experiment to do next and how to help the learners in writing of their practical reports. Therefore, teachers need to carefully consider written work of the learners and what they observed while learners were engaged during the experiment.

Whenever teachers are developing practical investigations in which learners are expected to write practical reports, they must consider their learners' current level of knowledge and skills, the range of possible laboratory experiences available, and how a given experience will advance their learning (Deng, 2001). This helps teachers to decide what kind of phenomena are important and appropriate to their learners to learn as well as the degree of structure their learners require (Deng, 2001). Currently, teachers rarely provide opportunities for learners to participate in formulating questions to be addressed in the laboratory. Thus learners seem to only carry out practicals and answer questions on the practical which were already prepared by the teacher. Perhaps this is because, among scientists, decisions about the kind of questions to be asked and the answers to be

sought are often developed by the scientific community rather than the isolated individual (Millar, 2004). Learners need to have knowledge on how to formulate questions for the experiment to be carried out. This might help them to have more insight of what the experiment is all about. However, guiding learners to formulate their own questions and design appropriate investigations require sophisticated knowledge:

The teacher's ability to use sophisticated questioning techniques to bring about productive learner-learner and learner-teacher discussions in all phases of the laboratory activity is a key factor in the extent to which the activity attains its goal. However formulating such questions can be difficult. To succeed at it and ask the higher level and cognitively based questions that appear to support student learning, teachers must have considerable science content knowledge and science teaching experience (Driver, 1995, p.9).

This illustrates that, to have improved practical activities, the weakness in teachers' understanding of the nature of science needs to be addressed. That is, teachers should not just be encouraged to engage learners in laboratory experiences, in isolation, without giving them training on how to do so. The understanding of teachers on the nature of science laboratory may be improved through training. This is confirmed by Catley (2004), who indicates that, just as engaging learners in laboratory experiences in isolation lead to little or no increase in their understanding of the nature of science, engaging prospective or current science teachers in laboratory activities lead to little or no increase in their understanding of the nature of science. Therefore teachers should be given workshops on how to carry out experiments and how to write practical reports effectively.

Experiments done at most of the schools in some countries are sterile and un-illuminating exercises, whose purpose might be lost on the learners. This is supported by Hodson (1990, p. 54) who pointed out that:

In many countries practical work is ill conceived, confused and unproductive. Whatever goes on in the laboratory has little to do with learners' learning of science. Demonstrations are usually done by the teachers who also often miss the point of the demonstration. Small group work is done, but the follow up discussions on the purpose of the exercise are usually counterproductive. Learners do not report on what they have learned during the experiment. In many cases the experiments are derived from mostly irrelevant cultural settings with the attendant equipment disasters.

This means that in some of the schools practical work might be there but the teachers might not be doing it the right way. Hodson (1990) further, points out that some teachers who could be doing practical work the right way do not prepare for practical lessons and the learners tend to follow a fixed programme of experimental manipulations and observations set by the teacher without carrying out the practical themselves. Therefore, learners need to be prepared to carry out experiments themselves and report on what they have experimented.

Hodson (1990) furthermore, indicates that for improved laboratory activities, schools should be designed to support laboratory work. That is, schools should have well equipped laboratories for experiments to take place effectively. The environment inside the laboratory should be conducive for experiments to take place. Administrators at schools should also allocate time, like other resources, as a way to support teachers in carrying out practical work and in guiding learners to

write practical reports. Bruner (1996) points out several types of inflexible scheduling that may discourage effective laboratory experiences (laboratory reports), including (a) limits on teacher planning time, (b) limits on teachers setup of the experiment and cleanup time after the experiment, and (c) limits on actual time for practical work and writing of practical reports. Therefore, shared teacher planning time may be a critical support for improved laboratory teaching, because of the unique nature of the laboratory education (Chaney, 1995). Teachers should employ team work at school to learn from one another. For example, a teacher might be faced with an ongoing tension between allowing learners greater autonomy in the laboratory and guiding them towards accepted scientific knowledge. Another teacher might also face uncertainty about how many learners to struggle with and how much to narrow the procedure for investigation, etc. Therefore, to overcome these issues, teachers need to look for solutions from others through co-planning. This is supported by DeSimone, Garet, Birman, Porter, & Yoon (2003) who suggested that school administrators could help teachers overcome their isolation and learn from each other by providing time and space to reflect on their laboratory teaching and on learner learning in the company of the colleagues. This develops teachers' abilities to assess the way they conduct their practicals and increase their confidence in producing good and quality lessons for the benefit of the learners.

2.4 SUMMARY

This chapter presented the theoretical framework that informed this study, namely Kolb's Experiential Learning Theory (ELT), which focuses on process whereby knowledge is created through the transformation of experience, in which learners experience reality on what they have learned in their theory class. This chapter also provided the review of relevant literature to determine what has already been conducted locally, nationally and internationally on learners'

perceptions of writing practical reports in Physical Science. It also explored literature on the concept of practical work, with the special focus on: the importance of practical work in Physical Science, the importance of writing practical reports in Physical Science and the features of a good practical report. It further reviewed the strategies that could be used to improve learners' understanding of writing practical reports in schools. The next chapter presents the research methodology used in this study.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter presents the methodology which was used in collecting and analyzing the data from the participants. This includes the research design, population, sample and sampling procedures, research instruments, pilot study, data collection procedures, data analysis and ethical considerations.

3.2 RESEARCH DESIGN

This study used a sequential explanatory mixed method design. Creswell (2014) states that sequential explanatory mixed method is that in which quantitative data are collected and analyzed followed by a collection and analysis of qualitative data. The researcher in this study used qualitative results to assist in explaining and interpreting the findings obtained from quantitative data. In so doing, quantitative and qualitative data were merged to comprehensively analyze the research problem. Loraine (2004, p. 51) points out that “Quantitative research consists of those studies in which the data can be analyzed in terms of numerical values”. In this study quantitative approach was used to collect numerical data. Likewise, qualitative approach was used in that the learners completed open ended questionnaires to provide in-depth understanding about learners’ perceptions on the importance of writing practical reports. The researcher also observed different practical sessions to find out the extent to which Grade 12 Higher Level Physical Science learners carried out practicals and wrote practical reports to make relevant interpretations and draw appropriate conclusions.

3.3 POPULATION

The population of this study was all 320 Higher Level Physical Science learners in Grade 12 in the Omusati Educational Region.

3.4 SAMPLE AND SAMPLING PROCEDURE

There were ten schools offering Higher Level Physical Science at Grade 12 in Omusati Educational Region. The number of class groups for Grade 12 Higher Level Physical Science in these schools ranged from 1 to 2. Simple random sampling was used to select four out of ten schools. The schools were assigned numbers. The papers with numbers were folded and put in a bucket then random samples of four schools were drawn with replacement. The sample for this study consisted of four schools offering Physical Science on higher level and all male and female Grade 12 Higher Level Physical Science learners at the selected schools took part in the study.

3.5 RESEARCH INSTRUMENTS

This study used questionnaire and observation schedule to collect data.

3.5.1 The Grade 12 Higher Level Physical Science learners' questionnaire

A questionnaire for the learners was designed to collect the required data. The questionnaire consisted of both close-ended and open-ended questions in its three sections. Section 1 had questions on the extent to which the Grade 12 Higher Level Physical Science learners in four selected secondary schools carried out practicals and wrote practical reports, made relevant interpretations and drew appropriate conclusions. Section 2 consisted of seven Likert scale type requiring students to indicate the extent of agreement from strongly agree, agree, not sure, disagree or strongly disagree. It had questions on learners' perceptions of writing Practical Reports in

Physical Science in the Omusati Educational Region. Section 3 had questions on strategies that might be used to improve Grade 12 Higher Level Physical Science learners' understanding of writing practical reports among the schools in Omusati Educational Region schools.

3.5.2 The Grade 12 Higher Level Physical Science learners' observation schedule

For this study, observation schedules were used to collect information on the extent to which Grade 12 Higher Level Physical Science learners carried out practicals and wrote practical reports to make relevant interpretations and draw appropriate conclusions. The researcher observed among others, the following activities done by the learners: handling of laboratory equipment, taking of measurements, recording of data, analyzing of data, interpretation of data, writing conclusions and whether the learners answered questions correctly when writing reports. During observations, the researcher also analyzed learners' reports on how they analyzed, interpreted, and made conclusions. There was only one Grade 12 Higher Level Physical Science teacher at all the four selected schools. The researcher observed five practical sessions in each of the four sampled schools in the Omusati Educational Region, totaling 20 lessons. The researcher was a non-participant observer to avoid influencing the outcome of the research.

3.6 DATA COLLECTION PROCEDURES

The researcher scheduled appointments with the schools' management for the easy collection of data. Practical work were carried out by the teachers on the scheduled dates for practical work, during the normal teaching and learning hours because after school, all the teachers went home. Hence, the observations were done on the scheduled dates for practical work. However, the questionnaire was administered after the normal school hours (during the study time) on the days

when there were no scheduled practical sessions. This was done to avoid disturbances to the normal practical sessions, because learners started filling the questionnaire during the practical session. The questionnaires were collected after two days to give the participants enough time to answer all the questions in the questionnaire.

3.7 PILOT STUDY RESULTS

A pilot study is a small trial done in preparation of the full scale study. It involves pre-testing of research instruments, such as questionnaires and observation schedules (Cohen et al., 2011). A pilot study is done to ensure the reliability and validity of the research instruments. This includes ensuring that the research instruments (questionnaires and observation schedules) are understood by the participants and whether the instruments are giving the information that is expected (Cohen et al., 2011).

For this study, a pilot study was conducted at one of the secondary schools in the Omusati Educational Region that offered Grade 12 Higher Level Physical Science. This school was not included in the main study because the participants in this school had already been exposed to the instruments and, therefore, could respond differently from those who had not been previously exposed to it (Holloway, 2012).

There was only one class group for learners doing Physical Science on Higher Level at the pilot school. All twenty five Grade 12 learners doing Higher Level Physical Science at this school participated in the pilot study. The researcher observed one practical session every day for a week, totaling five sessions. The questionnaire was administered on the first day after the normal school hours during the study time to avoid the disturbances of the normal practical sessions. The whole

piloting process was completed within a week. The research instruments were revised and rectified after the pilot study according to participants' comments as indicated below.

3.7.1 Analysis of the pilot study

Instrument 1. Learners' Questionnaire: From the pilot study it was found that the participants understood most of the items in the questionnaire. The results of the pilot study also indicated that most questions in the questionnaire prompted the participants to provide answers to the main questions of the study as targeted by the researcher. However, some questions in the questionnaire needed revisions as they were not clear to the participants. Cohen et al. (2011) argued that there may always be a possibility of errors in the designing of research instruments, hence the need to revise them. Some of the items in the questionnaire were rephrased to make them clearer because some of the participants understood the questions differently to that intended. The questionnaires were revised as shown herein.

- *Question 14* was rephrased because the participants did not know the meaning of '*Lab manual*'. So it was stated differently to make it easy to be understood by the participants. It was restated as follows: *Does your teacher provide you with lab manuals (procedures on how practicals should be done)? (Please tick) Yes () No ()*
- *Statement 1.6* was deleted because it was repeated as *Statement 1.7* in *Section C number 1* so the number of statements under *Section C number 1* in the revised paper decreased to seven.
- *Statement 6.7* in *Section C* was rephrased to make it clearer. It was re-stated as follows: *Writing lab reports motivates me to work with other learners when solving Physical Science problems.*

- *Question 1* and *Question 3 (i)* in Section D were also rephrased by removing difficult key words with those that were easily understood by the participants. *Question 1* and *Question 3 (i)* were rephrased as follows:

Question 1: Did you receive training on how to write practical reports? (Please tick)

Yes () No ()?

Question 3: Is the mark given for lab reports a fair assessment of your work? (Please tick)

Yes () No ()

(i) If not, how do you think lab reports should be assessed?

- The whole questionnaire was then revised for grammar, correcting wrongly spelled words as well as numbering of questions correctly (see Appendix 5: Learners' Questionnaire).

Instrument 2. Observation Schedule: The *Observation Schedule* was first given to the researcher's supervisors to make changes and corrections which were then included in the final instrument. *Item 6.1(b)* was removed as it was already included in *item 5(c)*. So the number of items were reduced to nine.

Few challenges were experienced during the administration of the questionnaires. These included the following: some learners only answered the easiest questions and left those they felt were difficult to them; some of the learners did not return the questionnaires, they claimed to having lost them; some tried to get answers from their teachers; and some returned unanswered questionnaires, saying they were too long and they could not find time to complete them.

Learners who lost the questionnaires were given new ones to complete. Learners who were trying to look for answers from their teachers (according to their teachers) were encouraged to do it on their own and those who could not complete the whole questionnaire were encouraged to finish.

The challenges experienced during the pilot study were put into consideration for improvements during the main study.

3.8 DATA ANALYSIS

The researcher used descriptive statistics such as frequency tables and percentages to present the quantitative data from questionnaires and observation schedule. Qualitative data from the questionnaires were analyzed by grouping the responses according to the identified themes from the participants' views (Daramola, 2003). Quantitative data was collected and analyzed followed by a collection and analysis of qualitative data. Qualitative findings were used to explore quantitative findings. This means that an initial analysis of quantitative data was followed by a qualitative data analysis phase, in which the qualitative phase built directly on the results from the quantitative phase. In this way, quantitative results were explained in more detail through qualitative data.

The observation checklist for each class being observed was scored and frequency tables were created to obtain quantitative data on the extent to which Grade 12 Higher Level Physical Science learners carried out practicals and wrote practical reports to make relevant interpretations and drew appropriate conclusions. Descriptive statistics were used to analyse quantitative data such as: handling of laboratory equipment, taking of measurements, recording of data, analyzing of data, interpretation of data, writing conclusions and whether the learners answered questions correctly when writing reports. The researcher also analyzed the observation schedules to obtain qualitative data from learners' reports on how they analyzed and interpreted results from experiments and

how they made conclusions in their report writings. The findings from the observation schedules were analyzed in conjunction with the findings from the questionnaires.

3.9 ETHICAL CONSIDERATIONS

The researcher first obtained permission to collect data from the University of Namibia Postgraduate Centre and the ethical clearance from the University of Namibia Research Ethics Committee (UREC). The researcher then requested permission to carry out research from the Ministry of Basic Education, Arts and Culture through the Omusati Regional Director of Education. A letter was sent to the Regional Director of the Omusati Educational Region requesting permission to conduct the research. The researcher also requested permission from the principals and teachers of the selected schools and sought consent from the learners. The information about the aim of the study helped participants to make informed decisions on whether to participate in the research or not. Information from participants were treated with highest confidentiality. The participants' identities and that of their school were protected by using codes to avoid tracing the origin of the information. The results were kept by the researcher in a store room for a period of 3 years, before destroying them with a shredder.

3.10 SUMMARY

This chapter described the research design, population, sample and sampling procedures, the research instruments, pilot study, data collection procedures, data analysis and ethical considerations. The research instruments used in the data collection were also described. This chapter also discussed how the pilot study was conducted and how all the amendments to the

instruments were made to produce the final instruments. The next chapter presents the research results and discussion of the study.

CHAPTER 4

PRESENTATION OF RESULTS AND DISCUSSION

4.1 INTRODUCTION

In this chapter the researcher presents and discusses the data on the extent to which the Grade 12 Higher Level Physical Science learners in four selected secondary schools in the Omusati educational region carry out practicals and write practical reports, make relevant interpretations and draw appropriate conclusions. The perceptions of the Grade 12 Higher Level Physical Science learners on writing practical reports in Physical Science are also presented and discussed in this chapter. The findings on the strategies devised by learners that can be used to improve Grade 12 Higher Level Physical Science learners' understanding of writing practical reports in Omusati educational region are as well presented, interpreted and discussed in this chapter.

4.2 DEMOGRAPHIC INFORMATION OF THE PARTICIPANTS

The results for this study were collected from 107 Grade 12 Higher Level Physical Science learners from four secondary schools in the Omusati Educational Region. Sixty one (57%) of the learners were female and 46 (43%) were male. The 107 learners were aged between 17 and 19 years. Table 3 shows a list of the secondary schools as well as the total number of learners per school who participated in this study.

Table 3: Number of learners per school in the study (N=107)

| School Name | Number of learners | | Total |
|--------------------|---------------------------|---------------|--------------|
| | Male | Female | |
| School A | 12 | 20 | 32 |
| School B | 12 | 16 | 28 |
| School C | 9 | 13 | 22 |
| School D | 8 | 17 | 25 |
| Total | 41 | 66 | 107 |

Table 3 shows that there were more female than male learners who took part in this study.

4.3 THE EXTENT TO WHICH THE HIGHER LEVEL PHYSICAL SCIENCE LEARNERS CARRY OUT PRACTICALS AND WRITE PRACTICAL REPORTS

To provide answers to the above objective, the researcher used questionnaires and an observation schedule (see Appendices 5 and 6). The results from the questionnaires and the classroom observations are presented below.

4.3.1 Results from the learners' questionnaire

A total of 107 questionnaires were distributed to the NSSCH Physical Science learners in the selected secondary schools in the Omusati Educational Region and all questionnaires were completed and collected for analysis by the researcher. The following sections present results on the availability of Physical Science laboratories in each school as well as the extent to which the Higher Level Physical Science learners carried out practicals and wrote practical reports.

(a) Number of Physical Science laboratories found in each school

There was only one laboratory available in each school for Physical Science practicals in all four secondary schools. This implied that Higher Level Physical Science learners shared the same laboratory with both Ordinary Level Physical Science learners and Junior Science learners. The sharing of one laboratory by all the Physical Science learners in the whole school resulted in different sessions crusing in the laboratory because practical sessions were not scheduled in the school timetable.

(b) The number of the NSSCH Physical Science learners who carried out practical work. In Grade 12

The NSSCH Physical Science learners were also asked to indicate whether they had carried out practical work in Physical Science at their schools in Grade 12. All 107 participants indicated that they had carried out practical work in Physical Science at their schools.

(c) The number of the NSSCH Physical Science learners who wrote practical reports in Grades 8-11

The participants in each school were asked to indicate whether they had written practical reports before in Grades 8 through 11. All the 107 NSSCH Physical Science learners study indicated that they had not written practical reports in Grades 8-11. This suggests that learners were not prepared before Grade 12 on how to write practical reports.

(d) Frequencies of carrying out practical work by the NSSCH Physical Science learners

The NSSCH Physical Science learners were further asked to indicate the frequency of carrying out practical work in Physical Science. Their responses are presented in Table 4.

Table 4: Frequency of carrying out practical work by the NSSCH Physical Science learners

| Frequency | Number of learners |
|------------------|---------------------------|
| Once a week | 9 (8%) |
| Twice a week | 6 (6%) |
| Once a month | 71 (66%) |
| Twice a month | 21 (20%) |
| Total | 107 (100%) |

Table 4 shows that 8% of the learners indicated that they carried out practical work in Physical Science once a week, while 6% of the learners indicated that they carried out practical work in Physical Science twice a week. The majority (66%) of the learners indicated that they carried out practical work in Physical Science once a month, while 20% indicated that they carried out practical work in Physical Science twice a month.

The fact that 66% of the learners indicated that Physical Science practical sessions only took place once a month, seems to suggest that the NSSCH Physical Science learners were not well prepared to write practical reports. Carrying out practicals after a long time of theory class is not enough to prepare learners on how to carry out practicals and write practical reports (Woodley, 2009).

(e) Chances of writing practical reports after each NSSCH Physical Science practical session

The NSSCH Physical Science learners were asked to indicate whether they got a chance to write practical reports after every Physical Science practical. Their responses are presented in Table 5.

Table 5: Chances of writing practical reports after each NSSCH Physical Science practical session

| School Name | Number of learners | |
|--------------------|---------------------------|-----------------|
| | Yes (%) | No (%) |
| School A | 11 (34%) | 21 (66%) |
| School B | 6 (21%) | 22 (79%) |
| School C | 9 (41%) | 13 (59%) |
| School D | 9 (26%) | 16 (46%) |
| Total | 35 (33%) | 72 (67%) |

Table 5 shows that the majority (67%) of the NSSCH Physical Science learners indicated that they did not get any chance to write practical reports after each Physical Science practical. From the findings, it is clear that some NSSCH Physical Science learners carried out experiments but did not get the opportunity to write practical reports.

(f) Frequency of writing practical reports after practical sessions by the NSSCH Physical Science learners

When the NSSCH Physical Science learners were asked to indicate the frequency of writing practical reports after practical sessions, 26 (24%) out of 107 learners indicated that they did not. Nineteen (17%) indicated that they did not write practical reports at all as the teacher was the only

one who always explained the results for them after the experiment. The following were some of the learners' responses:

Learner 9 (School A): *we see these things once a year in the examinations* [18 April 2018].

Learner 9 (School B): *As many times as possible* [18 April 2018].

Learner 13 (School B): *During some practical sessions* [18 April 2018].

Learner 12 (School C): *We do not write anything the teacher explains everything* [19 April 2018].

Learner 10 (School D): *We only see these things in the examinations* [19 April 2018].

These findings reveal that some NSSCH Physical Science learners did not write practical reports at all. By looking at the views expressed by the learners it was clear that even if learners had chances to conduct experiments, they did not write practical reports. For examples Learner 9 at School A claimed: "*we see these things once a year in the examinations*". Therefore, one could conclude that some NSSCH Physical Science learners only encountered writing practical reports in the examinations.

(g) NSSCH Physical Science practical periods in the school timetable

The NSSCH Physical Science learners were asked to indicate whether the practical periods were indicated on the school timetable. All 107 (100%) participants indicated that there was no practical periods shown on the school timetable. The learners went to the laboratory either during the normal Physical Science periods or after school to carry out practicals and write practical reports.

(h) Availability of NSSCH Physical Science laboratory manuals in the school

The participants were asked to indicate whether their teachers provided them with the laboratory manuals (i.e. procedures on how practicals should be done) during practical sessions. Their responses are presented in Table 6.

Table 6: Availability of NSSCH Physical Science laboratory manuals in the school laboratory

| School Name | Number of learners | |
|--------------------|---------------------------|-----------------|
| | Yes | No |
| School A | 23 (72%) | 9 (28%) |
| School B | 16 (57%) | 12 (43%) |
| School C | 17 (77%) | 5 (23%) |
| School D | 15 (60%) | 10 (40%) |
| Total | 71 (66%) | 36 (34%) |

The results in Table 6 show that 71 (66%) of the learners indicated that their teachers provided them with procedures on how practicals should be done.

(i) Ease of following laboratory manuals

Seventy one (66%) of the learners who had indicated that they were provided with procedures (Table 6) on how practicals should be done were further asked to indicate whether these procedures were easy to follow. Twenty eight percentage of these learners indicated that the procedures were easy to follow as teachers always summarized everything for them. However 51 (72%) of the learners indicated that it was not easy to follow the procedures because the laboratory manuals were always distributed in the laboratory. These learners preferred that the laboratory manuals be distributed in advance before the practicals were conducted, for them to read through on their own and understand the procedures. The following are quotations of some of the learners:

Learner 9 (School A): *It is easy to follow because there is already the instructions on how to do them. The teacher shows you some examples on how you can carry out a practical* [18 April 2018].

Learner 12 (School A): *Yes it is easy to follow because it directs us on what and what not to do however laboratory manuals are only given during examinations not during practical periods* [18 April 2018].

Learner 2 (School B): *This is very easy because we usually know what can be done first* [18 April 2018].

Learner 6 (School B): *Sometimes it is confusing* [18 April 2018].

Learner 18 (School C): *Not easy because we do not have enough time to go through, why only receiving these in the Laboratory only, we should go through on our own at the hostels* [19 April 2018].

From the learners' responses one could conclude that even if the laboratory manuals were summarized by the Physical Science teachers, it might still be difficult for learners to follow them because learners did not prepare in advance for the practicals as practical manuals were only provided during the practical session. The laboratory manuals should be distributed in advance before the practical session for the learners to read through on their own and understand the practical procedures.

(j) Carrying out practicals in the absence of laboratory manuals

Thirty six (34%) learners who indicated that they did not receive laboratory manuals from their teachers (Table 6) were asked to explain how they carried out experiments at their schools.

Seventeen (15%) of these learners explained that their teachers never prepared procedures for them, but repeated experiments which were already done in the textbooks. Nineteen (18%) indicated that their teachers used past Paper 3 question papers to set up the same experiments done during past examinations.

Furthermore, 12 (12%) of the learners indicated that their teachers only read the procedures to them when carrying out experiments. fifty nine (55%) of the 107 learners indicated that they did not carry out experiments on their own, but their teachers demonstrated everything to them and asked them questions at the end of the demonstrations. Some of their responses were:

Learner 4 (School B): *Our teacher repeat some of the experiments in the textbook* [18 April 2018].

Learner 7 (School B): *We follow the teacher read the procedures or explain the procedures to us so that we can then carry out the practical* [18 April 2018].

Learner 16 (School C): *You carry them out based on your understanding in relation to the instrument provided* [19 April 2018].

Learner 20 (School C): *We follow the instructions in the past question papers* [19 April 2018].

Learner 15 (School D): *We do not carry out practicals, we only write mock exams in Grade 12* [19 April 2018].

These findings seem to suggest that in the absence of laboratory manuals, teachers carried out experiments for the learners instead of learners themselves. However, learners need to be given the chance to carry out experiments themselves and report on what they had done and found. This might help them to have more insight in what the experiment was all about.

4.3.2 Results from laboratory observations

Laboratory observations were carried out by the researcher as a non-participant observer and information on the extent to which the NSSCH Physical Science learners in four secondary schools carried out practicals and wrote practical reports was collected. Since the number of class groups for Higher Level Physical Science in the selected schools ranged from 1 to 2, all Higher Level Physical Science learners at the selected schools took part in the study. The researcher observed five practical sessions at each selected school, totalling 20 practical sessions. The observation schedule (see Appendix 9) was used to collect data regarding the extent to which the NSSCH Physical Science learners carried out practicals and wrote practical reports. The researcher observed the following activities by the learners at the four schools: Number of learners in the practical session; Laboratory organization; Safety in the laboratory; Availability of resources; Preparations for experiments; practical sessions and Writing of practical reports by the NSSCH Physical Science learners. These activities are provided in the following sections.

(a) Number of learners in the practical session

The results in Table 7 present information on the number of NSSCH Physical Science learners who carried out practicals observed at each of the four selected schools.

Table 7: Number of learners in the practical session observed per school

| School Name | Total number of NSSCH Physical Science learners | Number of NSSCH Physical Science learners in the practical sessions | Number of NSSCH Physical Science learners absent from the practical sessions |
|--------------------|--|--|---|
| School A | 32 | 30 (97%) | 2 (3%) |

| | | | |
|--------------|------------|------------------|---------------|
| School B | 28 | 26 (96%) | 2 (3%) |
| School C | 22 | 22 (100%) | 0 (0%) |
| School D | 25 | 23 (92%) | 2 (3%) |
| Total | 107 | 101 (94%) | 6 (6%) |

Table 7 indicates that all the NSSCH Physical Science learners at School C, 97% at School A, 96% at School B, and 92% at School D attended the practical session. Table 7 also indicates that 3% of the NSSCH Physical Science learners at Schools A, B and D did not attend practical sessions.

4.3.3 Laboratory organization

The following subsections provide information about how the laboratories were organized in terms of the seating arrangement of learners in the laboratory as well as the storage of laboratory equipment.

(a) Seating arrangement of the learners in the practical session

The observations on the seating arrangements of the NSSCH Physical Science learners in the practical sessions are presented in Table 8.

Table 8: Seating arrangements of the NSSCH Physical Science learners in the practical sessions

| Seating arrangement | School A | School B | School C | School D |
|---|-----------------|-----------------|-----------------|-----------------|
| (a) Learners sitting everywhere in the Laboratory | | | | |
| (b) Learners sitting individually in rows | √√ | | √√ | √ |
| (c) Learners sitting in pairs | | | | |
| (d) Learners are sitting in groups of three or more | √√√ | √√√√√ | √√√ | √√√√ |

KEY: √ Seating arrangements of learners in five practical sessions observed at each selected school

Table 8 shows that in School A and C, the learners sat in groups of three or more in three of the practical sessions observed, but were sitting individually in rows in two of the practical sessions observed. At School B, learners sat in groups of threes or more in all the five practical sessions. At School D, the learners sat in groups of threes or more in four of the practical session observed and individually in rows in one practical session. The results in Table 8 seems to suggest that Physical Science teachers were more likely to group learner when conducting practicals.

(b) Number of the NSSCH Physical Science learners in each group

The results in Table 9 present the number of the NSSCH Physical Science learners in each group during the practical sessions observed.

Table 9: Number of learners in each group during the practical sessions

| Number of learners in each group | School A | School B | School C | School D |
|----------------------------------|----------|----------|----------|----------|
| (a) 2-4 learners | | | | |
| (b) 5-7 learners | | | √ | |
| (c) 8-10 learners | √ | | | √ |
| (d) 11-13 learners | | √ | | |
| (e) 14 or more learners | | | | |
| (f) Other sitting arrangements | | | | |

KEY: √ Number of learners in each group during the practical sessions observed at selected schools

Table 9 indicates that the number of learners in each group during the five practical sessions observed at School A and School D ranged from 8 to 10 learners, while for School C and School C the number ranged from 11 to 13 learners and from 5 to 7 learners respectively. The high number of learners in each group at School B might have been a result of lack of recourses or the lack of available space in the laboratory.

(c) Seating arrangements of the participants in each group during the practical sessions

It was found that in all four school, learners sat in a circle around the table during the practical sessions observed.

(d) Storage of laboratory equipment

It was found that in school B, all laboratory equipment were kept in the storeroom for safe keeping, while in A and D, some laboratory equipment were kept in the storeroom and some were displayed

around the Laboratory because there was no enough space in the store room. In School C, some laboratory equipment were kept in the storeroom and some were displayed around the laboratory for learning purpose.

4.3.4 Safety in the laboratory

Table 10 presents information on the safety measures enforced when learners were carrying out practicals in the laboratory.

Table 10: Safety in the laboratory

| Statement | School A (SA) | School B (SB) | School C (SC) | School D (SD) |
|--|------------------|------------------|------------------|------------------|
| (a) Learners wear laboratory coats during practical sessions. | | | | |
| (b) Learners wear hand gloves coats during practical sessions. | | | | |
| (c) Learners wear goggles during practical session. | | | | |
| (d) Learners have access to water in the laboratory. | √ | √ | √ | √ |
| (e) There are safety doors in the laboratory in case of emergency. | √ | √ | √ | √ |
| (f) There is a fire extinguisher in the laboratory. | | √ | | |
| (g) Windows provide enough ventilation of air in the laboratory. | √ | √ | √ | √ |
| (h) There is enough space in the laboratory for conducting practicals. | | √ | | √ |
| (i) Laboratory rules are displayed around the laboratory. | | √ | | |

KEY: √ Learners' safety in the laboratory enforced

Table 10 indicates that when learners were conducting their practicals in the laboratories they did not wear laboratory coats, gloves, and goggles to protect themselves in case of accidents in all 4 schools. The learners had access to water in the laboratory in case of an accident such as fire or acid spills in all 4 schools. According to Table 10, there were safety doors in the laboratories at all the 4 schools, however, only School B had a fire extinguisher in the Laboratory. Table 10 also indicates that the windows of the laboratories at all four schools provided enough ventilation in the Laboratories. While there was enough space in the. Laboratories for conducting practicals at Schools B and D. Furthermore, Table 12 shows that only School B, had laboratory rules displayed around the laboratory.

From the results in Table 10 the safety of the NSSCH learners appear to have been compromised when carrying out experiments. The learners did not wear laboratory coats, gloves, and goggles to protect them in case of accidents. Besides, only school B had fire extinguishers and displayed rules in the laboratory.

4.3.5 Availability of apparatus

The results in Table 11 present information on the availability of resources for carrying out NSSCH Physical Science experiments at the four schools.

Table 11: Availability of apparatus

| Statement | School A | School B | School C | School D |
|---|-----------------|-----------------|-----------------|-----------------|
| (a) Learners are provided with the correct apparatus during practicals. | √ | √ | √ | √ |
| (b) The apparatus are enough for all the learners/groups. | | | | |
| (c) Learners share equipment/apparatus. | √ | √ | √ | √ |

| | | | | |
|--|---|--|---|---|
| (d) The apparatus given to the learners are up-to-date. | √ | | | |
| (e) Learners have access to the internet at school. | √ | | | |
| (f) Learners are provided with laboratory manuals. | √ | | | |
| (g) Instructions in the laboratory manual are clear. | √ | | √ | |
| (h) Learners are allowed to use textbooks in the Laboratory. | √ | | √ | √ |

KEY: √ Availability of resources for the learners at the selected schools

Table 11 shows that the NSSCH Physical Science learners at four secondary schools were provided with the correct apparatus during practicals, but the apparatus were not enough for all the learners. Further, the apparatus at Schools A, C and D were outdated except at School B where learners used up-to-date apparatus. The results in Table 11 also illustrate that only at School A, did the learners have access to the internet, to do further research. At School B, learners were provided with laboratory manuals to carry out experiments themselves, while at School A, C and D teachers carried out the experiments for the learners and asked them to answer questions related to the experiments.

The results in Table 11 further show that the instructions provided in the laboratory at Schools A and C were clear, while at Schools B and D they were not clear or were missing. Furthermore, it was observed that learners at School B were not allowed to use textbooks during the practical sessions.

4.3.6 Preparations for experiments by the teachers

The observations on the preparations for NSSCH Physical Science experiments by the Physical Science teachers are shown in Table 12.

Table 12: Teachers' Preparedness for Physical Science experiments

| Statement | School A | School B | School C | School D |
|---|----------|----------|----------|----------|
| (a) The teacher prepares apparatus for the learners before the session. | √ | √ | √ | √ |
| (b) The teacher sets up the experiment/apparatus for the learners. | √ | | √ | √ |
| (c) Learners set up experiment themselves. | | √ | | |
| (d) Learners are told to read experiment procedures before the session. | | | | |
| (e) The teacher improvises where apparatus are not enough. | | √ | | |
| (f) The teacher makes sure the Laboratory is clean before the experiment. | √ | √ | √ | √ |

KEY: √ Teachers' preparedness for experiments

Table 12 shows that the teachers prepared the apparatus and cleaned the Laboratory before the practical session. Table 12 also shows that at School B learners set up experiments themselves, while teachers set up the experiment for the learners at Schools A, C and D. The results in Table 12 also indicate that the learners were not given experiments' procedures to read before the practical sessions at all school, instead only received the procedures while in the practical sessions.

Furthermore, Table 12 indicates that teachers at Schools A, C and D did not improvise in case of a shortage of materials. It was found that instead the practical lesson was cancelled until the apparatus was found. Teachers at School B improvised to make sure the experiment worked even if not all the materials were available.

4.3.7 Practical sessions

The following subsections present the results from the observed practical sessions.

(a) Carrying out experiments

The results in Table 13 present observations on how the experiments were carried out by the NSSCH Physical Science learners at the 4 schools in Omusati Educational Region.

Table 13: Carrying out experiments

| Statement | School A | School B | School C | School D |
|--|----------|----------|----------|----------|
| (a) Learners handle equipment by themselves. | √ | √ | | |
| (b) Learners set up experiment themselves. | √ | √ | | |
| (c) All learners are involved in carrying out practicals. | | √ | | |
| (d) Learners do the measurements by themselves. | √ | √ | | √ |
| (e) Learners interact with each other. | √ | √ | √ | √ |
| (f) Learners interact with the teacher. | | √ | | |
| (g) Learners are free to move around the Laboratory and look for help. | | | | √ |
| (h) Learners remain at their benches until the end of the experiment. | √ | √ | √ | |
| (i) Learners do the recording of the results by themselves. | | √ | √ | |
| (j) Learners clean the benches at the end of the experiment. | √ | √ | √ | √ |

KEY: √ Learners' activities during the experiments at the selected schools

Table 13 indicates that the learners at Schools A and B handled and set up the experiments themselves. Also all learners at School B were involved in carrying out experiments. This might suggest that learners who were good in setting up of experiments were selected by other learners to do so, while watched.

Table 13 also indicates that learners at Schools A, B and D did the measurements of different quantities by themselves. Further, Table 13, shows that learners at all the selected 4 schools interacted with each other during the experiments, however, only learners at School B interacted with the Physical Science teacher. Only learners at School D were free to move around the laboratory to seek help from other learners while learners at Schools A, B and C were not allowed to move around the laboratory and remained at their benches until the end of the experiment.

(b) Facilitating practicals by the Physical Science teachers

The results in Table 14 present information on how the NSSCH Physical Science teachers facilitated the experiments during the practical sessions.

Table 14: Facilitating practical work by the Physical Science teachers

| Statement | School A | School B | School C | School D |
|---|-----------------|-----------------|-----------------|-----------------|
| (a) The teacher gives the introductions orally. | | √ | | √ |
| (b) The teacher explains to the learners what to do verbally. | √ | √ | √ | √ |
| (c) The teacher writes all the instruction on the chalkboard. | | √ | | √ |
| (d) The teacher goes around each table to guide the learners. | √ | √ | | √ |
| (e) The teacher shows learners how to handle apparatus. | √ | √ | √ | |
| (f) The teacher reminds the learners of some of the names of the apparatus. | √ | √ | √ | √ |
| (g) All instructions are written in the laboratory manual. | | | | |

KEY: √ Teachers’ activities during the experiments at the selected schools

It is evident from Table 14 that the NSSCH Physical Science teachers at all 4 schools explained the procedure of the experiments to the learners verbally and reminded them about the names of

some apparatus. Table 14 also show that not all the instructions for carrying out the experiments were written in the laboratory manuals at all the schools, sometimes the teachers wrote the instructions on the chalkboards. Teachers at Schools B and D read out the instructions to the learners orally.

4.3.8 Writing of practical reports by the NSSCH Physical Science learners

The results in Table 15 present information on the learners' ability to carry out and write practical reports during or after their practical sessions.

Table 15: Writing of practical reports by the NSSCH Physical Science learners

| Statements | School A | School B | School C | School D |
|--|-------------|----------|----------|----------|
| (a) Learners share scientific information during practical work. | √ | √ | √ | √ |
| (b) Learners can record the data correctly. | | | | |
| (c) Learners can write correct introductions for their reports. | | | | |
| (d) Learners can write practical procedures clearly. | | √ | √ | |
| (e) Learners interpreted the data correctly. | | | | |
| (f) Learners obtained correct results. | | √ | | |
| (g) Learners are able to write practical reports as required. | | | | |

KEY: √ Learners' ability to carry out practicals and write practical reports

Table 15 shows that the learners at all the selected schools shared scientific information with each other during practical work. However, they did not write practical reports correctly. Table 15 also indicates that the learners did not record and interpret the data correctly. The results in Table 15 further show that learners at Schools B and C wrote correct practical procedures as compared to those at Schools A and D. Table 15 also indicates that learners at Schools A, C and D did not

obtain correct results, as is evident from the teacher’s comments when facilitating writing of the practical reports.

4.3.9 NSSCH Physical Science practical test questions

The results in Table 16 present information on the nature of practical questions, teachers’ involvement and the learners’ ability to answer practical questions correctly.

Table 16: The nature of practical questions, teachers’ involvement and the learners’ ability to answer practical questions correctly

| Statement | School A | School B | School C | School D |
|--|----------|----------|----------|----------|
| (a) The questions stimulate learners to think critically. | √ | √ | | √ |
| (b) Questions are only focusing on the explanation of the results. | | | √ | |
| (c) Practical questions help learners to reflect on what they were told in the theory class. | √ | √ | | √ |
| (d) The teacher helped the learners with answering of the questions | | | √ | |
| (e) Learners discussed the questions in groups. | √ | √ | | √ |
| (f) Learners can answer questions individually. | | √ | | √ |
| (g) Most learners can answer questions correctly after practical sessions. | | √ | | √ |
| (h) Most learners are struggling to answer questions related to practicals correctly. | √ | | √ | |
| (i) Learners simply copied answers from each other. | √ | | √ | √ |
| (j) Learners are allowed to use textbooks and summary books when answering questions. | √ | √ | √ | √ |
| (k) Some questions require learners to do more research. | √ | √ | | √ |

KEY: √ The nature of practical questions, teachers’ involvement and the ability of the learners to answer post practical questions correctly

Table 16 indicates that practical questions enabled learners at Schools A, B and D to think critically and helped them to reflect on what they were taught theoretically in the class. From Table 16 some questions required learners at Schools A, B and D to do further research than those set at School C. Table 16 also shows that teachers at School C helped learners answer the questions, while learners at Schools A, B and D discussed the questions in groups. Table 16 again shows that learners at Schools B and D answered the questions individually and correctly after practical sessions. Table 16 finally indicates that learners at all the selected schools were allowed to use textbooks and summary books when answering questions.

4.4 THE LEVEL OF THE GRADE 12 HIGHER LEVEL PHYSICAL SCIENCE LEARNERS' KNOWLEDGE OF WRITING PRACTICAL REPORTS

The researcher used a questionnaire (see Appendix 6) to gather data about the level of the Grade 12 Higher Level Physical Science learners' knowledge of writing practical reports in Physical Science in four secondary schools in the Omusati educational region. The results from the participants' questionnaires are presented next.

4.4.1 Results from the Grade 12 Higher Level Physical Science learners' questionnaire

A total of 107 copies of questionnaires (see Appendix 6) were distributed to the Grade 12 Higher Level Physical Science learners in the Omusati Educational Region. All the 107 questionnaires were completed and collected for analysis by the researcher. The questionnaire consisted of a Likert scale questionnaire with 7 questions. Learners were asked to choose from strongly agree (5), agree (4), not sure (3), disagree (2) to strongly disagree (1).

The learners gave their responses by indicating their level of agreement to each statement under the questions on: mastering of subject content, retention of subject content, writing skills, scientific skills, research skills, motivation and technical skills (see tables 19, 20, 21, 22, 23, 24 and 25).

(a) Higher Level Physical Science learners' level of knowledge on mastering of subject content.

The level of knowledge provided by the Grade 12 Higher Level Physical Science learners on mastering of subject content are presented in Table 17.

Table 17: Higher Level Physical Science learners' level of knowledge on mastering of subject content

| Statements | Frequency (%) | | | | | Total |
|---|---------------------------|------------------|---------------------|---------------------|------------------------------|------------------|
| | Strongly Agree (5) | Agree (4) | Not sure (3) | Disagree (2) | Strongly Disagree (1) | |
| Writing laboratory reports helps me to understand subject content better. | 22 (20) | 80 (75) | 3 (3) | 0 (0) | 2 (2) | 107 (100) |
| Writing laboratory reports helps me to get what the teacher is trying to say in the theory class. | 31 (28) | 66 (62) | 10 (9) | 0 (0) | 0 (0) | 107 (100) |
| Writing laboratory reports helps me to explain most of the scientific concepts in my own words. | 15 (14) | 75 (70) | 12 (11) | 5 (5) | 0 (0) | 107 (100) |
| Writing laboratory reports helps me to discover new definitions. | 5 (5) | 43 (40) | 50 (47) | 7 (7) | 2 (2) | 107 (100) |
| Writing laboratory reports helps me to relate the subject content to the real world | 64 (60) | 35 (33) | 6 (6) | 1 (1) | 1 (1) | 107 (100) |

| | | | | | | |
|---|---------|----------|---------|---------|---------|------------------|
| Writing laboratory reports helps me to discover new ways of carrying out experiments. | 2 (2) | 105 (98) | 0 (0) | 0 (0) | 0 (0) | 107 (100) |
| I always have difficulty in applying what I know from writing laboratory reports. | 15 (14) | 21 (20) | 22 (21) | 38 (36) | 11 (10) | 107 (100) |
| Writing laboratory reports is a waste of time | 0 (0) | 0 (0) | 2 (2) | 8 (7) | 97 (91) | 107 (100) |
| The Physical Science teacher does not pay attention to laboratory reports | 1 (1) | 2 (2) | 5 (5) | 45 (42) | 54 (50) | 107 (100) |

Table 17 indicates that 80 (75%) of the learners agreed that writing laboratory reports helped them to understand the subject content better. Sixty six (62%) agreed that writing laboratory reports helped them to get what the teacher was trying to say in the theory class. Table 17 also shows that 75 (70%) agreed that writing laboratory reports helped them to explain most of the scientific concepts in their own words. Fifty (47%) learners were not sure that writing laboratory reports helped them to discover new definitions, while 43 (40%) agreed with this statement. The results of Table 17 further indicates that 64 (60%) strongly agreed that writing laboratory reports helped them to relate the subject content to the real world, while 35 (33%) agreed with the statement. Table 17 further shows that the majority 105 (98%) of the learners agreed with the statement that writing laboratory reports helped them to discover new ways of carrying out experiments.

Furthermore, Table 17 indicates that 38 (36%) of the learners disagreed with the statement that they had difficulty in applying what they knew from writing laboratory reports, while 22 (21%) learners were not sure. The majority 97 (91%) of the learners strongly disagreed with the statement that writing laboratory reports was a waste of time. Table 17 finally indicates that 54 (50%) learners strongly disagreed that Physical Science teachers did not pay attention to laboratory reports.

(b) Higher Level Physical Science learners' level of knowledge on retention of subject content

The level of knowledge provided by the Grade 12 Higher Level Physical Science learners on retention of subject content are presented in Table 18.

Table 18: Higher Level Physical Science learners' level of knowledge on retention of subject content

| Statements | Frequency (%) | | | | | Total |
|---|--------------------|-----------|--------------|--------------|-----------------------|------------------|
| | Strongly Agree (5) | Agree (4) | Not sure (3) | Disagree (2) | Strongly Disagree (1) | |
| Writing laboratory reports helps me to remember subject matter well. | 19 (18) | 49 (46) | 26 (23) | 6 (6) | 7 (7) | 107 (100) |
| Writing laboratory reports helps me to remember what I did during the experiment. | 28 (26) | 63 (59) | 11 (10) | 4 (4) | 1 (1) | 107 (100) |
| Writing laboratory reports helps me to remember how to carry out experiments on different topics. | 19 (18) | 61 (57) | 9 (8) | 14 (13) | 4 (4) | 107 (100) |
| Writing laboratory reports helps me to remember how to set up different equipment used in the laboratory. | 92 (86) | 8 (7) | 7 (7) | 0 (0) | 0 (0) | 107 (100) |
| Writing laboratory reports helps me to remember experiment procedures. | 13 (12) | 90 (84) | 1 (1) | 2 (2) | 1 (1) | 107 (100) |
| Writing laboratory reports helps me to remember the names of the apparatus in the laboratory. | 35 (32) | 61 (57) | 2 (2) | 6 (6) | 3 (3) | 107 (100) |
| Writing laboratory reports helps me to remember what I have studied in tests and examinations. | 12 (11) | 39 (36) | 18 (17) | 27 (25) | 11 (10) | 107 (100) |
| I do not remember most of what I learned during laboratory report writing. | 9 (8) | 13 (12) | 8 (7) | 40 (37) | 37 (35) | 107 (100) |

Table 18 indicate that 49 (46%) of the learners agreed that writing laboratory reports helped them to remember subject matter well, while 26 (23%) were not sure. Table 18 also shows that 63 (59%) of the learners agreed with the statement that writing laboratory reports helped them to recall what they did during the experiment. The majority 92 (86%) of the learners strongly agreed that writing laboratory reports helped them to remember how to set up different equipment used in the laboratory. Table 18 further indicates that 61 (57%) of the learners agreed that writing laboratory reports helped them to remember names of the apparatus in the laboratory while 35 (32%) learners strongly agreed with the statement. Thirty nine (36%) of the learners agreed that writing laboratory reports helped them to remember what they studied in tests and examinations, while 27 (25%) indicated that they were not sure.

(c) Higher Level Physical Science learners’ level of knowledge of writing skills gained from writing practical reports

The results in Table 19 present the level of knowledge of the Grade 12 Higher Level Physical Science learners on writing skills they might gain from the writing of practical reports.

Table 19: Higher Level Physical Science learners’ level of knowledge of writing skills gained from writing practical reports

| Statements | Frequency (%) | | | | | Total |
|---|--------------------|-----------|--------------|--------------|-----------------------|------------------|
| | Strongly Agree (5) | Agree (4) | Not sure (3) | Disagree (2) | Strongly Disagree (1) | |
| Writing laboratory reports helps me to know how to write introductions. | 10 (10) | 85 (79) | 11 (10) | 1 (1) | 0 (0) | 107 (100) |

| | | | | | | |
|---|---------|---------|---------|-------|-------|------------------|
| Writing laboratory reports helps me to know how to write conclusions. | 23 (21) | 68 (64) | 15 (14) | 0 (0) | 1 (1) | 107 (100) |
| Writing laboratory reports helps me to know how to give instructions. | 15 (14) | 55 (51) | 31 (29) | 4 (4) | 2 (2) | 107 (100) |
| Writing laboratory reports improves my language skills. | 21 (20) | 46 (43) | 28 (25) | 7 (7) | 5 (5) | 107 (100) |

Table 19 indicates that the majority, 85 (79%) of the learners agreed that writing laboratory reports helped them to know how to write introductions. Table 19 also shows that 68 (64%) agreed that writing laboratory reports helped them to know how to write conclusions while 23 (21%) strongly agreed with the statement. Table 19 further shows that 55 (51%) agreed that writing laboratory reports helped them to know how to give instructions, while 31 (29%) learners were not sure. Forty six (43%) learners agreed and 21 (20%) strongly agreed, while 28 (25%) learners were not sure that writing laboratory reports improved their language skills.

(d) Higher Level Physical Science learners' level of knowledge of science skills gained from writing practical reports

The results in Table 20 present the level of knowledge of the Grade 12 Higher Level Physical Science learners on science skills they might gain from the writing of practical reports.

Table 20: Higher Level Physical Science learners' level of knowledge of science skills gained from writing practical reports

| Statements | Frequency (%) | | | | | Total |
|--|--------------------|-----------|--------------|--------------|-----------------------|------------------|
| | Strongly Agree (5) | Agree (4) | Not sure (3) | Disagree (2) | Strongly Disagree (1) | |
| Writing laboratory reports improves my measuring skills. | 41 (37) | 47 (44) | 6 (6) | 6 (6) | 7 (7) | 107 (100) |
| Writing laboratory reports improves my prediction skills. | 18 (17) | 38 (36) | 12 (11) | 28 (26) | 11 (10) | 107 (100) |
| Writing laboratory reports improves my observation skills. | 26 (24) | 61 (57) | 4 (4) | 11 (10) | 5 (5) | 107 (100) |
| Writing laboratory reports improves my interpretation skills. | 19 (17) | 67 (62) | 10 (10) | 6 (6) | 4 (4) | 107 (100) |
| Writing laboratory reports improves my concluding skills. | 51 (47) | 43 (40) | 5 (5) | 5 (5) | 3 (3) | 107 (100) |
| Writing laboratory reports expose me to practical aspects of the laboratory. | 69 (64) | 34 (32) | 4 (4) | 0 (0) | 0 (0) | 107 (100) |

Table 20 indicates that 41 (37%) of the learners strongly agreed that writing laboratory reports improved their measuring skills, while 47 (44%) of the learners agreed with the statement. The majority 38 (36%) of the learners agreed that writing laboratory reports improved their prediction skills. Sixty one (57%) learners agreed that writing laboratory reports improved their observation skills and 26 (24%) learners strongly agreed with the statement. A total of 67 (62%) learners agreed that writing laboratory reports improved their interpretation skills. Table 20 further indicates that 51 (47%) learners strongly agreed and 43 (40%) agreed that writing laboratory reports improved their concluding skills. Furthermore, the majority 69 (64%) of the learners strongly agreed that writing laboratory reports exposed them to practical aspects of the laboratory.

(e) Higher Level Physical Science learners' level of knowledge of the research skills gained from writing practical reports

The results in Table 21 present the level of knowledge of the Grade 12 Higher Level Physical Science learners regarding the research skills they might gain from the writing of practical reports.

Table 21: Higher Level Physical Science learners' level of knowledge of the research skills gained

| Statements | Frequency (%) | | | | | Total |
|--|---------------------------|------------------|---------------------|---------------------|------------------------------|------------------|
| | Strongly Agree (5) | Agree (4) | Not sure (3) | Disagree (2) | Strongly Disagree (1) | |
| Writing laboratory reports helps me to learn how to collect data by taking correct measurements. | 33 (31) | 51 (47) | 6 (6) | 11 (10) | 6 (6) | 107 (100) |
| Writing laboratory reports helps me to learn how to do observations during practicals. | 39 (37) | 42 (39) | 13 (12) | 8 (7) | 5 (5) | 107 (100) |
| Writing laboratory reports helps me to learn how to record data correctly. | 35 (33) | 58 (54) | 10 (9) | 3 (3) | 1 (1) | 107 (100) |
| Writing laboratory reports helps me to learn how to present data logically. | 20 (19) | 27 (25) | 28 (26) | 21 (20) | 11 (10) | 107 (100) |

Table 21 shows that 51 (47%) learners agreed and 33 (31%) learners strongly agreed that writing laboratory reports helped them to learn how to collect data by taking correct measurements. Table 21 also indicates that the majority 42 (39%) of the learners agreed that writing laboratory reports helped them to learn how to do observations during practicals and 39 (37%) participants strongly agreed with the statement. Table 21 further indicates that 58 (54%) of the learners agreed that

writing laboratory reports helped them to learn how to record data correctly. Twenty (19%) learners strongly agreed that writing laboratory reports helped them to learn how to present data logically and 27 (25%) learners strongly agreed with the statement, however 28 (26%) learners were not sure.

(f) Higher Level Physical Science learners’ level of knowledge of self-motivation gained from writing practical reports

The results in Table 22 present the level of the Grade 12 Higher Level Physical Science learners’ knowledge on how writing of practical reports could motivate them to perform well in Physical Science.

Table 22: Higher Level Physical Science learners’ level of knowledge of self-motivation

| Statements | Frequency (%) | | | | | Total |
|--|--------------------|-----------|--------------|--------------|-----------------------|------------------|
| | Strongly Agree (5) | Agree (4) | Not sure (3) | Disagree (2) | Strongly Disagree (1) | |
| Writing laboratory reports motivates me to be a self-independent learner. | 15 (14) | 23 (22) | 44 (41) | 11 (10) | 14 (13) | 107 (100) |
| Writing laboratory reports motivates me to do experiments. | 43 (41) | 50 (46) | 7 (6) | 5 (5) | 2 (2) | 107 (100) |
| Writing laboratory reports motivates me to do more readings. | 25 (23) | 33 (31) | 26 (24) | 17 (16) | 6 (6) | 107 (100) |
| Writing laboratory reports motivates me to develop confidence in the subject. | 27 (25) | 47 (43) | 6 (6) | 20 (19) | 7 (7) | 107 (100) |
| Writing laboratory reports motivates me to cultivate interest in Physical Science. | 39 (36) | 58 (54) | 1 (1) | 6 (6) | 3 (3) | 107 (100) |

| | | | | | | |
|---|---------|---------|-------|---------|-------|------------------|
| Writing laboratory reports motivates me to study very hard. | 16 (15) | 12 (11) | 9 (8) | 61 (58) | 9 (8) | 107 (100) |
| Writing laboratory reports motivates me to work with other learners when solving Physical Science problems. | 29 (27) | 77 (72) | 0 (0) | 1 (1) | 0 (0) | 107 (100) |

Table 22 indicates that 44 (41%) of the learners were not sure if writing of laboratory reports motivated them to be self-independent learners. However, 23 (22%) agreed with the statement. Table 22 also shows that the majority 50 (46%) of the learners agreed and another 43 (41%) learners strongly agreed that writing laboratory reports motivated them to do experiments. Thirty three (31%) learners agreed that writing laboratory reports motivated them to do more readings. The majority 47 (43%) of the learners agreed that writing laboratory reports motivated them to develop confidence in the subject. Table 22 also indicates that 77 (72%) of the learners agreed that writing laboratory reports motivated them to work with other learners when solving Physical Science problems.

(g) Higher Level Physical Science learners' level of knowledge of technical skills gained from writing practical reports

The majority 86 (80 %) of the Grade 12 Higher Level Physical Science learners strongly agreed and 22 (21%) agreed that writing laboratory reports helped them to learn how to operate laboratory equipment. This implied that Grade 12 Higher Level Physical Science learners perceived writing of laboratory reports as helping them in the development of their technical skills.

4.5 STRATEGIES THAT CAN BE USED TO IMPROVE HIGHER LEVEL PHYSICAL SCIENCE LEARNERS' UNDERSTANDING OF WRITING PRACTICAL REPORTS

In this section, the strategies that were suggested by the Grade 12 Higher Level Physical Science learners to improve their understanding of writing practical reports in Physical Science are presented and discussed. The researcher used a questionnaire (see Appendix 5, Section D) to gather data on the strategies that could be used to improve Grade 12 Higher Level Physical Science learners' understanding of writing Physical science practical reports in four selected secondary schools in the Omusati Educational Region. In order to gather data on the strategies that were suggested by the learners to improve their understanding of writing practical reports in Higher Level Physical Science, the researcher made use of open-ended questions (see Appendix 6).

4.5.1 Strategies to help the Grade 12 Higher Level Physical Science learners to know how to write practical reports

When the Grade 12 Higher Level Physical Science learners were asked to give their views on what the teachers should do to help them know how to write laboratory reports, the following were the views of some of the learners:

Learner 1 (School A): *As a learner I feel like teachers should give us extra lessons to help on how to write laboratory reports because we hardly get time to practice or do any practicals. Teachers should also give us past laboratory reports so that we familiarize ourselves on past papers. Teachers by all means, need to give us as much as practicals as possible.*

Learner 7 (School B): *Teachers should manage their time and try to teach us. They need to be giving us as many practicals as possible and let us write our reports after every practical or showing us past practical reports and let us check and try them.*

Learner 5 (School C): *Teachers should make us carry out a certain practical activity, write our practical reports on our own and make corrections with the teacher after marking the reports.*

Learner 10 (School C): *They should teach us from the beginning of Grade 11 and facilitate laboratory practicals of each topic, which would ultimately push us to write the reports and be assessed according to national board exam standards.*

Learner 13 (School D): *Its needed to be part of the syllabus in order for the teachers to complete their teaching on how to write practical reports in the laboratory, because now it seems like teachers are not really committed on teaching us about how to write and present laboratory reports.*

The participants highlighted the need for teachers to give them extra lessons in the afternoon for practical sessions. Some stressed the need to incorporate practical sessions into the school timetable. The learners also stated that teachers needed to allow learners to carry out practicals on their own and train them on how to write practical reports.

4.5.2 Strategies on how practical reports should be assessed

The Grade 12 Higher Level Physical Science learners who participated in this study suggested strategies on how practical reports should be assessed. Some of their responses were:

Learner 3 (School A): *Teachers should add our practical marks to those we obtain in examinations. What is the use of carrying out experiments if we are not getting any final mark out of it?*

Learner 7 (School B): *After the teacher assess our reports, he/she should provide the feedback. We want to see if we can write well.*

Learner 1 (School D): *Practical reports should be assessed according to the name of chemicals used, instrument the quantity of the substance results and observation.*

Learners 4 (School D): *we should also write tests just like we do in every subject.*

With regards to the assessment of practical reports, the learners suggested that practical report marks should contribute to the final mark at the end of the year. The learners also suggested that they should be provided with feedbacks to find out their level of understanding in writing practical reports. The learners further indicated that they needed to write tests on practical reports. This might help them to master the components of a practical report better.

4.5.3 Strategies to overcome challenges faced by the Grade 12 Higher Level Physical Science learners when writing practical reports

The participants suggested strategies that could be used to overcome the challenges faced by the Grade 12 Higher Level Physical Science learners when writing practical reports. Their responses were as follows:

Learner 4 (School A): *Enough time should be provided to practical reports. Expose learners to different chemicals that are discussed in the syllabus or in class. Learners should be allowed to do experiments themselves.*

Learner 20 (School B): *We should have practical session lessons. Practice how to answer questions on different experiments.*

Learner 12 (School C): *Teachers should provide learners with many examples and spend time teaching learners how to write proper practical reports. Learners must get enough time to complete finish their practical reports.*

Learner 14 (School C): *Have enough practical equipment. Having enough laboratories to carry out practicals and write reports.*

The Grade 12 Higher Level Physical Science learners suggested that more equipped laboratories should be built in schools and should be enough for the learners to carry out experiments on their own. They also highlighted the importance of providing enough time to the learners by accommodating practical sessions in the school timetable instead of just splitting the theory class into both teaching and practical sessions, which in most cases, requires the teacher to only do demonstrations.

4.5.7 Strategies to improve Grade 12 Higher Level Physical Science learners' understanding of NSSCH Physical Science

The participants suggested the strategies for improving the Grade 12 Higher Level Physical Science learners' understanding of NSSCH Physical Science. Some of their responses are given below:

Learner 16 (School A): *Writing practical report helps me to understand the content of the subject way better because it help me to relate the content to the real world thus it helps me remember things much clearer about what I did during the experiment, help me remember names of apparatus and procedures which I can be able to explain on my own words.*

Learner 10 (School A): *Practical help me to understand theory better. It help us to recall everything in the exams and apply it.*

Learner 19 (School B): *Practical reports do really help me because the more I write the reports, the more I get to know ways of carrying out different practicals by heart. In this way I get to realize some facts we have learned in physical science.*

Learner 15 (School D): *It help me understand results after experiment.*

The learners called for the teaching of Physical Science to be focused more on practical investigations because writing of practical reports was more likely to help them to relate theory to the real world. This might help them to understand the content much better.

4.5.8 Strategies to help the Grade 12 Higher Level Physical Science learners to benefit more from writing practical reports

In responding to this question in the open-ended questionnaire, the participants suggested strategies that could be used to help the Grade 12 Higher Level Physical Science learners benefit more from writing practical reports. Their responses were as follow:

Learner 3 (School A): *In order for Higher Level Physical Science learners to benefit from writing practical reports more practical reports should be given to learners to assess whether the learners really do get the concept of what is taught in class.*

Learner 6 (School A): *Higher level learners should be given more practical work and write more laboratory reports. They should at least at least try to do practical on all topics for a better understanding of theory.*

Learner 1 (School B): *Provision of equipment and chemicals in advance because now right now we only memorize the practical procedure, but we don't carry them out in the laboratory, due to lack of laboratory equipment and chemicals.*

Learner 2 (School C): *The duration for practical must be increased and more practical report writing should be given, but we should get feedbacks on our reports after.*

Learner 17 (School D): *Practical sessions must be included in the timetable so that learners get more time to do practicals and writing practical reports often. Teachers should dedicate a lesson for the learners to visit the laboratory at least once every week.*

From the responses above, the Grade 12 Higher Level Physical Science learners suggested that they should be allowed to carry out as many practicals as possible on their own and write practical reports. This might help them to develop measuring skills, prediction skills, observation skills, interpretation skills, concluding skills, which are the requirements for Paper 3 examination. The learners suggested that more laboratory equipment should be provided and practical sessions should feature in the timetable to ensure that there is enough time for carrying out the experiments

and feedback. Providing feedback to the learners on the written reports might help them to see where they needed to improve in their reports writing in future.

4.5.9 Strategies to involve all the Grade 12 Higher Level Physical Science learners in practical work

The participants suggested strategies to involve all Grade 12 Higher Level Physical Science learners in practical work. Below are some of the learners' responses:

Learner 2 (School A): *Writing of practical reports in Higher Level Physical Science should be compulsory. Practical reports should at least be written three times a week.*

Learner 5 (School A): *Make sure there is enough instrument to be used by every learner and individually and all learners should be assessed.*

Learner 4 (School B): *At least there must be a timetable for practicals whereby every class has its own unique session to be taken to the laboratory.*

Learner 8 (School C): *When we are carrying out practicals every learners must be involved because after the practical we all have to write practical reports.*

Learner 2 (School D): *Make sure every learner has something to do. Give tasks or experiment for each learner.*

The findings revealed that the Grade 12 Higher Level Physical Science learners indicated that they were not involved in carrying out practicals themselves, but in most cases, only the teacher demonstrated to them. The learners submitted that carrying out of practicals and writing of practical reports should be made compulsory and there should be formal recognised assessment of practical reports to prompt both teachers and learners to take practicals seriously. The learners also

suggested the need to have enough and well equipped laboratory rooms at schools to accommodate all the learners in cases where the number of learners was high. They also underscored the need for teachers to educate learners about the importance of carrying out practicals and writing practical reports.

4.6 DISCUSSION OF THE RESULTS

The results of the questionnaire showed that there was only one Physical Science laboratory available to conduct practicals in each secondary school that participated in the study despite the higher number of learners who took Physical Science on higher level. The researcher also observed that the Namibia Senior Secondary Certificate Higher Level (NSSCH) Physical Science learners at all the selected schools were always conducting practicals in one laboratory and they were allowed to sit in larger groups for lack of resources and space. Apart from NSSCH Physical Science learners, the same laboratories were used by other Physical Science learners in the whole school at all the four selected schools. The time allocated to NSSCH Physical Science practical sessions was not enough because other Physical Science learners at other levels (e.g. Namibia Senior Secondary Certificate Ordinary Level (NSSCO) and Junior level) needed to use the same laboratories. Hodson (2006) states that for improved laboratory activities, schools should be designed to support laboratory work. That is schools should have enough and well equipped laboratories for experiments to take place effectively. The environment inside the laboratory should be conducive for experiments to take place. Teachers at schools should allocate time, and resources, as a way of supporting teachers in carrying out practical work and in guiding learners to write practical reports. So where there are not enough or no laboratories, the school management

should strive to build and sustain a laboratory by seeking special funds from the government, from funding agencies or from the community being served by the school.

The results from the questionnaire on the number of Higher Level Science subjects currently enrolled in by Grade 12 learners in the selected schools, indicated that 66% of the Higher Level Physical Science learners also registered for other science subjects (Biology, and Mathematics) on higher level. Registering more than one subject on Higher Level might help learners to transfer their writing skills from one subject to another when writing practical reports in different subjects. Chaney (1995) found that shared teacher planning may be a critical support for improved laboratory teaching, because of the unique nature of the laboratory activities. This finding is also supported by DeSimone, Garet, Birman, Porter, & Yoon (2003) who suggested that school managements should help teachers to overcome their isolation and learn from each other by providing time and space to reflect on their laboratory teaching and on student learning in the company of the colleagues. This develops teachers' abilities to assess the way they conduct their practicals and increase their confidence in producing good and quality lessons for the benefit of the learners.

From the results of the questionnaires, all the NSSCH Physical Science learners who took part in the study did not write practical reports in Grades 8-11. This means that learners were not prepared well on how to write practical reports before final examinations because they only started to write practical reports while in Grade 12. From the observations of practical sessions, teachers had difficulties in deciding what kind of practical activities were important and appropriate to their learners to learn as well as the degree of practical questions their learners required. Deng (2001) states that whenever teachers are developing practical investigations in which learners are expected to write practical reports, the teachers must consider learners' current level of knowledge and

skills, the range of possible laboratory experiences available, and how a given experience will advance their learning. Therefore, science learners need to be prepared to carry out experiments themselves and report on what they have experimented from Grade 11 to 12.

It is also clear from the results (Table 6) that learners at all 4 selected schools carried out practicals in Physical Science practical sessions at their schools, however 66% of the learners indicated that practical sessions only took place once a month. This means that NSSCH Physical Science learners did not write practical reports after every Physical Science topic. Hofstein and Lunetta (2004) state that it is necessary for learners to carry out and write practical reports on each topic because learners construct understanding in the theory and practical classes based on the findings they obtain from experiments. This implies that learners need to carry out and write practical reports after every experiment for them to critically evaluate data and support or reject claims from the theory class with evidence from the practicals. Therefore, laboratory reports writing is a focal site of development of knowledge, skills and an empirical way of thinking for science learners in every topic.

Sixty seven percent of the NSSCH Physical Science learners indicated that they did not write practical reports after every Physical Science practical session. The Malaysia Ministry of Education (2005, p. 2), notes that “Practical reports enable learners to acquire scientific and thinking skills, as well as apply knowledge and skills in a creative and critical manner for problem solving and decision-making”. This seems to imply that learners should always write practical reports after every practical session to gain knowledge and skills in handling equipments used in Physical Science. Learners can also gain knowledge of following the procedures when carrying out experiments as well as experiences in reporting the results from the experiments in Physical Science.

The learners' responses (Table 5) on the frequency of writing practical reports after NSSCH Physical Science practical sessions revealed that learners only wrote practical reports during examinations but did not write practical reports throughout the year. The researcher found during classroom observations that learners at four participating schools shared the scientific information during practical work, however, they did not write practical reports according to the scientific process (record, interpret data correctly and making a conclusion). Millar and Abraham (2009) state that learners who only carry out experiments without explaining the results obtained through writing practical reports after the experiments were deficient in the simple skills needed to successfully carry out laboratory activities, such as using instruments to make measurements and collect accurate data. It is important that learners write practical reports after practical sessions because development of practical skills especially writing practical reports may help learners to achieve the intended results in the experiments.

It is further clear from the results (4.5.1) that there were no practical slots shown on the school timetable. This means that there was not enough time allocated to carry out practicals during the normal school hours. The teachers used their normal teaching periods to conduct practicals, however, writing of practical reports was done after school. Hodson (2006) suggests that schools should allocate time as a way to support teachers in carrying out practical work and in guiding learners to write practical reports. Allocating practical slots in the school timetable avoids inflexible scheduling that may discourage effective laboratory experiences including limits on teacher planning time, limits on teachers' setup of the experiment and cleanup time after the experiment, and limits actual time for practical work and writing of practical reports (Black, 2000).

Sixty six percent of the learners (Table 6) indicated that teachers always provided them with procedures on how practicals should be done. Another 19% of the learners indicated that the

procedures were easy to follow as teachers summarized everything for them. However, 43% of the learners indicated that it was not easy to follow the procedures because the laboratory manuals were always distributed in the laboratory. Johnstone, & wood (2001) state that the conventional way of preparing learners for experiments would be to encourage them to read the laboratory manuals before entering the laboratory because the goals, aims and objectives are well defined in the manuals. Therefore, the laboratory manuals should be distributed well in advance before the practical session for them to read through on their own. This might help the learners to prepare for the practicals if the laboratory manuals were distributed well in advance. In this way, they could understand the procedure better.

Fifty five percent of the learners indicated that they did not carry out experiments on their own, but rather their teachers demonstrated everything to them and asked them questions at the end of the demonstrations. Millar (2004) states that learners need to be prepared to carry out experiments themselves and report on what they have experimented. This might help them to have more insight into what the experiment is all about.

During classroom observations, the researcher observed that the learners were provided with most of the resources such as laboratory apparatus for use during the practical sessions, even though they were not enough for all the learners. Hodson (2006) explained that for improved laboratory activities, schools should be designed to support laboratory work. This means that schools should have well equipped laboratories for experiments to take place effectively and the environment inside the laboratory should be conducive for practical work. Therefore, learners needed to be provided with laboratory apparatus and manuals in order to follow the procedures when carrying out experiments and writing reports.

During the observations, it was found that teachers at Schools A, C and D carried out experiments while the learners were observing. The teachers then asked them to answer questions based on the experiment. However, learners at School B handled the equipment themselves and set up experiments themselves compared to learners at the other three schools. Worth (2010) affirms that learning science is more than just gaining the facts and understanding on a particular topic. Learning through hands-on experiments is an effective option as it encourages learners to experience and discover from observation or feelings. This may lead to the development of learners' problem solving skills, creativity skills and independent learning skills (Shymansky et al., 1990).

From the observations, the NSSCH Physical Science teachers at the four schools were able to explain to the learners what to do verbally and reminded the learners of some of the names of the apparatus. The researcher observed that learners at all the schools shared the scientific information (i.e. names of equipment, measuring, recording of data, analyzing and interpreting of data) during practical work, however, learners at Schools A, C and D did not write practical reports correctly, except learners at School B. Millar and Abraham (2009) found that learners who only carry out experiments without writing practical reports after the experiments were deficient in the simple measurement and recording skills needed to successfully carry out laboratory activities. This means that helping learners to develop relevant report writing skills in controlled post laboratory activities might reduce compromising important measurements in a laboratory experience in the future due to learners' lack of expertise with the apparatus (Hofstein and Mamlok-Naaman, 2007). Furthermore, the researcher observed that post practical questions stimulated learners' thinking at Schools A, B and D and helped them to reflect on what they were told in the theory class. These findings are in line with those by the Malaysia Ministry of Education (2005, p. 2), who notes that

“Practical reports enable learners to acquire scientific and thinking skills, as well as apply knowledge and skills in a creative and critical manner for problem solving and decision-making”. This means that writing practical reports might help learners to be critical thinkers, creative and able to apply their knowledge to real life situations.

The Namibia Senior Secondary Certificate Higher Level (NSSCH) Physical Science learners in the Omusati Educational Region perceived writing of practical reports in various ways. Seventy five percent of the learners indicated that writing laboratory reports helped them to: understand the subject content; explain most of the scientific concepts in their own words; discover new definitions; relate the subject content to the real world and discover new ways of carrying out experiments. These findings are in line with the views of Lerner (2007) who states that writing laboratory reports helped learners to develop or sharpen their skills associated with scientific inquiry, the scientific method, scientific thinking, and scientific communication, which are at the heart of the scientific process.

Fifty nine percent of the learners at the selected schools expressed the view that writing of practical reports helped them to retain the content, names of equipment and experimental procedures of Physical Science. This finding supports that by Millar, & Abraham (2009) who found that through writing practical reports, learners are likely to know the names of the equipment used in the school laboratory as well as the experimental procedures followed. This means that gaining more experience in conducting and writing practical reports helps learners to be able to carry out experiments on their own and to set up procedures required for a given experiment. Therefore, one can conclude that although schools do not have enough equipment to carry out practicals, learners felt that teachers needed to improvise experiments and find time to carry out most of the practicals. Eighty five percent of the learners expressed the view that writing of practical reports improved their

writing and language skills. They indicated that writing of practical reports helped them to know how to: introductions; write conclusions and interpret data. This finding supports Hofstein, & Lunetta (2004) who indicated that learners perceived the writing of practical reports interesting, because through practical reports writing, they discussed their findings with their peers, explained what they observed during the practical session and related their findings to what they had learned in the theory class. Therefore, the writing of practical reports allows learners to interact with their peers and the teacher, by asking questions based on what they were able to see, smell, feel, touch and hear. This seems to imply that the learners' higher order learning skills of analysis, interpretation, problem solving, evaluating and concluding are improved through the writing of practical reports.

Furthermore, learners perceived that the writing of practical reports improved their scientific, research and technical skills such as measuring, prediction, observation, interpretation and concluding skills, and learning how to operate laboratory equipment. Woodley (2009) states that practical work induces scientific skills, develops problem solving skills and improves conceptual understanding of the subject content. Therefore, learners need to carry out experiments themselves instead of a teacher demonstrating in front, for them to be familiar with the apparatus because manipulative skills may be acquired by the learners if they are allowed to familiarise themselves with the apparatus.

Learners were of the views that writing of practical reports motivated them to: be independent learners; do experiments on their own; read more; develop confidence in the subject; cultivate interest in Physical Science and work with other learners when solving Physical Science problems. Hofstein, & Lunetta (2004, p. 61) explained this better by remarking that "learners perceive writing of practical reports motivating, because through writing practical reports, they discuss their

findings with their peers, explain what they observed during the practical investigation lesson and relate their findings to what they have learned from the teacher in the theory class”. This implies that writing practical reports motivate learners to interact with their peers and the teacher, by asking questions based on what they were able to see, smell, feel, touch and hear. Through the writing of practical reports, learners evaluate their own work and that of other learners without copying from each other, hence increasing motivation and self-confidence of learners in their individual abilities.

The results from the questionnaires revealed that NSSCH Physical Science learners were of the opinion that teachers needed to give them extra lessons in the afternoons for practical sessions or incorporate practical sessions into the school timetable. Splitting the theory class into teaching and practical sessions in most cases, can result in the teacher only doing a demonstration because the time is not enough to carry out the whole experiment in one lesson (Ministry of Education, 2014).

The learners also suggested that practical reports should be assessed continuously and the Continuous Assessment (CA) marks should contribute to the final grade at the end of the year only if both learners and teachers are to take writing of practical reports seriously. Therefore, carrying out of practicals and writing of practical reports can be made compulsory and there can be a recognized formal assessment of practical reports to prompt both teachers and learners to take practicals seriously.

Further, the results of the questionnaire revealed that the learners asserted that the teaching of physical science could be focused more on the investigation because the writing of practical reports is more likely to help them to relate theory to the real world, thus it helps them to understand the content much better. This finding supports Cooper (1993) who indicated that meaningful learning

can be made possible in the laboratory as learners construct understanding based on the findings, critically evaluating data and supporting claims with evidence, when writing practical reports. Therefore, laboratory reports writing, may be a focal site of development of knowledge, skills and an empirical way of thinking for science learners.

4.7 SUMMARY

This chapter presented and discussed the results of the study from the questionnaires, and observations. This was done in order to answer the three research questions. The results from both the questionnaire and the observation schedule indicated that Namibia Senior Secondary Certificate Higher Level (NSSCH) Physical Science learners did not carry out adequate practicals and wrote practical reports because the time scheduled for physical science lessons was not enough. Practical sessions were not scheduled in the school timetable to ensure that there was enough time for carrying out the experiments and writing of practical reports. The results also revealed that the learners perceived writing of practical reports as important because it improved their writing, language, scientific, research, technical and cognitive skills.

The next chapter provides the summary, conclusions and recommendations emanating from this study.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

The purpose of this study was to investigate the perceptions of Grade 12 learners of writing practical reports in NSSCH Physical Science in four selected secondary schools in Omusati Educational Region.

In this chapter, the researcher provides a summary, conclusions and recommendations of the study with specific reference to the main research objectives.

5.2 SUMMARY

The Namibian Ministry of Education (2014) indicates that often Grade 12 Higher Level Physical Science learners in some Namibian Secondary schools carry out Practical work with their teachers, but they do not apply their scientific knowledge and understanding to make relevant interpretations and draw appropriate conclusions in the Paper 3 examination. Applications of scientific knowledge with respect to making interpretations and conclusions were lacking in Namibian Grade 12 Higher Level Science learners. The 2014 National report seems to be confirmed by the Omusati Regional Advisory Services (ORAS) (2017), which reported that Omusati Region is one of the poorly performing regions in Namibia Senior Secondary Certificate Higher Level (NSSCH) Physical Science Paper 3 national examinations. As a NSSCH Physical Science teacher at a secondary school in Omusati Educational Region I observed that Grade 12 NSSCH Physical Science learners do not write practical reports after their practical sessions throughout the year but they are required

to report on experiments they carry out during Paper 3 Examinations. In Paper 3 they are required to carry out a practical in the examination and answer questions related to the experiment they have carried out. Therefore, this study investigated the perceptions of Grade 12 learners of writing practical reports in NSSCH Physical Science in four selected secondary schools in Omusati Educational Region.

Research objectives

This study intended to achieve the following objectives to:

1. Find out the extent to which the Grade 12 Higher Level Physical Science learners in four selected secondary schools in the Omusati Educational Region carry out practicals and write reports.
2. Determine the level of the Grade 12 Higher Level Physical Science learners' knowledge of writing practical reports in Physical Science in four selected secondary schools in the Omusati educational region.
3. Devise strategies that can be used to improve Grade 12 Higher Level Physical Science learners' understanding of writing practical reports in Omusati educational region.

The population of this study included 320 Higher Level Physical Science learners in Grade 12 in the Omusati Educational Region. This study consisted of four Secondary schools offering Physical Science on higher level and all Higher Level Physical Science learners at the selected schools took part in the study. Simple random sampling was used to select four out of ten schools. Two research instruments were used to collect the data from the Grade 12 Higher Level Physical Science learners, a Questionnaire and an Observation Schedule. This study employed a sequential

explanatory mixed methods design in order to seek responses to the stated three objectives, by collecting and analyzing quantitative data first followed by collecting and analyzing the qualitative data. Both quantitative and qualitative data were collected by using close-ended and open-ended questions respectively in the Questionnaire, and validated by data of the Observation schedule. Descriptive statistics i.e., frequency tables and percentages were used to analyse quantitative data from the Questionnaire and Observation schedule. Qualitative data from the questionnaires were analyzed by grouping the responses according to the identified themes from the learners' views.

It was found that the Higher Level Physical Science learners in Omusati educational region were not prepared well on how to write practical reports before final examinations because they only started to write practical reports while in Grade 12. The Higher Level Physical Science learners in Omusati educational region did not write practical reports after every topic, but they were required to report on experiments they carry out during Paper 3 Examinations. The resources such as laboratory apparatus for use during the practical sessions were not enough for all the learners. The results also showed that: there were not well equipped laboratories in schools to carry out practicals and write practical reports; the time allocated to Higher Level Physical Science practical sessions was not enough and there were no practical slots shown on the school timetable. Further, it was found that NSSCH Physical Science learners did not write practical reports as required by their teachers because they did not record the procedures, did not write correct introduction and failed to interpret the data found correctly.

However, the learners in this study perceived the writing of practical reports as important because it helped them to understand the subject matter. They stated that writing practical reports was important because it improved their writing, language scientific, research and technical skills. Finally, the learners suggested different strategies to improve their understanding of writing

practical reports in Higher Level Physical Science, namely: extra practical lesson sessions; integrating practicals into the school timetable; training learners on how to write practical reports; building well-resourced laboratories; carrying out as many practicals as possible on their own and teachers should provide feedback to the learners on the written reports.

5.3 CONCLUSIONS

Based on the findings of the study it can be concluded that the NSSCH Physical science learners in Omusati educational region were not prepared well on how to write practical reports before the final examinations because they only started to write practical reports in Grade 12. The Namibia Senior Secondary Certificate Higher Level (NSSCH) Physical Science learners in the Omusati educational region did not write practical reports after every topic, but they were required to report on experiments they carry out during Paper 3 Examinations. It can also be concluded that there were no practical periods shown on the school timetable at the four schools studied in the Omusati educational region. In addition, it was not easy for NSSCH Physical Science learners to follow the procedures on how practicals should be carried out because the laboratory manuals were distributed in the laboratory. Furthermore, learners were provided with most of the resources such as laboratory apparatus for use during the practical sessions. These were however, not enough for all the learners. They had to share these practical apparatus.

This study further concludes that the NSSCH Physical Science learners in Omusati educational region perceived the writing of practical reports to be important because it helped them to understand the subject content better. However, it was challenging to implement writing practical

reports at the schools because the laboratories were not well equipped to carry out practicals, write practical reports and the time allocated to NSSCH Physical Science practical sessions was not enough and were not shown on the school timetable.

5.4 RECOMMENDATIONS

The following recommendations were made:

5.4.1 Ministry of Education, Arts and Culture

5.4.1.1 The Ministry of Education, Arts and Culture should set aside funds for the building of well equipped Physical Science laboratories at Secondary schools.

5.4.1.2 The Ministry of Education, Arts and Culture should consider incorporating practical slots on the school timetable and a reasonable duration of practical sessions should be designated in order to enable teachers and learners to complete their practicals and complete practical reports.

5.4.1.3 The Ministry of Education, Arts and Culture should consider introducing Continuous Assessment marks from written practical report activities, which should form part of the final marks at the end of the year. This might motivate learners to take up writing of practical reports seriously.

5.4.2 School managements

The School Management should organise bazaars, fundraising activities and any other money raising events in order to generate funds to buy laboratory equipment and chemicals for carrying out experiments.

5.4.3 NSSCH Physical Science teachers

5.4.3.1 The teachers should make sure that they carry out practicals at the end of every theoretical topic in Physical Science.

5.4.3.2 Teachers should prepare practical sessions in advance and provide feedback to the learners on the written reports on time.

5.4.3.3 The teachers should try to improvise in cases where the laboratory equipment for use by the teachers and learners during the practical sessions were not enough.

5.5 FURTHER RESEARCH

This study focused only on four selected Secondary schools in the Omusati region, which had a small school population compared to the total number of schools offering Namibia Senior Secondary Certificate Higher Level (NSSCH) Physical Science in the whole country. Therefore, there is a need to conduct similar studies in other educational regions in Namibia to shed more light on the importance of writing practical reports in NSSCH Physical Science.

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Appendix 1: Ethical Clearance Certificate



UNAM
UNIVERSITY OF NAMIBIA

ETHICAL CLEARANCE CERTIFICATE

Ethical Clearance Reference Number: FOE/306/2017 Date: 10 October, 2017

This Ethical Clearance Certificate is issued by the University of Namibia Research Ethics Committee (UREC) in accordance with the University of Namibia's Research Ethics Policy and Guidelines. Ethical approval is given in respect of undertakings contained in the Research Project outlined below. This Certificate is issued on the recommendations of the ethical evaluation done by the Faculty/Centre/Campus Research & Publications Committee sitting with the Postgraduate Studies Committee.

Title of Project: Grade 12 Learners' Perceptions Of Writing Practical Reports On Higher Level Physical Science, In Omusati Educational Region

Researcher: Johannes I. Shivute

Student Number: 200502140

Faculty: Faculty of Education

Supervisors: Dr. H. M. Kapenda (Main) Prof. C. D. Kasanda (Co)

Take note of the following:

- (a) Any significant changes in the conditions or undertakings outlined in the approved Proposal must be communicated to the UREC. An application to make amendments may be necessary.
- (b) Any breaches of ethical undertakings or practices that have an impact on ethical conduct of the research must be reported to the UREC.
- (c) The Principal Researcher must report issues of ethical compliance to the UREC (through the Chairperson of the Faculty/Centre/Campus Research & Publications Committee) at the end of the Project or as may be requested by UREC.
- (d) The UREC retains the right to:
 - (i) Withdraw or amend this Ethical Clearance if any unethical practices (as outlined in the Research Ethics Policy) have been detected or suspected.
 - (ii) Request for an ethical compliance report at any point during the course of the research.

UREC wishes you the best in your research.

Prof. P. Odonkor: UREC Chairperson

Ms. P. Claassen: UREC Secretary

Appendix 2: Permission request letter from Centre for Post Graduate Studies

CENTRE FOR POSTGRADUATE STUDIES

University of Namibia, Private Bag 13301, Windhoek, Namibia
340 Mandume Ndemufayo Avenue, Pioneers Park
☎ +264 61 206 3275/4662; Fax +264 61 206 3290; URL: <http://www.unam.edu.na>



ANNEX 16

RESEARCH PERMISSION LETTER

Student Name: Johannes L. Shivute

Student number: 200502140

Programme: Master of Education (Science)

Approved research title: Grade 12 Learners Perceptions of Writing Practical Reports on Higher Level Physical Sciences, In Omusati Educational Region.

TO WHOM IT MAY CONCERN

I hereby confirm that the above mentioned student is registered at the University of Namibia for the programme indicated. The proposed study met all the requirements as stipulated in the University guidelines and has been approved by the relevant committees.

The proposal adheres to ethical principles as per attached Ethical Clearance Certificate. Permission is hereby granted to carry out the research as described in the approved proposal.

Best Regards

A handwritten signature in black ink, appearing to read 'M. Hedimbi', is written over a horizontal dashed line.

Dr M. Hedimbi

Director: Centre for Postgraduate Studies

Tel: +264 61 2063275

E-mail: directorpgs@unam.na

A handwritten date '08/10/2017' is written in black ink above a horizontal dashed line.

Date

Appendix 3: Permission letter from the Permanent Secretary



REPUBLIC OF NAMIBIA

MINISTRY OF EDUCATION, ARTS AND CULTURE

Tel: +264 61 -2933200/86
Fax: +264 61- 2933922
Enquiries: C. Muchila/G Munene
Email: Cavin.Muchila@moe.gov.na/gm12munene@yahoo.co.uk

Luther Street, Govt. Office Park
Private Bag 13186
Windhoek
Namibia

File no: 11/1/1

Mr. Johannes I. Shivute
P O Box 1737
Oshakati
Cell: +264 81 157 7753
Email: jshivute@unam.na

Dear Mr. Shivute

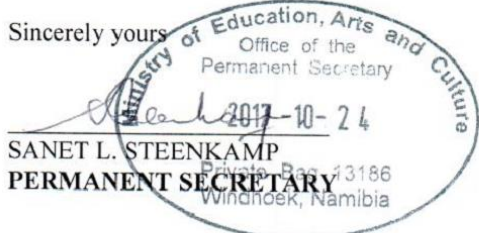
SUBJECT: PERMISSION TO CONDUCT RESEARCH IN OMUSATI REGION

Kindly be informed that permission to conduct research for your Master's Degree in "Grade 12 Learners' Perceptions on the Importance of Writing Practical reports on Higher Level Physical Science, in Omusati Educational Region" is herewith granted. You are further requested to present the letter of approval to the Regional Director to ensure that research ethics are adhered to and disruption of curriculum delivery is avoided.

Furthermore, we humbly request you to share your research findings with the ministry. You may contact Mr C. Muchila/ Mr. G. Munene at the Directorate: Programmes and Quality Assurance (PQA) for provision of summary of your research findings.

I wish you the best in conducting your research and I look forward to hearing from you soon.

Sincerely yours


SANET L. STEENKAMP
PERMANENT SECRETARY

27.10.17.
Date

All official correspondences must be addressed to the Permanent Secretary

Appendix 4: Permission letter from the Omusati Regional director



REPUBLIC OF NAMIBIA



OMUSATI REGIONAL COUNCIL

DIRECTORATE OF EDUCATION, ARTS AND CULTURE *Team Work and Dedication for Quality Education*

Tel: +264 65 251700

Private Bag 529

Fax: +264 65 251722

OUTAPI

Enq: Apollonia Hango

11 January 2018

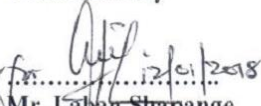
Mr. Johannes I. Shivute
P.O. Box 1737
Oshakati

Subject: Permission to Conduct an Educational Research in Omusati Region

This letter serves to notify you (**Mr. Johannes I. Shivute**) that permission has been granted to conduct research at Haudano SS, Onawa SS, Canisianum RCHS and Nuuyoma SS in "grade 12 learners' perceptions on the importance of writing practical report on higher level Physical Science, in Omusati Educational Region". Please be informed that the research to be conducted at schools should by no means whatsoever disrupt teaching and learning.

We hope and trust this exercise will enhance quality education in the Region.

Yours faithfully


Mr. Laban Shapange
Director of Education Arts and Culture

OMUSATI REGIONAL COUNCIL
DIRECTORATE OF EDUCATION

2018 -01- 12

OFFICE OF THE DIRECTOR
PRIVATE BAG 529, OUTAPI
REPUBLIC OF NAMIBIA

Teamwork and dedication for
quality education

Cc: *Inspectors of Education, Okalongo, Anantulenge and Oshikuku Circuits
Principals for Haudano SS, Onawa SS, Canisianum RCHS and Nuuyoma SS*

All official correspondence must be addressed to the Chief Regional Officer.

Appendix 5: Consent letter

PO BOX 1737
Oshakati
Mobile:+264811577753
Email: jshivute@unam.na
10 February 2017

Dear Participant,

I am Johannes I. Shivute, a Master student at the University of Namibia doing a research to determine your *perceptions on writing practical reports on Higher Level Physical Science*, in the Omusati Educational Region. I am inviting you to take part in this research. Your sincere responses will help in improving the effective teaching of Physical Science in our schools. You are assured that the information you will give in this research will be treated with maximum confidentiality by using pseudo names and numbers in the report and the information will only be used for the purpose of this study. If you are willing to participate in this research please fill in your full name and sign in the space provided. Signing the consent form means you declare that you will participate willingly in this research and you have the right to withdraw from the study at any time.

Thank you very much.

Yours truly,

.....

Mr J. I. Shivute

Consent:

Iagree to participate in the research entitled
“Grade 12 learners’ perceptions on writing practical reports on Higher Level Physical Science, in Omusati Educational Region”, as outlined above.

.....

.....

Signature

Date

Appendix 6: Learners' questionnaire

Introduction

My name is Johannes Iiyambo Shivute, a student doing Master in Education degree at the University of Namibia. I am doing a research to determine *perceptions on writing practical reports on Higher Level Physical Science*, in Omusati Educational Region. Your sincere responses will help in improving the effective teaching of Physical Science in our schools. The information you provide in this research will be treated with maximum confidentiality by using pseudo names and numbers in the report and the information will only be used for the purpose of this study. Please answer the following questions as honestly as possible.

Thank you

SECTION A: DEMOGRAPHIC INFORMATION

1. Name of school
2. Your Grade
3. Your sex: Male Female
4. Your Age
5. What was your level of study in Physical Science in Grade 11? Please indicate by putting a cross (X) in the box that correctly represents your level.

| Level | Put an X |
|-------|----------|
| NSSCH | |
| NSSCO | |

SECTION B: EXTENT OF WRITING PRACTICAL REPORTS

6. How many Physical Science laboratories are in your school?

7. How many science subjects are you currently doing in Grade 12? You may use a cross (X) in more than one box.

| Science subject | Put an X |
|------------------|----------|
| Physical Science | |
| Biology | |
| Mathematics | |
| Agriculture | |

8. Have you written a practical report in Grades 8-11? (Please tick) Yes () No ()

9. If **yes**, in what grade and in which subject?

(i) Grade

(ii) Subject

10. Do you carry out practical work in Physical Science practical sessions at your school?

(Please tick)

Yes () No ()

11. If **yes**, how often do you carry out practical work in Physical Science? Please indicate by putting a cross (X) in the box that correctly represents your frequency of carrying out practical work.

| Frequency | Put an X |
|---------------|----------|
| Once a week | |
| Twice a week | |
| Once a month | |
| Twice a month | |

Others specify)

12. Do you write practical reports after every Physical Science practical session? (Please tick)

Yes () No ()

13. If **not**, how often do you write practical reports after Physical Science practical sessions?

.....

14. Are Physical Science practical sessions/slots shown in the school time table? (Please tick)

Yes () No ()

15. If **yes**, what is the duration of each practical session?

.....

16. Does your Physical Science teacher provide you with lab manuals (procedures on how practicals should be done)? (Please tick) Yes () No ()

17. If **yes**, is it easy to follow?

.....

.....

.....

.....

18. If **not**, how do you carry out your practicals? Explain.

.....

.....

.....

SECTION C: Please indicate by putting a cross (X) in the box that correctly represents your opinion.

1. Your views on mastering of subject content.

| Statements | Strongly Agree (5) | Agree (4) | Not sure (3) | Disagree (2) | Strongly Disagree (1) |
|--|-------------------------------|----------------------|-------------------------|-------------------------|----------------------------------|
| 1.1 Writing lab reports helps me to understand subject content better. | | | | | |
| 1.2 Writing lab reports helps me to get what the teacher is trying to say in the theory class. | | | | | |
| 1.3 Writing lab reports helps me to explain most of the scientific concepts in my own words. | | | | | |
| 1.4 Writing lab reports helps me to discover new definitions. | | | | | |
| 1.5 Writing lab reports helps me to relate the subject content to the real world | | | | | |
| 1.6 Writing lab reports helps me to discover new ways of carrying out experiments. | | | | | |
| 1.7 I always have difficulty in applying what I know from writing lab reports. | | | | | |
| 1.8 Writing lab reports is a waste of time | | | | | |
| 1.9 The Physical Science teacher does not pay attention to lab reports | | | | | |

2. Your views on retention of subject content

| Statements | Strongly Agree (5) | Agree (4) | Not sure (3) | Disagree (2) | Strongly Disagree (1) |
|---|-------------------------------|----------------------|-------------------------|-------------------------|----------------------------------|
| 2.1 Writing lab reports helps me to remember subject matter well. | | | | | |
| 2.2 Writing lab reports helps me to remember what I did during the experiment. | | | | | |
| 2.3 Writing lab reports helps me to remember how to carry out experiments on different topics. | | | | | |
| 2.4 Writing lab reports helps me to remember how to set up different equipment used in the lab. | | | | | |
| 2.4 Writing lab reports helps me to remember experiment procedures. | | | | | |
| 2.5 Writing lab reports helps me to remember names of the apparatus in the lab. | | | | | |

| | | | | | |
|---|--|--|--|--|--|
| 2.6 Writing lab reports helps me to remember what I have studied in tests and examinations. | | | | | |
| 2.7 I do not remember most of what I learned during lab report writing. | | | | | |

3. You views on writing skills

| Statements | Strongly Agree (5) | Agree (4) | Not sure (3) | Disagree (2) | Strongly Disagree (1) |
|--|--------------------|-----------|--------------|--------------|-----------------------|
| 3.1 Writing lab reports helps me to know how to write introductions. | | | | | |
| 3.2 Writing lab reports helps me to know how to write conclusions. | | | | | |
| 3.3 Writing lab reports helps me to know how to give instructions. | | | | | |
| 3.4 Writing lab reports improves my language skills. | | | | | |

4. Your views on scientific skills

| Statements | Strongly Agree (5) | Agree (4) | Not sure (3) | Disagree (2) | Strongly Disagree (1) |
|--|--------------------|-----------|--------------|--------------|-----------------------|
| 4.1 Writing lab reports improves my measuring skills. | | | | | |
| 4.2 Writing lab reports improves my prediction skills. | | | | | |
| 4.3 Writing lab reports improves my observation skills. | | | | | |
| 4.4 Writing lab reports improves my interpretation skills. | | | | | |
| 4.5 Writing lab reports improves my concluding skills. | | | | | |
| 4.6 Writing lab reports expose me to practical aspects of the lab. | | | | | |

5. Your views on research skills

| Statements | Strongly Agree (5) | Agree (4) | Not sure (3) | Disagree (2) | Strongly Disagree (1) |
|---|-------------------------------|----------------------|-------------------------|-------------------------|----------------------------------|
| 5.1 Writing lab reports helps me to learn how to collect data by taking correct measurements. | | | | | |
| 5.2 Writing lab reports helps me to learn how to do observations during practicals. | | | | | |
| 5.3 Writing lab reports helps me to learn how to record data correctly. | | | | | |
| 5.4 Writing lab reports helps me to learn how to present data logically. | | | | | |

6. Your views on motivation

| Statements | Strongly Agree (5) | Agree (4) | Not sure (3) | Disagree (2) | Strongly Disagree (1) |
|--|-------------------------------|----------------------|-------------------------|-------------------------|----------------------------------|
| 6.1 Writing lab reports motivates me to be a self-independent learner. | | | | | |
| 6.2 Writing lab reports motivates me to do experiments. | | | | | |
| 6.3 Writing lab reports motivates me to do more readings. | | | | | |
| 6.4 Writing lab reports motivates me to develop confidence in the subject. | | | | | |
| 6.5 Writing lab reports motivates me to cultivate interest in Physical Science. | | | | | |
| 6.6 Writing lab reports motivates me to study very hard. | | | | | |
| 6.7 Writing lab reports motivates me to work with other learners when solving Physical Science problems. | | | | | |

7. Your views on technical skills

| Statements | Strongly Agree (5) | Agree (4) | Not sure (3) | Disagree (2) | Strongly Disagree (1) |
|---|-----------------------|--------------|-----------------|-----------------|--------------------------|
| 7.1 Writing lab reports helps me to learn how to operate lab equipment. | | | | | |

Other (specify):

SECTION D: Strategies that can be used to improve skill of writing lab reports in Physical Science.

1. Were you taught by your teachers how to write practical reports? (Please tick) Yes ()

No ()

(i) If not, what should the teachers do to help you know how to write lab reports?

.....

2. In your own view what are your roles during the practical sessions?

.....

3. Is the mark given for lab report a fair assessment of your work? (Please tick) Yes () No ()

(ii) If not, how do you think lab reports should be assessed?

.....

.....
.....
4. What are some of the challenges that you face when writing practical reports?

.....
.....
.....
.....
.....
.....
(i) In your own view; what should be done to overcome these challenges to improve practical reports in Physical science?

.....
.....
.....
.....
.....
.....
5. In your own view; how do writing practical reports contribute to your understanding of Physical Science?

.....
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.....
.....
.....
.....
6. In your own view; how can writing practical reports prepare you for a practical examination?

.....
.....
.....
.....
.....
.....
7. In your view, what do you think should be done in order for Higher Level Physical Science learners to benefit more from writing practical reports?

.....
.....
.....

8. Are all the learners in your class involved in carrying out practicals? (Please tick)

Yes () No ()

(i) Explain your answer.

.....
.....
.....

(ii) If not, what should the teachers do to make sure all learners are involved in practical work?

.....
.....

9. Any other comments you would like to make about writing practical reports in Higher Level Physical Science?

.....
.....
.....
.....
.....

Thank you very much for your time!

Appendix 7: Observation Schedule

1. GENERAL INFORMATION

Name of School: _____ Grade: _____

Duration: _____ Date: _____

Number of learners in the practical lesson: _____

Topic of the experiment: _____

2. LABORATORY ORGANIZATION

2.1 Seating arrangement

| | |
|------------------------------------|--|
| (a) Learners are sitting at random | |
| (b) Learners are sitting in rows | |
| (c) Learners are sitting in groups | |

2.2 If learners are seating in groups, how many learners are in each group?

| | |
|--------------------------------|--|
| (g) 2-4 learners | |
| (h) 5-7 learners | |
| (i) 8-10 learners | |
| (j) 11-13 learners | |
| (k) 14 or more learners | |
| (l) Other sitting arrangements | |

2.3 If learners are seated in groups, how are they arranged in each group?

| | |
|---|--|
| (a) Learners are sitting in a circle | |
| (b) Learners are sitting in a semi-circle | |
| (c) Learners are sitting on one side of the table | |
| (d) Other (specify) | |

2.4 Storage of laboratory equipment

| Statements | Yes | No |
|---|-----|----|
| (a) All laboratory equipment are kept in the store room. | | |
| (b) All laboratory equipment are displayed around the laboratory. | | |

| | | |
|--|--|--|
| (c) Some laboratory equipment are kept in the store room and some are displayed around the Laboratory. | | |
| (d) There are labels on each equipment | | |

3. SAFETY IN THE LABORATORY

| Statements | Yes | No |
|---|-----|----|
| (j) (All/some) learners wear lab coats during practical sessions. | | |
| (k) (All/some) learners wear hand gloves coats during practical sessions. | | |
| (l) (All/some) learners wear goggles during practical session. | | |
| (m)(All/some) learners have access to water in the lab. | | |
| (n) There are safety doors in the lab in case of emergency. | | |
| (o) There is a fire extinguisher in the lab. | | |
| (p) Windows provide enough ventilation of air in the lab. | | |
| (q) There is enough space in the lab for conducting practicals. | | |
| (r) Lab rules are displayed around the lab. | | |

4. AVAILABILITY OF RESOURCES

| Statements | Yes | No |
|---|-----|----|
| (s) Learners are provided with the correct apparatus during practicals. | | |
| (t) The apparatus are enough for all the learners/groups. | | |
| (u) Learners share equipment/apparatus. | | |
| (v) The apparatus given to the learners are up-to-date. | | |
| (w)Learners have access to internet at school. | | |
| (x) Learners are provided with lab manuals. | | |
| (y) Instructions in the lab manual are clear. | | |
| (z) Learners are allowed to use textbooks in the lab. | | |

5. PREPARATIONS FOR EXPERIMENT

| Statements | Yes | No |
|---|-----|----|
| (g) The teacher prepares apparatus before the session. | | |
| (h) The teacher sets up the experiment/apparatus for the learners. | | |
| (i) Learners set up experiment themselves. | | |
| (j) Learners are told to read experiment procedures before the session. | | |
| (k) The teacher improvises where apparatus are not enough. | | |
| (l) The teacher makes sure the lab is clean before the experiment. | | |

PRACTICAL SESSION

6.1 Carrying out the experiment

| Statements | Yes | No |
|---|-----|----|
| (k) Learners handle equipment by themselves. | | |
| (l) Learners set up experiment themselves. | | |
| (m) All learners are involved in carrying out practicals. | | |
| (n) Learners do the measurements by themselves. | | |
| (o) Learners interact with each other. | | |
| (p) Learners interact with the teacher. | | |
| (q) Learners are free to move around the lab and look for help. | | |
| (r) Learners remain at their benches until the end of the experiment. | | |
| (s) Learners do the recording of the results by themselves. | | |
| (t) Learners clean the benches at the end of the experiment. | | |

6.2 Facilitating of practicals

| Statements | Yes | No |
|---|-----|----|
| (h) The teacher gives the introduction orally. | | |
| (i) The teacher explains to the learners of what to do verbally. | | |
| (j) The teacher writes all the instruction on the chalkboard. | | |
| (k) The teacher goes around each table to guide the learners. | | |
| (l) The teacher shows learners how to handle apparatus. | | |
| (m) The teacher reminds the learners of some of the names of apparatus. | | |
| (n) All instructions are written in the lab manual. | | |

6. PRACTICAL REPORTS

| Statements | Yes | No |
|--|-----|----|
| (h) Learners share scientific information during practical work. | | |
| (i) Learners can record the data correctly. | | |
| (j) Learners can write correct introductions for their reports. | | |
| (k) Learners can write practical procedures clearly. | | |
| (l) Learners interpreted the data correctly. | | |
| (m) Learners obtained correct results. | | |
| (n) Learners are able to write practical reports as required. | | |

7. POST PRACTICAL QUESTIONS

| Statements | Yes | No |
|---|-----|----|
| (l) The questions stimulate learners to think critically. | | |

| | | |
|---|--|--|
| (m) Post questions are only focusing on the explanation of the results. | | |
| (n) Post practical questions help learners to reflect on what they were told in the theory class. | | |
| (o) The teacher helped the learners with answering of the questions | | |
| (p) Learners discussed the questions in groups. | | |
| (q) Learners can answer questions individually. | | |
| (r) Most learners can answer questions correctly after practical sessions. | | |
| (s) Most learners are struggling to answer questions related to practicals correctly. | | |
| (t) Learners simply copied answers from each other. | | |
| (u) Learners are allowed to use textbooks and summary books when answering questions. | | |
| (v) Some questions require learners to do more readings. | | |

End of observation schedule.