

**An investigation into how grade 9 girls participate during practical work in  
Physical Science lessons: A case study**

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**by**

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## DECLARATION OF ORIGINALITY

I, Johanna Munyanyo (Student number: 611M0014), declare that this thesis: *An investigation into how grade 9 girls participate during practical work in Physical Science lessons: A case study* is my own work written in my own words. Where I have drawn on the words or ideas of others, these have been acknowledged using the reference practices according to the Rhodes University Education Department Guide to Referencing.

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## ABSTRACT

This research report documented in this thesis focused mainly on the participation of grade 9 girls during practical work in the topic of ‘Electricity’ in Physical Science lessons at Mwatya (pseudonym) Junior Secondary School in Ohangwena region of Namibia. The study was triggered by the lack of participation of girls during practical work.

Underpinned by an interpretive paradigm, the study took the form of a qualitative case study and my unit of analysis was girls’ participation during practical work on electricity in particular. The perceptions and experiences of girls about practical work in Physical Science were investigated using the administered questionnaires. The participation of girls during practical work was further explored using interviews (semi-structured and focus group interviews) and observations of selected girls. A thematic approach to data analysis was adopted.

The qualitative data from the audio and video transcripts were analysed according to the categories developed and themes that emerged from the analysis process. The categories developed for presenting the data are: teaching methods preferred by girls; importance and roles of practical activities; things that girls enjoy during practical activities; problems experienced by girls during practical activities; preference for doing practical work in groups or as an individual task; if practical work given in groups should the sex of learners be considered or not; activities preferred by girls when they are in single sex and in mixed sex groups; factors that enable girls to participate; and factors that prevent girls from participating.

The study found that girls’ perceptions about practical work affect their participation during practical work in the topic of Electricity. It also revealed different factors that contribute to either good or poor participation of girls, namely, factors such as mixed-sex group-work, limited science prior experience (knowledge), unequal treatment from teachers during lessons and home environment were identified as contributing to poor participation. Girls however suggested some factors that they think could enable them to participate freely and actively during practical work.

In view of these findings, this study recommends that teacher training institutions should train teachers to plan practical work in a gender sensitive manner. Schools should be provided with

enough materials as sharing materials can contribute to poor participation of girls during practical work especially when they are in mixed groups with boys. There is a need for science teachers to assess the learning taking place during practical work and, finally, textbook suppliers should be monitored in a way that enables the supply of gender sensitive printed materials.

## **DEDICATION**

This thesis is dedicated to my mom, Tuhafeni Absalom, my late dad, Onesmus Munyanyo and my son, for being my source of inspiration.

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## **LIST OF ABBREVIATIONS AND ACRONYMS**

MKO:	More knowledgeable one
STEM:	Science, Technology, Engineering and Mathematics
UNESCO:	United Nations Educational, Scientific and Cultural Organisation
ZPD:	Zone of proximal development
F1:	Focus group interview one
F2:	Focus group interview two
G1:	Girl one
G2:	Girl two
T:	Teacher
L:	One learner
LL:	Majority of learners in a group
LLL:	All learners in a group

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## CHAPTER ONE: SITUATING THE STUDY

*Although worldwide female enrolment at all levels of education is increasing, girls and women still face barriers to education and particularly to science and technology related education at all levels (UNESCO, 2007, p.57).*

### 1.1 Introduction

This chapter introduces the case study focusing on the participation of grade 9 girls during practical work on the topic of current electricity in Physical Science classes. My research interest was motivated both by my personal experiences in the teaching of Physical Science for a period of seven years, and by the research that I had conducted in my BEd honours Science Elective course on the topic of what causes poor participation of girls during science lessons. Regarding my teaching experience, I have always noticed some disparities in the general participation of the girls and boys in Physical Science lessons. I noticed that boys tend to dominate lessons. My study at honours level confirmed this and motivated my decision to conduct a further investigation on the same area focusing on the participation of girls during practical work on the topic of current electricity.

The first section in this chapter describes the background of the study. The potential value of the study suggested is elaborated and this is followed by the research goal and research questions. Thereafter, I discuss the theoretical framework underpinning the study, followed by a list of data generation techniques used in this study. The definitions of concepts used in the study are given in order to assist readers. The outline of the thesis is indicated and the chapter ends with some concluding remarks.

### 1.2 Background of the study

In Namibia, female students' participation in science subjects differs from that of the males, especially at tertiary level (Kasanda, Kapenda & Kanjeo-Narenga, 1999) which is not very different from the situation in other countries (Kasanda & Shaimemanya, 1998). Most girls do

not receive enough support to enrol for science subjects either from their teachers or from their parents (Kasanda, et al., 1999). In the Namibian school system all learners from grade 1 through to grade 10 are expected to participate in science subjects, while in grade 11 they can opt for subjects of their choice which may not include sciences. This selection affects the participation of girls in sciences because those who do not intend to pursue their study in science at grade 11 do not put much effort in their science studies at the lower levels, and this in turn affects their participation during lessons, including practical lessons.

Science subjects become elective at grade 11 and 12 in Namibia, by which stage many girls have already developed perceptions of science as 'difficult'. This impression is a carryover from the colonial curriculum where science subjects were only taught to a few privileged intelligent blacks. This impression seems to be difficult to erase from many Namibian students' minds, and as a result most students in Namibian schools, especially girls, are afraid to pursue studies in science related subjects (Kasanda, et al., 1999). Similarly, Namibian society's beliefs and norms tend to relegate females to inferior positions and to the kitchen in particular. Females are not expected to compete on an equal footing with males in society in general; this situation is sadly carried over to the classroom situation. The classroom interactions and teaching reflects these expectations, as a result female students are mostly left out during classroom interactions and teachers tend to spend more time with boys than girls in the same classrooms (ibid).

According to Gerald's (2001) article at a Reform Forum on the provision of equal access to education for boys and girls in formal schooling in Namibia, some studies reveal that teachers hold negative views about girls' learning capabilities. These negative views drive their treatment of girls in the classroom situation. This is not just a lack of gender awareness in their training or an inheritance from the previous education system; it is also a product of cultural and societal perceptions of women's roles.

It is noted that, in general, enrolment in Physics courses at all levels is low in many African countries (Musasai, Abacha & Biyoyo, 2012). Although the enrolment in Physics is low, some studies show that the enrolment of girls in science fields is increasing. For instance, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) (2007) indicate that the enrolment of females at all levels of education is increasing worldwide, although girls and

women are still facing barriers to education, particularly, to science and technology related education. In many regions of the world, women are more likely than men to be uneducated or undereducated, especially in science and technology related fields (ibid).

Reasons for the low enrolment of girls and women into science fields include inadequate lower level preparation, lack of job opportunities outside the teaching profession, inadequate teaching qualifications as well as possession of below standard pedagogical content knowledge (Semela, 2010). Other issues linked to low enrolment in sciences at secondary schools include a shortage of inspirational and well-trained teachers, inadequate laboratory facilities and the accompanying limited exposure to practical instruction (Daramola, 1987).

De Welde, Laursen and Thiry (2007) in their report for Science, Technology, Engineering and Mathematics (STEM), indicated an explanation for the low number of women at all stages of STEM careers despite the large number of enrolment of women in education. They stated that the classroom climate for girls in school classrooms and for women students and faculty in university departments has been classically described as ‘chilly’. That is, girls and women are treated differently, for example, teachers give more attention to boys in the class and boys are praised by the teachers more than girls are. Girls pick up these biases, and tend to see themselves as inferior, thus hindering their participation.

The findings of Mutekwe and Modiba (2012) about girls’ career choices as a product of a gendered school curriculum in Zimbabwe showed that boys receive more teacher-initiated contact from teachers by the amount of questions boys are asked compared to girls in the same classroom, by the opportunity of contributions that boys are granted to make during classroom discussions, and by the feedback that boys receive from the teachers.

Textbooks also convey gender stereotypes. According a study by Gudhlanga, Chirimunta and Bhukuvhani (2012), on moving towards a gender inclusive curriculum in Zimbabwe’s education system, there are a number of examples of gender stereotyping in the textbooks such as doctors and engineers typically being depicted as males and females depicted as nurses. The more active roles are portrayed as male while passive roles are portrayed as roles which women should fill. This case, however, is not limited only to Zimbabwean schools. Bhusumane (1993) found that

textbooks in Botswana schools are gender biased, and notes that most of the textbooks contain stories in which men are portrayed as dominant, superior and more able than women.

This gender inequality has a negative impact on girls' education, specifically on their performance. Mutekwe and Modiba (2012) studied the prevalence of patriarchy and gender role ideology in co-educational schools. Girl participants revealed that teachers think that boys know better than girls and as a result of this stereotype tend to pose more questions to boys than to girls. Sometimes teachers make comments such as, '*Boys, please do not be as quiet as girls in classes*' (p. 285). Girls participating in the study felt that boys are expected to be more vocal in the classroom than them and were surprised that even female teachers ridicule girls who want to compete with boys. The study revealed that female teachers make gendered comments such as, '*You reason like a boy*' (p.285) and ridicule girls with remarks like, '*If you continue behaving like a boy, you may never get married*' (p.285).

Ifegbesan (2010) suggests that to steer clear of gender bias in the classrooms, teachers should avoid using language that limits one gender from participating in the classroom interaction, and notes that there is a need to make girls aware that they are equal to boys. He also suggests that teachers need to be able to choose gender-neutral educational materials to use during teaching as a step to combat this bias.

As I have already stated, the participation of girls during practical activities is gender related: the stereotypes carried by both teachers and learners themselves affect the way learners behave in the classroom. When these stereotypes persist, the whole learning process is affected and the cognitive development of learners will be limited or absent. It is therefore critical that science teachers become aware of their own stereotypes as well as those which learners bring with them into the classroom. This awareness will make it possible for teachers to assist learners in identifying any other stereotypes that hinder them from learning sciences. Once these stereotypes are identified, students would be able to participate actively in all lessons, especially in lessons that involve practical work. If they are participating actively during practical work their chances of performing better in science subjects could be enhanced.

In a different vein, students themselves are shaped by the stereotypes of people around them. Besides the differences in the ways boys and girls do behave, there are differences in their ideas on how they should behave – those things which are ‘boyish’ or ‘girlish’. The differences in behaviours resulting from gender stereotypes lower the self-esteem of girls concerning their scientific abilities. In cases where girls are not made aware of how to deal with these stereotypes, they continue to underestimate their ability to the extent that they believe that science is too difficult for them. As a result, they often choose alternative fields that are non-scientific (Halpern, Aronson, Reimer, Simpkins, Star & Wentzel, 2007).

On a more personal note, within my own science teaching experience, I have been on a journey of discovery concerning gender issues in the science classroom. Previously, I was unaware of the relationship between gender and science education even to the point of considering boys better suited to hands-on science activities. Now I continually work to be mindful of the kinds of examples I use in the science classroom, intentionally planning lessons with gender issues in mind and placing emphasis on practical activities which involve all learners equally. In my experience, girls in the science classroom really do bring societal stereotypes with them, but by being aware of this, I am able to help them move beyond those stereotypes and affirm their capability by including them in practical activities.

### **1.3 Rationale for the study**

From the background of the study, it is made quite clear that the Namibian education system is aiming to provide quality and free education to all Namibian citizens. The ‘Learner Centred Education (LCE) Policy’, within its gender and cultural discourse, emphasises that every learner should be empowered to learn to the best of her/his ability. Teachers must have a holistic view of learners, valuing each learner’s life experience as the starting point of their learning. The Learner Centred Policy allows teachers to select the content and methods that suit and respond to the learners’ needs. All learners must participate actively by bringing in their prior experiences (Ministry of Education, 2003). The LCE approach calls for all learners in the classroom to participate actively irrespective of their gender.

In the context where girls are treated differently to boys, as discussed in Section 1.2, another set of factors arise which can result in poor participation of girls in science. For this study, I intended to find out the perceptions and experiences of girls on practical activities; I also intended to identify factors that enable and those that constrain girls' participation during practical work. I have chosen this topic because practical activities form an integral part of science teaching and learning and if a learner does not actively participate in these learning activities, learning science will be a meaningless process.

#### **1.4 Potential value of the study**

The value of doing research in the participation of girls during practical activities is that it might provide some insights into what enables or constrains the participation of girls during practical work and in doing so pave the way forward for further comprehensive research on gender differences in science learning. This study might also provide useful information to teachers, society, schools and curriculum developers to address gender issues in science education. It might also assist in narrowing or closing the gender gap regarding participation of boys and girls in practical work during Physical Science lessons, especially in mixed sex classrooms.

#### **1.5 Research goal and research objectives**

The main goal of this study was to investigate how grade 9 girls participate during practical work in Physical Science lessons in current electricity. To achieve this goal the following main question was asked:

##### **Main question:**

How do grade 9 girls participate during practical work in Physical Science lessons in current electricity?

To answer the main research question, the following sub-questions were asked:

- What are grade 9 girls' perceptions and experiences about practical work in current electricity?

- What is the observed participation of grade 9 girls during practical work in current electricity?
- What enables grade 9 girls to participate during practical work in current electricity?
- What constrains grade 9 girls' participation during practical work in current electricity?

## **1.6 Theoretical framework**

The classroom is a social unit where learning takes place. In this social unit learners from different backgrounds interact with each other and with their teachers too. In their interaction process they learn from their teachers and other learners. These interactions result in learning which results in cognitive development. Mediation is then necessary to bring in cognitive development through a scaffolding process. Mediating tools can be either language which is useful for social interactions, or artefacts which are useful during practical activities. From this socio-cultural perspective, Vygotsky's (1978) theory of learning and social constructivism and a constructivist learning approach were seen as appropriate for this study. A detailed discussion of the theoretical framework is provided in Section 2.5.

## **1.7 Data generation techniques**

The following data generating techniques were used:

- Document analysis
- Questionnaire
- Observation
- Interviews

I have used different data generating techniques to enhance validity trustworthiness of data in this study.

## 1.8 Thesis outline

This thesis documented the findings from 30 grade 9 learners at Mwatya (pseudonym) Junior Secondary School in Ohangwena region. It consists of six chapters and they are presented as follows:

In **Chapter 1**, I presented an overview of the context and the background of the study, the motivation for carrying out this study, the research goal and research methodology including data gathering techniques and the theoretical framework underpinning the study. The rationale and potential value of the study is stated, a definition of key concepts is provided, the thesis is outlined and concluding remarks are given.

In **Chapter 2**, I reviewed the literature relevant to the study. The literature is divided into different units such as: the views of the curriculum on practical activities; the role of practical activities; and general participation of girls during practical work. Herein the theoretical framework underpinning the study is discussed.

In **Chapter 3**, I presented the methodology used in this study. Firstly, I presented the interpretive paradigm which informed my study. I then discussed the different data generation techniques that I used, followed with the research site and participants. Ethical considerations are also discussed together with how validity and trustworthiness were ensured in this study.

In **Chapter 4**, I presented and analysed the data gathered using different techniques including document analysis, questionnaire, observations and interviews. The data is presented in two main sections. In section A I have presented the data from questionnaires while section B consists of data gathered from document analysis, observations and interviews.

In **Chapter 5**, I interpreted and discussed the data in relation to the relevant and available literature reviewed in Chapter 2. Data is discussed in sub-titles and categories which emerged from the data analysed and presented in Chapter 4.

In **Chapter 6**, I presented a summary of findings, provided some recommendations that might be useful for future planning as well as areas for future research. The limitations of the study, personal reflections and the conclusion are provided.

### **1.9 Definition of concepts**

I define terms used in this study as follows:

**Investigation:** Finding out about something in a systematic way.

**Participation:** To take part in the activities going on in the class.

**Practical work:** This refers to all the activities that require the use of hands-on materials to mediating learning.

**Perceptions:** The act of perceiving or apprehending by means of the senses or of the mind; cognition; understanding.

**Gender:** Either the male or female division of a species, especially as differentiated by social and cultural roles and behaviours.

**Sex:** The state of being female or male.

### **1.10 Concluding remarks**

In this chapter, I presented an overview of the study. I started with the background of the problem, whereby the place of women and girls in Namibian education and worldwide is discussed. In addition, the general issues of girls in science education are also discussed.

The role of practical activities in Physical Science is discussed in this chapter. The rationale for the study is also explained based on the curriculum views on the practical activities. The research goal is stated together with the research questions. The theoretical frameworks, techniques used to gather the data, potential value of the study, definition of concepts used in the study and the thesis outline are all discussed in this chapter. In the next chapter I review relevant literature that informed my study.

## CHAPTER TWO: LITERATURE REVIEW

*A literature review establishes and justifies the need for the research to be conducted, and establishes its significance and originality (Cohen, Manion, & Morrison, 2011, p. 121)*

### 2.1 Introduction

In this chapter of the study on how girls participate during practical work in Physical Science lessons, I discuss the literature that informed my study. The reviewed literature looks at the following issues:

- Gender in Namibian science curriculum;
- Girls' participation in science ;
- Girls' perceptions about the topic 'electricity';
- The role of practical work in learning Physical Science; and
- The theoretical framework that underpins the study.

### 2.2 Gender in Namibian science curriculum

Within the mainstream of science education in Namibia, all learners are expected to take Natural Science subjects as from lower to junior secondary level. At the senior secondary level, they have to choose their field of study such as sciences, social sciences, commerce and so on.

The Natural Sciences are fundamental in fostering the development of logical thinking skills and form part of the foundation needed for pursuing most careers. It is therefore important to include gender perspectives in the curriculum in order to raise awareness of gender stereotyping (Ministry of Education, 2010, p. 3). Natural Sciences include practical activities in their curriculum which are highly recommended for enhancing learning and better understanding of the subjects. It is therefore recommended that the best approach to teaching and learning must include active involvement of learners in the learning process through a high degree of participation, contribution and production (ibid). Each learner should be treated as an individual

with his or her own needs, pace of learning, experiences and abilities. Cooperative and collaborative learning should be highly motivated wherever possible. Practical activities or demonstrations are considered essential and all learners (irrespective of their gender) should be exposed to them, both during teaching and as preparation for assessment (ibid).

As briefly alluded to in Section 1.2, the inclusion of practical work in teaching Physical Science is clearly stipulated in the national documents such as the Physical Science syllabus (2010). The review of the syllabus revealed that practical activities are essential in teaching, thus their inclusion in the teaching process is compulsory. The syllabus states that:

*Suggestions for practical activities or demonstrations are included at the end of each topic. These suggestions for practical activities or demonstrations are considered essential and all learners should be exposed to them, both during teaching and as preparation for assessment (Ministry of Education, 2010, p.6).*

It is therefore necessary to make sure that all learners in Physical Science lessons are participating actively in practical activities as appropriate practical activities enhance learners' experiences, understanding, skills and enjoyment of science enabling students to think and act in a scientific manner (Musasia, Abacha & Biyoyo, 2012).

All teachers are obliged to promote gender equality in all spheres of life. In all the activities carried out within the scientific area of study, female learners should gain confidence which will motivate them to continue in the natural science stream throughout their school career and beyond (MoE, 2010). To attain this, teachers are expected to know the potential behavioural differences between boys and girls and be aware of how to respond to them. It is very important that teachers are aware of their own ways of learning; this makes it easier for them to understand better that learners also have their own ways of learning and they should understand that their preferred teaching methods may not suit all their students. A 'one size fits all' approach does not work in the classroom environment (Gurian, Stevens & King, 2008).

### **2.3 Girls' participation in Science**

Ndunda (1999) states that many Namibian science teachers have low expectations of girls and that they generally believe that girls cannot do as well as boys in science subjects. In addition, Mwetulundila (2000) emphasises that teachers unwittingly allow boys in mixed schools to dominate equipment. Teachers generally encourage boys to carry out the experiments and girls are left having to ask the boys to show them how they have done it; an environment that creates a norm where boys are the ones who render assistance while girls constantly need to be helped.

Mwetulundila (2000) stressed that males carry more informal experiences of practical science into science classrooms when compared to girls, and that this sets boys up as insiders to science, more so than girls. Boys are more likely to have repaired bicycles, for example, or to have handled the tools that are commonly found in science laboratories, and this affords them added advantages in familiarising them with science. Unlike the experience of boys, toys which girls typically play with as children do not prepare them for the science classroom.

Haambokoma (2000) conducted a study which investigated the factors contributing to the low number of Zambian females choosing to train as science teachers and found that there were numerous factors within the school environment which can influence girls' attitudes toward science. He pointed out factors such as gender biased classroom interactions which favour boys, teachers' negative attitudes towards girls and poor attitudes of boys towards the girls. He further argues that boys often mock girls and use abusive language that insults them, lowering their self-esteem and confidence and preventing them from expressing themselves in such an environment.

Gender diversity is essential to creativity and innovation, and science is an area in which the input of both men and women is needed. Encouraging more women to enter the field of science and allowing greater public understanding of their individual personal qualities will help to address the issues of gender stereotypes in science education (Rocard, Csermely, Jorde, Lenzen, Walberg-Henriksson & Hemmo, 2007).

Chikunda (2010) conducted a study assessing the level of gender awareness of science teachers in two Zimbabwean education districts and he found that about 86% of the teacher participants indicated that it is necessary for them to discourage girls from being passive onlookers and

encourage them to participate actively in science activities. This indicates that although teachers are moving towards a more gender responsive science curriculum, they still negatively compare the behaviour of boys with girls in the classroom.

## **2.4 Girls' perceptions and attitudes towards science**

Some researchers in Africa studied self-concept and performance in science, and concluded that if girls believe they are doing well in science they will continue to study it further and conversely if they think that they are not doing well the likelihood is that they will drop out (MacKay, 2011). Clegg (2007) further adds that unfortunately girls do not believe they are as good as boys in subjects such as mathematics and physics even where this is objectively not the case. It seems that girls are socialised into this low Physical Science self-concept by various forces circulating at home, at school and within the wider society. Halpern, et al. (2007) adds that, girls only choose science courses and perform well if they have strong self-belief regarding their scientific abilities. This implies that girls can only be retained in science fields when their self-confidence is improved, as high self-confidence influences them positively in choosing science and performing better in scientific subjects (ibid).

Many girls live in societies where they are perceived as less capable than boys in a variety of areas, and the field of science is no exemption. Girls receive daily cultural cues that reinforce the stereotype of science as male domain (Mwetulundila, 2000). Kalu (2005) adds that in these contexts, women are expected to: be subservient to men; leave decision making to men; and to not be outspoken in public, especially against men. These social expectations on males and females affect classroom interactions because teachers perpetuate, consciously or unconsciously, the long held view of science being considered inappropriate for girls (Chikunda, 2010).

Although teachers have the potential to be influential role models in science fields, they lack an awareness of this influence, instead underestimating the significant role they could play in countering the widespread stereotypes about sciences. It is only when teachers are aware of their own stereotypical ideas as well as the impact they can have on others, that they can change the mindset of children regarding gender and science (Milgram, 2007).

It is therefore of critical importance that science teachers understand students' identities and how these overlap or do not overlap with school science identities. As some writers have put it,

*We need to understand how students are constructed and construct themselves as girls, as members of a particular racial or ethnic group, as a "good" girl, as an athlete, and how these identities overlap in important ways with students' views of scientific identities* (Brickhouse, Lower & Schultz, 2000, p.444).

It is noted by Musasai, et al. (2012) that science teachers' education correlates positively with their learners' achievements. The theoretical content and pedagogical content knowledge possessed by the teacher, the ways in which teachers deliver instructions to their learners, and teachers' attitudes toward science have been shown to have an impact on student learning and achievement. These factors are also true of the laboratory environment. It is unlikely that teachers with low pedagogical content knowledge will be able to draw meaning from practical and experimental work, which requires high level abstraction.

As highlighted in the findings from the DelpHE project about girls in science and technology, girls at secondary school were observed to be less able to participate in team work especially in mixed sex schools. Teachers who teach in mixed sex schools were observed to interact more with boys than with girls. It was also observed that boys have a tendency to dominate the class by undermining girls' confidence (Abbott, Tukahabwa, Nzabonimpa & Sapsford, 2010).

McCullough (2004) emphasised suggestions made by other researchers that science teachers need to be aware of the contexts they use in their classrooms, so that they do not unknowingly disadvantage the girls that they teach. By knowing context and contextual biases, classrooms can be more accommodating to girls and they can invite a broader participation of girls in science classrooms.

Textbooks also convey gender stereotypes. According to the study conducted by Gudhlanga, Chirimunta and Bhukuvhani (2012), which focused on moving towards a gender inclusive curriculum in Zimbabwe's education system, there are a number of examples of gender stereotyping present in the textbooks. In these textbooks, more active roles tend to be depicted as male, while passive roles are reserved for women, for example doctors and engineers always

being depicted as males and nurses as females. These cases are not, however, only restricted to Zimbabwean textbooks.

## **2.5 How home environment affects the participation of girls during practical work?**

Some studies have suggested that gender differences in performance of learners at school are deeply linked to home and school environments, more so than they are dependent on innate differences (UNESCO, 2007). Many reasons for girls being less interested in scientific subjects are socio-cultural in nature, involving attitudes toward and beliefs about what is considered appropriate for girls and women. These attitudes are frequently passed on from parents to their daughters (ibid) and these negative stereotypes impact on girls' interest in science and contribute to anxiety when doing science. Gurian, Stevens and King (2008) stressed that girls and boys are not only different biologically but also in the way they are perceived and in the way they behave; only when teachers are aware of the potential differences between boys and girls and know how to respond to them, is it possible for significantly effective education for both boys and girls to take place.

Science is still largely considered as 'a man's world' and not suitable women by many people. People still believe that science is difficult and dull, and that all scientists are 'geeks' and 'socially inept' (Halpern, et al., 2007). As most parents are unaware of their stereotypes regarding sciences (ibid), they either consciously or subconsciously tend to raise their sons and daughters differently. When children are playing, for instance, girls are expected to play with dolls, crayons and other social and creative toys. In contrast, boys are expected to play with cars and other technical toys. Since girls play less with technical toys, this prevents them from gaining greater technical experiences at an early age which would set them up for later success in science (Milgram, 2007).

## **2.6 Girls' perceptions about the topic 'electricity'**

I studied the findings of the research report compiled by Rennie, Parker and Hutchinson (1985) concerning the effect of in-service training on teacher attitudes and primary school science classroom climates in Australia. In the study, children were asked about their enjoyment and perceptions on the topic of electricity. Girls did not expect to enjoy the electricity work as much

as boys, possibly because they did not have enough experience in this area. However, when they started to work with electricity they found it very interesting and started liking it.

Rennie, et al. (1985) also discussed findings on the perceptions of competence in working with electrical components, stating that most boys were perceived to be good at handling components, and that boys perceived themselves as competent to handle the components properly. On the other hand, girls were perceived as less competent than most boys, and saw themselves as less capable of handling the components correctly. This study indicates that girls have low self-confidence in this area of science.

## **2.7 The role of practical work in learning science**

The science classroom is seen as a cultural setting with mediating tools that learners use to achieve particular learning goals with the help of more knowledgeable others. The specific science tool-conventions might include how to read a thermometer, how to focus a microscope, and how to create a bar graph to record the height of growing plants. Science classroom artefacts might include worksheets, use of calculations and science texts (Scott & George, 2012).

Additionally, Millar (2004) defines practical work as any teaching and learning activity which involves the learners in observing or manipulating real objects and materials. The main aims of these types of activities are to draw the students' attention to the phenomenon, to isolate parts of the phenomenon for scrutiny and to provide room for discussion as a way of thinking about it. Abell and Lederman (2007) defined practical activities as those which include learning experiences in which students interact with materials or with secondary sources of data to observe and understand the natural world.

Akhtar and Hussain (2013) add that the term 'hands-on' activities refers to the activities that may or may not be actual experiments such as observations and measurements, and that they are not necessarily always carried out inside the laboratories, but include all the activities that allow students to handle, use and observe scientific processes. Practical activities are further described as learning experiences in which students interact with materials and/or models to observe and understand the natural world (Hofstein & Lunetta, 2003).

Millar (2004) states that practical activities are irreplaceable when a teacher is teaching something that the students are unlikely to have observed, or observed it in insufficient detail, in their everyday lives. He further posits that practical activities motivate students to pursue their own enquiries and that these activities tap into the students' natural curiosity. In this environment, students discover things for themselves through their own efforts, which may also help them to remember the process more readily.

Researchers have advocated that creativity and higher order of learning can be gained by the use of hands-on activities. Hodson (1990) stressed that practical work allows learners to develop abstract ideas from concrete situations, and arouses a greater curiosity in learners. Musasai, et al. (2012) add that if practical work is practiced in the right manner from an early age, critical thinking skills can be obtained because practical work puts the students in the centre of learning where they are able to participate, rather than being told about things. In this way the desire and eagerness to know more about what the subject can offer is developed.

Helliar and Harrison (2011) point out one important role of practical work in science teaching: that it links and scaffolds scientific concepts with real world situations giving relevance to the subjects which helps students to understand the difficult matters of the subject. They further add that good usage of practical work clarifies abstract phenomena and gives greater relevance, ownership and insights to students studying science. As noted by Millar and Abrahams (2009), the aim of science teachers during science lessons is to extend students' knowledge of the natural world and to develop their understanding of the ideas, theories and models that the scientists found to be useful in explaining and predicting certain behaviours. This is better understood when a teacher shows things to learners or exposes them to situations in which they are able to observe things themselves.

Millar and Abrahams (2009) stress that practical activities enable the students to observe objects, materials and events; this helps them to remember them. It also helps students to understand the ideas that are used in science to describe or explain observations. For students to attain all this, they need a particular set of ideas drawn from the perspectives of the activities that are making sense to them. In addition, Musasia, et al. (2012) advocate that practical work in Physics assists learners to develop familiarity with apparatus, instruments and equipment. This helps learners to

acquire manipulative skills and become experts in reading of scales, thus allowing learners to gain understanding of Physics concepts. Millar and Abrahams (2009) argue that ‘doing’ is as important as ‘thinking’ and suggest that involving learners in ‘hands-on’ and ‘minds-on’ activities might be the best way to attain understanding of concepts.

Akhtar and Hussain (2013) also highlight the importance of hands-on activities in students’ learning of science and encourage teachers to do more than just lecture their learners, but rather allow students to experience science interacting with materials and equipment. Through these interactions, learners observe scientific phenomena which enhance learning of the theories associated with the phenomena. The use of hands-on activities in science teaching satisfies the need for concrete experiences in science instruction, which is advocated because it enhances students’ learning and provides a more authentic view of science for learners. Practical activities are proven to be a fruitful and effective means for learning, allowing learners to switch between collecting data, processing and interpreting it.

Roberts (2004) described practical work as more than a way of teaching due to its capability of ‘developing practical skills and techniques’, causing learners to become ‘problem-solving scientists’ and helping learners to get a ‘feel for phenomena’.

A study, conducted by Maselwa and Ngcoza (2003), aimed to investigate the impact of ‘hands-on’, ‘minds-on’ and ‘words-on’ practical activities in facilitating learners’ conceptual understanding of electrostatics. The study revealed the following experiences and perceptions of learners about practical activities: learners enjoy the way science is being taught at their school because their teachers do practical work with them; practical work that is done in groups is more enjoyable especially when the teacher asks them questions in order to ensure they have understood; and practical work exposes learners to manipulating apparatus, helping them gain manipulative and observation skills that stimulate their interest and enhance their understanding of the scientific and concepts. Maselwa and Ngcoza (2003) further added that learners’ belief that science is difficult can be addressed through the use practical work.

Maselwa and Ngcoza’s (2003) study also revealed that although learners enjoy doing practical work in groups, they prefer doing it themselves instead of a teacher demonstrating to them because teachers’ demonstrations are sometimes too fast and learners cannot really benefit from

them. The study showed that group practical work needs full participation and cooperation from all learners, and that learners need the chance to explain what they have learned and how they understood what they have learned during the activity to others and to the teacher. Demonstrations and laboratory experiments are regarded as attempts to create a cooperative learning environment for students. A cooperative environment is known as a collaborative learning environment where students learn by working together to understand concepts rather than passively absorbing information (Grosling, 2004).

## **2.8 Critiques of practical activities**

Helliar and Harrison (2011) suggest that not all the students learn from practical work as many authors and researchers are contesting. Hodson (1990) suggests that practical activities at times can be “ill-conceived, confused and unproductive” and states that if implemented inappropriately they provide little real educational value to learners. Hodson (1990) further states that young children can be motivated to learn by giving them an opportunity to manipulate apparatus or to make observations; while older children are motivated by cognitive stimulus such as exploration of ideas and investigations of “inconsistencies, or confrontation of problems”. Despite the belief among teachers that practical work has the capacity to motivate learners; it seems unrealistic to expect all learners to be motivated in the same way. Motivation is not aroused by just doing practical work; learners need to be provided with interesting and exciting experiments that allow them a measure of self-directed investigation (*ibid*).

Musasai, et al. (2012) suggest that the reality on the ground is that most practical activities are sterile and non-insightful, and that their purpose is often lost on the learners. This can happen when demonstrations are done by teachers who can miss the purpose the demonstration; when practical activities are done in small groups but follow-up discussions are unproductive; when limited planning and formulation of hypothesis is done by the teacher; when experiments are derived from mostly irrelevant cultural settings; and when equipment is in poor condition. This shows that just because practical activities may be taking place in the science classroom or in the laboratory, this does not guarantee that students are developing their learning of science.

Teachers’ perceptions of learners are significant in determining whether a particular teacher would engage in practical work with learners or not. According to Hatting, et al. (2007), teachers

who perceive their learners to be motivated and non-disruptive are more likely to engage their learners in higher-level practical work. Another important factor to consider is the attitude of the school and the teacher towards innovation. If a school values and support innovation, it is more likely that science teachers will engage in higher levels of practical work (ibid).

## **2.9 Theoretical framework**

This study is underpinned by social theories (constructivists' views) enriched by gender lenses as a way of understanding the intersection of practical activities and gender in Physical Science teaching and learning. In a constructivist view, learning is individualised, it is social and occurs within a context, and knowledge is acquired through active construction and reconstruction of meaning (Fraser, 2006). This study focused on the participation of girls during practical activities, as active participation is one of the essential features of knowledge construction, and the participation of learners during practical work facilitates the process of knowledge acquisition.

The laboratory or classroom where the practical work is carried out is a social space in which learners are interacting with their teachers and with other learners. As socio-cultural theory emphasises that both the social and cultural world co-determine the way in which people approach learning in various settings, and social constructivism refers to the idea that knowledge can be situated on the social plane (Davidson, 1999), it seems logical that a social theory of learning is a useful theoretical lens for this study. However, in this study I also rely on gender lenses to tease out pedagogical practices as they relate to patriarchal power socialisation and sex-role expectations inherent in most African communities.

### **2.9.1 Socio-cultural perspective**

Socio-cultural theory is Vygotsky's learning theory which looks at the importance of society in the development of an individual. It describes the interaction between the development of people and the culture in which they live. This development depends on the interaction of people with the tools that the culture provides to help them form their own view of the world (Gallagher, 1999). One way in which cultural tools are passed on from person to person is instructed learning which involves remembering the instructions of the teacher and then using the instructions to

regulate you (ibid). According to Scheon (2011), socio-cultural philosophy is a theory which is concerned with how individuals, social and contextual issues impact human activity, especially learning and behaviours.

From a socio-cultural perspective, classroom activities are tied to cognitive development by the premise that learning is social in nature and the classroom activities constitute the patterns taking place in the classroom between the teacher and the learners or among the learners themselves. Children's cognitive development occurs through guided participation in social interactions with more experienced people, which means that what children can do with the help of other people may be more indicative of their mental development than what they can do alone. Socially supported activity in the zone of proximal development (ZPD) (Vygotsky, 1978) 'awakens and provides' paths for intellectual development (Allahyar & Nazari, 2012).

Vygotsky believed that any pedagogy creates learning processes that lead to ZPD. A ZPD is described as the difference between the actual development level as determined by individual problem solving and the level of potential development as determined through problem solving under the guidance of a more knowledgeable person (Gallagher, 1999).

If socio-cultural theory places an emphasis on how individuals develop through the use of cultural tools, then it is important to look at how boys and girls are treated differently to track their development process. If the true measure of intellectual development is related to the presence and guidance of a more knowledgeable other to scaffold learning, then in the context of the science classroom, girls are at a distinct disadvantage. Where girls are less involved in interactions in the science classroom and during practical activities, and where teachers pay more attention to boys during learning (see Section 2.4), girls' chances of effectively learning Physical Science are diminished.

According to Hedegaard (1990), Vygotsky's zone of proximal development connects a general psychological perspective on child development with a pedagogical perspective on instruction thus psychological development and instruction are both socially connected. In order to understand both of these perspectives, society and social relations need to be analysed. Using a socio-cultural lens, development is attained through social interaction making it of utmost

importance that teachers interact with all learners during lessons, helping them to attain the maximum level of development.

Scott and Palinscar (2013) argue that to understand the relationship between development and learning, the two developmental levels must be differentiated as ‘actual’ and ‘potential’ levels. The ‘actual’ is the level of development that refers to what a child can do alone or perform independently while the ‘potential’ level is the one that involves the ‘ZPD’ or what a child can do with the assistance of the More Knowledgeable One (MKO) (ibid).

In a patriarchal context, however, where teachers carry biases that boys are more capable than girls in Physical Science, the potential level of development of girls is hindered. As discussed in Section 2.4, teachers tend to interact more with boys, ask more questions of boys than girls, and praise boys in class more than girls, minimising not only the process of zone of proximal development for girls in Physical Science lessons, but also the opportunity for girls to develop abstract knowledge from concrete activities, as was stressed in Section 2.6.

### **2.9.2 Social constructivism**

Social constructivism sees learning as a social process whereby students acquire knowledge through interaction with their environment instead of merely relying on the teachers’ lectures (Fraser, 2006). McRobbie and Tobin (1997) define social constructivism as a construction of knowledge which is socially mediated through cultural experiences and interactions with others in the same culture. They further assert that a social constructivist perspective on learning suggests that learners should have control over their own learning and be able to construct meanings for their experiences in terms of what they know at the time of learning (p.199).

However, in the context where females are perceived as less powerful than their male counterparts, opportunities to construct meanings will be limited and learning will be hindered. As it is the belief of social constructivists that learning is socially mediated through cultural experiences and interactions (as discussed in Section 2.4), in a patriarchal context in which teachers and learners themselves are holding gender biases, interactions are limited for girls. This could potentially affect girls’ participation during the learning process.

### 2.9.3 Mediation of learning

Mediated learning is the social interaction between the teacher and learner for the purpose of enriching the students' learning experiences (Presseisen & Kozulin, 1992). Feuerstein (1979) as cited in Fraser (2006) sees the child as an individual who is malleable, capable of being changed and modified. Vygotsky (1981) argues that human activities and mental functioning are mediated and facilitated by tools, cultural practices, and artefacts, the most effective tool among these being language (Gibbons, 2003).

According to Peer and McClendon (2002), social constructivism is based on the work of Vygotsky, who asserts that cognitive development is rooted in social interactions and mediated by abstract symbols that are referred to as tools. These tools are not created in isolation but rather produced by socio-cultural evolutions of individuals who are actively involved. This is where the main concept of Vygotsky's work comes in, which is called the '*Zone of Proximal Development*' (ZPD). The zone of proximal development is defined as the distance between what one can achieve alone and what one can achieve with the help of others. This idea emphasises that humans develop higher cognitive levels when the gaps in their thinking and problem solving are supported by either adults, peers or more capable others. This type of support is called *scaffolding* (ibid).

Peer and McClendon (2002) further clarify that a scaffolding process consists of creating supported situations in which students extend their current skills and knowledge. The strategies used during scaffolding help students to make connections between old and new information in a social, active environment. In the active learning environment, students are constantly analysing, puzzling over significance, searching for explanations, and speculating about relations between experience and what they already know. If the process is used liberally, it stimulates students' interest and also simplifies tasks so that they become meaningful to them. It also motivates students to pursue their goals. In the constructivist model, peers and instructors are the ones that provide the scaffolding by relating concepts and principles to real situations which lead to new knowledge development.

The Vygotskian theory emphasises that development of the child's higher mental processes are highly dependent on mediation (Kozulin, 2003), and that what teachers do during the process of

mediation is important because it enables learners to participate in activities that will help them learn. The teacher cannot learn for the learners, the best the teacher can do is to provide clear guidance and assistance that makes it easy for students' learning processes (Fraser, 2006). According to Kozulin (2003), the socio-cultural theory suggests that the style of human mediation cannot be properly comprehended unless the role of available symbol mediators is acknowledged. According to Vygotsky, symbolic tools for mediation should be appropriate to the child's context for particular socio-cultural activities, the most important of which he considered as formal education. One should, however, know that symbolic tools are always appropriated in terms of the goals of the given community in which learning is taking place.

During the mediation process, the educator should broaden the child's environment thus helping a child to connect the previous experiences to the child's background. Educators should consider creating learning opportunities where learners are acquiring knowledge and skills through critical and creative thinking, research, group discussions, group work, role play, chart work, experimentation and solving real-life problems (Fraser, 2006). In a patriarchal context where girls regard themselves as less capable of doing science, as discussed in Section 2.4, the mediation process that involves acquiring knowledge through group discussion and group work would be ineffective, due to the stereotypes girls hold about themselves.

## **2.10 Concluding remarks**

In this chapter I have explored the literature that relates to my study, focusing on two main themes: participation of girls in science practical work; and the role of practical work in learning science. It has been argued that learners' performance in science activities is not dependent on their gender. What does play a role, however, is the type of society the learners have grown up in, and the kinds of gender expectations they bring to the learning environment. In a school setting where teachers and other educational stakeholders are invested in a process of change, these expectations and stereotypes can be effectively challenged.

It has also been argued in this chapter that practical work is just another way of presenting science that many teachers believe to be more effective in helping learners acquire higher cognitive development of science concepts. I briefly discussed the participation of girls during

practical work in relation to the constructivist theoretical framework that informs the study. The discussion focused on socio-cultural theory and social constructivism, attempting to show how these theories influence the teaching and learning of sciences. This chapter also looked at mediation of learning, which allows for the cognitive development of a child as well as how these theories will be used in analysing the data in the study. In the next chapter I discuss the data gathering process, and look at how data gathered was analysed.

## CHAPTER THREE: METHODOLOGY

*In general, qualitative research generates rich, detailed and valid (process) data that contributes to in-depth understanding of the context (Anderson, 2006, p.3).*

### 3.1 Introduction

The goal of my study was to investigate how girls in grade 9 participate during the practical work which forms an integral part of science teaching and learning. This chapter provides a detailed overview of the methodological framework that has guided the research process in this study. The purpose of selecting a qualitative case study within an interpretive paradigm is to explore the problem in this study. This chapter also describes the research process, that is, the data gathering procedures, the instruments used, data analysis procedures, validity and trustworthiness, ethical considerations and limitations of the research design.

### 3.2 Research design and orientation

Research design is a skeletal structure of the research project which guides the researcher in gathering, analysing and interpreting observed facts (Bless & Higson, 1995). Kumar (2011) defines research design as a plan of investigation so conceived as to obtain answers to the research questions or problems (p.94). The research design is procedural and its function is to ensure that these procedures are adequate to obtain valid, objective and accurate answers to the research questions (ibid). It specifies how the research question will be answered, thus providing the glue that holds the research project together (Donnelly & Trochim, 2008).

#### 3.2.1 Research paradigm

A paradigm consists of ontology, epistemology, methodology and methods (Scotland, 2012). Ontology is concerned with what constitutes reality whereas epistemology is concerned with how knowledge can be created, gained and communicated. Methodology is the plan of action and methods refer to specific techniques and procedures of gathering data and how to analyse

them. Each paradigm is therefore based upon its own ontological and epistemological assumptions (ibid). This research study is situated within the interpretive paradigm.

An interpretive paradigm is characterised by a concern for the individual, and the central endeavour in the context of the interpretive paradigm is to understand the subjective world of human experience (Cohen, Manion & Morrison, 2011). Interpretive methodology is directed at an understanding of a phenomenon from an individuals' perspective by studying the interactions among individuals as well as the historical and cultural contexts which people inhabit (Creswell, 2009). The role, therefore, of the scientist in the interpretive paradigm is to “understand, explain, and demystify social reality through the eyes of different participants” (Cohen, et al., 2007, p.19). The duty of the researcher in this paradigm is to seek understanding rather than to provide explanations (Mack, 2010).

This study adopted an interpretive approach in order to understand how girls participate during practical work in Physical Science lessons. It helped me to get a clear understanding of the disparities in participation between boys and girls in Physical Science lessons and allowed me to investigate the problem from the perspective of the girls involved. Scotland (2012) notes that interpretive methods yield insights and understandings of behaviours, explain actions from the participants' perspective, and do not dominate the participants (p.12).

Cohen, et al. (2011) adds that in order to maintain the integrity of the phenomena being investigated, the researcher must make an effort to truly understand the unique perspective of the individuals under study. Thus, interpretive researchers begin with individuals and set out to understand their interpretations of the world around them (Cohen, et al., 2011, p.18). Within the interpretive paradigm, this research study employed a qualitative case study methodology, which I discuss below.

### **3.2.2 Research approach**

Within the interpretive paradigm a case study approach was employed. A case study is an intensive study of a specific individual or specific context (Donnelly & Trochim, 2008). A case study provides a unique example of real people in real situations whose context is distinctive and dynamic. The human relationships and other factors in this unique instance help to establish

cause and effect (Cohen, et al., 2011). A case study approach was appropriate for this topic because it allowed me to investigate and examine the participation of girls in practical work, enabling me to gain insight and understanding of the problem from girls' perspective. Rule and John (2011) note that a case study allows a researcher to examine a particular issue in-depth rather than looking at multiple instances superficially.

In this study the particular issue under investigation was the participation of girls during practical work given in Physical Science focused on the topic of electricity, for the purpose of gaining insights into the perceptions and experiences of grade 9 girls in both mixed-sex and single-sex groups. My unit of analysis is grade 9 girls' participation during practical work in current electricity.

### **3.3 Research site, sample and sampling procedure**

This study took place at a school in Ohangwena region at a school called Mwatya Junior Secondary School (pseudonym) which is one of the junior secondary schools in Ohangwena region, situated about 15 km from the borders of Namibia and Angola. The school accommodates some learners who travel far from the villages that are close to the borders. This school is a mixed school accommodating both boys and girls in the same classrooms. I selected this school because of its access as this is the school where I was teaching.

From the population of 358 learners at the school, the sample of 31 girls from grade 9 were chosen for this study. A sample is a subset of a population (Bless & Higson-Smith, 1995). For a researcher to get a sample; a sampling procedure must be followed. Sampling is the process of selecting units from a population of interest so that by studying the sample you can generalise your results to the population from which the units were chosen (Donnelly & Trochim, 2008). The procedure I followed in choosing these learners was gender based. I decided to select girls from the group of learners at Mwatya JSS because of the nature of my study. Lodico, Spaulding and Voegtler (2006) define a purposeful sampling as a procedure where the researcher identifies key informants who have some specific knowledge about the topic being investigated. My study focused on the participation of girls during practical work which explains why I have chosen only girls to be part of this study.

### **3.4 Research goal and questions**

The main goal of this study was to investigate how grade 9 girls participate during Physical Science lessons when doing practical work in current electricity. To achieve this goal, the following main research question and sub-questions were explored:

#### **Main Research Question:**

**How do grade 9 girls participate during Physical Science lessons when doing practical work in current electricity?**

To answer this main question, the following sub-questions were answered:

1. What are grade 9 girls' perceptions and experiences about practical work during Physical Science lessons?
2. What is the observed participation of grade 9 girls during practical work in Physical Science lessons?
3. What enables grade 9 girls to participate during practical work in Physical Science lessons?
4. What constrains grade 9 girls' participation during practical work in Physical Science lessons?

### **3.5 Data gathering techniques**

The following data gathering techniques were used:

- Document analysis;
- Questionnaires;
- Observations; and
- Interviews.

Different data generation techniques were used to enhance the validity and trustworthiness of data through triangulation of methods. I now discuss each of these data gathering techniques in detail below.

### **3.5.1 Document analysis**

A document is defined as a record of an event or a process that is produced by either an individual or groups which can take various forms (Cohen, Manion & Morrison, 2011). Creswell (2012), stresses that “documents represent good sources for text (word) data that suits a qualitative study” (p.223). Documents provide the advantage of being in the language and words of the participants and can be ready for analysis without the transcription required for other instruments (ibid). Once documents are located and examined, they do not speak for themselves but require careful analysis and interpretation (Cohen, et al., 2011).

For the purposes of this study, I analysed a textbook and a syllabus. The textbook provided context for how the suggested practical activities should be carried out as well as helping me to understand the nature of stereotypes and gender biases conveyed by the teaching materials we use in our teaching. For example, I looked at the diagrams used in the textbook to note the depiction or absence thereof of women or girls using scientific apparatus and so on. As far as the syllabus was concerned, I wanted to ascertain the views of the syllabus on practical work. This data gathering technique generated the data for questions on experiences and perceptions of girls about practical activities. I selected this technique to generate data due to learners’ familiarity with the concepts and images in the textbook. In addition to the document analysis helping me with data generation, it also added some value to my subject knowledge. Another technique that made it possible to gain data from the respondents was the questionnaire. This is discussed below.

### **3.5.2 Questionnaires**

A questionnaire is a measure that presents a set of written questions to which all individuals in a sample respond (Gall, Gall & Borg, 2007). Gay, Mills and Airasian (2009) add that a questionnaire is a written collection of survey questions to be answered by a selected group of research participants (p.177). The aim of the questionnaire was to gather the data on the experiences and perceptions of girls about practical work.

I distributed 31 questionnaires to 31 grade 9 girls at the school where this project took place. Since the questionnaires were personally administered, all 31 questionnaires were returned and

most of the questions they contained were answered. According to Cohen, et al. (2011), self-administered questionnaires are completed in the presence of the researcher. They further stressed that the presence of the researcher is helpful because it enables all the questions and uncertainties to be addressed immediately with the person who has designed the questionnaire (see Appendix C). I found administering questionnaires helpful because girls were able to clarify terms they did not understand and ask me questions directly.

### **3.5.3 Observation**

Observation is another data gathering technique that I used in this study. Observation is the systematic process of recording the behavioural patterns of participants, objects and occurrences without necessarily questioning or communicating with them (Nieuwenhuis, 2007). I used observation to gain a deeper insight and understanding of the problem in my study (ibid). By using observation, I was able to gather ‘live’ data from the naturally occurring setting of practical activities in the class (Cohen, et al., 2011), looking directly at what was taking place *in situ* rather than just depending on second-hand accounts (ibid).

In this study, I observed two lessons in which the teacher was conducting practical lessons on the topic of ‘*electricity*’. During these lessons, I focused my observation on three particular clusters in the class made up of different groupings of boys and girls. Elton-Chalcraft, Hansen and Twiselton (2008), state that observations can be useful for overcoming the differences that exist between what people say and what they do in practice (p.79). My observations allowed me to get a good idea of how the girls behaved during practical work. In addition to observations, four interviews were conducted and this is discussed below.

### **3.5.4 Interviews**

According to Elton-Chalcraft et al. (2008), a typical interview represents a one-on-one discussion with an interviewer that leads to asking questions to which the interviewee responds. Gall, et al. (2007) define an interview as a form of data collection involving direct interaction between the researcher and the research participant, using oral questions by the interviewer and oral responses by the participant.

I have used interview as a data gathering technique because it helped me to see the world through the eyes of participants, as Nieuwenhuis (2007) suggests. The interview also helped me to obtain rich descriptive data that aided my understanding of the participants' construction of knowledge and social reality (ibid). My study made use of two types of interviews, namely, semi-structured and focus group interviews. These are discussed below.

### **(a) Semi-structured interviews**

Semi-structured interviews were used in this study to corroborate data gathered from elsewhere (Nieuwenhuis, 2007). Gall, et al. (2007) describe semi-structured interviews as involving a series of structured questions and then probing more deeply with open form questions to obtain additional information. Lodico, et al. (2006) posit that in a semi-structured interview researchers usually prepare a list of questions to be asked but allow respondents the opportunity to probe beyond the protocol (see Appendices I & J). In the semi-structured interviews I conducted, I interviewed two girls to gain insight into their experiences and perceptions, and asked about factors which enable and those which prevent them from participating during practical work. The participants were asked to respond in the language they were most comfortable with, which allowed our communication to be less inhibited. Accordingly, the girls code-switched from English to Oshikwanyama (vernacular) during the interviews.

I found the semi-structured interviews challenging due to the way in which the respondents answered the questions. At times they provided very brief answers, and even with further probing seemed reluctant to respond further, choosing rather to agree with me, or keeping quiet. The interviews were tape-recorded and transcribed verbatim.

### **(b) Focus group interview**

A focus group is a group of participants interacting with each other rather than with the interviewer. The participants dominate the interview session rather than the interviewer, and the data emerge from interaction of the group members (Cohen et al., 2011). I found focus group interviews more helpful in obtaining rich data because, as Nieuwenhuis observes,

*Participants are able to build on each other's ideas and comments to provide an in-depth view not attainable from individual interview; unexpected comments and new perspectives can be explored easily within the focus group and can add value to the study ( 2007, p.90).*

Furthermore, focus groups elicit a multiplicity of views and emotional processes within a group context (Gibbs, 1997) and these multiple understandings can be unpacked through group interactions (Liamputtong, 2011). This provided me with insights into the different perspectives put forward regarding participation of girls during practical activities. Using this technique, I interviewed two focus groups with four grade 9 girls in each group, gaining deeper insight into their experiences and perceptions about practical work in Physical Science. This data corroborated the data collected from other techniques used.

Focus groups didn't include the girls who were involved in the one-on-one interviews. Girls who made up these two groups were selected due to their better communication skills, and during the focus group interviews most of them expressed their opinions freely. At times they supported each other's' ideas, by building on what the previous person had said, and at other times they merely provided their own individual views. The focus group interview technique provided me with the rich data I was looking for in this study.

### **3.6 Data analysis**

The data gathered from the grade 9 girls who participated in this study was analysed in order to provide insight and understanding on the participation of girls during practical work. Data sets were grouped into categories and developing themes which emerged from the data were identified (Brand & Glasson, 2004). According to Creswell (2012), coding is the process of segmenting and labelling text to form descriptions and broad themes in the data (p.243). The data were colour coded according to the sub-questions (categories): perceptions and experiences of girls about practical work; things that enable and those that constrain the participation of girls during practical work in Physical Science lessons and the observed participation of girls during practical activities. To be able to interpret the data gathered in this study, a thematic analysis is employed.

Thematic analysis is defined by Ibrahim (2012) as a type of qualitative analysis that classifies and presents themes and patterns that relate to the data (p.10). Ibrahim describes thematic analysis in the following way:

*Thematic analysis allows the researcher to determine precisely the relationships between concepts and compare them with the replicated data. By using, thematic analysis there is the possibility to link the various concepts and opinions of the learners and compare these with the data that has been gathered in different situation at different times during the project (2012, p.10).*

Socio-cultural and social constructivism theories were used as theoretical frameworks which helped me to examine the perceptions, experiences and participation of girls during practical work. A socio-cultural perspective as discussed in Section 2.8.1 focuses on how learning is acquired in social set ups such classrooms; and social constructivism as discussed in Section 2.8.2 focuses on how active participation leads to learning from social interactions and cognitive development through mediation.

### **3.7 Validity and trustworthiness**

To validate findings is to determine the accuracy or credibility of the findings (Creswell, 2012). Validity, therefore, refers to the degree to which the findings and the implication of the methods that are used to generate data can be trusted (Botes, 2003). The methods that have great impact on validity are: techniques of data collection; methods of data analysis and interpretation; and methods of choosing the population and the size of sample (ibid).

To ensure validity in this study, data generated were corroborated through triangulation. Firstly, I administered questionnaires in which the girls submitted their own views and experiences. Secondly, observation was conducted to investigate the girls' behaviour in class, and thirdly, interviews were conducted to gather more data from the participants. Creswell (2012) emphasises that triangulation helps to corroborate the data from different methods. Furthermore, triangulation serves as the confirmation that the data gathered is relevant by using more than one method of data gathering, more than one source (participant), more than one method of data analysis, and more than one perspective (Botes, 2003).

### **3.8 Ethical considerations**

In this study, a series of measures were employed to ensure that the highest degree of ethical protocols in the research was established. From the outset I gained permissions from the Director of Education of Ohangwena region (see Appendix B). Consent to conduct the classroom observations was initially gained via verbal communication with the Physical Science teacher, and this was later confirmed in writing via a consent letter (see Appendix A). I held a short, informal meeting with the grade 9 girls informing them about the purpose of the study. Learners participating in this study received thorough information about the purpose of the study so that they could make informed decisions on whether or not to participate. As Donnelly and Trochim (2008) note, researchers must ensure that participants are taking part in a study voluntarily and not under coercion.

### **3.9 Concluding remarks**

This chapter described the research design and orientation, the research site, sample and sampling procedure. The research goal and research questions were outlined, data gathering techniques such as document analysis, questionnaire, observation and interviews were discussed. Data analysis, validity and trustworthiness, as well as the research ethics were also discussed in this chapter. The next chapter is the presentation and analysis of data generated.

## CHAPTER FOUR: DATA PRESENTATION AND ANALYSIS

*There is no single or correct way to analyse and present qualitative data; how one does it should abide by the issue of fitness for purpose (Cohen, Manion & Morrison, 2011, p.537).*

### 4.1 Introduction

The main goal of this study was to investigate how grade 9 girls participate during Physical Science lessons when doing practical work in current electricity. In this chapter, I present findings from the entire data gathering techniques used in this study, namely questionnaire, document analysis, observation and semi-structured interviews.

The presentation and analysis of the data forms two parts. Part A consists of the data gathered using the questionnaires, which is presented in analytical categories that are formulated in the analysis process. Tables and graphs are used to present the data that is numeric in nature. Part B presents the data gathered using document analysis, observations and interviews.

### 4.2 Learners' profiles

Thirty one (31) girl learners were involved in this study, all of whom completed the questionnaires. Of the thirty one, six girls from the same class were observed during practical lessons. This group of six girls was further sampled into semi-structured and focus group interviews where four girls took part in a focus group interview and the other two took part in individual semi-structured interviews.

These girls are from the same school, Mwatya JSS (pseudonym). They are all in grade 9, some are repeaters and others came from grade 8 the previous year. Socially, the majority are based in rural areas, and commute daily to the school. On an academic level, they had all previously studied sciences subjects, even though they came from different feeding schools before they came to Mwatya JSS for grade 8.

### **4.3 The selection sample from each data set**

Samples of data sets presented in this chapter were chosen in line with the research questions, and the data is presented according to the data gathering techniques. As each data gathering technique was used to answer a specific question or questions, the following categories were developed to identify the presented data from the collected data:

1. Teaching methods preferred by girls;
2. Importance and roles of practical activities;
3. Things that girls enjoy during practical activities;
4. Problems experienced by girls during practical activities;
5. Preference for doing practical work in groups or as an individual task;
6. If practical work given in groups should the sex of learners be considered or not;
7. Activities preferred by girls when they in single sex and in mixed sex groups;
8. Factors that enable girls to participate; and
9. Factors that constrain girls' participation.

## **PART A**

### **4.4 Questionnaire**

Questionnaires were used to gather the data in this study. A total numbers of 31 questionnaires were distributed to 31 girls from grade 9 at the research site as described in Section 3.3. The questionnaires were administered, all 31 questionnaires (100%) were returned and all questions were attempted.

The purpose of the questionnaire was to answer the three main research questions which are:

- What are the perceptions and experiences of girls about practical activities?
- What enable girls to participate actively and freely during practical activities? and
- What constrain girls' active and free participation during practical activities?

The data from questionnaires were thus organised and presented according to the main questions above.

#### 4.4.1 Perceptions and experiences

Data gathered on the perceptions and experiences of the grade 9 girls about practical work is presented into categories as described in Section 4.3. Below is the presentation of data regarding the perceptions and experiences of girls of practical activities.

##### a) Teaching methods preferred by girls

To gather this data, four suggestions of the teaching methods were provided in the questionnaire in order for them to select their most preferred teaching method. The suggestions were:

- Teacher talks and writes on a chalkboard only;
- Learners discuss in groups;
- Teacher does experiments and learners look at it and write down the results; and
- Learners do experiments themselves and write down the results.

The aim of asking this question was to ascertain whether girls prefer experiments which are part of practical activities over other teaching methods that do not involve hands-on activities. It also aimed to check whether girls like to carry out experiments themselves or whether they preferred teacher demonstrations.

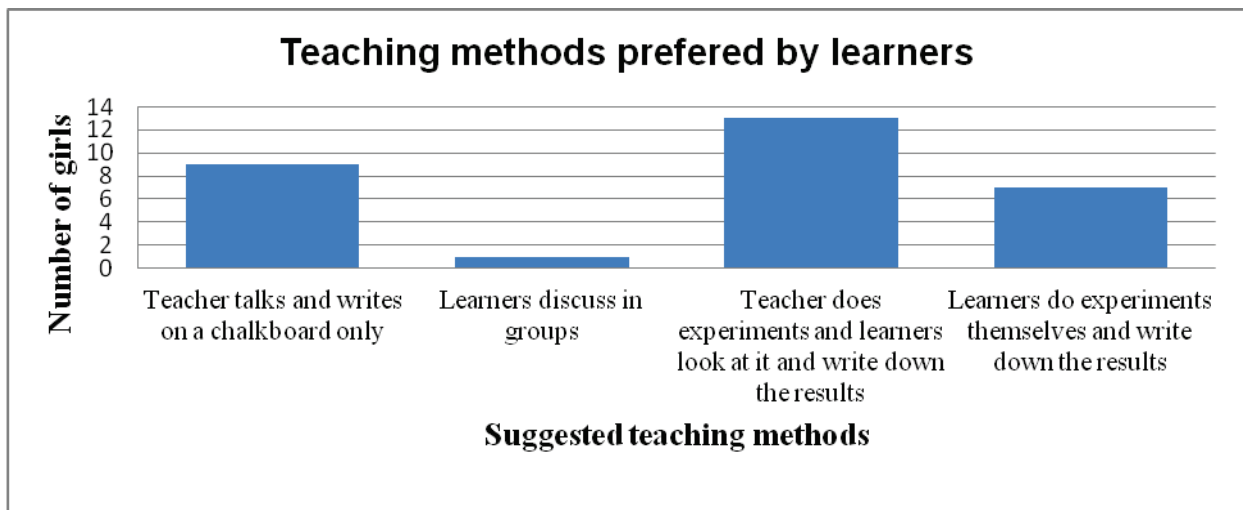


Figure 4.1 Preferred teaching methods

Figure 4.1 showing four suggested teaching methods indicate that 13 girls (43.3%) who took part in this study preferred the teacher doing the experiments and the learners writing down the results, whereas 7 girls (23.3%) preferred learners doing the practical experiments themselves. Ten girls (33.3 %) did not choose practical experiments as their preferred teaching mode in Physical Science.

#### **a) Importance and role of practical activities**

This question was asked to gain an understanding of what the girls thought regarding the importance and roles of practical activities in learning Physical Science.

The responses indicated that practical activities improve their subject knowledge and that the students learn more about something that they did not previously understand than when they learn without practical investigation. This is what one learner said: ‘...*is important because when we learn about something and practical about it we understand it very well instead of writing summary.*’ They further stated that practical activities teach them concepts like connecting electrical components more effectively than merely copying notes from the chalkboard. Practical activities also bring greater understanding of the content the teacher was addressing during teaching, helping students better prepare for examinations. Learners noted that practical activities challenge them mentally and add to their existing understanding.

The responses showed that practical work enables the learners to effectively use science equipment and materials through hands-on experience. By doing experiments the learners believe that they will gain confidence in using a range of laboratory instruments. Girls further indicated that doing practical activities earned them continuous assessment marks that are added to their end of year examination marks.

#### **a) The things that girls enjoy during practical activities**

Participants reported their enjoyment of working with materials and instruments, as well as testing the materials. They described their delight in seeing the way things work. One participant wrote, ‘*I enjoy connecting wires like in electricity and looking at how bulbs light connected like doing movies.*’ Another one commented, ‘*I do (feel) good because I use the instruments that are*

*giving me the results.*' Another one wrote, *'I see how something became (happens) like measuring water, I see how different materials are used.'* The participants enjoyed scoring marks from the practical activities, and appreciated the sound understanding they gained of the concepts at hand. The practical activities were also reported to provide motivation for the students to apply themselves in their studies.

### **b) Problems experienced by girls during practical activities**

This question was asked to allow the girls to reflect on the problems they experience when they are carrying out practical activities.

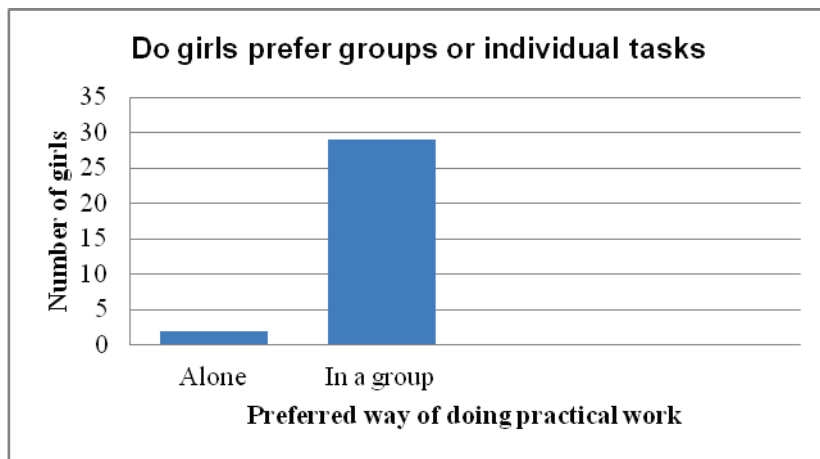
A lack of support from teachers was identified by girls as one of the problems experienced. Girls reported that at times teachers refused to help learners when they were struggling to complete the task on their own, or where they lacked understanding. Another problem experienced was a lack of learning taking place during a demonstration. The participants indicated that should the teacher repeat the demonstration they may understand the concepts but that there was not enough time in class to do this.

Misbehaviour was also listed as a problem experienced by girls during practical activities. Girls indicated that sometimes learners refused to concentrate on the activity, and tended to create a disturbance. Other learners were reported to destroy or damage instruments, or even steal the instruments, leaving the learners with a lack of equipment to use in class. Some girls stated that conflict tended to arise when working in groups with boys.

Participants described a problematic situation where activities were given to learners without accompanying instructions and nobody to provide assistance. Another problem that was indicated was that in the case where learners were instructed to use materials or equipment which they were unfamiliar with, it was likely that they may break the equipment, in which case they were asked to pay for the materials. Other problems included a lack of knowledge of how to accurately measure readings. Some learners stated that language became an issue where teachers taught in English, but the learners did not understand. Limited materials is also on the list of problems experienced by girls during practical activities, as not everyone is afforded the opportunity to work directly with the materials.

### c) Preference for doing practical work in groups or as an individual task

The purpose of this question was to find out whether girls prefer to do practical activities in groups or as individuals. They were asked to give reasons for their preference. The data gathered for this category is presented in a graph below and the reasons for their preferences are presented thereafter.



#### Figure 4.2 shows how practical activities are preferred by girls

Figure 4.2 showing the preference of girls for group or individual tasks indicates that the majority of the girls who participated in this study, 29 out of 31 girls (94%), preferred to do practical activities in groups, whereas only 2 girls (6%) preferred to do practical activities as individuals.

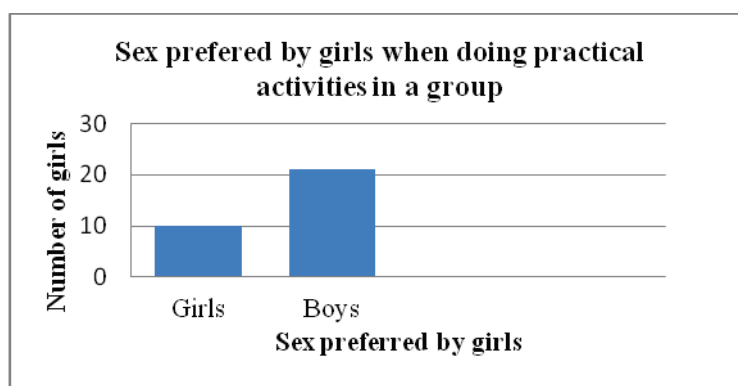
The participants who prefer to work alone indicated that learners work hard when they are alone, reasoning that when one is alone one works hard in order to achieve one's goals. When working alone, according to the participants, a learner is able to determine whether they understand every aspect of the subject they are studying, or whether they need help in a specific area.

In contrast, some girls preferred to work with others in a group for the following reasons: it is more convenient because learners assist each other in learning Physical Science content; learners can ask other learners who have a better understanding of the concepts at hand; if one learner misses some information in the class, other members of the group can fill them in; and those who

lack working knowledge of equipment and materials can be instructed and helped by other group members while the learner first observes the process.

#### **d) Sex preferred by girls during practical work**

This question aimed to find out whether girls like/prefer to do practical activities with other girls or with boys. They were also asked to give reasons for their preference. The data gathered for this category is presented in a graph, and the reasons for the girls' preference is presented in the discussion following.



**Figure 4.3 Sex preferred by girls during practical activities**

Figure 4.3 showing the sex preferred by girls during practical activities done in groups indicates that 21 learners (68%) of the girls who participated liked/preferred to work with boys in a group, whereas 10 girls (32%) liked to work with other girls in a group, inferring that they do not want boys in the group. Below is the presentation of the reasons as to why they prefer to work with the stated sex.

Participants who preferred to work with boys in a group indicated that boys have more knowledge of Physical Science than girls, boys participate more than girls and they are more helpful. It was also recorded in their questionnaires that boys have good ideas and better information than girls. Respondents noted that they prefer boys over girls because girls do not like to do practical activities and when in a group, girls tend to start gossiping instead of doing their work.

Furthermore, they added that boys have practical knowledge of the materials and are able to work with the materials very well. Boys were reported to work quickly, confidently and accurately. Respondents also reported that while boys treat girls with respect, girls can show disrespect for others in the group and continually debate issues.

The girls who preferred to work with other girls stated that girls are cooperative, work well in groups, are pleasant to work with, are practical, well-behaved, and have good relationships. One respondent wrote, '*Girls, because girls are like me I can do well. Boys, they do not like to take the materials.*' Another wrote, '*Girls, because I can be free from doing anything. Some of the boys like to quarrel each other.*' They further added that they prefer working in girls-only groups because some boys do not like to work with girls. One girl wrote in her questionnaire, '*Because some boys they did not like to work together with girls.*'

#### **e) Activities preferred by girls when they are doing practical activities with other girls and when they are with boys in a group**

This question aimed to find out the type of activities girls prefer to do when they are in a group with boys and when they are in a group with other girls only.

Girls who participated in this research prefer to do a number of specific activities in a group where there are only girls. One of these activities is writing. One girl stated, '*I write because I have good handwriting.*' Most of the respondents stated that in a group of only girls they prefer using the materials in order to learn more, one of them noting, '*I prefer to work with materials or objects,*' while another added, '*I would like to do practical activities. I want to participate about what we are doing.*'

In girls-only groups, some of the girls prefer to present the findings for their groups, stating that by doing so they can improve their English. One respondent indicated that in a girls-only group she would want to correct others who are completing the practical work incorrectly.

The respondents were then asked about the practical activities they preferred to engage in when working in mixed groups. Some indicated that they preferred writing because they felt that boys did not have good or legible handwriting. One girl explained, '*To be secretary because boys they*

*do not write nice word,*’ while another girl wrote, *‘I write because some boys do not have good hard writing which you can see.’* Another added, *‘I want to be a writer because some boy have bad hand writing,’* and another, *‘I want to write activities because the boys they cannot write very clearly.’*

There are some girls who prefer handling materials. One participant indicated that she prefers connecting things because boys like to work slowly and some of the boys play during the lessons. She wrote, *‘I want to connect the cells and connecting wire in the series with boys.’* While some of the girls prefer this, one of them preferred to observe how materials are connected together.

#### **4.4.2 Factors that constrain girls’ active participation during practical activities**

The participants were asked to suggest factors they think prevent girls from participating actively during practical activities. Most of the participants stated that girls are afraid to either talk to use materials because they fear making mistakes. They reported that learners laugh when others make mistakes. One respondent wrote, *‘Sometimes the learners like to laugh at each other when someone does a mistake,’* while another stated, *‘Girls are always afraid to talk freely because boy they like to laugh at girls.’*

Furthermore, some participants indicated that girls do not participate actively because there are tensions between learners and other learners, as well as learners and teachers. Respondents reported that certain learners do not like each other, that some of the boys insult and beat each other, and that some girls hate the teachers. Others reported that learners laugh at those who are presenting something to the class, at which point girls can become embarrassed and stop doing their work. Some participants noted that girls are lazy and refuse to complete their work, while others stated that girls act selfishly at times by making sure they get their work done, while not making room for other girls to use the materials.

Another factor that affects the participation of girls during practical activities is romantic relationships in the classroom. Since some girls have boyfriends in the same class, it was reported that if the girl has a problem in class the boy may start to treat her badly, causing her to

become passive, ashamed and demotivated in class. Other factors that were reported to hinder girls from participating in activities were ‘our skirts’, gossiping and jealousy.

#### **4.4.3 Factors that enable girls to participate actively during practical activities**

This question was asked to allow girls to state what they think would help them to participate more actively and freely during practical activities. One suggestion was that they need to be motivated by their teachers, *‘Be hard work always, try to be understood always, take part in experiments.’* Learners suggested that teachers have meetings with learners where they set boundaries for all learners to be treated respectfully in class, thus eliminating such behaviour as ridiculing learners when they present material publicly. One participant indicated a need for teachers to speak to learners with a respectful tone or, *‘a good voice.’*

Some of the girl participants have suggested that for the girls to be able to participate actively during practical work, they must be separated from boys since they felt that boys ridicule their mistakes and make jokes at their expense, hindering their work in the classroom. Some girls suggested that both boys and girls need to be taught how to respect each other and that they need to be motivated to love and care for each other. Other participants noted that the learners should be more cooperative towards each other, and should stop gossiping, insulting and laughing at one another.

## **PART B**

The data gathered from the questionnaires was triangulated through document analysis, observation and interviews. The next part in this chapter is the presentation of the data from the aforementioned data gathering techniques.

### **4. 5 Document analysis**

#### **4.5.1 New Physical Science**

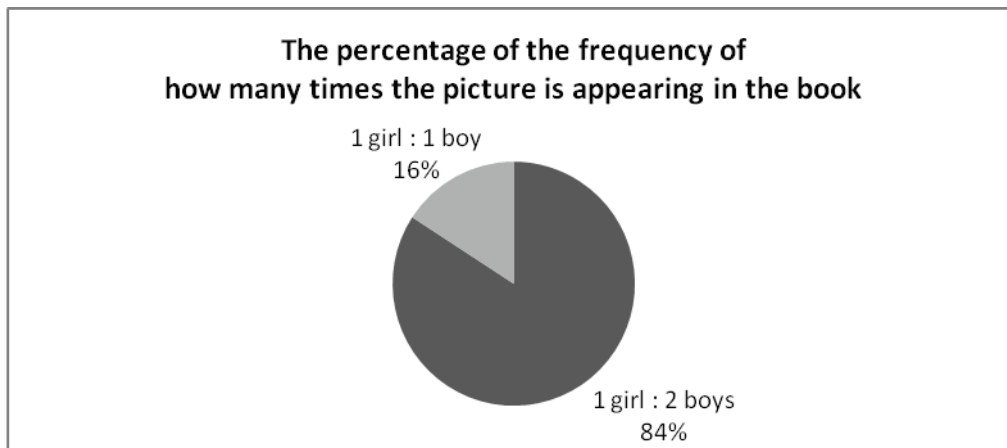
I chose to analyse a textbook called New Physical Science for grade 9 because it is widely used by the learners in the school where the study was situated. The data gathered from this textbook answered the questions: *What enables or constrains girls’ active participation during practical activities?* I formulated a hypothesis that the textbook might convey particular messages to

learners, and thus decided to analyse the topic of current electricity in this textbook in order to see how the topic is presented to learners. My interest related specifically to the illustrations used since I wanted to investigate any gender messages conveyed by these pictures, and to look at whether the suggested practical activities carry any gender biases.

- **Pictures used on this topic**

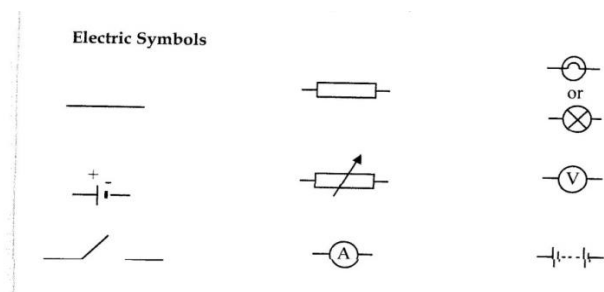
The textbook suggested practical activities for the learners and indicated whether group work or pair work was required. There was no individual practical activity suggested in the textbook. The illustrations contained in the book suggested that the group work should consist of three learners (one girl and two boys), while pair work should consist of two learners (a boy and a girl). The frequency of the appearance of the illustration is recorded in the pie chart below:

The pie chart 4.1 shows the number of times the illustration appears throughout the textbook, with a ratio of 1 girl: 2 boys and 1 girl: 1 boy.



**Pie chart 4.1 showing the percentage of the frequency of how many times the picture is appearing in the textbook**

- **The materials used as examples in the textbook**



**Figure 4.4 showing some of the materials used during practical work on the topic of electricity**

The textbook suggests that the materials shown above should be used by the learners in the topic of electricity. They are illustrated in their scientific symbols that is more easy to use than their really physically appearance.

#### 4.5.2 JSC Physical Science syllabus

The syllabus states that:

*Suggestions for practical activities or demonstrations are included at the end of each topic. These suggestions for practical activities or demonstrations are considered essential and all learners should be exposed to them, both during teaching and as preparation for assessment (Ministry of Education, 2010, p.6).*

The syllabus stresses the importance of practical work in the process of teaching Physical Science, suggesting that after every topic teachers plan for practical work to help facilitate greater understanding of the topic.

#### 4.6 Lessons observation

Observation, one of the data gathering techniques used in this study, enabled me to gather data from live situations that is the classroom in which the participants were involved in practical activities. The aim of using this technique was to answer the main question which is: *What is the observed participation of grade 9 girls during practical work?*

I managed to observe two lessons, in which learners were engaged in practical activities. During the observation session, I focused on what girls are doing (actions) in a group. Even though there was no systematic or specific observation schedule, I did make some observation notes (see Appendices D, E & F) and I focused the observation on the following behaviours: *who was reading the instructions; who was connecting the materials; who was writing/drawing and the verbal communication.*

The teacher introduced me as a visitor at the start of the lesson, together with the camera person who was filming the lesson. She then gave instructions to learners concerning the practical work they would do in groups, which involved the connection of electrical components as per the instructions given in their worksheets. Learners then began with their group work which was organised by their teacher.

During the observation process I noticed that girls tended to avoid handling the scientific equipment, especially when in a mixed groups with boys. I found challenging to accurately hear what all members of the group were saying during the discussion time, and had to rely on the actions of the students as well as snippets of the discussion to figure out what was going on.

#### **4.6.1 Lesson 1: Mixed groups**

The topic of this lesson was current electricity, and learners were supposed to connect components and measure current and voltage according to the instructions provided in their worksheets. The work was to be carried out in mixed sex groups. Since there were very few girls in the class, only two of the groups were relevant for my study. The data gathered from the two groups is presented below.

##### **Group one: Three girls and three boys**

This activity began with all the learners in the group struggling to organise the specific materials they needed for their activity. Two of the girls were less involved in using and connecting the materials, and preferred to observe, whereas one girl who was more actively involved. Although some of the girls didn't have a chance to interact directly with the materials, they at least chose materials and handed them over to the boys for further work. Although their involvement was less than that of the boys, the girls did act in a way which showed that they were capable of

handling the materials: *a girl put a connector into the circuit; a girl placed one cell into the board; a girl placed a connector in, closer to the cells, and told others to put a switch in; and a girl held a bulb, one boy took it from her hand and fixed it in.*

There was also good verbal communication among the learners which the girls had took part in. When they had to decide where to put the component one girl suggested: *'Put it here,' a boy shows the position in the circuit board; 'Put it there,' another boy pointed; 'Put it here,' a girl also pointed at the same position.* On another occasion one girl participant suggested where to connect the component, saying: *'Oshiima eshi ngeno ota shii apa (I think we should put this thing here),'* a girl suggested pointing with her figure.

When it was a time to draw the circuit diagram on the paper, the girls refrained from doing so, while one of the boys drew the diagram. Girls were, however, quick to act when it was time to reconnect the materials before they left the table and handed over the materials to another group.

### **Group 2: Three girls and two boys**

The group activity started with learners familiarising themselves with the instructions. While they were busy reading from the instruction paper learners were pointing to the paper. When a girl started doing the same, one boy pushed her finger away, but she continued reading.

Girls were not connecting the materials themselves; instead what they did was to take the materials and put them back or give them to boys to connect. The following actions were recorded: *'Tulapo aka (put this one in),'* a girl gives a black crocodile clip to the boy who is busy positioning the cells. *'Tula aka kwinya (put this one that side),'* she added for the red crocodile clip, while the boy is busy placing them. *One girl is touching the cells and makes sure they are well connected.*

There was good communication during the activity, some of which included girls saying: *'Unima nava fike nawa nawa (things must be placed in nicely),'* a girl reminded the others. When it was a time to draw the circuit diagram on the paper, none of the girls drew it, while one boy did. When it was a time to reconnect the materials it was only one girl who took part in this activity.

#### **4.6.2 Lesson two: Girls only group**

The purpose of this group was to look at how girls participate during a practical activity when they are in a group with boys. The aspects to be observed remained the same as for the other groups and this is what was observed.

The girls appeared to be more active in this group, with all of them showing a readiness to connect the materials. They laughed at each other when one of them made a mistake. In my observations I noted: *‘They laugh once there is a mistake, but why those who had the materials dropped them after laughter?’* From the transcript of the lesson observation the same thing was observed: *‘One girl took a red crocodile clip, started laughing and drops it on a table, another girl took it and drops it also, and all went back to the instruction paper.’*

The cooperation among the group was good and they were working together as before, until at a certain point they started doing one thing at a time. The actions I recorded were: *girls show each other the positions where to put the materials; when the disagreement came in about the red crocodile clip, they went back to the instructions.*

#### **4.7 Interviews**

An interview is another data gathering technique that I used to gather data in this study. I conducted two semi-structured interviews with one girl participant per each interview. In addition to these interviews, I conducted two focus group interviews consisting of four girls each. The data gathered through interviews aimed to answer the main questions that are: *what are the perceptions and experiences of the girls about practical work? What factors enable girls to participate actively during practical work? What factors prevent (constrain) girls from participating actively during practical work?* The data gathered from the interviews is presented according to the categories developed. These categories are listed as:

- The role of practical activities in learning Physical Science;
- How often do girls want practical work to be conducted;
- Things which girls enjoy during practical activities;

- Whether girls prefer to do practical activities alone or in a group and their preference of sex; Activities preferred by girls when working with boys and when working with other girls;
- Things that enable girls to participate actively; and
- Things that constrain girls' participation.

### **Category 1: Role of practical activities in learning Physical Science**

This question was posed to girls to allow them to identify the role of practical activities in learning Physical Science. It also aimed at finding out whether girls know the importance of doing practical activities. Girls who participated in this study gave a list of the things that they found to be the role and importance of practical activities in learning Physical Science. They also put forward their ideas on what they think is the importance of practical activities.

Participants from focus group 1 [F1] responded that practical work helps learners to understand things better because learners see the demonstrations that the teachers are showing them. Another participant from the same group indicated that practical work can improve their understanding of the topic. One participant responded that practical work helps learners form connections between what learners were taught in the class and what they are observing. It helps learners to understand difficult topics. She stated that: *'Each topic is having some difficult parts, sometimes you do not understand something, it is just a word or an instrument which is there but you do not know how to use it...'*

From focus group 2 [F2] one learner indicated that practical activities help them to study for examinations because some of the same material is covered in both areas. Another girl added that: *'A practical activity in learning Physical Science they are important because we learn how teachers teach us, and see how things are working like bases and acids... the teacher is teaching and showing us how bases change things, and we see with our eyes how things are changing, we see how the colours are changing then we are learning more.'* A participant from a one-on-one interview stated that practical activities help them understand how things are used, and gave an example of a microscope, *'If you want the thing to be big, you can see it yourself, and you can do it yourself with your hands yourself.'*

### **Category 2: How often do girls want practical activities to be conducted?**

This question was posed to the participants in order to allow them to suggest the frequency of conducting practical activities. A girl from the focus group interview [FG1] suggested that practical activities should be done the moment the topic is being taught or immediately after the topic. This is because if it takes some time from the time a topic was taught, they will be dealing with a different chapter/topic and they will have forgotten some of the content from the previous topic.

### **Category 3: Things which girls enjoy during practical activities**

The participants who were answered this question responded that there are things that there are aspects of practical work which they enjoy. A participant from F2 commented that she enjoys seeing and using materials, especially those that she saw for the first time. She said, '*Ohatu kala tuudite nawa shaashi katu shishi (we feel good because we don't know the things), yoo iinima oyo tai longifwa opo kuishi nale ngaash iee litmus paper dinya (the things that are being used you didn't know them before, you haven't seen them before like those litmus we have used), katu dishi nale kwali ngaashi eshi ta dishe ndjee color molwiinima eyi tai longifwa otwali twahafa shili (we didn't know them before even when they are changing the colours because the things that are being used we were so surprised) and we have learned more.*'

A participant from interview two [G2] responded that she enjoys using and discovering new materials: '*I only know that batteries are only used in radios, when I came to the class I have seen that, there are small electrical components that can be connected to batteries, eish! I was so impressed!*'

### **Category 4: Whether girls prefer to do practical activities alone or in a group; and their preference of sex**

The participants were asked to explain whether they preferred to do practical work alone or they preferred to work in groups. They were further asked to give the sex they preferred to work with when they are working in groups. Their responses were varied. One girl from the focus group interview preferred to work in a group noting that in a group ideas are shared and students assist one another with how to use the materials. Another participant supported the idea of working in a group, saying, '*In a group, because others can help you, like boys they use instruments at their houses, when they, when you are in a group with them, you just say that which instrument do we suppose to connect and how to use it in a correct way.*' They further observed that boys tended to have greater knowledge on how to use the various instruments.

Additionally, boys were reported to be very speedy when using instruments, unlike girls. One girl remarked, '*Yes, shaashiovamatiotavaduluokweendelelandeetava mane diva diva (boys can do their work fast and get done with it), manga uukadona, ukadonaomadilaadiloavohao nana haaendelelengaashiovamati (while girls... girls their minds are so slow they are not faster as*

boys).’ I tried to probe further about boys’ use of the materials at home. The participants remarked that boys are already familiar with some of the instruments because they use some of the things at home. This was their response:

*T: Owapopyapo nee oshinimashimwepenyawatii (you have said something on boys that... of something that), ovamati, ohavalongifae instrument komaumbo (that boys use instruments at home?) Uukaadonavooihavalongifae instrument komaumboano (do girls not use instruments at home?)*

*Chorus: Aaye (nooo).*

*T: Shaashi (why)?*

*G1: Boys connect their radios, us girls we do not.*

*T: But you see radios at home?*

*Chorus: Yes.*

*T: Why can’t you just take the radio and connect it?*

*Chorus: We do not know.*

*T: You don’t know?*

*Chorus: Yes.*

*T: How did boys come to know?*

*LL: May be they are engineers.*

*T: Engineers by birth or how?*

*Chorus: Ee (yes).*

Girls in this group kept on insisting that boys are better than girls. Another discussion follows:

*G1: Ovamatioveshishinale (boys they know already).*

*T: Ovamatiohavakalaveshishiviilongapeni (where did they learn things from)?*

*G1: Oveholekupangela (because they like fixing up things), shaashinande owe mupaongodiyoyeopotohangeaieomunhueipangululamo (even if you give him your phone you will find him dissembling out the things), tatikailinawa, ihaikwataonetwork, ngahootaviilongoaiekekupangela (claiming that is not working well, so so, in that process they are just learning).*

Apart from the preference of working with boys in the group, some girls from the focus group [F1] indicated that they do not have a preference for the demographic of the group, and that working in any group is helpful. One girl said: *'I like to be with both boys and girls'*, and *'Boys knows many things like electricity and girls know other topics.'* Through clarificatory questions, I probed for a list of the 'other topics' girls might know and the responded said, *'Girls like measuring and other things like acids and alkalis.'*

Some girls preferred to work in a group with other girls. A girl from interview 1 [G1] reasoned that she liked to be with other girls in a group because when you ask questions of girls they respond well, unlike if you ask boys.

#### **Category 5: Activities preferred by girls when working with boys and when working with other girls**

The research participants were asked to indicate the activities they prefer doing when: in a group; when they are working in a group where there are boys; and in a group where there are only girls. When girls are in groups with boys they prefer writing. From F1, a girl stated that she liked writing. She preferred to observe when boys are using the materials because she wants to know how things work. *"I like writing"*, G1 also added. She reasoned that some boys have illegible handwriting and that if boys are given the task of writing for the group they do not write what is being discussed in a group.

Another participant indicated that she liked writing and giving the materials to boys to use. Through further clarification, this discussion ensued:

**G4:** *Ohandi tale amehandivapulaomapulo (I will observe and ask them questions).*

**T:** *Inohalaku connecting iinima (so you do not want to connect things)?*

**G4:** *Aaye (no).*

**T:** *Why?*

**G4:** *Iinimakandiishinawa (I don't know things well).*

**T:** *Ovamatina vopamwekaveshishi (maybe the boys don't know also)?*

**Chorus:** *Aiye, ovamatioveshishi (No! They know).*

*T: Omunaikeeitavelokutyavamatioveshishiiinimandishi (you just believe that boys know everything)?*

*Chorus: Eeee (yes).*

*T: Do you know that you know better than the boys?*

*Chorus: Yes we know...*

*T: Tashitiihamufiyepoovamatimo class yeni (or didn't you performe better than boys in your classes before)?*

*Chorus: Ohatuvafiyepo, (we do).*

*GG: Ndeevoooveshiku connecting iinima (but boys are good in connecting things).*

There were some girls, however, who preferred working in groups with other girls. One of them indicated that she liked connecting materials when she is with other girls because they are just like her in that they also don't know what to do. Another participant stated that she wanted to use the materials because she wanted to know how things work, and when she could not do it she asked other group members. When referring to why they preferred girls over boys one participant stated: '*Ohandi connecting (I will connect). Ovamatifimbolimwe nee kave hole... (it is only that boys sometimes they don't like...), oveholeaikengeengetovapeiinima (they only like us to give them things so that they connect themselves), itava hale uningengenootekupe ashikeushangeove to kala aikengaho (they will not give you a chance to connect, they will only tell you to write).*

#### **4.7.2 Things that enable girls to participate actively during practical work**

The aim of this question was to draw some ideas from these girls on the things that can make them participate actively during practical work. When they were asked to state what they had stated as well as reasons thereof, they listed the following. The first factor listed here is motivation. Girls suggested that those girls who are free to participate must be motivated by the teachers. They also suggested that girls need extra lessons in addition to the normal lessons. Teachers need to discourage misbehaviour especially from boys who laugh at other's mistakes. These girls indicated that girls need to be given enough chance to work on their own and not just observing when someone is doing for them. And girls need to be separated from boys when doing practical work is done; and this suggests the boys' only and girls' only groups.

### 4.7.3 Things that constrain girls' active participation during practical work

This question was posed to girls in order to gather the data about factors which prevent girls from actively participating during practical work. The participants indicated that girls are not free in the class; some are shy and some have low confidence (low self-esteem). Even if a girl were to make a slight mistake, others would start laughing. However, a girl from the second interview indicated that it was not only boys that laugh at other's mistakes, and that girls did the same. She noted, *'Like in electricity, I enjoyed connecting, when you do not connect correctly things we laugh at you...'*

Some participants added that certain girls are too busy paying attention to themselves, fixing their uniforms and neglecting to pay attention to the lesson. They perform poorly in assessment because there were not listening. Another issue that was raised was the response girls received from boys if they made a mistake. One girl commented: *'When girls are with boys they are afraid of making mistakes and once they do a mistake some boys say bad words to them.'*

Participants revealed that one hindrance to active participation in Physical Science activities is the way their parents treat them at home. Girls noted that their parents think that girls are not capable of doing hands-on activities at home. One girl gave this example: *'Me, I can give an example. We were connecting bulbs at the generator. Ndee meme tatii (then my mother said), ovedjapokushishiotoningiuxwikeiinima (You! Leave the things, you don't know them, you can burn the things), napayeomumatioueshishinawa (let the boys do it). I do not why; mbelaosheshi nee ameokaadonashopamwetatikandishishinawa (maybe is because I am a girl that is why she is saying I do not know).'* Continuing from her example, the group started a new discussion focusing on the home environment:

**L:** *Even when boys are making cars from wires, if a parent finds you making cars with the boys, they will ask you saying, "Even you, you are a girl and you are making wire cars? Those things are for boys, do you want to hurt yourself with wires; those are boys' things." I don't know why because we are all the same with boys.*

**T:** *When now parents are telling you not to play with wires, what do they allow you to play with?*

**L:** *Uunonaviilapi (dolls from cloths).*

*T: If a parent finds you doing that she/he will never complain?*

*LLL: Aaaye! (Nooo!)*

*L: But if they find a boy doing dolls, mem (mom!) he will be stopped from doing that.*

*T: How about playing? What type of playing activities do girls do the most?*

*L: Okangoma (dancing traditional songs), omaumbo (houses), dilaekende (filling a bottle with sand while others are trying to beat you with a cloth ball in the process), eehaye (running between two lines counting up to a certain number and you will win the game if your reach the number without being beaten with a cloth ball), uma (jumping over a rope at different levels, if you touch the rope then you have lost the game).*

*T: Boys?*

*LLL: Okatanga (soccer ball).*

*L: And making cars from the wires.*

*T: Don't you think what you have stated about playing have effects on how you do practical work at school?*

*LL: It has.*

*T: How?*

*LLL: No response.*

This discussion indicates that parents play a significant role in providing learners with a range of experiences and activities based at home. If girls are only allowed to play with dolls, as stated in the excerpt above, and boys are allowed to play things that help them attain some science-related experiences, then the home environment plays a role in the way girls and boys behave in science classrooms.

#### **4. 8 Concluding remarks**

In this chapter I have presented and analysed data generated through different techniques, namely questionnaire, document analysis, observation and interviews which were discussed in Chapter 3. In the questionnaires, I focused on the perceptions and experiences of girls together with things that prohibit and those that allow girls to participate actively during practical work. The data generated through this technique is analysed and presented in part A.

In part B, I used document analysis to generate data on the things that can allow and those that can limit the participation of girls during practical activities. The Physical Science syllabus for JSC was analysed to study the part of the syllabus that stresses the inclusion of practical work in Physical Science teaching; and the suggestions for conducting practical work in the topic of electricity in grade 9. The New Physical Science textbook was also analysed. From the textbook I have focused on the illustrations to see if they are gender sensitive and on the suggested materials for the practical work suggested. Additionally, I observed two lessons where practical work was conducted. From these lessons I could observe the real life situations in which girls were interacting, generating the data for the observed behaviour/actions of girls during practical work.

Finally, I used interviews that generated the data on perceptions, experiences, and things that allow girls to participate actively and those that limit girls' participation. The data generated using all four techniques was analysed and presented in categories that were developed during the analysis process. The next chapter focuses on the data interpretation and discussion.

## CHAPTER FIVE: INTERPRETATION AND DISCUSSION OF FINDINGS

*When researchers gain sudden insights about the data with which they have been working, they may experience a sense of excitement. The data have been interpreted: They have been transformed into new discoveries, revelations, and enlightenments (Leedy & Ormrod, 2010, p.25)*

### 5.1 Introduction

The preceding chapter dealt with the presentation and analysis of the data generated from the four instruments used in this study, namely questionnaire, document analysis, observation and interviews. In this chapter I interpret and discuss the findings on the participation of girls during practical work. The data is discussed under these headings: *preferred methods of teaching Physical Science; importance and roles of practical activities; things that girls enjoy during practical activities; problems experienced by girls during practical activities; preference for doing practical work in groups or as an individual task; if practical work given in groups should the sex of learners be considered or not; activities preferred by girls when working with boys and when working with other girls; factors that enable girls to participate; and factors that constrain girls' participation during practical work.*

The discussion of the data is interwoven with the literature presented in Chapter 2. The discussion of data is also supported by personal views. During the presentation, I use thick descriptions to support the findings.

### 5.2 Data interpretation and discussion

#### 5.2.1 Teaching methods preferred by girls

Recognising the importance of practical work in learning Physical Science, the syllabus for Physical Science analysed suggested some of the practical work or demonstrations at the end of each topic. These suggestions are considered essential and all learners should be exposed to them during both teaching process and assessment (Ministry of Education, 2010).

It is noted from the findings that the majority of girls who participated prefer practical work over other teaching methods. As indicated by Figure 4.1, the majority (43.3%) of participants preferred the teacher doing the experiments while they write down the results whereas 23.3% preferred doing the practical experiments themselves. This makes up a total of 66, 6% of participants who prefer practical work during Physical Science lessons. However, the minority (33.3%) of the girls who participated do not prefer practical work as a teaching mode.

Even though there are some learners who do not prefer to practical work, Musasia, Abacha and Biyoyo (2012) emphasise that it is necessary that all learners in Physical Science lessons participate actively in practical work. This is because appropriate practical work enhances learners' experiences, understandings, skills and enjoyment of science. It also enables students to think and act in a scientific way.

According to my experience, learners enjoy practical work if the teacher gives them an opportunity to handle the instruments themselves, and when the outcomes of the experiments match their expectations. Conversely, when the results of the work do not meet their expected outcomes, learners may feel that practical work is of no use. In support of my experience Musasai, et al. (2012), note that practical work can be a sterile and un-illuminating activity whose purpose is often lost on the learners. This is the case: when teachers miss the point of the demonstrations; when practical work is done in small groups but follow-up discussions are unproductive; when limited planning and formulation of hypotheses are mostly done by the teacher; and when experiments are derived from mostly irrelevant cultural settings with equipment that is not in good condition.

Gurian, Stevens and King (2008) stressed the importance of teachers being aware of their own learning styles. This awareness helps teachers understand that learners also have their own ways of learning and that not all of their preferred teaching methods may suit all their students. It is therefore makes sense that 33.3% of girls who participated do not prefer practical work as a teaching method.

### 5.2.2 Importance and role of practical work

Millar (2004) defines practical work as any teaching and learning activity which involves the learners at some point in observing or manipulating real objects and materials. The main aim of this type of activity is to draw the students' attention closer to the phenomenon, to isolate parts of the phenomenon for scrutiny and give room to talk towards a way of thinking about it.

Girls who participated in this study understood the importance and role of practical work in learning Physical Science. The role and importance of practical work stated by girl participants were as follows: practical work helps learners to understand things better because they see the demonstrations that the teachers are showing them; they improve the understanding of the topic; and practical work helps learners make connections between what they were taught in the class and what they are observing during demonstrations/experiments. This echoes what Millar (2004) posited in that practical work assists learners in discovering things through their own effort. Practical work also helps them with knowledge retention.

Furthermore, practical work helps learners to understand difficult topics. As one participant stated: *'Each topic is having some difficult parts, sometimes you do not understand something, it is just a word or an instrument which is there but you do not know how to use it.'* Kannari and Hodson (2004) describe the importance of practical work, stating that practical work is important because it gives students a feel for the problematic of measurement and an appreciation of every presence of uncertainty. Any method of teaching that encourages students to carry out the task themselves rather than merely writing down a plan is vital for learning.

Practical work was found by the participants to help them study better for examinations. One girl indicated that practical activities help them to study for examinations because some of the work that is covered in the practical activities also comes up in the examinations. Girls found that practical work helps them to study for examinations because it allows them to develop abstract ideas from concrete situations (Hodson, 1990) linking scientific concepts with real world situations. Practical work also gives relevance to the subject which encourages students to learn difficult parts of the subject (Helliard & Harrison, 2011).

In this study, girls believed that practical work helps to improve subject knowledge. Through practical work, they are afforded an opportunity to use materials and become familiar with laboratory instruments. One participant used the example of a microscope to explain this: *'If you want the thing to be big, you can see it yourself, and you can do it yourself with your hands yourself.'* This notion was also supported by another participant who stated that: *'A practical activity in learning Physical Science, they are important because we learn how teachers teach us, and see how things are working like bases and acids...if the teacher is teaching and showing us how bases change things, and we see with our eyes how things are changing, we see how the colours are changing then we are learning more.'*

These findings are supported by Musasia, et al. (2012) who indicated that practical work helps learners to develop familiarity with apparatus, instruments and equipment. This in turn enables learners to acquire manipulative skills and become experts in reading of scales, where the observations they make and results obtained are used to gain understanding of Physics concepts. Millar and Abrahams (2009) support the idea that involving learners in hands-on and minds-on activities might be the best way to attain understanding of concepts. From the social constructivist view, learning is a social process whereby students acquire knowledge through interaction with their environment instead of merely relying on the teachers' lectures (Fraser, 2006).

### **5.2.3 General participation of girls during practical work**

From the observations made, it can be concluded that when girls are doing practical work in a mixed group with boys, they do not really put much effort into handling the materials. Based on the findings of the observations, when girls were in a group of boys, not all the girls were actively involved in using and connecting the materials. Girls gave materials to boys and suggested positions where materials could be connected, instead of connecting them themselves. However, there were some actions that girls did take part in, such as: *a girl put a connector into the circuit; a girl placed one cell in the board; a girl placed a connector closer to the cells, and told others to put a switch in; and a girl holds a bulb and a boy took it from her hand and fixed it in.*

When the same girls were placed in a girls-only group, they seemed more active, readily joining in and handling the materials. The main problem observed in this group was that girls felt shy when someone laughed at their mistakes, which put them off and discouraged them from continuing with their work. From the observation an action was noted, however, *‘One girl took a red crocodile clip, started laughing and drops it on a table, another girl took it and drops it also, and all went back to the instruction paper.’* This action was confirmed by the findings from the interviews which revealed that some learners enjoyed laughing at others’ mistakes. A participant from the second interview indicated that it was not only the boys who laugh at others’ mistakes, but that girls tend to do the same thing. She noted, *‘Like in electricity, I enjoyed connecting, when you do not connect correctly things we laugh at you...’*

Girls displayed good cooperation in their groups. They seemed to work together more than when in mixed groups, and moved through one activity at a time. Actions recorded from the observations include: *girls show each other the positions where to put the materials; when the disagreement came in about the red crocodile clip, they went back to the instructional paper.*

Most of the actions observed and discussed in the previous paragraph are confirmed by Mwetulundila (2000), who stressed that teachers unwittingly allow boys in mixed schools to dominate the handling of equipment. She further noted that teachers generally encourage boys to carry out experiments and girls have to ask the boys to show them how they have done it. These dynamics reinforce stereotypes that boys are more capable in science subjects and that girls must rely on their help.

#### **5.2.4 Things that girls enjoy during practical work**

Participants enjoyed connecting materials together and working with, as well as testing the materials. One girl wrote in her questionnaire: *‘I enjoy connecting wires like in electricity and looking at how bulbs light connected like doing movies.’* Another wrote: *‘I do (feel) good because I use the instruments that are giving me the results.’* Yet another responded: *‘I see how something became (happens) like measuring water, I see how different materials are used.’* One participant described her enjoyment of discovering and using new materials, stating, *‘I only know that batteries are only used in radios, when I came to the class I have seen that, there are small electrical components that can be connected to batteries, eish! I was so impressed!’*

Girls enjoyed seeing and using materials especially those that they were coming into contact with for the first time. One participant stated, '*Ohatu kala tuudite nawa shaashi katu shishi (we feel good because we don't know the things), yoo iinima oyo tai longifwa opo kuishi nale ngaashi ee litmus paper dinya (the things that are being used you didn't know them before, you haven't seen them before like those litmus we have used), katu dishi nale kwali ngaashi eshi ta dishendjee colour molwiinima eyi tai longifwa otwali twahafa shili (we didn't know them before even when they are changing the colours because the things that are being used we were so surprised) and we have learned more.*'

The enjoyment of the work during practical activities is multiplied when this practical activity is carried out in groups. This is supported by the findings of a study done by Maselwa and Ngozoa (2003) in South Africa which aimed to investigate the impact of hands-on, minds-on and words-on activities in facilitating learners' conceptual understanding of electrostatics. This study revealed that learners enjoy the way science is taught at their school because their teachers do practical work with them.

### **5.2.5 Problems experienced by girls during practical activities**

The participants indicated a number of challenges which they experience during practical work. They noted that learners don't receive enough support from the teachers as some teachers are not willing to assist in a more in-depth way during teacher demonstrations. At times when learners failed to grasp concepts, teachers reported they had no time to repeat explanations or activities. Hatting, et al. (2007) discussed the issue of teachers' perceptions of their learners as the main factor determining whether they will do practical work with learners or not. Teachers who perceive their learners to be motivated and non-disruptive are more likely to engage their learners in higher level types of practical work. The findings that girls are not getting enough support from their teachers might suggest that their teacher is not motivated or is just not innovative towards practical work.

Misbehaviour also appeared as a problem experienced by girls during practical activities. This is noted because some learners' behaviour prevents other learners from concentrating and in some cases disallows them from completing their work. Forms of misbehaviour noted were: noise

making; learners destroying or damaging instruments; and theft of instruments leave other learners with no access to instruments.

Participants made mention of other challenges which they faced during practical activities. At times learners were given work to do, but had no knowledge of how to use the instruments provided. In addition, the problem of damage to the apparatus or breakage thereof was mentioned. Participants noted that with no working knowledge of how to use the instruments, it was easy to break it, and in such cases the school would charge them for the damage. When asked to use materials they were unfamiliar with, learners noted that this resulted in incorrect readings. Limited numbers of materials was listed a problematic since everyone in the group was not able to work directly with the materials themselves. These problems affect the participation of girls in a negative manner.

As discussed in Section 2.9.1, from the socio-cultural perspective classroom activities are tied to cognitive development by the premise that learning is social in nature and the activities are patterns happening between the teacher and the learners or among learners themselves. Children's cognitive development occurs through guided participation in social interactions with more experienced people. It is therefore true that what children can do with the help of other people may be more indicative of their mental development than what they can do alone (Allahyar & Nazari, 2012).

### **5.2.6 Preference for doing practical work in groups or as an individual task**

On whether practical work should be given in groups or as individual tasks, the findings from the questionnaires showed that the majority (94%) prefer to do practical work in groups, whereas 6% prefer to do practical work as an individual. Though the majority of girls prefer to do practical work in groups, the study done by Maselwa and Ngcoza (2003) revealed that learners prefer doing practical work themselves instead of having a teacher demonstrating to them. Teachers' demonstrations are sometimes too fast and learners do not really benefit from them.

Some girls preferred to work with others in a group. Those who preferred to work in groups stated that working in a group was more convenient because in a group learners assist each other in different ways. The assistance they give each other includes asking each other questions where

there is a lack of understanding, showing each other how to correctly use instruments, and discussing correct answers. Furthermore, participants who preferred to work in groups indicated that the information sharing that happens in groups is valuable learners can share information, compare knowledge, correct each other's mistakes and together come up with better answers. When working along, however, there is no one else to correct your mistakes.

Those who preferred to work alone indicated that this motivated them to work harder. When working alone, participants noted that they needed to have a thorough understanding of the topic for themselves, as opposed to relying on someone else for help.

### **5.2.7 Sex preferred by girls during practical work**

Figure 4.3 in Section 4.4 shows the sex preferred by girls during practical work done in groups. The results showed that 21 learners (68%) who participated liked/preferred to work with boys in a group; whereas 10 girls (32%) liked/prefer to work with other girls in a group.

The reasons given by the majority of girls for their preference included: the notion that boys have more knowledge of Physical Science than girls; the belief that boys participate more than girls; and that boys help girls to a great extent. One participant commented in the questionnaire that, *'Boys have good ideas and good information than girls'* while another stated that, *'We have different thinking capabilities with boys, when I cannot get the ideas on something the boys will think about it'*. The participants preferred boys over girls giving the reason that girls do not like to do practical work. Additionally, boys were reported to be very efficient when using instruments, unlike girls. One girl remarked, *'Yes, shaashi ovamati otava dulu okweendelela ndee tava mane diva diva (boys can do their work fast and get done with it), manga uukadona, ukadona oamadilaadilo avo hao nana haaendelele ngaashi ovamati (while girls... girls their minds are so slow they are not faster as boys).'* Another reason participants gave for their preference for working with boys was that boys seemed to already be familiar with some science-related materials from home and as such were more confident in working with these materials in the school setting.

Many still view the realm of science as a man's world which is not suitable for women and people believe that science is difficult and dull (Halpern, et al., 2007). As parents are unaware of

their stereotypes regarding sciences (ibid), they are either consciously or unconsciously raising their sons and daughters differently. For instance, when children are playing, girls are expected to play with dolls, crayons and other social and creative toys, whereas boys are expected to play cars and other technical toys. Since girls play less with technical toys, they gain less technical experiences at an early age and do not acquire the basics for later success in science (Milgram, 2007).

On the other hand, there are girls who preferred to work with other girls in a group when doing practical work. They prefer working with other girls because girls are cooperative. They also feel free when they are with girls only. From the interview with G1, she reasoned that she likes to be with other girls in a group because when you ask a question, the girls answer very well, unlike the situation with boys. I also observed this during the practical activities (as discussed in Section 5.2.3): girls who were alone in a group were more cooperative.

#### **5.2.8 Activities preferred by girls when doing practical work with other girls and when they are with boys**

There was not much difference in the type of activities preferred by girls in the different groups. Girls seemed to have mixed feelings on this issue, but could not provide reasons for their reactions. When the girls are placed with a group of boys during practical work, they prefer activities like writing simply because they consider themselves as having better handwriting than boys. Some girls indicated that they prefer handing over materials for boys to use, which was something I noticed during my lesson observations. Some of the girls preferred to present the findings for the group, stating that by presenting the results they had the opportunity to improve their English proficiency.

Girls stressed that they preferred working with boys because of their skill with connecting materials, although they were unable to provide reasons for where this knowledge might come from.

Some of the participants preferred working in groups with other girls. One of them indicated that she liked connecting when she is with other girls because of their similarity to her, and that they

also lack understanding like she does. Another participant stated that she wanted to use the materials because she wanted to discover how things work,

### **5.2.9 Factors that enable girls to participate actively during practical work**

Motivation is considered to be the main factor that can enable girls' participation during practical work. Girls suggested that they need to be motivated by their teachers. Other helpful factors suggested by the participants were: the separation of girls and boys during practical work; extra lessons in addition to the normal lessons; and the development of respect and cooperation among learners. Teachers need to address bad behaviour, especially when it comes to learners laughing at the mistakes of others. Participants indicated that they need to be given enough opportunity to do the work themselves, as opposed to merely observing someone else working.

### **5.2.10 Factors that constrain girls' active participation during practical work**

Participants indicated that they feared making mistakes, which stemmed from the fact that in cases where they do make mistakes, other learners, specifically boys, tend to laugh at them. The participants indicated that girls do not feel free to actively participate in the class during practical work due to shyness, a lack of confidence, and low self-esteem. Even when they make a slight mistake, they start laughing, as do other learners, and then shy away from the task at hand. Romantic relationships between boys and girls in same classroom are also a factor which girls see as a hindrance to free participation. Other factors mentioned by girls in the questionnaires were dress code and poor relationships among the learners.

After an analysis of the textbook, I put forward that the nature of the illustrations used may contribute to the girls' participation, or lack thereof, during practical work. The textbook illustrations depict two boys and one girl only in each group, which may communicate a message that practical small groups should consist of a majority of boys and a minority of girls. The frequency with which these illustrations appear in the textbook may reinforce this message. Textbooks also convey gender stereotypes. According to a study by Gudhlanga, Chirimunta and Bhukuvhani (2012), on moving towards a gender inclusive curriculum in Zimbabwe's education system, there are a number of examples of gender stereotyping in textbooks such as doctors and engineers always being depicted as male and nurses as female. The more active roles are

assigned to males, while passive roles are assigned to females. This gender stereotyping in textbooks is not restricted Zimbabwe only. Bhusumane (1993) found that textbooks used in schools in Botswana are gender biased. He stated that most of the textbooks contain stories that portray men as creators and rulers of the world.

Home environment is also a factor that girls felt contributed to their participation during practical work. Parents treat them differently at home especially when it comes to handling practical implements. One girl provided this example: *‘Me, I can give an example. We were connecting bulbs at the generator. Ndee meme tatii (then my mother said), ovedjapo kushishi otoningi uxwike iinima (You! Leave the things, you don’t know them, you can burn the things), napaye omumati oueshishi nawa (let the boys do it). I do not know why, mbela osheshi nee ame okaadona osho pamwe tati kandishishi nawa (maybe is because I am a girl that is why she is saying I do not know).’*

Other examples of girls being treated differently by parents involve play in the early childhood phrases. Girls are not allowed to play with things such as cars made from wire, but are rather encouraged to play with dolls made from soft cloth. Mwetulundila (2000) confirmed these findings, noting that males carry more informal experiences of practical science into science classrooms as compared to girls, and that this gives boys an insider’s view into science. At home, boys are more likely to have repaired bicycles and handled tools that are commonly found in science laboratories, affording them an added advantage by familiarising them with science. On the other hand, girls are presented with dolls as toys which do not necessarily prepare them for the science that they will meet at school.

I tend to agree with the argument put forward here, that both girls and boys should be encouraged to play with a range of toys during their childhood. While boys are exposed to mechanically built toys, bringing that mechanical knowledge with them to the science classroom they, girls are not afforded the same opportunity. For example, if boys fix their bicycles then in the classroom setting when they are learning about gears, they already have a base of understanding for what they are learning about, and are able to visualise what is being taught, while girls do not have this same understanding.

### **5.3 Concluding remarks**

In this chapter I have interpreted and discussed the data generated from questionnaires, document analysis, observation and interviews. From the analysis I discussed the data using different themes. Using these themes I explored the participation of girls during practical work where the discussion focused on the data generated from the girls. In connection with the learning theory of socio-cultural, social constructivism and mediation, I discussed the role of practical work in learning Physical Science, general participation of girls during practical work, problems experienced by girls during practical work, and social factors that influence the participation of girls during practical work.

In the next chapter, I will provide the summary of findings and recommendations for future studies. I further discuss the limitations of the study, share critical reflections on the research journey and bring the study to its conclusion.

## CHAPTER SIX: SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

### 6.1 Introduction

This chapter presents a summary of the findings of this study. It also suggests some recommendations that could be implemented within Namibian Education Curriculum as well as areas for future research. Here I discuss the limitations of the study, reflect on the research journey and conclude with some general comments.

### 6.2 Summary of the findings

The study attempted to investigate the participation of grade 9 girls during practical work in Physical Science lessons. In order to find out more about the participation of girls during practical work, a number of questions were formulated from the main research question and the findings associated with them are discussed below.

*What are grade 9 girls' perceptions and experiences about practical work in current electricity?*

It was found in this study that learners readily identify practical experiments as one of the teaching methods used in teaching Physical Science, but that not all learners prefer doing practical work. Those that do prefer engaging in practical activities have varying ideas of what kinds of activities would best suit their learning needs. Some learners prefer to complete activities on their own, and others prefer teacher demonstrations.

The study also confirmed that girl participants are aware of the role of practical work in their education. This correlates with the literature which indicates that girls know the value of practical work, the reasons for practical work, as well as its place in the process of learning Physical Science. The study also explored the concept of group practical work, noting that most of the girl participants prefer group work over individual learning when it comes to practical activities.

The study revealed that the girl participants enjoy practical work. They reported enjoying using materials, connecting various materials and working with instruments, especially those that are new to them. They did, however, report a range of challenges which they face when working with science-related practical activities. These included: a lack of, or little support from the teacher; poor behaviour of learners during practical work; a lack of knowledge on how to correctly use materials which leads to incorrect results; and limited materials which prevent all learners from taking part equally in the activities.

*What is the observed participation of grade 9 girls during practical work in current electricity?*

This study found that girls only participate actively during group practical work when they are arranged in a single sex group. It was observed that when girls work in mixed groups with boys, they tend to avoid handling the materials provided as part of the activity. In mixed groups, the girls seemed to be less active in using and connecting materials, rather handing materials over to the boys and making suggestions about what should be done, as opposed to being ‘hands-on’ during the process.

On the other hand, when the same girls were placed in a single sex group, they appeared to be more actively involved during the group work activities. The participants were more willing to handle the materials, and their involvement was greater than when working in mixed sex groups. The girl participants showed a higher level of cooperation among themselves, more so than when they were working in mixed sex groups.

*What enables grade 9 girls to participate during practical work in current electricity?*

Motivation is considered to be the main factor that enables girls to participate fully during practical work. The participants suggested that they need to be motivated by their teachers. Other factors that they suggested to enable their participation were: the separation of girls and boys during practical work; the provision of extra lessons in addition to the normal lessons; and an atmosphere of respect and cooperation among each other. Teachers need to discourage misbehaviour, especially from learners who laugh at others’ mistakes. The participants noted that they need more opportunity to do the ‘hands-on’ work themselves, rather than merely observe work someone else is involved in.

Interview data suggest that girls prefer working in mixed groups which is similarly found out from the questionnaire. But the classroom observation suggests otherwise. This indicates to me that girls have different choices of gender during practical activities when working in groups. It is however very important for the science teachers to know this issue.

*What constrains grade 9 girls' participation during practical work in current electricity?*

The respondents noted that one of the main constraints to their active participation in the practical activities is the fear of making mistakes, which they report to be a result of the way in which other learners, specifically boys, laugh at others' mistakes. The girls indicated that they are not 'free' in class, and struggle with shyness, a lack of confidence, and low self-esteem. One last factor which girls reported as hindering their involvement during practical work, was the issue of dress code – wearing skirts was seen as impractical.

In addition to asking the research questions outlined above, I also analysed the textbook used by learners. An analysis of the textbook revealed that the illustrations used may contribute to the nature of the girls' participation during practical work. The illustrations indicate that the norm for group configuration during practical activities is two boys and one girl. This may have an influence on the thinking of the participants when it comes to how group activities should be conducted; if they are to follow the example given in the textbook, they should always be outnumbered by boys in their group activities. This notion is strengthened by the frequency with which these illustrations appear in the textbook. The home environment of the participants is also a significant factor contributing to girls' participation during practical work. Typically, Namibian parents in the context of this research treat boys and girls differently when it comes to the handling of materials and the type of toys they allow their children to play with. While boys are encouraged to play with cars constructed from wire, girls are encouraged to play with dolls and other items made from soft materials. There is not much flexibility with items children are encouraged to handle at a young age, which could influence the level of confidence present among boy and girl learners when it comes to the handling of materials in the Physical Science classroom.

### **6.3 The following recommendations are made:**

- Teacher training institutions should place greater value on creativity and innovation in planning practical work for their learners. The way the teacher demonstrates to learners and the way in which the teacher plans and guides practical work has a direct effect on the way learners respond and act during that practical work.
- I would recommend that the government increase the budget for the Ministry of Education, making sure that sufficient funds are allocated to the sector responsible for the provision of resources to schools. This study found that learners experience barriers to learning due to inadequate materials in the context of their practical activities. Learners are expected to work with poorly functioning equipment which leads to inaccurate results or no results. This is demotivating and causes learners to lose interest in practical work.
- Science teachers need to take into consideration issues of gender when it comes to practical work in the Physical Science classroom. Teachers ought to have an awareness of the type of learners in their classes, as well as the conditions under which the learners perform best in order for teachers to plan their activities carefully. Teachers should constantly evaluate their teaching strategies and be prepared to change them, should the learners not be performing well in mixed groups.
- There is a need for science teachers to assess the actual learning taking place during practical work. It is misleading to think that because learners may express enthusiasm for working with new materials, that they are necessarily gaining knowledge. Assessment will help to evaluate how much is actually being learned.
- There is a need for the monitoring of textbooks supplied to schools. Only textbooks that are gender sensitive should be provided to the schools.

### **6.4 Limitations of the study and challenges**

The focus of the study was to investigate how girls participate during practical work. This study was limited by the time available to me as a full time teacher. The study was only carried out with 31 girls from one school in the region and as a result the findings cannot be generalised. Nonetheless, it provided some insights into how girls participate during practical work.

The study is also limited by language issues. Participants were given an opportunity to respond in the language that they are comfortable with and most switched from English to Oshiwambo. In the transcription process, I translated back to English, which limits the study because in the process meaning may have been lost.

Lastly, this study focused on the observation of girls during practical work, which was constrained by the problems of poor or inadequate apparatus in the classroom. As a result, I was not able to observe the girls doing practical work alone, which would have given me a more thorough picture of their participation.

If this study were to be repeated, there are a few changes I would make to the research process. I will discuss this in the next section.

### **6.5 Areas for future research**

If a similar study is to be conducted, the following areas should be studied:

- The same study could be done with an increased number of sample participants from different schools in the region; and
- The time length could be extended so that girls in different areas of Physical Science could be included in the study.

### **6.6 Personal reflections**

This study taught me a lot and helped me to develop personally, academically and professionally. It is through this study that I have learned to deal with the disappointment that comes with research, like participants not meeting my expectations. I gained a lot of insight into my field of interest, firstly through studying the literature and secondly through the research process. This was a great learning experience for me. This study has taken me to a new professional level, and I find myself looking at issues and situations far more critically.

## **6.7 Conclusion**

In this chapter, I summarised the findings, discussed the limitations and challenges, made some recommendations and provided ideas for further research. I also reflected on my own experience of the research project.

This has been a worthwhile research journey. Although, as a case study, the findings cannot be generalised, I would hope that these research outcomes would provide recommendations which can help improve the education system in Namibia. My hope is also that through a greater awareness of the issues of gender disparity that stem from a patriarchal society, schools and teachers would begin to treat both boys and girls equally in Namibian schools. .

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## APPENDICES

### Appendix A: Consent letter to the teacher

Ms. Johanna Munyanyo  
PO Box 7102  
Oshakati  
Namibia

Ms. Elizabeth Matheus  
Physical Science Teacher  
Udjombala JSS

#### **Subject: Requesting for a permission to observe Physical Science practical lessons**

I, the undersigned hereby humbly asking for the permission to observe some of your Physical science lessons, with practical activities by grade 8 learners. The focus of the exploration is to observe the participation of girls during practical activities.

The observation is scheduled to commence as from 28/06/2014 up to 15/07/2014. The observed lessons will be videotaped, and **we** will watch the videos together. Some girls will be interviewed from the observed will be interviewed as a group and as individuals. ***I am ensuring you that the information from the lessons presentation is for the study purposes only and your details will be kept at anonymity state.***

As a proof of acceptance, you are humbly requested to complete the letter at the back of this covering letter.

Thanks for your support in this research study.

Yours sincerely

Ms. Johanna Munyanyo (11M0014)

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**Appendix B: Consent letter and its approval from the director of Ohangwena region**

Ms. Johanna Munyanyo  
PO Box 7108  
Oshakati, Namibia  
Cell #: 0812208498  
12 June 2014

The Director of Education  
Ohangwena region

**Subject: Request for the permission to carry out my educational research at Udjombala JSS**

I am Johanna Munyanyo, a Physical science teacher and a head of department at Udjombala Junior secondary school, hereby requesting a permission to carry out a research study at the above mentioned school. As per University's requirements I need to get the permission from my supervisor(s) for me to start with the research.

I am doing a Master Degree in Science Education with Rhodes University in Grahamstown South Africa, since January 2013. This is a two-year course, which consist of Coursework in the first year (2013) and a thesis in the second year. I am in my final year (2014), where I am to carry out a research study. The research study entitled "**An investigation into how grade 8 girls participate during practical work in Physical Science lessons: A Namibian case study**".

Researchers have found that teachers tend to teach Physical science without considering the gender issues that may affect the process of teaching and learning Physical science. It is also argued that girls tend to participate poorly comparing to boys in the same classes during practical works that are done in Physical science as per national curriculum (2010) and Physical Science syllabus (2007). It is against those backdrops that I have decided to embark on such research with a view to help a Namibian child.

I am intending to carry out my research during week days. I am assuring your office that I am going to do compensatory teaching for any interruption that this study may bring in my teaching process.

I am looking forward to hearing from you.  
Yours sincerely,

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Johanna Munyanyo  
(Student number: 11M0014)



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OHANGWENA REGIONAL COUNCIL  
DIRECTORATE OF EDUCATION  
DIRECTOR'S OFFICE

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Enquiries: Magano Gaoses  
Email: [mcnotto@yahoo.com](mailto:mcnotto@yahoo.com)

13 June 2014

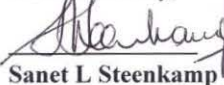
Ms. Johanna Munyanyo  
P.O Box 7108  
Oshakati  
Namibia  
Cell: 081 220 8498

Dear Ms. Munyanyo,

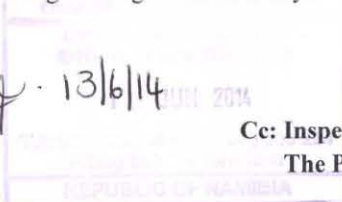
**Subject: Request for permission to carry out educational research at Udjombala JSS**

1. Receipt of your letter on the above subject matter is hereby acknowledged.
2. Permission is granted for to carry out the research on “an investigation into how grade 8 girls participate during practical work in Physical Science lessons.
3. Embarking on a case study as yours is indeed welcomed as it is done with a view on improving the way of the teaching and process that is going to benefit both the Teacher and the Namibian child.
4. As this is directly affecting the learners, it will be appreciated, as per your statement that any time lost will be compensated as it is very critical that learners stay up to date with the learning process.
5. This office hereby wishes you the best in your research and salutes you for the initiative you have taken to go through with the study.

Yours Sincerely,

  
Sanet L Steenkamp

Director: MoE  
Ohangwena Region



Cc: Inspector of Education –Ohangwena Circuit  
The Principal – Udjombala JSS

## Appendix C: Questionnaires record APPENDIX A

### QUESTIONNAIRE DATA

#### How do you like Physical Science subject to be taught

Teacher talks and write on a chalkboard only	9
Learners discuss in groups	1
Teacher do experiments and learners look at it and write down the results	13
Learners do experiments themselves and write down the results	7

#### What are the importance and roles of practical activities in learning Physical Science?

- It because I will get more information in Physical Science. I know how I will do it. I will sure that subject improves.
- Practical activities is important because in practical activities teach us to know more things like connect electricity than in writing in chalkboard.
- It is important because the learners will know the material should be used them self.
- You get more information from each other. You share the idea with your friend. You can get data you can learn more things.
- To know how to work them. Some people they do not have work and we learn Physical Science when we do your work, you take money for your own.
- You can do better if you are given activity or assessment to be complete or done. You can even learn more things.
- It is important because we can get more knowledge then that you had before you do practical work.
- To know how to use laboratory instrument by doing experiment and write a results. To know how some observations are happening.
- To know how to use experiment. To test our mind.
- It important because you know that when you do something such as practical activities is happen when you do things.
- It helps us to know how practical activities are important, it help us learners to know Physical Science is and we can to be passing.
- It is important because in Physical Science we learning the good things to catch in your head and get more information in Physical Science in the practical activities in learning Physical teacher must be prepared to learning a learner about Physical science when you learning Physical Science you will be qualified.
- For learners to understand what teachers talk about, help the learners to improve their English in speak or understand.
- It is important because when the learners do practical activities can know something when react and can help the learners when they study for examinations.
- Because some people or a teacher are very too educated by the learners. When you are practical your subject you can improve your mind.
- Is good because the teacher they pick up a CASS marks.
- To know when you are listening or you are not listening, to be learning about Physical Science and understand, to know more information.
- It important to us to know how the instruments are work, to know electrical charges or how to calculate voltage.
- It is important for us to get CASS marks and to know how to do and answer practical activities.
- Is important because it improve our ideas of making things in order to understand it.
- For the learners to know more about the Physical experiments, to know and understand the subject well.
- To know more information, to know how things work, to know how to write and reading.
- It is important because when a teacher does experiments and learners look at it and write down the result and learners they will get more about this.

- Is good because it can increase the understanding of the chapter/topic it is all about.
- It is important because learners should learn more through practical activity. And know how to work with materials.
- To get marks, to get the experience in doing experiments, to know the Physical Science activities.
- Teacher must write on the chalkboard after he/she explain to the learners.
- Do practical in class together with other learners and teachers so that learners must know how the experiment is worked for.
- Learners will learn more about something that they did not understand in learning without practical investigation. They will also be taught how things work.
- It is important because it gives us good knowledge and to know many things which is good in our life.
- Is important because when we learn about something and practical about it we understand it very well instead of writing summary and explain it and leave.

#### **What do you enjoy when doing practical activities?**

- I score more marks, I understand very well, I write very well but the problem I don't know how to write the words.
- I enjoy electricity activities because I like to connect the cells and bulbs in parallel.
- Because I will also learning if I do practical work my mind is also taking something and I will keep it in my mind.
- I like to ask questions from my partners where I am not understand, avoiding stress.
- I will be happy because when we do Physical Science work, I will learn more things.
- You can learn more things from others. You can even improve learning you can attend the practical work you can improve you spoken English.
- I can find more information came from practical and improve my words that I can spell wrong and also talk wrong.
- By connecting instruments together, by writing down the results.
- Give more effort to study hard, help me to minimize my mind, and help to know a lot.
- Crushing mahangu, I would like to crush mahangu because it is easier to me than other practical work.
- I like to work with others because can be learners learn things that I do not know.
- We are enjoying when doing practical work even in a class or you can do it at home that is your cares you what to choose in yourself and make it a plan to work hard in your practical because will be happy to do practical work in normal.
- I enjoy it because it helps me to know something that I didn't understand, also help me on answering some question and give some idea.
- Because when we do practical work we must know to answer question and can help us to put more effort for thinking that we do we avoid stress.
- It is because when you are join together in your group you will received many importance to your friend and decision your activities what can we do in your activities.
- I am enjoying better because some topic of Physical Science I cannot understand thus why I say enjoying better like topic of bonding.
- I was happy because I like work to do when a teacher is explaining well about work.
- To know everything like when to you the topic of electricity, I am very much happy to see the instrument or the way they are connected.
- We enjoy because we get knowledge and learn how things work and later to do them by ourselves.
- By sharing duties with my partners and by doing a practical that I do not know.
- I enjoy testing the material; I enjoy studying the practical works.
- Because the thing is easier and when you practice the people will help you in practice. To know the thing work e.g. microscope.
- I enjoy it when I am doing practical work by doing electricity.
- I like to connect the materials together and to write down the results.
- I enjoy it very much because sometimes you do not know how to work with materials and when other practice I enjoy it also.
- I enjoy writing, I enjoy talking when giving each other answers and I enjoy thinking more about practical work.
- Home work because home work testing you whether you understand or not.
- When we work together with others.

- I enjoy connecting wires like in electricity and looking at how bulbs light connected like doing movies. I also like to be recorded by teacher and sometimes I feel very really honored.
- I see how something became (happens) like measuring water, I see how different materials are used.
- Because I really do (feel) good because I use the instruments that are giving me the results. When you practical you ask when you do not understand is better than you do for yourself.

**What problems do you experience when doing practical work?**

- Other teachers they do not want to help learners with the word they do not understand well, they do not want to be asked something that they do not understand.
- No problem because when I doing the practical work I need to be free and to pay attention to the practical work that I am doing.
- The problem when I do practical work I get confused because sometimes I was not understand that practical activities.
- Sometimes most learners they did not like to participate, they make a lot of noise.
- Some people make a lot of noise and some people did not do the work.
- To be not well understanding and the teacher have no time to repeat again to what she said.
- The problem came from when you are doing practical with girls even with boys is there many gossiping came from your partner that you doing with practical.
- Some learners they do not like to do the practical, some learners they do not like to listen to others.
- Sometimes I would not able [how] to use instrument and I had no body to ask, poor in decision making.
- Problem of practical work is when you do something that cannot know and you do not know how to use it.
- Some practical not like to well. Some learners they do not like do work they are lazy of work.
- The problem is the teacher because teacher they do not want to teach a learner about the importance of experiments we doing practical work learners they did not getting anything in head they just look like a paper surrounded upward the air.
- I experience the problem of I did not understand some word or teacher ask me some question but did not understand it.
- By leading, and the materials are not enough to the learners to use and do not put more confident about that when teacher show us.
- Some people are not listening to teachers as anybody we can talking or decision in the class and when teachers are teaching here some people or person are doing something here what can be doing others.
- Sometimes the teacher you will give a learner like a class work but the learners did not understand but the teacher just go to the office.
- The problem is we are not understand about teach is learners. The problem is the teacher is not serious with her work.
- Some people do or some cannot do. Some the problem is the word you do not understand, to write the word you do not understand.
- We experience problems when doing practical works because some learners destroys the instruments and stole them.
- Some experience we do understand it even some learners do not like to do share their common ideas with others so that they finish that practical.
- Sometimes no enough materials to work with.
- The problems are that we do not know how the thing work, the teacher are not gives any information.
- I do experience it when you do it in a group, some learners are selfish, they do not want to do anything but I do enjoy when I am alone.
- Some learners they only want to make the practical only, while some are just quiet they do not do with others.
- Some learners especially boys they do not want to try their best they only want others to do and work with materials.
- Noisy making learners, teacher likes to speak English which some we cannot hear.
- Copying because boys like to copy very much, they do not like to make their own thing.
- Some learners they do not concentrate on what the teacher is doing.
- Problems can come when we are doing with boys because something they might be conflict. Some of the boys are lazy and they do not like doing anything.
- Breaking the materials and the school will ask you to pay for those materials. The learners take results which are not correct.
- Is only few learners who are practice on that practical work. Some are just quiet waiting for others to write and practice for them. We are not sometimes doing the same thing.

**(a) Do you like to do practical activities in a group or alone?**

<b>Alone</b>	2
<b>In a group</b>	29

➤ Group, because when you are they do all the answer because some do not understand.

because they are in the group they participate well and alone no one help you they are put more effort in the group

- Group, because in a group we a sharing information and different ideas.
- Group, because if you do practical activities in group you will share many ideas in group sometimes you will not understand.
- Group, because when I do practical activities with others I can ask some learners who understand that practical activities and next I get to understand the things.
- Alone, because when you do in alone, you work hard so that you want to achieve your goals and it will do well.
- Group, because some of topic you cannot get them correctly and then when you are in group and there is somebody who knows it is to be completed and you can learn from her.
- Group, because with alone is not good because there is no one who can give you things that you could not know, in groups if you do not know this your partner must be knowing it.
- Group, because sometimes you did not understand the topic and your classmate will help you, sometimes you do not know how to connect material others learner can help you to understand easily.
- Group, because in a group people share information and it can be easy to afford all marks. If more information compared it can be easy for all members to understand well.
- Group, because when you are wrong with something you are doing one of your group members can correct the thing because she knows very well.
- Group, because like to do by a group so that I can know thing how it work. It helps me know to be with people and sharing ideas.
- Group, because if you did not understand something you are not clearly you must [it is] easy to ask in group and give good answer and all of them must be participate in group.
- Group, with a group because it help me to ask some word from my learners that I did not understand also its help me to practical some question.
- Group, because when we do practical in group you must know things that some are know and you do not know and you can share ideas in a group.
- Group, sometimes when you are doing a group you can decision everything that you can do understand or whatever you do not hearing.
- Group, because they will understand because they will advice 'kutya' [that] what to do and know do you understand.
- Group, because at one time you are not listening well and your learners that in group they listen well more ideas from other learners that in group.
- Group, in a group because when you working in a group you will not forget that you do in a group.
- Group, because when doing alone you donot get time and you do have somebody to correct the mistakes you are doing.
- Alone, to know either I understand that topic or may I need some help.
- Group, for use to share the ideas, to learn from the other who knows best, to help others who do not well understand the task.
- Group, because you will share information when you do not understand your friend will help you.
- Group, I do like to do it in a group because when you are doing it in the group different ideas will come up and you will discuss which one is the best.
- Group, because in a group you can share information and you will do were you are good at.
- Group, because we share ideas and we are able to make up something very easier because we are many in the group.
- Group, because we can share the ideas, because some write and some speak or give answers.

- Group, because you add your ideas together and find the answer.
- Group, because when we do the practical activities every learner must become up with her ideas then you can put it together.
- Group, because I can learn on my mistakes and also learn other were they did not understand. Sometimes I like discussing in a group to learn new ideas.
- Group, in a group because a group is something which is not difficult people can correct each other if you do not understand people can correct you.
- Group, because when you do it in a group you have full chance to ask your colleagues where you do not understand when you work for yourself you do not ask anyone is good because you shared the ideas.

**(b) When you are in a group do you like to work with girls or do you like to work with boys and why?**

<b>Girls</b>	<b>10</b>
<b>Boys</b>	<b>21</b>

- Boys, with the boys they have more knowledge, they participate more than girls, they try to help girls.
- Boys, because they have good ideas and good information than girls.
- Boys, because if you do with girls you will discuss things that are expected.
- Boys, because sometimes girls they did not like to do practical activities they like stories.
- Girls, because all girls are practical well.
- Boys, boys have no problem with the activity because some of girls were not like each others may be sometimes are jealous with other girls and boys have no problem to be done that practical activities.
- Boys, with boys because boys that do not have any problem like girls. Girls have more gossiping with other girls.
- Boys, because boys they know how to connect materials very well, they are easily to them to understand the topic especial electricity.
- Girls, because girls can cooperate with each other well.
- Boys, because sometimes boy have more knowledge of practical work.
- Boys, because boys the...
- Boys, because we work with a boy even in class there is boys and girls we ...
- Boys, with a boy because that boys make something fast than girls.
- Boys, because gender are the same when do practical activities with boy can share information.
- Girls, because of the girls are very nice to do make good behaviors.
- Girls, because the girls have good behaviors.
- Boys, because the boy have a good practice.
- Boys, because the boy have respect but the girls they like to gossiping each other.
- Boys, because maybe some of ours do not have enough information about the activities and do not have knowledge about it.
- Girls, because some boy they did not like to work together with girls.
- Girls, because girls have a good relationship.
- Girls, because girl you will have cooperation together.
- Boys, I do like to do it with boys because boys are always take it as it as the best. Boys give different ideas and then stop telling stories.
- Girls, because girls are like me I can do well boys they do not like to take the materials.
- Boys, because boys they are not shy they can do thing correctly.
- Boys, because we have different capability and when the idea I am not think about it the boy can think it.
- Boys, boys just like girls because your work together in order to find the answer.
- Girls, because when the girls do a practical with the boys some girls they can do well and they cannot concentrated and they cannot get something because they are with boys.
- Girls, because I can be free from doing anything some of the boys like quarreling each other.
- Boys, because we girls we hate each other if you are all girls you will debate.

- Boys, because in school everyone girls or boys they all give an answer when he knows it.

**(c) When doing practical work with girls, what activities/tasks do you like/prefer to do in a group and why?**

- I want to participate very well; I want to do my home work.
- I want to write the results.
- Using materials, because I want to learn more.
- Write because girls they like to write when they give something to do in a group.
- She just does what he/she good at all girls are practice give them an idea.
- I just to motivate them and I want also to do representation always so that I can improve my English and to be always written.
- I want to participate about what we are doing and I am the one who present in front of the class.
- I want to connect instrument together and writing the results.
- Advice them to work very hard and reach all mark as possible
- I will be there to correct people who are wrong with practical work.
- I want to be the one who recording result.
- When I am in the group I will be discussing about the important of school and how my life can be changed to go hard.
- About what factor affect a girl to have a pregnancy.
- I want to become the write and give the answer and read.
- I want to do anything that we can all doing the task activities.
- I want to write and practice and I will ask about the answer.
- To be leadership, I want to be a leader to tell them what to do.
- To write and talk to playing
- We can do any practical work because we also want to know how thinks work and to work out by ourselves.
- I will be there giving ideas to my partners
- Measuring instrument to know and get their reading for you to know.
- To write the answer
- I prefer to do electricity because electricity it is very easy you will just have to connect components.
- I prefer to work with the materials or objects
- When I am in a group with girls I want to practice well in the group without shy..
- I write because I have good handwriting and I learn more from them
- To write the answer because writing is easy to find the answer.
- I would like to do a practical activities and me I want to be the one who is writing and put some ideas.
- Writing down the result, because I like learning from my speaking and mistakes.
- To choose who is going to write and to take the main point.
- I write the result and practicing with other colleagues.

**(d) When doing practical work with boys, what activities/tasks do you like/prefer to do in a group and why?**

- I practice use instruments how they are used and writing the result that we are getting.
- To be secretary because boys they do not write nice word.
- Connecting things, because boys like to work slowly and some of the boys play in the lessons.
- I would like to put some ideas and am the one who writing and am the one who present it.
- To write then we add our idea together
- I write because some boys do not have good hard writing which you can see.
- When I am in a group with boys I will take the result only and writing them
- I prefer to write the result as a secretary.
- I prefer to do electricity with boys because most of the boys they are good at connecting and they are not shy as girls.
- To talk the information
- Speaking task, because boys like talking too much.

- I just want to share intelligence work and ask where I cannot understand
- We can also do any because some of the boys know exactly how things are going on.
- I do laugh to playing with them or to beating
- I want to be a writer because some boy have bad hand writing
- I want to write activities because the boys they cannot write very clearly.
- The boys can give me answer and I am writing something.
- I want to give the answer on the group to show whether I know or not.
- Anything because I want to help a boy to answering question.
- I am just tell the boys to respect girls and also can have a good behavior and must be work hard.
- I want to do the like leadership
- I want to produce something that can I know best by comment of boy.
- Tell them for not having disagreement and advice them to study
- I want to look at how material are connected together and analyzing
- I want to participate and I am the one who going to present our work.
- When I given work with boys I want always to write activities because boys have bad handwriting.
- I do, but not well some boys did not practice and making a lot of noise.
- To draw because boys they know how to draw
- Writing practical because we will share the ideas.
- I want to connect the cells and connecting wire in the series with boys.
- It because of boys they do not gossiping they are respect other.

**(e) What factors do you think prevent girls from doing much work during practical activities?**

- Because they were some afraid to talk and also to make mistake because some they like to laugh simple things.
- They do not like each others. They like to disturb they like to gossiping each other.
- Some of the boys like insulting others. And some of the girls hate teachers.
- Because girls they shy and they are lazy and some boys because boys when you are with them they like to look at you.
- Girls like to laugh at you when you present something
- Thinking about work, the material that I cannot know, the boy disturbing me.
- Girls are always afraid to talk freely because boy they like to laugh at girls.
- Girls they like complaining and they are afraid of laugh and they even become shy.
- Most of the girls when there are in the class they are always shy and they do not take education as it serious thing in the future.
- They make noise.
- Some girls they like their bodies, so they only let others to do as well as they think that the group members will cover her.
- By not listening to the teacher when he teaches, some learners whose making noise.
- Our skirts
- Gossiping each other
- Jealous
- Beating each other
- They teach they are talkative and the always making noise. Because of the drinker because of work at how.
- Some of teacher they prevent the learners because the teacher use to do the work.
- The some girls are having boyfriend that is factors that they do not do it, because some are having problems and treated you bad and you sometimes you did not understand what teachers are talk.
- Because when girls are in the same class with their boyfriends they do not do well in class sometimes some girls like gossiping.
- The girl because I want to help a boy to answering question.
- I think the problem came about problem of the boys because boys like to check girls in face or in the body and also boys are making lot of noise.
- Because they like laughing and afraid learners.

- Because some girls hate other girls because of clever of girls.
- They are very laziness, when doing practical with boy sometimes girls are shy.
- Boys they didn't like girls to do because they first benefit themselves sometimes we are ashamed to do wrong things.
- When girls have his boyfriend in class girls can embrace his boyfriend. Other things girls it must look selfish.
- Girls are making noise and then when you tell them to keep quiet they say they do not want this make as not to done.
- The will not get time to practice and some they are just seeing themselves in a mirror.
- Sometimes the learners like to laugh at each other when someone does a mistake
- Not to be free with other learners
- It because they are thinking bad things, they do not understand what to do they do not think boy they are gossiping.

**(f) What factors do you think enables girls from doing much work during practical activities?**

- I want to think very well, I want to improve what to do in the activities; I want to put more effort.
- The teachers need to tell girls that they need to be free.
- Using the material sometimes the material you do not know to use them.
- Teacher must do the meeting with the learners to tell them that when they see a learner laugh any one another they can be punishment.
- You get time to practice well and if teacher talking and you do not understand ask her.
- Teacher should be in class always so that they can tell those that make noise to keep quiet.
- To be not having friend in school even in your class, you need to live the friends that you see is not good.
- They suppose to do a work after school without boys, they suppose to improve life to be free when they doing practical.
- Be hard work always, try to be understood always, take part in experiments.
- Must have peace with other people, cooperation and have love with all people.
- I want to be free with others and share ideas to help others to know Physical science very well.
- I can do to work hard and teacher he does not want to help the girls to meet with a girl in a good place and tell us about practical activities.
- To understand some words to know how to write some word also help as speak proper English and answering some question in good way.
- By the learners you must look to one another learners when do practical activities.
- You can to and very study.
- To listen because I am listening than answering the following question because. You cannot listen you cannot answer the question.
- To be listening at teacher, I want to be faithful with school and work; we want to be good in listening.
- You level the bad friend, the material that I do not know to use them.
- To wear trousers
- Some equipment that are use in practice, some girls who like talkative.
- Good communication with other learners, when the teacher is concentrating in what you are doing.
- To listening to the teacher so that you can know much.
- Boys they are always work to make jokes and laugh at girls mistakes. In this ways girls will be not free.
- I need to be free and learners should not laugh to one another.boy should separated from girl for girls to work with girls and boys to work with boy in practical activities.
- To disturb from boys, the teacher need to teach us about the material which we do not know.
- Stop laughing, insulting other when present.
- Mixed boys and girls and much materials and teacher can be serious to what they do on practical activities.
- Teachers must talk with good voice with learners; boys must be separated from girls work.
- Stop gossiping; like each other; teacher should tell the learners to do work and give any examples.
- Teacher must tell girls to be free when they do practical activities; teachers make meeting and advice the girl how to be.

## Appendix D: Lesson observation transcript –Mixed-sex group

### VIDEO TRANSCRIPT 2 THREE GIRLS AND THREE BOYS

Both boys and girls were struggling to start, and the teacher showed them how to place the cells on the circuit board.

A boy took three (3) bulbs out of the circuit and a girl put a connector into the circuit. Two girls are pointing into the instruction paper.

The teacher instructed them to remove all the components from the circuit board and all the learners were busy taking them out.

A girl placed one cell into the board followed by a boy. One boy took over to all the 3 cells into the right position. “*Ohali kala ngaha*” (*it is placed like this*), one boy changed the position of the cells.

A girl placed a connector in, closer to the cells, and told others to put a switch in.

Teacher: “*Okudja komamanya wauka oku?*” (*from the batteries to this side?*) she pointed to the side of the board pins.

When a teacher probed them, a girl puts in the crocodile clip.

Two boys are were holding the black crocodile clip, assisting each other on how to put it on.

There is a disagreement on where to put the bulb being held by one (but I couldn't pick up their voice very well).

“Put it here” a boy is showing the position in the board/ “put it there” another boy pointed, “put it here” a girls pointed at the same position.

A girl holds a bulb; one boy took it from her hand and fix it in.

Another boy holds a bulb, “*otakayi apa*”? (*Are we placing it here*) a boy asked, a girl shook her head, another boy said “*aaye*”(no).

“*Oshiima eshi ngeno otashii apa*” (*we should put this thing here*) a girl suggested pointing with her figure.

A boy completed the circuit with a connector; another boy pressed the switch and the bulbs light.

Teacher: Did you read the instruction?

Boy: Yes

Teacher: If your bulbs seen lighting, then that means? All are now trying to reach and read from the paper. Another boy pressed the switch again and the bulbs lights again.

## **Appendix E: Lesson observation transcript- mixed sex group**

### **VIDEO TRANSCRIPT 2 THREE GIRLS AND TWO BOYS**

All the group members have started by familiarizing themselves with the instructions in the paper.

Two boys and girls are pointing in the paper for instructions.

One boy fixed in a cell, he removed it out and placed in a bulb.

Girls are more serious in following the instructions like the two girls are trying to follow what is in the paper.

One boy fixed in all the three cells, “**Tulapo aka**” (put this one in) a girl gives a black crocodile clip to the boy who is busy placing the cells in.

“**Tula aka kwinya**” (put this one that side) she added for the red crocodile clip, while the boy is busy placing them in. All the two boys are busy with connecting the clips in.

“**uunima nava fike nawa nawa**” (things must be placed nicely) a girl reminded them .

The two boys pressed them down.

One girl moved the cells and made sure they are well connected, a boy pressed the switch and the bulbs light.

A boy started drawing, the diagram, while all the group members are busy observing his diagram.

A girl asked a boy a question (that I couldn't pick up bit she is pointing in the circuit board), “they are six’ a boy responded pointing the circuit board. Two boys and a girl disconnected the circuit.



## Appendix F: Lesson observation transcript- single sex group

### VIDEO TRANSCRIPT 3 SIX GIRLS

Four girls reached a table first.

Three of them are busy with the connection while one is reading the instruction.

Other two joined them.

They are showing each other where to put the connectors and bulbs.

All are busy with the connection of materials. “**Kamwe okaapa**” (one is for this position)” one girl pointed a gap in the circuit.

One took a red crocodile clip, started laughing and drops it on a table, another girl took it and drops it also, and all went back to the instruction paper.

There is a disagreement on where to put a red crocodile clip.

They are struggling with both the clips and some are even laughing.

One of them pressed the switch and the bulbs give off light. “**kuwete**” (See), one of them shouted.

“Next”? One of them came back to the instruction paper.

“Use this to draw” one gave a connector to the other but the other one dropped it and continue drawing.

Four girls started to disconnect the components.

## Appendix G: Focus group interview one

### INTERVIEW TRANSCRIPTION

#### FOCUS GROUP ONE

*Do you think practical activities are needed in teaching and learning Physical Science?*

*(Owuudite kutya okulongifanokuulikilwa nghene iulongifomwa hayi longo oshafimana mokwiilonga oshilongwa eshi shuunongononi?)*

**G1:** Yes

**T:** Why?

**G1:** Because you have to ... you have to learn to be like any one ... **opo omunhu akale auda nokutya oshinima shonumba otashi longo ngaipi.** (For the person to understand how objects work).

**G2:** **opo ovanafikola venyaa... opena ngoo ndishi ovalongwa vamwe ihava uduko diva, eshi teshimono mo group oteshi uduko shaashi ...**(For the learners who...there are some learners who do not understand things fast , if they see it in a group they will understand it better.)

**T:** **Oh, aaye, epulo ino luudako nawa. Epulo ota litii, owuudite kutya ee practical activity oda pumbiwa mokwiilonga o Physical Science?** (Oh, no, you didn't get the question very well, the question means, do you think practical activities are important in learning Physical Science?)

**G2:** **Eheno nadi kale hadi ningwa. Shaashi iinima opo taveyuuduko nawa. Iinima otavii ningi viiwete , tave yuulikilwa, taviilongifa.**(Yes, we must do practical activities because, learners understand things better, when they are doing it, they sees them, demonstrated to them and they are using them.

**G3:** Is important because it can improve the understanding of the topic. It makes learners to understand what teacher is teaching them better.

**G4:** **oya fimana shaashi, opena ovalongwa vamwe havadimbwa diva. shima aike va longwa oshiima opuwo ovadimbwa , ovapumbwa, nee vaakale hava ningi ee practical shaash...**(Practical activities are important because there are some learners who forget about things very fast, when they are just taught about something, they will forget about it, they need then to do practical activities.)

**T:** **Ee practical activities otadi kwafele ngaipi mokudimbwa?** (How do practical activities help them in recalling things?)

**G4:** **Opo ngoo nande otalesha ngoo nande oexams. Ota dulu oku dimbulukila komapulo enya apulwa.** (Even when they are studying for examinations, they are able to remember from the questions he/she was asked.)

*T: How often do you want practical activities to be done in Physical Science? (Owahala iilonga eyi youkulongifa iulongifomwa ikale hai longwa lungapi ile efimbo lifike peni mokwiilonga uunongononi)*

**G4: Nadi kale hadiningwa pefimbo olo, otopic oyo... pefimbo olo kwali ngeno omulongi ta popi kombinga yo topic oyo tainingwa.**(Practical activities must be done the moment the topic is being taught or immediately after the topic.)

**T: Ngee okwei yandje papita efimbo?** (What if the teacher gives the activity after a while?)

**G3: Opo ngaa aalongwa vakale vuuditeko kutya eshi kwali hatu longwa mboli osheshi shili kombinga yaashi hatu ningi paife ngaha.** (For the learners to know and make connections between what they were taught and what is being demonstrated to them.) **G1: Keshe otopic ndishi oina ngaa iinima imwe haikala idjuu, omunhu oshinima shimwe kushuuditeko nawa kutya otashiti ngaipi, oshitya ashike ngoo ngeno shili opo, ile ngeno o instrument kushi kutya ohai longifwa ngaipi.** (Each topic is having some difficult parts, sometimes you do not understand something, it is just a word or an instrument which is there but you do not know how to use it...)

**T: Omwapumbwa nee mwiilongife nyee mwiitale pefimbo opo?** (So you need to use it and look at it?)

**G1: Ehee**(yees)

**T: Ngee opapiti efimbo lile oshina oproblem yashike?** (What will be the problem if the teacher gives you the activity after a while?)

**G1: Ohatu hangika twaya nale ko next chapter, eshi tashi kaningwa omunhu owa dimbwa nale.** (We will be dealing with a different chapter, and we might forget about some of the things that are covered in the previous chapter.)

*T: When you are given practical activity, do you like doing it as a group or as individual?*

*(Ngeenge wa pewa iilonga eyi yokutala nokulongifa oyiilongifomwa, ouhole okulonga oove auke ile ouhloe kulonga nava kweni mokangudu kashona?)*

**G4: Ngeno eshi shiwaaa, oku ninga muli mo group** (what is good is to do it in a group), **shaashi** (because)...

**G3:** In a group, because you can share the information and tell others on your group... in a group who don't understand, how to you use the materials.

**G2:** In a group, because some of the learners they don't, they cannot understand things in individual that means when they are in a group...

**G1:** In a group, because others can help you, like boys they use instruments at their houses, when they, when you are in a group with them, you just say that which instrument do we suppose to connect and how to use it in a correct way.

**T: Owa popya po nee oshinima shimwe penya watii** (you have said something on boys that... of something that), **ovamati, ohava longifa ee instrument komaumbo** (that boys use instruments at home?) **Ukaadona voo ihava longifa ee instrument komaumbo ano** (do girls not use instruments at home?)?

**Chorus: Aaye** (nooo)

**T: Shaashi** (why)?

**G1:** Boys connect their radios, us girls we do not.

T: But you see radios at home?

**Chorus:** Yes

T: Why can't you just take the radio and connect it?

**Chorus:** We do not know.

T: You don't know?

**Chorus:** Yes

T: How did boys come to know?

**G2:** May be they are engineers.

T: Engineers by birth or how?

**Chorus:** Eeeee (yes).

*T: When doing practical activity in a group, do you like working with boys or girls?*

*(Ngeenge wapewa iilonga yokulongifa iilongifomwa mokuningashaa, ouhole kuolnga novamati ile onoukadona vakweni?)*

**G1:** With boys

T: Why with boys?

**G1:** Because boys they know how to connect well.

T: That is when you are connecting, if you are mixing up things for example when using a universal indicator to test for acidity and alkalinity?

**G1:** That is not difficult. The difficult thing is all about electricity.

T: Is it only in electricity that you want to work with boys.

**G1:** Ehee... (Yes)

T: Can we be general not just focusing on electricity.

**G2:** Is better to mix boys and girls, **opo aike ovanhu hatu luudifako nawa, kashina nec kutya omumati ile okaadona, shima aike hatuluudifako nawa otopic oyo** (so that they make each other understand well, it does not matter whether is a boy or a girl as long as they are helping each other to understand the things.)

T: **Opena ngoo eyooloko pokati ko group yuukadona no group yovamati** (is there a difference between a group of girls and a group of boys)?

**G1:** **Yes, shaashi ovamati otava dulu okweendelela ndee tava mane divadiva** (boys can do their work fast and get done with it), **manga uukadona, ukadona omadilaadilo avo hao naana haa endebele ngaashi ovamati** (while girls... girls their minds are so slow they are not faster as boys).

T: **Pamwe ovamati ohava mane diva ndee ihai kala ili mondjila** (may be boys they only do their work faster but their answer are not correct or maybe they do not do things in the right way?)

**G1:** **Aaye ohai kala ili mondjila imwe** (no, mostly they do it right and give correct answers), **okutya aike okaana kokamati manga aike taka kulu nande okena eemwedi 5 lwaapo otaka ningi nale iinima yokupangela ngaho** (is only that a boy even when he is just growing up about 5 months , he is already doing things that are related to the use of hands.)

**G3:** I like to be with both boys and girls.

**T:** Why?

**G3:** Boys knows many things like electricity and girls know other topics.

**T:** Topics like what?

**G3:** Like measurements, like alkali and acids.

**G4:** **Ondihole aike mo group** (I like to be in a group), **muna uukadona ovo aveke** (where there are girls only), **shaashi ovamati vamwe kavena elandulafano** (because boys they are not good,) **ohavakala nande okuli viikwetele novamati** (sometimes if they have issues), **nuukadona** (with girls), **ndee itashi keenda vali nawa** (and they will not do the work as needed).

**T:** **Itashi keenda vali nawa ngaipi** (they will not do the work, why may be?)

**G4:** **Tava kala ngoo tavii pulaapula ngoo iinima** (they will be asking each other different thing apart from the activity given to them).

**T:** **Shahala kutya iilonga yofikola ohave ifiyepo manga** (which means they start talking about other things)?

**G4:** Eeee (yees)

**T:** Concentrating on private issues?

**G4:** Eeee (yees)

*T: When you are given a practical activity to do with boys, which tasks do you prefer to do in a group? (Ngeenge nee tamulongo mounghudu ovo vashona novamati, ouhole kulongapo shike pokangudu keni?)*

**G1:** **Ondahala ngoo kukala taa pula nge omapulo** (I want them to ask me questions), **ame handi tale ngoo ngeenge ondishi ngoo** (so that I will see if I know), **ngaashi ngoo ndapewa iinima yinya yomolaboratory** (like when I am given laboratory instruments), **ndee ngeno ngaashi ngoo omaadi ngee ohaa dissolving momeya** (like to observe whether oil mixes with water), **handi ningi nee ngaho** (I want to do it myself), and how to connect electricity.

**T:** **Ngeno ngaho ove nee otoning mo shike? Oto shangee, oto mix ile oove to popi** (what do you want to do there, writing, mixing or telling others what to do?)

**G1:** **Aame handi mix** (I want to mix).

**T:** What else?

**G1:** **No kupangela** (and connecting)

**G2:** **Ondahala ngoo ngeno ndilipo handi shange ame handi tale nee venya eshi tava ningi** (I want to be the one who is writing and observing how they are doing things).

**G3:** Me I like writing and giving the materials to boys to connect together.

**G4:** **Ohandi tale ame handi vapula omapulo** (I will observe and ask them questions)

**T:** **Ino hala ku connecting iinima** (so you do not want to connect things)?

**G4:** **Aaye** (no)

**T:** Why?

**G4: Iinima kandiishi nawa** (I don't know things well).

**T: Ovamati navo pamwe kaveshishi** (may be the boys don't know also?)

**Chorus: Aiye, ovamati oveshishi** (No! They know).

**T: Omunaike eitavelo kutya ovamati oveshishi iinima ndishi** (you just believe that boys know everything)?

**Chorus: Eeee (yees)**

**T: Do you know that you know better the boys?**

**Chorus: Yes we know...**

**T: Tashiti ihamufiyepo ovamati mo class yeni** (or didn't you performed better than boys in your classes before)

**Chorus: Ohatu vafiyepo,** (we do)

**GG: Ndee voo oveshi ku connecting iinima** (but boys are good in connecting things.)

*What activities do you prefer to do in a group when you are doing practical activity with other girls? (Ngee mouli pokangudu nuukadona vakweni, oinakuwanifwa ili hokala wahala kulongapo?)*

**G3: Me, I want to connect because we are all girls and all girls they do not know like me.**

**G2: Ame ohandi connecting ngoo opo ndimone kutya iinima ohai lingifwa ngaipi** (I want to connect so that I will know how things work), **ame handi pula ngoo nava kwetu apa nghiheudite** (then I will ask them where I don't understand), **iyaa.**

**G1: Ohandi connecting** (I will connect). **Ovamati fimbo limwe nee kave hole...** (it is only that boys sometimes they don't like...), **ovehole aike ngeenge tovape iinima** (they only like us to give them things so that they connect themselves), **itava hale uninge ngeno otekupa aike ushange ove to kala aike ngaho** (they will not give you a chance to connect, they will only tell you to write).

*What do you think can make girls take part in practical activities freely? (Oshike uwete sha pumbwa okuningwa opo oukadona vakale hava kala vamangulu mokulonga oilonga ngaashi eyi?)*

**G3: Just to be freely.**

**T: How can they be made free?**

**G1: They need to be trained first.**

**T: Trained how?**

**G1: Like mhhh... We need classes after school, and taught how to connect the materials and they practice and they can do it themselves during the classes.**

**T: After classes, are you alone or are you together with boys?**

**G1: Aaye ovamati inava kalamo** (no boys must be there).

**G2: Uukadona otuna eehoni mbela** (girls are shy), **otwapumbwa okulombwelwa kutya natukale ashike twa mangulukaa** (we need to be told to be free), **opo aike niinima hatu yuuduko diva** (so that we can understand things better), **shaashi ngeenge ino manguluka** (because if you are not free), **eshi vakweni tava ningi, ove**

**owamwena aike, otwa pumbwa kukala twandjanga** (when others are doing the work, you are just quiet, we need to be free and active).

**G3: Novanhu venya ngeenge owa tula shinima ponhele yapuka** (there are those people that if you put an object at a wrong place), **yee omunhu ote kuyolo ngaho** (a person will laugh at you). **Paife oho kala aike wamwena kutya itii tulapo vali pamwe ohandi kala ndiyolwe** (from there you will just be quiet; you will not do anything anymore because you are afraid of people to laugh at you.)

**T: Ohamukala mwaatila kuyolwaa** (so you are just afraid to be laughed at)?

**G3: Keshe umwe eli po group ota kala aike ena kutya ou ota longo shike** (everybody in a group must have a responsibility to do), **ou ota longo shike, keshe umwe nakale eshi oshina kuwanifwa shaye** (everybody must know his/her responsibility in a group).

**G1: Uukadona nava kale valongwapo nawa nawa** (girls must be taught very well), **eshi taveya vaninge ove shishi nawa** (when they start to do the activity they know already).

**T: Voo ovamati** (and the boys)?

**G1: Ovamati oveshishi nale** (boys they know already).

**T: Ovamati ohavakala veshishi viilonga peni** (where did they learn things from)?

**G1: ovehole kupangela** (because they like fixing up things), **shaashi nande owe mupa ongodiyoye opo oto hange aike omunhu ei pangululamo** (even if you give him your phone you will find him dissembling out the things), **tati kaili nawa, ihai kwata onetwork, ngaho ota viilongo aike kupangela** (claiming that is not working well, so so, in that process they are just learning).

**T: What else do you want to say about practical activities?**

**G3: Ame ondahala aiaake ngeno, dikale hadiningwa eshi ngoo mwadja mo topic imwe, ile eshi ngoo otopic mwei manaako nyee otamu iningi** (I just want practical activities to be done after every topic; they must be done more often).

## Appendix H: Focus group interview two

*T: What is the importance of practical activities in learning Physical science?*

**L:** practical activities help us to understand in more details, sometimes the things that we find in practical activities are the things that we find in examinations, this help us learn more and pass in the examinations.

**L:** Practical activities is important in learning Physical science because like in a topic of bases and alkalis we learn more and we have learned about how materials work, you see how everything work and you learn how and learn the colors.

**T:** colors? Which colors did you learned from that?

**L:** Red and blue

**T:** Okay. Who else want to add?

**L:** A practical activity in learning Physical science they are important because we learn how teachers teach us, and see how things are working like bases and acids...if the teacher is teaching and showing us how bases change things, and we see with our eyes how things are changing, we see how the colors are changing then we are learning more.

*T: what do you enjoy when doing practical work?*

**L:** We enjoy when the teacher teaches us and we making laughing and when a learner making a mistake we enjoy laughing.

**T:** so you laugh at each others' mistakes?

**LLL:** Yes!

**T:** Why?

**LLL:** No response.

**T:** When a teacher gives you the materials to use, don't you enjoy touching and using them?

**LLL:** We enjoy!

**T:** For example?

**L:****Ohatu kala tuudite nawa shaashi katu shishi** (we feel good because we don't know the things), **yoo iinima oyo tai longifwa opo kuishi nale ngaashi ee litmus paper dinya** (the things that are being used you didn't know them before, you haven't seen them before like those litmus we have used), **katu dishi nale kwali ngaashi eshi ta dishendje ee color molwiinima eyi tai longifwa otwali twahafa shili** (we didn't know them before even when they are changing the colors because the things that are being used we were so surprised) and we have learned more.

*T: What problems do you experience when doing practical work?*

**L:** Not always that we experience problems when doing practical activities, because you listen and ask, where you do not understand.

**L:** The problems only come when a teacher is teaching and a learner does not listen, when a teacher gives something to do, you were not listening. To me this is a problem.

**T:** Mhhhh...the problem comes in when you were not listening?

**LLL:** Mhhhh..

**T:** Anything else?

**LLL:** no response.

**T: *What factors do you think prevent girls from doing much work during practical activities?***

**L:** For example, may be I have my boy friend in the same class, when we are busy with the activities, I get shy to him.

**T:** Does that make you not to do your work?

**LLL:** Yees..

**T:** What else?

**L:** Boys are talkative if you make any mistake they will talk about you and they will laugh at you and you will never continue.

**T:** What else?

**L:****Oukadona fimbo limwe ihava kala vamanguluka shaashi** (girls sometimes are not free because), **ovena eehoni** (they are shy), **nande okwaninga aike omistake kashona yee ota tameke nale afa tafii uunye ewete kutya keli mondjila, shaa afii uunye, voo ovanhu otava tameke okuyola opuwo osho ohamwena aike** (even if she make a slight mistake she starts losing confidence and doubting her answers, is she does that other learners can also start laughing and she only stops there to try).

**L:****Vamwe ova tetwako kuufuuli, nande omunhu okuli moclass ota ningi aike nawa iikutu yaye neenghaku daye paife iha concentrate vali** (some girls are too much on themselves, when they are in the class they are just cleaning their shoes and making up their uniforms this also make them not to concentrate).

**T:** How about teachers? Do not you think teachers have an effect on the participation of girls during practical activities?

**L:** Aaye (**no**).

**T: *What factors do you think enables girls to do much work during practical activities?***

**L:** Girls must be mixed with boys, so they learn the attitudes of boys so that the day they will be given work with boys they will not be afraid of boys.

**L:** Teachers must be free for learners; teacher must tell boys that if a person makes a mistake they must not laugh at that person, so that girls will be free to participate.

**L:** Sometimes because a person does a mistake, another person will talk about to other people from other classes when you go outside.

**L:** A teacher must tell boys that no person should laugh at other peoples' mistakes; a person must just be corrected.

**T:** What else?

**LLL:** No response.

**T:** There are some writings that say girls do not actively take part in practical activities because parents at home do not allow them do the things that can help them develop these skills; they only allow boys to do them. Do you think this is true?

**LLL:** Yeeees!

**T:** Anyone with an example?

**L:** Me, I can give an example. We were connecting bulbs at the generator. **Ndee meme tatii** (then my mother said), **ove djapo kushishi oto ningi uxwike iinima** (you! Leave the things, you don't know them, you can burn the things), **napeye omumati ou eshishinawa** (let the boys do it). I do not why, **mbela osheshi nee ame okaadona osho pamwe tati kandishi shi nawa** (may be is because I am a girl that is why she is saying I do not know).

**L:** Even when boys are making cars from wires, if a parent finds you making cars with the boys, they will ask you saying "even you, you are a girl and you are making wire cars? Those things are for boys, do you want to hurt yourself with wires; those are boys' things". I don't know why because we are all the same with boys.

**T:** When now parents are telling you not to play with wires, what do they allow you to play with?

**L:** **Uunona viilapi** (dolls from cloths).

**T:** If a parent finds you doing that she/he will never complain?

**LLL:** **Aaaye!** (Nooo!)

**L:** But if they find a boy doing dolls, mem (**mom!!**) he will be stopped from doing that.

**T:** How about playing? What type of playing activities do girls do the most?

**L:** **Okangoma** (dancing traditional songs), **omaumbo** (houses), **dila ekende** (filling a bottle with sand while others are trying to beat you with a cloth ball in the process), **eehaye** (running between two lines counting up to a certain number and you will win the game if your reach the number without being beaten with a cloth ball), **Uma** (jumping over a rope at different levels, if you touch the rope then you have lost the game).

**T:** Boys?

**LLL:** **Okatanga** (soccer ball)

**L:** and making cars from the wires.

**T:** Don't you think what you have stated about playing have effects on how you do practical work at school?

**LL:** It has.

**T:** How?

**LLL:** No response

**T:** Anything else?

**T:** No response.

## Appendix I: Semi-structured interview- one

*T: What do you like the most the most about practical work?*

**G1: Ondiholemo shaashi aalongwa ohava kala tava uduko nawa nghene, kutya oshinima ohashi longifwa ngaipi, veudite oshiima shoovene kutya oshinima ohashi ningwa ngaipi.** (I like it because learners understand things better, how, how, the thing is used, understand the thing itself, how it is being done.)

**T:** Ooooooh...

**G1: Nove shiwete no nomesho avo** (And they can see it with their own eyes.)

**T: Ooooh...Oshinima ngeno ngaashi shike?** (Ooooh...something like what?)

**G1: Ngaashi hatu longifa, oka microscope**(Just like when we use a microscope)

**T:** Mhhhh...

**G1: Ngee oka microscope owahala kakale taka, aaa, ngeenge owahala kaninge oshinima shikale shakula, oshiwete nale ove mwene, toshi ningi ove mwene keenyala doye ove toshi....**(If you want the microscope to, aaa, if you want the thing to be big, you can see it yourself, you can do it yourself with your hands yourself)

**T: Oooooh..nashike vali?** (Oooooh..What else?)

**G1:** Mmmmmh...

**T: Osho ashike osho kutya, o o o ,ohashi kuulikile utale oshiima ngeee tashining ove mwene?**( That is all, o o o, that it shows you how something work?)

**G1:** Mhhhh...

**T: Nakutya ohashilongo ngaipi, ngaashi wahandja o example yo microscope**(And how it works, like the example you gave of the microscope)

**G1:** Mh..

**T:** That's good.

**T: Do you like to do practical activities in a group or alone?**

**G1: Ondihole haatuningi mo group.** (I like doing it in a group)

**T: Shaashi?** (Why?)

**G1: Shaashi ngeenge iinimwe, kakwali wuyuuditeko nawa...**(Because if some of the things you didn't understand them well...)

**T:** Mhhhh...

**G1: Oto dulu kupula omapulo muvakweni eshi tava ningi, ove totale eshi tavaningi.**(You can ask others questions, when they are doing it, and you look at how they are doing it.)

- T: **Ooooh... totale eshi tava ningi?** (Ooooh...you look at how they are doing it?)
- G1: Eeee...
- T: **Ile ngee ovo tava ningi fimbo olo, tovapula?** (Or if they are doing it that time, you ask them questions?)
- G1: Mh....
- T: **Ngeno toti ngoo nande ngaipi?** (What type of questions will you ask?)
- G1: **Ngaashi ngoo haiti, eshi ohashi kala shili peni? Shaashi efimbo limwe kushi kutya ohashi longifwa peni, ove topopi nee kutya eshi ohashi kala peni, nongeenge ohashikala, nongeenge eshi to ningi oshili ngoo mondjila.** (Like, where do I put this thing? Like sometimes, you don't know something is used, and/or can others where it is placed if you know it, and if what you are doing is correct.)
- T: **Voo tave kupula ngoo.** (And, they will you questions).
- G1: Eeeee
- T: Okay, that's good.
- T: *When you are given practical activities with other learners, do you like to be with boys or do you like to be with other girls?***
- G1: **Ondi hole kukala nuukadona.** (I like to be with girls)
- T: **Ouhole kukala nuukadona vakweni?** (You like working with other girls?)
- G1: Mhhhh...
- T: Why?
- G1: **Nanditye nande ngeno oto pula epulo, ngaashi efimbo limwe, omunhu, nuuyelegele nghuushi, ngeenge oulimo nuukadona omunhu otodulu kupula ndee tave kunyamukula nana nawa, fimbo limwe ovamati ohaakala nee nande okuli...shima wemupula ite ku nyamukula nawa, maara omafimbo amwe uukadona eefriend ngoone detu oto dulu kuvapula ngoo ndee tave kunyamukula nawa.** (Let me say when you are asked a question sometimes, a person, do not know the information, if you are with girls, a person, you can ask and they will answer you very well, sometimes boys they are like, if you ask them, he will not answer you well, but sometimes girls are friends, so you can ask them and they will answer you well.)
- T: **Oooohh.. shahala kutya ovamati owakoneka kutya shaa tamuningi iinima, ihava kala vahala kumunyamykula nawa?** (Oooohh you have noticed that when you are doing the work together with boys they do not answer you very well?)
- G1: Mhhhh
- T: **Ngeno ounapo example imwe to dimbulukapo, ngoo, omunhu wemupula ndee te kunyamukulanayi?** (Do you remember any example of a person, whereby, you ask him and answer you badly?)
- G1: (silent)
- T: **But owa koneka kutya** (You have noticed that) in most cases that is how they answer you.

**T: When you are doing practical activities with boys, what tasks do you prefer to do in a group?**

G1: **Ondi hole ku kala ha ndi shange.** (I like writing.)

T: Ooo.. you like taking records?

G1: Mhhhh

T: **Oshiketoshangele itaku shangwa ngoo nande oko mumati?** (Why do you want to write, not giving it to boys?)

G1: **Fimbo limwe omake ovamati ito kala nana uli wete nawa, ile efimbo limwe , fimbo limwe omumati otashange eshi ahala, eshi topopi asho ahala kushanga yee otekunyamukulanayi.** (Sometimes the handwritings of boys you cannot read it well or sometimes, sometimes boys write what they want, he doesn't write what you are telling him, and he is answering you badly.)

T: **Ooooh, shahala kutya ovamati ihava shange eshi tashi discuss mogroup?** (Ooooh, which means boys they do not write what, is being discussed in the group?)

G1: **Mhhh, fimbo limwe noho omunhu otashange oshiima ndee inama, tayi ashike nande okuli. Ngeenge owashange ove mwene oto dulu kuka wedapo iinima, voo ovena onyalo ita dulu nanakushininga oye aeke.** (Mhhh, sometimes a person is just writing something and he will not get done with the writing, and he will go. If you write it yourself, you can even add some of the things, and they are lazy, they cannot do it alone.)

T: **Ovena onyalo?** (They are lazy?)

G1: Mmmmm

T: **Itaka wedapo?** (He will not add things?)

G1: **Aaaye itaka wedapo.** (No he will not add things.)

T: **Oooh, nyee fimbo ngee omunhu nande inamumana nawa otodulu uka rounding shaawamana?** (Oooh, like you said when given the work and the work is done you can add something)

G1: Mhhhh

T: **Ooooh..ovamati osho hava behave ngaho.** (Ooooh...boys behave that way?)

**T: When you are given a practical activity to do with other girls, what activities do you like to do in a group?**

G1: **Ondihole ngaashi ngeno hatuningi, ngaashi kwali hatu ningi o o o electrical in current ngeno ondahala handi connecting nee iinima.** (I like doing it like, when we were doing o o o electrical in current, I want to connect things.)

T: **Ngeno oove to connecting?** (So you want to be the one who is connecting?)

G1: **Mhhhh, shaashi ngeenge, ngeenge eshi hai connecting ondahala ndiva pule nawa omapulo, ame handi vapula kutya oye eheuditeko, ngeenge oshinima aame ndishi udite, ame handi vapula kutya oye ehe uditeko, ame handi valombwele kutya oshaenda ngaipi. Ngeenge kandishi uditeko ngaha eshi handiningi ohandi koneke voo tava lombwelenge nee kutya apa ohandining ngenongaha.** (Mhhh, because if, if I am connecting, when I am connecting I want to ask them questions, I will ask them who do not understand, if I

understand it better, I will ask them who do not understand, I will tell them how it went about it. If I do not understand it better, when I am connecting they will tell me how I suppose to do it.)

T: **Oooh, oto ningile ngoo kutya , ngee kushishi**, you will learn more, **ngeenge oove ushi**, you will make others learn more. Thus why, when you are with other girls, you will real want to help other girls who do not understand that topic. Oooh, you are doing it like, if you do not know, you will learn more, if you know, you will make others to learn more. Thus why, when you are with other girls, you will real want to help other girls who do not understand that topic.

G1: Mhhh

T: Wow, that's good.

T: **What do you think prevents girls from doing much work during practical activities?**

G1: **Ohava kala ngoo vahala kuninga shaashi, otashi dulika nande okuli...ngeno eshi tavaningi voo inava hala kuninga naave?** (They use to be like they want to do, because it can be ... is it like they do not want to do it together with you or what?)

T: **Aaye, ngeno o o o o ovahala ngeno kuninga**, (they want take part) but they are not like doing things, connecting, they don't want to connect, they don't want to measure. No, is like o o o o they want to do, but they are not like doing things, connecting, they don't want to connect, they don't want to measure.

G1: **Ohaakala, fimbo limwe ohavakala vatila, ndishi ngeno oveli nuukadona vakwao?** (They are, sometimes they are afraid, is it when they are with other girls?)

T: **Kutya nee oveli nuukadon ile oveli novamati.** (Whether they are with girls or boys, it does not matter.)

G1: **Unene nene ngee veli novamati, ohava kala vatila okupukifa voo tavuulwa nee omalakamayi.** (Mostly when they are with boys, they are afraid of making mistakes so that boys say bad words to them.)

T: **Ngee veli mo group novamati, ohavakala vatila?** (When they are in a group with boys, they use to be afraid?)

G1: Mhhhh...

T: **Shaa wapukifa, ovamati ohava ningi shike?** (When you make a mistake, what do boys use to do?)

G1: **Fimbo limwe otave kuhandukile ile vekuule omalaka mai, shaashi ovamati fimbo limwe, oushi kutya ovamati ohava hale kudenga divaaa. Shima aike wapukifa kashona yee otahaleku ku denga.** (Sometimes they get angry with you or they will say bad words to you, boys sometimes, as you know that boys like beating, when you make a slight mistake, he is already about to beat you.)

T: **Ngeenge ngeno uukadona oveli mogroup yuukadona vakwao?Natango ohava kala ngoo inava hala kuninga ile, ohaalongo na na ngeipi shaa veli mo group yuukadona vakwao?** (When girls are in the group with other girls, do they still behave in the same way or, how do they really work?)

G1: **Ngeenge uli mo group yuukadona vakweni oto ningi ngoo nawa shaashi naave owahalakwiilonga mukaweni.** (When you are with girls you do it better because you also want to learn from others.)

T: **Shaa tamuningi novamati, iha mwiilongo mosha muvo?** (When you are with boys don't you learn anything from them?)

G1: **Ohatwii longo mo ngoo, maar omunhu shaa nee fimbo limwe, aaye, okukala novamatihava kala wahala...**(We learn things, but a person, sometimes, nooo , if you are with boys, they are...)

T: Ooooh..Okay.

*T: What are the suggestions that you have that you think should be done in order for the girls to participate freely during practical activities?*

G1: **Nava kale tete, tete otava kala have, taveendeepo manga voo vene.** (They first, must do, doing it themselves.)

T: **Ovo aveke?** (Alone?)

G1: **Mhh..voo tava ..voo ngee moclase omuna omunhu nande omulongi voo ovamati tava pulanee kutya ngeenge nee apa ongaha, osho oweshi enda ngaipi nande okuli.** (Mhh..and they... if there is a someone in the class maybe a teacher, boys will ask that, if , here is like this, this, how did you get this for instance.)

T: **Tava pulwa kovamati?** (Asked by boys?)

G1: **Mhhh, ile ngoo kuudanoa vakwao.** (Mhhh, or, with other girls.)

T: Oooo

G1: Mmhhh

T: **Eshi tava endepo voo vene ngaho, ota veendepo veli mo class ile otamu ningi before the class?** (When they are doing it themselves, are they doing it during the lesson or after the lesson?)

G1: **Nande ovaningi ngoo ngee veli mo class. Ile ngoo kutya nee ka tuli mo class, shima aikeosho ha shiningwa tete.** (It can be even when they are in the class. Or even we are not in the class, as long as they do it first.)

T: **Oto popile ngee ovanhu hatuyandje ee experiemnet ,ovanhu vakale hava mix, ovamati vakalehava kala nuukadona?** (Are you supporting that when people are giving experiments, Boys must be mixed with girls?)

G1: **Aaye, uukadona nava kale aike havii kalele novamati nava akale aike havii kalele.** (No, girls must be separate from boys.)

T: **Oshike vali wahala kupopya kombinga yo practical activities?** (What else do you want to talk about practical activities?)

G1: **Ohaiti ngoo ngeno o practical activity nai kale hainingwa keshe fimbo shaashi,opo ovanafikola vakale havuuduko nawa, shima palongwa kashona, shimaike palongwa nandeokaima kashona, konima yefimbo opo vaudeko nawa.** (I am saying that practical activities should be done every time because, for the learners to understand better, when a piece of topic is taught, when for instance a piece of topic is taught, after that time for them to understand better.)

## Appendix J: Semi-structured interview-two

**T:** What do you think are the importance of practical activities?

**G2:** As for me, practical activities, it help the learners at the end of chapter, learners should be like, **ngeno oshinima eshi veshii longo okwa pumbwa kukala eshi nokutya ohashi ningwa ngaipi** (like if we have learned about something, we need to know how that thing works). I think it is helpful.

**T:** You said is helpful?

**G2:** Mh...

**T:** How?

**G2:** I find it helpful because if I do not understand it by writing a summary... **ngeenge ondashanga** osummary than, after I did something, **ondina okukala ndishi nokutya, ok, mboli oshiima eshi ohashi ningwa ngaho**. (If I wrote a summary about something, I must know how that thing is used). **Nande ondakala inandi pita nawa eshi handiya keeskola dopombada oshinima ondeshillonga nale pedu apa**. (Even if I fail to get good marks here, when I get to the vocational schools I know already how some of the things work.)

**T:** What do you enjoy when doing practical activities?

**G2:** of course yees.

**T:** what do you enjoy about it?

**G2:** Like in electricity, I enjoyed connecting, when you do not connect correctly things we laugh at you...

**T:** do you enjoy things like using the materials yourself?

**G2:** Mhhh..cos, like,something you don't know like batteries, **ototi aike omabatteries ohaa longifwa aike meeradio, eshi ndeya koclass ondamona kutya mboli** (I only know that batteries are only used in radios, when I came to the class I have seen that) there are small electrical components that can be connected to batteries, eish! I was so impressed!

**T:** What problems do you experience when doing practical work?

**G2:** Problems that I have experienced from my other classmates or where?

**T:** Yes anywhere.

**G2:** sometimes they try to be selfish.

**T:** In which way?

**G2:** They do not want to do things, some learners are being selfish, some of them are good like boys are good at connecting and I like working with them.

**T:** Is that all from other learners?

G2: yes

T: From the side of the materials? Don't you may be finding them difficult to use?

G2: Is only when the teacher do not do it first. When you only have a summary and you don't know, cos, English sometimes is difficult and it is like, if the teacher is the one who is first doing it, then I will watch, the teacher what is doing, and I will do what the teacher is also doing.

T: From the side of the teachers?

G2: No... not yet.

**T: What factors do you think prevents girls from doing much work during practical activities?**

G2: girls like this of laughing. If you sometimes make a mistake they start to laugh. Instead of asking a teacher and collect a mistake, they only laugh.

T: Don't you think that the activities you do at home have an effect on this?

G2: Mhmhhh...

**T: What factors do you think enables girls to do much work during practical work?**

G2: Teachers should just talk to the girls, and tell them that just respect themselves, be who they are and for them to concentrate on what they are doing. Because if we are not concentrating I don't think our lives will be cool.

T: What do you think should be done to help girls in the class?

G2: Uukadona ovapumbwa okukala hava tulwa mumwe novamati, shaashi ngee ovatulwa uukadona ovo aveke, itava ningi posha ohava kala aike tava popi eestory dokomaumbo on keendjila. (**Girls need to be mixed with boys in the work because when they are the work alone, they do not do the given work they start talking about home and village stories.**)

T: What else?

G2: No response...