Understanding how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity: A case study

A thesis submitted in partial fulfilment of the requirements for the degree

of

MASTER OF EDUCATION

(SCIENCE EDUCATION)

of

RHODES UNIVERSITY

by

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March 2015

DECLARATION OF ORIGINALITY

I, Toini Iyambo, declare that this thesis with the title: *Understanding how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity: 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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(Signature) (Date)

ABSTRACT

Over the last decade of my teaching I have been grappling with how to incorporate learners' prior everyday knowledge into my Physical Science lessons to enable me to close the gap between school science and everyday knowledge.

I conducted this case study in two schools, one in Omusati region and one in Ohangwena Region, Namibia. Its purpose was to investigate how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching the topic of static electricity. Underpinned by an interpretive paradigm, the study made use of document analysis, observation (lessons were also video-taped) and semi-structured interviews to generate the data. Three data generating techniques were used for triangulation and validation purposes. To further validate the data, transcripts of video-taped lessons and interviews were sent back to the research participants for member checking.

The main findings of my study are that teachers did incorporate learners' prior knowledge in the lesson presentation on static electricity. It emerged from the study that, learners possess a great deal of prior everyday scientific and non-scientific knowledge and experiences about static electricity that they had acquired from their communities. Also, mobilization of learners' everyday knowledge and experiences about static electricity enabled learner engagement during the science lessons. Likewise, engaging learners in demonstrations on static electricity helped them to make meaning of the scientific concepts involved in the topic.

It also emerged from this study that teachers face challenges of lack of documentation of indigenous knowledge which is potentially a form of prior knowledge, language barriers and a lack of resources.

Based on my research findings, I therefore, recommend that learners' prior everyday knowledge and experiences about static electricity should be incorporated during the teaching and learning process.

DEDICATION

I dedicate this thesis to my parents, Johannes Iyambo and Sofia Jacobus who brought me into the world so that I could be able to carry out this study. I further dedicate this thesis to my sisters, brothers, Uncle Paulus Kapia, best friend, my principal Tressia Shoopala and the entire group of friends that were with me during my study. Their patience, motivation and support have been amazing.

ACKNOWLEDGEMENTS

I would like to thank the Almighty God for giving me strength and insight through his grace to be able to complete this study. I am grateful for his undying mercy and grace that he continuously showers upon me.

My sincere gratitude goes to my supervisors Dr Ken Ngcoza and Dr Charles Chikunda for supporting me throughout this study. I appreciate your motivation and guidance throughout this journey. I would also like to thank Mr Robert Kraft for making time to go through my work and making invaluable comments.

I further would like to thank all my research participants for their willingness to participate in this study. You were cooperative and willing to share what you know.

Lastly, my sincere words of gratitude go to my friends and the Rhodes family for assisting me with my research whenever I needed support even during the times when I wanted to quit. You always boosted my morale and motivated me to carry on.

Special thanks to Mwene Kanime for formatting my thesis.

Many more people have contributed in different ways to the success of this study and I am appreciative of all your support and contributions. Thank you!

LIST OF ABBREVIATIONS AND ACRONYMS

ETSIP	Education and Training Sector Improvement Programme
IK	Indigenous Knowledge
LTSMs	Learning and Teaching Support Materials
MOE	Ministry of Education
MOEC	Ministry of Education and Culture
NAAS	National Association of Academies of Science
NDP	National Development Programmes
PCK	Pedagogical Content Knowledge
T1	Teacher 1
T2	Teacher 2
ZPD	Zone of Proximal Development

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CHAPTER 1: INTRODUCTION

1.1. Introduction

This chapter introduces the study which focused on understanding how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity.

The first section of this chapter outlines the background of the study and curriculum issues, followed by an explanation of the interpretive paradigm which I used to guide my research, the research goal and questions, research site sampling as well as the data gathering techniques. In addition, I discuss the motivation for the study and then provide a definition of the key concepts used and sketch the thesis outline. The chapter ends with some concluding remarks.

1.2 Background of my study

The research study was motivated by my personal experience of 10 years in the teaching profession. During this time I have been grappling with how to incorporate learners' prior knowledge into my Physical Science lessons in order to close the gap between school science and everyday knowledge (Stears, Malcolm & Kowlas, 2003; Rennie, 2011).

In 2010, the Ministry of Education in Namibia introduced a new curriculum for Physical Science. One of the main objectives was cultural inclusivity which values the traditional cultural practices and discoveries in the educational system (Namibia. Ministry of Education (MOE), 2009). Researchers have pointed out that teachers tend to undervalue the effectiveness of learners' prior everyday knowledge, yet, the use of everyday knowledge in the science classroom increases the learners' level of engagement and they enjoy making links between their different experiences and the curriculum when it is designed to facilitate such links (Stears et al., 2003; Oloruntegbe & Ikpe, 2011; Rennie, 2011). These authors argue that educators need to acknowledge and value the prior everyday knowledge that the learners possess so that they can incorporate this knowledge into their lessons. Though the Physical Science curriculum requires that teachers make use of learners' prior knowledge during their teaching, there is no clarity as to what aspects of prior knowledge is needed and how should such prior knowledge be incorporated in the teachers' teaching. Therefore, this study specifically focused on the incorporation of the learners' prior knowledge in the teaching of static electricity in Physical Science at grade 8 level. This was done to fulfill the MoE's goal as stated above.

Prior everyday knowledge can help learners connect the curriculum to their own culture and experiences in a positive way This is supported by Roschelle (1995) who argues that prior knowledge influences learning and learners are able to construct concepts by drawing on it. I also experienced the difficulties learners have in understanding certain scientific concepts when they are only taught the theoretical part of the subject without making science relevant to their everyday lives. When learners learn subject content knowledge that is part of what they know, they develop an interest in the topic and their participation increases as they are curious to explore and learn more (Stears et al., 2003)

Oloruntegbe and Ikpe (2011) argue that the ability to effectively educate future scientists and citizens is predicted, in part, upon how learners are able to relate what they learn in school to their daily lives and how teachers can help learners to establish such connections during science teaching and learning. Lending support, Rennie (2011) refers to this as closing the gap between prior everyday knowledge and school science.

For this to be achieved, it is realized however that there is a need for and importance of preparing learning and teaching support materials (LTSMs) that are significant to learners' everyday world as suggested by Czerniewicz, Murray and Probyn (2000) as tools for assisting learners' scientific abstract progress. Czerniewicz et al. (2000) further argue that materials which structure and support learning and teaching, are a means of promoting both teaching and learning and promoting the love for life-long learning.

Herein lies the essence of my study whose focus was on the teaching of static electricity in the science classroom. For instance, Science Netlinks National Association of Academies of Science (NAAS) states that static electricity is a topic where learners can share their everyday experiences to make connections between day-to-day experiences or natural phenomena such as lightning, receiving shocks after taking off clothes that cling to each other out of the dryer and school science.

However, Nanghonga (2012) cautions that learners' prior everyday knowledge might mislead learners to unconventional interpretation of concepts. Learners bring misconceptions to the class and teachers might have difficulty in clearing up these misconceptions. For instance, some African cultures believe that lightning can be sent by people with magical power to destroy or harm adversaries. Therefore, if the teacher does not come from the same background or is not knowledgeable enough about the various cultural backgrounds of the learners that they teach, she or he is likely to experience some challenges in clearing these misconceptions.

1.3 Context of the study

This section presents the context of the study. It will present an overview of the Namibian education and the reforms that were implemented in the education system when Namibia got its independence.

1.3.1 Curriculum reform in Namibia

Before independence in 1990, teaching in Namibia was mostly teacher-centred (Chirimbana, 2014). Chirimbana further argues that teachers were the only source of information and they acted as the masters of all knowledge. Learners were thus perceived as receivers of such knowledge. That resulted in rote learning whereby learners had to memorize scientific concepts possibly without understanding them. Rote learning may have resulted in learners losing interest in the subjects and developing a negative belief that science subjects, in particular, are difficult (Naukushu, 2015).

After independence, however, the education system was transformed into *Education for All* and was underpinned by a learner-centred approach. Learners were thus encouraged to take responsibility for learning and to share their experiences. In addition, the National Curriculum for Basic Education in Namibia emphasizes empowering learners for the development of our country for the future as a knowledge-based society (MoE, 2010).

Thus, the National Curriculum for Basic Education of Namibian schools (MoE, 2010) indicates that teaching should embrace what the learners already know and can do. It is believed that this will result in the acquisition of new knowledge through ways of working which are applicable and meaningful for them, and show them how to apply knowledge creatively and innovatively as expected of a knowledge-based society (MoE, 2010).

A knowledge-based society is defined as the effective involvement of society and the wise use of existing knowledge which leads to the creation of new knowledge (Namibia. MoE, 2010). As a consequence of its reform in education, the new Namibian school curriculum requires teachers to shift from the textbook and content-based education to an education in which learners refer to their everyday knowledge in order to learn new scientific concepts, principles and skills. There is a need to fully appreciate that Namibia's current school curriculum focuses on the inclusion of learners' prior everyday knowledge and insists on learners' engagement in lesson presentations.

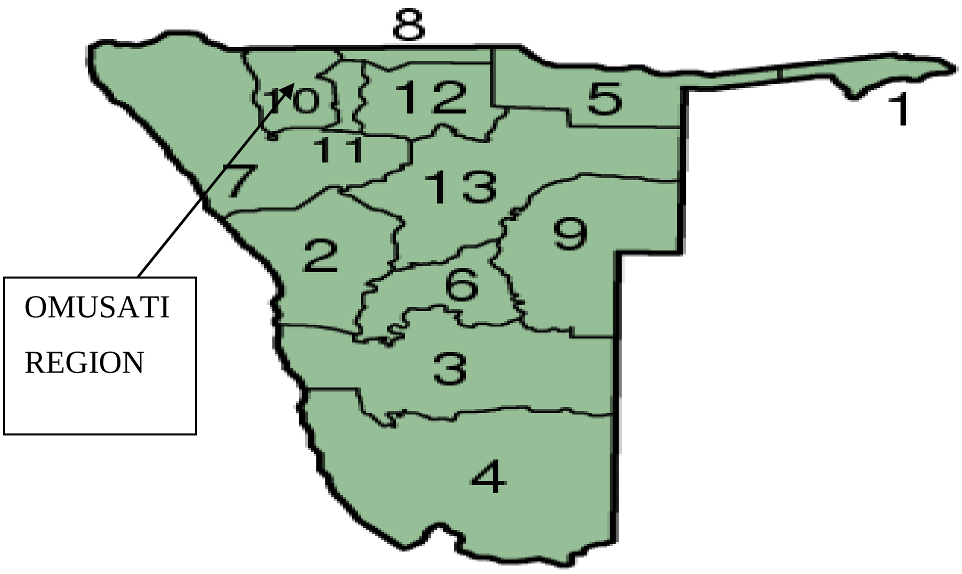
The Namibian curriculum further states that prior knowledge should be used as a starting point, which is sadly not always the case in most science classrooms. When teachers are teaching, they are expected to relate what is taught to what learners already know and keep on building on what learners know throughout the lesson. It is believed that prior everyday knowledge is a broad range of pre-existing knowledge, skills, beliefs and attitudes which influence how they attend, interpret and organize in-coming information, and in turn, affect how they remember, think, apply and create new knowledge (Roschelle, 1995). Roschelle (1995: 98) further states that prior everyday knowledge is a shift in viewing learning as "conceptual change models of learning". In addition, it helps learners to move from what they already know to the new information they obtain from the teacher. Despite such perceived benefits of incorporating prior everyday knowledge in the teaching of science, the Namibian curriculum does not articulate and specify how teachers should implement it.

These contextual realities formed the backdrop of my interest in finding out how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity. In addition, it is hoped that this research will help improve my way of teaching static electricity through observing various strategies on how to incorporate the learners' prior everyday knowledge.

1.4 Site and sampling

This research study was conducted in two schools, one in the Omusati region and one in the Ohangwena region. The first school is Shamba (pseudonym) a combined school in Etayi Circuit, Omusati region and Ndiki Junior Secondary school (pseudonym) a combined school in the Ohangwena circuit, Ohangwena Region (See the map below).

Figure 1: Namibian Map showing its 14 political regions



Omusati region is represented by number 10 on the map above. Ndiki Junior Secondary school has 353 learners comprising 179 boys and 174 girls. There are 15 teachers, seven are males and eight females, three support staff members, one administration officer and two cleaners. Thus, the teacher-learner ratio is 1:24. The school caters for learners from grade 1-10 and that makes up three phases (Lower Primary phase; Grade 0-4, Upper Primary phase; grade 5-7 and Junior Secondary phase; grade 8-10). Most learners come from the villages around the school. Being located in the northern part of Namibia all learners have the same cultural background and speak the same local language which is Oshiwambo even though English is the medium of instruction. The school is under-resourced, for example, there is neither a library nor a science laboratory. Science at this school is taught mainly theoretically, although most teachers do go an extra mile to get learning and teaching support materials as proposed by (Czerniewicz et al., 2000).

Shamba Combined School has 456 learners, 268 are boys and 188 are girls. There are 22 teachers, 16 are females and six are males, one secretary and two cleaners. At this school, the teacher – learner ratio is 1:21. The school only caters for grade 8-10, which is only one phase (Junior Secondary phase). Being located in the northern part of Namibian region of Owamboland, all learners speak the same local language which is Oshiwambo. Research participants that took part in this study are two, a male and a female.

1.5 Research goal and research questions

The main goal of this study was to understand how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity. This is important since the Namibian National Curriculum of Basic Education emphasizes that learning should start with what learners already know (the constructivist perspective of learning). The problem is how learners' prior everyday knowledge can be used to enhance the effective leaning of static electricity.

To realize this main goal, I endeavoured to answer the following main question.

How do grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity?

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

1. What are grade 8 Physical Science teachers' conceptions and experiences on the use of learners' prior knowledge when teaching static electricity?
2. In what ways do grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching the topic on static electricity?
3. In what ways can grade 8 Physical Science teachers improve learners' understanding when making use of learners' prior everyday knowledge when teaching static electricity?

This study has been conceptualized into two phases. In phase one, I undertook document analysis, interviews and observation to find out how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity. This phase aimed to answer research sub-questions 1 and 2.

In phase two, I co-developed, together with the two teachers, at least three model lessons on static electricity in order to facilitate effective teaching and learning of the topic with the aim of answering the third sub-question.

1.6 Data gathering techniques

The following data gathering techniques were used in this study:

- Document analysis;
- Observation; and
- Interviews (semi-structured interview and stimulated-recall interview).

Different data gathering techniques were used to enhance validation and trustworthiness in this study. This is called triangulation and is recommended to strengthen the validity of the research study. A detailed discussion on data gathering techniques as well as strategies to ensure validity and trustworthiness are outlined in Chapter Three.

1.7 Potential value of my study

This study is qualitative in nature and focused on how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity. It is hoped that this study will give me an opportunity to develop learning and teaching support materials using various resources rather than relying on textbooks as the only source of information when teaching the topic of static electricity.

This study will provide some insights into the teaching of static electricity and related scientific concepts, and hence cast light on the potential of the use of everyday materials and activities that arouse learners' interest in science.

The information from the study might be useful to grade 8 Physical Science teachers who are grappling with integrating learners' prior everyday knowledge in their lessons when teaching, science topics. As a Physical Science teacher myself, I will gain some knowledge and skills on how to enhance my understanding of this topic using prior everyday knowledge. The findings of this study might thus inform curriculum reform in Namibia and other countries with regard to the use of prior everyday knowledge in science teaching, specifically with respect to static electricity.

Furthermore, the study might be useful to those who would like to do further research in this field given that this area is under-researched especially in Namibia and some parts of Africa.

1.8 Definition of concepts

In this section, I define the key concepts that have been used in the study.

Code-switching: is the practice of changing from the language of teaching and learning to the learners' mother tongue in order for them to better understand the concepts being taught.

Constructivism: Vygotsky (1978) defines constructivism as a theory of learning and an approach to education that lays emphasis on the way that people create meaning of the world through a series of individual constructs.

Content knowledge: is knowledge of a subject such as concepts, theories, ideas, frameworks, evidence and proof and recognized practices including ways to develop such knowledge.

Indigenous knowledge: is the local knowledge acquired through social interaction in the society. Indigenous knowledge can be passed on from one generation to another.

Learner-centeredness: refers to an approach of teaching and learning which regards learners as central to the learning process.

Mediating learning: is the interaction between learners and a teacher as a mediator. In addition, it is a teaching method whereby a teacher assists learners to be fully engaged within the lessons through doing tasks.

Pedagogical content knowledge (PCK): is a type of knowledge that is unique to teachers and is based on the manner in which teachers relate what they know about teaching to what they know about what they teach (Shulman, 1986). In addition, PCK links together strategies and content knowledge to bring about learning that is built upon strong subject knowledge, teaching, and learning strategies (ibid).

Prior everyday knowledge: the knowledge that learners acquire from home, and the surroundings which can be both indigenous and scientific.

Prior knowledge: is the knowledge acquired from various subjects or previous lessons or grades.

Scaffolding: is a learning process that aims at promoting a deeper level of understanding of learning. In addition, Sawyer (2006) defines scaffolding as the assistance given during the learning process that is tailor made to fit the needs of the learners with the intention of helping them to attain their goals.

Social constructivism: is a sociological theory of knowledge that applies the general principle of philosophical construction. Knowledge is constructed by an individual and in its social aspect knowledge is socially mediated through cultural experiences and interaction with others (McRobbie & Tobin, 1997, p. 194)

Social-cultural constructivism: Lemke (2001, p. 297) points out that "sociocultural theory emphasizes that all human activities function on multiple scales, from the physiological to the interactional to the organizational to the ecological to the sociological to the social development to the biological to the historical to the linguistic to the culture and so also on the corresponding time scales from the momentary to the biological historical and evolutionary".

Teacher-centeredness: is a method of activities and techniques where the teacher decides what is to be learned, what is to be tested and how the class is to be run. In addition, the teacher is often the center of the classroom giving instructions with a little or no input from learners.

Zone of proximal development (ZPD): interpretation is the difference between what the child can do without help and what they can do but with assistance

1.9 Thesis outline

The thesis consists of six chapters as outlined below.

Chapter One: Introduces the background of the study, curriculum issues, research goal, research questions and the significance of the study, the significance of the study, definitions of concepts, the thesis outline and concluding remarks.

Chapter Two: Reviews the literature relevant to my study which looked at curriculum issues and conceptual framework about prior everyday knowledge and indigenous knowledge, static electricity and mediation of learning. It further discusses the theoretical frameworks underpinning the study which encompass constructivism, in particular, the social constructivism, socio-cultural perspective and pedagogical content knowledge.

Chapter Three: Presents the methodology used. It presents the interpretive paradigm which informed this study. In addition to that, it also discusses pedagogical content knowledge as an analytical tool to help me identify the types of teaching methods the participating teachers used. Research site and sampling issues are discussed in detail. Data gathering techniques are described, and how data were analyzed and validated as well as ethical issues. Finally, it presents the limitation of the study and concludes with some remarks.

In Chapter Four: I present and analyze the data gathered from document analysis, observation of lessons with my two participants and stimulated recall interviews with the participants. This chapter also presents some emerging categories from the processed data.

Chapter Five: Presents interpretation and discussion of the data drawing on literature review discussed in Chapter Two. In this chapter, I also try to make sense of the research outcomes in relation to the research questions outlined in Chapters One and the methodology used in Chapter Three of this thesis. In explaining this I describe my use of color coding for the various themes that emerged.

Chapter Six: I present a summary of my findings, recommendations, and limitations, areas for future research, my critical reflections and conclusion.

1.10 Concluding remarks

In this chapter, I discussed the background of this study. I started by discussing my teaching experience. I also gave a short sketch of the Namibian curriculum before and after independence as a way to situate my study in the education system of the country. I briefly outlined my research methodology highlighting the research goal and research questions, research participants and research site. I also defined key concepts of the study. In the last part of this chapter, an outline of the thesis has been provided.

In the next chapter, I review and discuss literature relevant to the study.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This chapter reviews selected literature in relation to how grade 8 Physical Science teachers mediate learning of static electricity. In this chapter, I describe literature on various perspectives of curriculum issues on static electricity as well as prior studies on the teaching of this topic. I further explore the four theoretical frameworks, namely; mediation of learning, social constructivism, socio-cultural constructivism, and pedagogical content knowledge (PCK). Within the mediation of learning as an umbrella concept for teaching and learning, I focussed on aspects such as prior everyday knowledge, indigenous knowledge (IK), scaffolding, zone of proximal development (ZPD), language (code-switching) and learning and teaching support materials.

2.2. Curriculum issues on the teaching of static electricity

The use of everyday context in science curriculum teaching has been promoted in Africa in the past. This was the main goal behind the research conducted by Kasanda, Lubben, Gaoseb, Kandjeo-Marenga, Kapenda and Campbell (2005: 807) in Namibia where they stated that, the drive for political and social self-confidence has encouraged the building of a science curriculum based on learners' everyday experiences (Stears et al., 2003). This is also highlighted strongly in the curricula of other African countries, for instance, in Ghana (Yakubu, 1994), Mozambique (Baloi, 1994) and Swaziland (Lubben, Campbell, Maphalala, & Putsoa, 1998) which encourage the inclusion of indigenous technologies.

As briefly highlighted in Chapter One, the Namibian education system was reviewed just after the country`s independence in 1990. The four educational goals were formulated as: access, equity, quality and democracy (Ministry of Education and Culture [MEC], 1993) and the education system was strengthened by a learner-centred education framework. A learner-centred approach assumes that teachers have a general view of the learners, valuing their life experiences and use these as the starting point in teaching (MEC, 1993).

Nyambe (2008:28) argues that the "learner-centred approach entails teaching pedagogies where teaching starts with learners' interest, the existing knowledge and understanding. He further asserts that our teaching methods must encourage active participation by learners in the learning process. Therefore, teachers should structure their classes to facilitate this active learner's role by using a variety of teaching techniques that fit the purpose and content of the lesson and encourage active participation of learners. Nyambe goes on to argue that it is now the time for teachers to value learners as human beings who are able to demonstrate a critical understanding of how society has changed and developed, and appreciate the learner as a responsible citizen who is able to participate in nation building (ibid). Thus, teachers are expected to work together as a team and to promote a cooperative culture of learning amongst learners, encouraging problem-solving and a project approach (Bernstein, 1996: 56).

From a learner-centred perspective, teachers should structure their lessons in ways that facilitate and encourage active learner-participation and involvement in the pedagogic process. In addition to active participation, teachers need to be knowledgeable in Pedagogical Content Knowledge (PCK). This means that teachers are expected to use "various methods such as excursions, demonstration teaching, micro-teaching, team-teaching, group work, individual study and tasks, tutorials and lectures" (MEC, 1993: 59).

Furthermore, the curriculum emphasises the ideas of 'constructivism' and 'social constructivism' perspectives where this study is also located. The purpose of this curriculum reform is to make the education system fit for the needs of the nation and be on a par with other nations in overcoming emerging global challenges such as; technology, HIV/AIDS and climatic changes.

The curriculum is also directed toward helping achieving the national development goals set out in the National Development Programmes two and three, NDP 2 and NDP 3; the Education and Training Sector Improvement Programme, ETSIP 2007; and the long term perspectives of Namibia Vision 2030 (MoE, 2009).

Through this lens, Namibia is seen as developing from a 'literate society' to a 'knowledge-based society,' - one where knowledge is constantly acquired and renewed, and used for innovation to improve the quality of life for all (MoE, 2009:2). With this understanding, learners are provided with an environment that will allow them to discover and continually construct knowledge in order to enhance their understanding of life.

Furthermore, in a learner-centred approach, there is a greater acknowledgement of human resources for teaching and learning than before. The knowledge and experience of the community, the learners themselves and the teachers are recognised and used as learning resources (ibid).

A sense of worthiness of learners' culture is encouraged in the Namibian curriculum (Chirimbana, 2014). For instance, this can be achieved by taking learners to the expert's place of work to observe a community-cultural practice which they could not initially imagine as being associated with classroom knowledge (Kasanda et al., 2005). This sense of worthiness extends to them, thus creating interest and confidence in the subject. Furthermore, Kasanda et al. (2005) concede that everyday contexts allow learners to take control of their own learning. Lubben, Campbell and Dlamini (1996) advised that using a context-based approach would increase the learners' participation in class and help to determine what is to be learned.

Delpit (1995:141) too, argues that, "in a mainstream educational thinking, many teachers feel that they are losing control if learners do not fit in with their traditional teaching content and methodologies". This means that there is still a big challenge in terms of transformation, because most teachers are still clinging on the old system, hence finding it difficult to fit in and effectively implement learner-centred approaches.

The Physical Science syllabus 2010 indicates that the learning content must be based on the Namibian context. Teachers should therefore, improvise to show scientific issues, concepts and processes. On the mediation of static electricity itself, teachers should be able to explain examples using everyday life when teaching the topic of static electricity. In addition, teachers should allow learners to discuss their experiences on the dangers of, for example, lightning to people. In such a context I thought it would be prudent to do a detailed study to understand how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity.

2.3. Conceptual framework

2.3.1. What is static electricity?

Static electricity happens when insulators are rubbed against each other (Maselwa, 2004). Maselwa (2004) further state that the cloud becomes charged through friction when colliding with air and other clouds. In the clouds, the negative charges move towards the bottom inducing a positive charge on earth (since the negative charges on earth are repelled by the negative charges in the clouds). When the potential difference is large enough, a spark will be formed between these opposite charges and lightning is formed which is an example of static electricity in nature (ibid).

Lightning, sparks from jerseys and rubbing of materials are examples of static electricity in everyday life. Due to the fact that these examples happen in our everyday life, they therefore should be used to aid in a learning strategy in assisting and stimulating learners' understanding of the science of static electricity. This knowledge involves part of the learners' cultural beliefs or capital and should be acknowledged.

The Namibian syllabus for Physical Science Junior Secondary phase (grades 8-10) (2010) requires that learners should be able to describe how the objects get charged by friction and explain how objects with unlike charges will attract each other and how those with like charges will repel each other (MoE, 2010a & b). Nevertheless, it is not explicit on how learners' prior everyday knowledge, for example, learners' cultural beliefs about lightning, some of which may be contradictory to scientific principles, should be incorporated during teaching and learning. For that reason, some science teachers tend to teach static electricity theoretically and focus only on what is in the textbook. Thus, learners are forced to memorize explanations and definitions given in the textbooks through rote learning.

However, though teachers incorporate learners' prior everyday knowledge; some beliefs are contradictory to the scientific explanations. Therefore, teachers need to be aware of these tensions in order to clear up any misconception that may occur.

2.3.2. Studies on the teaching of static electricity

In order to have more knowledge on a certain topic or area, you must research to understand how things are done in various communities. Nanghonga (2012) indicated that curriculum documents such as the syllabus and textbooks do not have adequate examples in relation to learners' everyday lives. She thus recommends that the curriculum should make provision whereby teachers use learners' everyday life experiences as an introduction to the lesson.

To help learners make the most of a new experience, educators need to understand how prior knowledge affects learning (Roschelle, 1995). The use of everyday knowledge in the science classroom increases the levels of engagement of learners and learners enjoy making links between their different experiences when the curriculum is designed to facilitate such links (Stears et al., 2003:111). Stears et al. (2003) argue that learners relate strongly to content that reflects their experiences. That is, the greater degree of connectedness with learning material, the deeper the level of engagement with each other and the teacher. If learners are taught what they do in their community, home or know already, then the involvement of learners may increase (ibid).

For example, in agricultural subjects like the topic on methods of catching fish, the teachers should not only rely on examples in the textbooks, because they may not address what learners do in their community. The teachers may not even think of other methods of catching fish like using nets or fishing baskets known as *Oshongo* in Oshiwambo. Therefore, when teaching this topic, teachers could ask learners to mention different ways of catching fish that they use in their own environment. Teaching them things relating to their everyday lives arouses their curiosity and their level of engagement will be increased.

Chirimbana (2014) contend that students learn more effectively when they already know something about a content area and when concepts in that area mean something to them and to their particular background or culture. When teachers link new information to the student's prior knowledge, they activate the student's interest and curiosity, and infuse instruction with a sense of purpose (ibid).

Moses further reported on ways in which learners' conceptions in science depend on their previous experiences including the way in which they link formal science to their everyday lives. There is evidence to suggest that learners differentiate between school science and out of school science (ibid).

Naukushu (2015) similarly argues that everyday knowledge is fragmented, localized and segmented whereas scientific knowledge is structured, systematized and connected. If prior knowledge is incorporated then learners will start linking what they already know to what they are learning in the class. Ultimately, the learners start grasping the importance of the subject and start liking the subject.

Oloruntegbe and Ikpe (2011) found that the ability to effectively educate future scientists and citizens is predicted, in part, upon how students are able to relate what they learn in school to their daily lives and how teachers have helped students to establish such connection during science teaching and learning. In addition, since "new knowledge is dependent on pre-existing knowledge and skills, knowing what students know and can do when they come into the classroom or before they begin a new topic of study, can help us craft instructional activities that build on students' strengths and acknowledge and address their weakness" (Oloruntegbe & Ikpe, 2011:289).

Learners learn and remember new information best when it is linked to relevant prior knowledge. Teachers who link classroom activities and instruction to prior knowledge build on their learners' familiarity with the topic and enable them to connect the curriculum content to their own culture and experience (Beyer, 1991). It is part of the agenda of this study to find out whether teachers are aware of the impact of not relating concepts to everyday knowledge.

2.4. Theoretical frameworks

The constructivist perspective underpins this study**.** The constructivist perspective on learning has dominated research in science education over the past decades (Kasanda et al., 2003). According to this perspective, meaningful learning does not lie in mere passive absorption of information but rather involves the active creation and modification of knowledge structures (Rahayu et al., 2011).

In other words, the perspective sees the learner as a responsible and an active agent in their knowledge acquisition process. The Namibian Curriculum (2010) point out that constructivism theory is based on observation and scientific study about how people learn. The constructivist theory maintains that people construct their own understanding and knowledge of the world through experiencing things and reflecting on those experiences (Namibian Curriculum, 2010).

Learning is considered a combination of an individual and social process that involves connecting new ideas and experiences to prior knowledge through interactions with the physical or social environment. This perspective further stresses the thought processes of the learner and assumes that prior knowledge, attitude, motivation and learning style affect the learning process (Rahayu et al., 2011:1441). Furthermore, constructivism involves the belief that meaning is constructed and not discovered (Gray, 2004: 17). Since people construct knowledge through and from their experience, it makes sense for prior everyday knowledge and experiences to be used in the teaching and learning of science. I now further discuss what constructivism entails.

2.4.1. Constructivism

Vygotsky (1962) argues that constructivism is a theory of learning and an approach to education that lays emphasis on the way that people create meaning of the world through a series of individual constructs. In constructivism learning is a process where learners build their thoughts and knowledge of the environment on the base of information received from the teacher, through experience and reflection on experiences, rather than taking everything that is passed on by the teacher. Vygotsky further emphasises that constructivism does not focus so much on what learners learn as on how they learn.

Since constructivist learning is about learners constructing their own understanding and knowledge of the world on the information received, through experiences and reflection on experiences, rather than absorption of information that is passed on by teachers and then this enhances their understanding of the concept better. In other words, constructivism focuses on how learners learn and not how much they teach (Taylor, 2002). The effectiveness of mediation is in that learners construct their own understanding and realize new understanding, building on what they already know.

My focus in this study will be on social constructivism and socio-cultural perspectives. Both these privilege learner experiences as a source for discussion and learning and construction and reconstructions of ideas as discussed below.

2.4.1.1. Social constructivism

McRobbie and Tobin (1997) assert that the 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. Social constructivism acknowledges that learning is a social activity in which learners are engaged in building consensual meaning over discussions and negotiations.

During these discussions, learners identify and clear clarify their own views, exchange ideas and reflect on other learners' views, reflect judgmentally on their own views and when necessary, rearrange their own views and negotiate common meanings (McRobbie & Tobin, 1997; Prawat, 1993; Salomon, 1987). Though individuals construct their own understanding; it is not done in isolation but in a social context. Since social constructivism deals with knowledge that is constructed by human beings in working with one another, cultural understanding by the teacher is vital. In social constructivist learning, learners do not rely on teachers in order to gain knowledge but instead by interacting with their environment. Therefore, teachers need to create a learning environment that enables learners to socially construct knowledge, for example, learners sharing their home experiences through interaction in their classrooms.

According to McRobbie and Tobin (1997: 194),

> Social constructivism recognizes the social and personal aspects of learning. In a personal sense meanings are constructed by the individual as new information, interests combine with extant knowledge. Learning is personal and subjective and exists in the mind of the learner. There are multiple ways in which an individual may construct their meaning from a given situation. While an individual's knowledge is personally constructed, the constructed knowledge is socially mediated as a result of cultural experiences, personal history, interaction with others from that culture and the collective experiences of the group.

From McRobbie and Tobin's point of view it could be argued that knowledge is socially constructed from a learner's society and culture.

2.4.2. Mediation of learning

Vygotsky (1962), posit that, mediation is the subtle social interaction between a teacher and a learner that enhances the learner's learning experiences. He further argue that in mediation the teacher should be a learning facilitator rather than a knowledge provider while the learner become self-regulated, independent and creative. In mediating learning, teachers give assistance and further explanations where learners fail to understand (Sisovic & Bojovic, 2000). Sisivic and Bojovic (2000: 57) further argue that "instead of the teacher giving all information to the learners, teacher should allow learners to discover answers on their own which is the process of learner-teacher, learner-learner and learner-teaching content interaction". Roschelle (1995:3) points out that "Vygotsky emphasizes the role of social process in learning, suggesting that new concepts are developed socially, and only slowly become psychological". She goes on to suggest that curriculum developers should provide social models of suitable activity that enable groups of learners to do more difficult activities than they could handle alone.

The active construction of knowledge through social interaction with the learning content provided by experimental work helps learners to develop cognition and understanding (Sisovic & Bojovic, 2000). Furthermore, for learning to take place, learners must know something or can do something that they never knew or could not do before. Fraser (2006) affirms that mediation is important so that learners can understand the environment and importance of this change (learning) that is taking place.

Fraser (2006) further argues that mediation is about bringing a change in understanding. In addition, during teaching and learning the change should be an individual insight, behaviour, perception or motivation and should lead to increased knowledge or the ability to do something that a learner did not do before. These changes are the ones that show that learning has taken place.

A learner's learning is therefore influenced by his own personal cognitive framework which he/she has built up on the basis of previous experiences, their existing knowledge and interaction with the people around him/her (Fraser, 2006). He went on to stress that as a mediator of learning you should not overlook the learners' cultural background and the knowledge they already have, but should rather use it as a basis to which new knowledge can be devoted. Teachers should guide learners to find their own responses to what any concept being learnt. Learners should be encouraged to construct their own questions, explore, and assess what they know (Maselwa & Ngcoza, 2003).

Teachers should act as the 'go-between' the contents and reality, and help learners to make sense of their own world. In addition, teachers should act as mediators of learning and not as a source of all of information they expect learners to learn (ibid).

Fraser (2006) suggested some implications for constructivists on the mediation of learning, which can be helpful in incorporating learners' prior everyday knowledge in the learning and teaching of science.

- **Active involvement**

Learners should be given an opportunity to construct their own meaning. It is believed that learners do understand better when they are actively involved or engaged and try to find solutions on themselves.

- **Learners should be helped to learn**

Teachers need to help learners to learn by creating the room for active participation of learners. For the learners to learn, the teacher should give proper guidance and assistance that makes it easy for them to learn.

- **Opportunity for knowledge construction should be created**

The mediation of learning should be based on the construction of knowledge rather than the imitation of information.

- **Creating a real world environment**

Learning should take place in a realistic setting and real world setting should be shaped. The focus should be on realistic methods to solve real world problems and teachers should help learners to attain strategies to solve problems.

- **Opportunities for reflective practices**

Learners should be inspired to reflect on their own experience, own learning strategies, practices, and assess which activities help learners to gain better understandings.

- **Opportunity for constructing knowledge through social negotiation**

Learners learn best through interaction with other learners. Therefore, learning should be a social activity. Cooperative learning should be fostered and encouraged.

- **Multiple representations of reality should be allowed**

Conceptual interrelatedness should be highlighted and numerous symbols or and viewpoints on subject content should be provided. Teachers should provide multiple interpretations and expressions of reality and tools that will help learners interpret multiple perspectives of the world (Fraser, 2006).

2.4.2.1. Zone of Proximal Development (ZPD)

According to Vygotsky, learning takes place within the Zone of Proximal Development (ZPD). The ZPD is an essential concept in sociocultural theory. According to Vygotsky (1962), the ZPD "is the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers". Essentially, it includes all of the knowledge and skills that a person cannot yet understand or perform on their own yet, but is capable of learning with guidance.

Hodson and Hodson (1998) point out that Vygotsky's perspective requires teachers to concentrate their efforts in the ZPD and create opportunities for learners to learn. They also indicate that learners can guide fellow learners through the ZPD, provided they are knowledgeable in the subject content knowledge. Vygotsky believes that peer interaction is an essential part of the learning process. Therefore, in order for children to learn new concepts/skills, less skilled learners need to be paired with the more competent ones. This helps in extending learners' understanding of the subject at hand beyond their prior understanding as an individual. When a learner is in the ZPD, providing them with the appropriate guidance and tools, which is also referred as scaffolding, gives learners what they need in order to accomplish the new task or skills.

2.4.2.2. Scaffolding

Scaffolding is support given to learners by the teacher (Wood, Bruner & Ross, 1976). These authors further argue that scaffolding represents the helpful interactions between a teacher and a learner to do something beyond their independent efforts. It is a learning process that aims at promoting a deeper level of understanding of learning. In addition, scaffolding is a temporary framework that is there for support and access to meaning, and is taken away when the learner secures control of success with a task. Therefore, teachers should make use of learners' prior everyday knowledge to scaffold learners. They should link what they are teaching to everyday knowledge so that learners can easily grasp what the teacher wants them to learn. Vygotsky pointed out some benefits of scaffolding as to (1) Provide clear directions and minimize learners confusion (2) help learners to understand the reason why they are doing the task and its importance (3) provide structure and a clear pathway for the students to use (4) reduce uncertainty and disappointment by giving learners expectations they aim to reach and proper tools to accomplish the task (5) direct learners to reliable resources.

2.4.2.3. Language as a mediational tool for learning

Effective teaching and learning depends on communication through appropriate, accessible language, so that learners can make sense of the teachers' explanations. Language is thus a special tool of communication that enables people to express their ideas. Language is the main medium making the learning process possible (Mwamwenda, 1995). Therefore, teachers have to ensure that the learners have acquired adequate competencies in language.

We have to take note of the fact that most learners in Namibia are taught in English, which is a second language to them. In another note, communication in the classroom is based on the meaning of thousands of words that are exchanged between teachers and learners. However, this communication will only be fruitful if the involved parties understand one another. That is, teachers should expose learners to the language of learning and learners should master the use of that language.

2.4.2.4. Code-switching

Code-switching means that a speaker in a multilingual community can switch from one language to another. (Yakubu, 1994; Lebben et al. 1998; Baloi, 1994) claim that code-switching encourages multilingualism and at the same time, it helps in stimulating shared understanding to link the cultures.

Lemke (1989) argue that communication is most dangerous when we think that we are in fact communicating, but our partners in dialogue do not see it that way. Azan and Narasuman (2013:195), posit that there are types of code-switching, namely, "tag-switching," "inter-sentential switching" and "intra-sentential switching". Code-switching aims to connect comprehension gaps and make salient information and instructions understandable. As a researcher, In addition whether allowing learners to express themselves in their home language gives them a space to share their prior knowledge that they cannot explain in English.

Azlan and Narasuman (2009) further assert that there are various reasons for code-switching such as lack of register, lack of facilities, mood of the speaker, emphasizing a point, habitual experience, pragmatic reasons, attracting attention as well as semantic significance. The researcher is looking to find out the reasons contributing to code switching and whether they are effective.

Probyn (2009) identified other ways to overcome language barriers during the teaching and learning of science, particularly in the South African context. Her results recommended that code-switching from English to the language that learners understand better may help learners with intellectual thinking in response to learners' limited English proficiency. She, however, acknowledges that, code-switching is in conflict with the MoE language policy and those physical science teachers sometimes had to 'smuggle' vernacular into the science classroom. This indicates that code-switching is covertly done to a large extent and not acknowledged as a genuine tactic for clarification purposes. It was further noted that code-switching as learning and teaching resource has its own challenges (Hart, 2003). For instance, the teacher may try to simplify concepts, but in the process they may misinterpret it. These views show that for effective code-switching to take place, there is a need for the teachers to be competent and sensitive to the potential problems.

2.4.2.5. Learning and teaching support materials (LTSMs) as mediation tools

Learning support materials are the prepared materials that are structured to assist in the learning and teaching (Czerniewicz et al., 2000). Czerniewicz et al. (2000) further argue that teachers should be the ones who prepare these materials even though they can also be prepared by other educationalists (specialists) but teacher are at a good position as they are aware of their learners' needs. They further point out some of the roles of learning support materials are (1) supplement the structured program of learning (2) enough LTSMs are important as they contribute to the successful implementation of the curriculum (3) LTSMs promote both good teaching and good learning in the classroom (4) LTSMs promote the love for life-long learning (5) LTSMs promote the pedagogy in the curriculum (Czerniewicz et al., 2000:34).

2.4.3. Pedagogical content knowledge

Maselwa and Ngcoza (2003) define pedagogical content knowledge (PCK) as teachers' interpretations and transformations of subject matter knowledge in the context of facilitating learning. They further proposed several key elements of PCK such as (1) subject content knowledge (2) understanding of students' conceptions of the subject and learning and teaching (3) teaching strategies (4) curriculum knowledge (5) educational content knowledge (6) Knowledge of the purposes of education (Maselwa & Ngcoza, 2003:56)

PCK includes an understanding of what makes the learning of specific topics easy or difficult: the ideas and biases that learners of different abilities and backgrounds carry with regard to learning the taught topics. Additionally, PCK is a professional knowledge that differentiates teachers from one another. A teacher may know a subject, but has not had the time to develop the knowledge needed to teach the subject excellently.

Pedagogical content knowledge (PCK) is the most powerful tool that gives the similarities, examples and explanations for a word, the ways of demonstrating and expressing the subject that makes it understandable to others. Even though PCK is the knowledge that teachers should possess, there are difficulties in capturing PCK in observation, in the sense that observation can provide very limited insight into a teacher's PCK because it's an internal construct (Shulman, 1986).

Shulman (1987) further explains that teachers need to understand what they teach in various ways. In order to cater for all learners in the learning process, teachers need to consider learners' different learning capabilities and their different experiences. PCK links together strategies and content knowledge to bring about learning that is built upon strong subject knowledge, teaching, and learning strategies (ibid).

Furthermore, Shulman states that PCK is knowledge and practice of teaching and learning that a teacher can use to maintain classroom management, classroom organizations and assessment. Subject content knowledge is knowledge of subject such as concepts, theories, ideas, frameworks, evidence and proof and recognized practices including ways to develop such knowledge. Shulman adds that an important part of what skilful teachers do is to transform subject matter content into forms that are accessible to their learners. To accomplish this, teachers draw on diverse types of pedagogical content knowledge of subject matter and pedagogical knowledge by relating it with learners' prior everyday knowledge. In PCK, teachers start moving past a preoccupation with technical competence to a more critical stance involving the transformation of subject matter for teaching.

Van Driel, Verloop and de Vos (1998) argue pedagogical content knowledge (PCK) is an exact classification of knowledge that goes beyond knowledge of subject matter *per se* to the aspect of subject matter knowledge. It entails a change of subject matter knowledge so that it can be used effectively and flexibly in the learning process. Therefore, teachers must have powerful pedagogical content knowledge to be good teachers (Loughran, Mulhall & Berry, 2004).

Loughran et al. (2004) find challenging concepts for a topic an important aspect of articulating one's pedagogical content knowledge, since it offers access to the way the science teacher organizes the topic. PCK may also be observed as the main ideas that teachers see as valuable in helping to conceptualize the topic as a whole and present the main concepts to the learners in an easy way that they understand better. Loughran et al. (2008) claim that a lack of deep conceptual understanding among teachers, results in subject matter knowledge being fragmented, compartmentalized and inadequately organized. Kasanda et al. (2003) argues that PCK is the content knowledge that compacts with the teaching process including the ways of presenting and expressing the subject that makes it clear to others. This knowledge includes knowing what teaching strategies are appropriate and knowing how basics of the content can be organized for better teaching. Furthermore, Kasanda et al asserts that this knowledge contains aspects of teaching methods, knowledge that integrates suitable abstract illustration, to address learners' difficulties and misunderstandings. In addition, it also consists of knowledge of what learners carry to the classroom, knowledge that might be facilitative for the precise learning mission at hand.

Kasanda et al. (2003) claims that pedagogical knowledge represents the combination of content and strategies into an understanding of how particular features of subject topics, issues or difficulties are organized modified and signified for the interest and abilities of learners.

Rennie (2011) also argues that "helping learners to learn about and use science in everyday contexts needs a great level of teaching strategies and the subject content". In addition, Rennie (2011) explains that using knowledge in various contexts often requires considerable deviation so that the knowledge can be used in new situations. In other words, teachers must be able to change the content to fit learners' context and this is a cumbersome task for some science teachers.

Van Driel et al. (1998) highlight that experienced teachers appear to have an advanced abstract background in which knowledge and beliefs about science subject matter, teaching and learning and learners are organized in a logical way. Abell (2008) too emphasizes that PCK is about the worth of information and how it is put into action. The concept of PCK incorporates all the other pedagogical strategies discussed in this section. By using PCK in this study as the main theoretical lens provided me with an opportunity to explore teachers' pedagogical strategies such as code-switching, mediation and scaffolding techniques and so forth. PCK as discussed also helped me to understand the nexus of content mastery specific instruction strategies. For the learning to take place the teacher should know the content and have strategies on how to help learners learn and move from one level to the next level. PCK in this study is vital as an analytical tool too that can improve learners understanding of some concepts that seem complicated to understand.

2.5. Concluding remarks

In this chapter the researcher reviewed the literature relevant to my research project. The discussions covered the literature on curriculum issues. Additionally, the researcher discussed literature on learners' prior everyday knowledge, indigenous knowledge (IK), static electricity and the mediation of learning with a help of scaffolding, the Zone of Proximal Development, language usage and learning and teaching support materials. The theoretical framework on constructivism was discussed, together with social constructivism. Lastly, pedagogical content knowledge (PCK) was discussed as an analytical tool which helped me to analyses the teachers' teaching practices involved in this study. In the next chapter the researcher discusses the methodology underpinning the study.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

In this chapter, I explain the research methodology used in this study. I start by discussing the research design and orientation, as well as the paradigm that underpins the study. To gain answers to the research questions, the following data gathering techniques were used: document analysis, lessons observations, and interviews (semi-structured and stimulated recall interviews).

I also discuss the research site and sampling, and describe the data analysis process, considering the study's trustworthiness, reliability and validity. Questions of ethics and limitations are also addressed.

3.2 Research design and orientation

Babbie and Mouton (2001) and McMillan and Schumacher (2010) argue that a research paradigm is a framework that directs how research should be constructed, according to the epistemological and ontological world views of the researcher and his/her subjects. Babbie and Mouton (2001) define epistemology as the theory or philosophy of understanding, while ontology is the theory of being, of the true nature of things. Together they can provide a philosophical understanding of what aspects of human existence are available for study.

In my attempt to gain insight into how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity, I decided to use a qualitative case study, located within an interpretive paradigm (Cohen, Manion & Morrison, 2011). These concepts are discussed below.

3.2.1 Interpretive paradigm

This study is underpinned by an interpretive paradigm. An interpretive paradigm has to do with understanding the subjective world of human experience and is concerned with the individual's actions and perceptions during a certain process (Cohen, Manion & Morrison, 2010). To retain the integrity of the phenomena being investigated, efforts are made to 'get inside' the person and to understand them from within (Cohen et al., 2011). The interpretive paradigm provides an in-depth understanding of the nature of activities to be done in any study (Cohen et al., 2010).

In this study I investigated how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity. The interpretive paradigm thus served to provide a framework that helped the teachers to understand how they could assist their learners to improve the mediation of the topic static electricity using learners' prior everyday knowledge.

Within the interpretive paradigm, a qualitative case study approach was adopted, as described below.

3.2.2 Case study

A case study aims at analysing phenomena from the perspective of the participants (Babbie & Mouton, 2006). This research was thus carried out in the normal location of the participants involved in the study. The emphasis was placed on their actions and their corresponding feelings and thoughts (Cohen et al., 2011). Case studies are usually described as holistic because they capture the various variables affecting a single case (ibid).

A case study approach is appropriate for this study as it allowed for the eliciting of in-depth information in a specific context. Furthermore, this case study focused on interpretation with the purpose of understanding how grade 8 Physical Science teachers use learners' prior everyday knowledge when teaching static electricity. Essentially, the particular case study approach employed can be described as qualitative.

Baxter and Jack (2008:56) define a qualitative case study as "an approach to research that facilitates study of an occurrence within its context using a variety of data sources". Denscombe (2007) asserts that case study research provides for data validation through a process called triangulation, which, according to Blanche, Durrheim and Painter (2006), entails collecting data in a variety of ways in order to get more or less the same information.

In qualitative research, researchers thus collect various forms of data and analyze them from various angles to construct a rich and meaningful picture of a complex, multifaceted situation (Leedy & Ormrod, 2010). A qualitative case study approach was therefore appropriate to this investigation of how grade 8 Physical Science teachers mediate learning of the topic on static electricity using learners' prior everyday knowledge. I made a close and detailed examination of the ways in which two grade 8 Physical Science teachers made use of their learners' prior everyday knowledge in class. This therefore constituted the case, while my unit of analysis was the mediation of learning.

3.3 Research goal and questions

This section presents the goal of this research study together with the research questions which this study intended to answer.

3.3.1 Research goal

The main goal of this study was to investigate how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity. To answer this goal, a research question and three sub-questions were posed, and these served as guidelines in achieving the aforesaid goal. Care was taken to ensure that the research questions were clear and well formulated, intellectually worthwhile, researchable and enabled a move from broad research to specific research, as proposed by (Mason, 2002).

3.3.2 Research questions

To achieve the main goal stated above, I endeavored to answer the following main question:

How do grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity?

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

1. What are grade 8 Physical Science teachers' conceptions and experiences of the use of learners' prior knowledge when teaching static electricity?

    - To answer this research sub-question, I observed two lessons which I later analyzed. I then conducted the stimulated recall interviews with the two teachers involved in this study.

2. In what ways do grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching the topic on static electricity?

- To answer this research sub-question, I obtained information from observation and interviews.

3. In what ways can grade 8 Physical Science teachers improve learners' understanding when making use of learners' prior everyday knowledge when teaching static electricity?

    - Answering this question involved making inferences from all the data collected in the light of appropriate theoretical postulates.

3.4 Research site and sampling

This section presents an explanation of the geographical locations of the schools which were used in this study.

3.4.1 Research site

As briefly explained in Chapter 1, this study was conducted at Shamba (pseudonym) Combined School in Etayi Circuit, Omusati region and Ndiki Junior Secondary School (pseudonym) at Ohangwena circuit, Ohangwena Region in northern Namibia. Ohangwena is a region that borders Angola in the northern part of Namibia. Ohangwena is one of the regions that performs well in the junior secondary examination (JSC), as shown by their 2013 results in which they shifted from position five to position four.

Ndiki junior secondary school has 353 learners, 179 boys and 174 girls. There are 15 teachers (seven males and eight females), three support staff members, one administration officer and two cleaners. The Omusati region is a neighbour to the Ohangwena region and is on the border of Angola. Omusati region is one of the best performing regions in Namibia, with most of the teachers working very hard and achieving good results. This is evidenced by five consecutive years of excellent JCS results (MoE 2008). Shamba Combined School has 456 learners, 268 boys and 188 girls. There are 22 teachers (16 females and six males), one secretary and two cleaners.

3.4.2 Research participants

Sampling refers to the process of defining the population which the research will focus on: in other words, it is "a method used to select a given number of people from a population" (Mertens, 2005:69). In this study, purposive sampling was used. Cohen et al. (2011) state that in purposive sampling researchers simply choose the sample on the basis of particular judgments regarding their typicality or possession of the particular characteristics being sought. Furthermore, researchers build up a sample that satisfies their specific needs. Sampling decisions must be taken early in the overall planning of a piece of research. Factors such as expertise, time, and accessibility frequently prevent researchers from gaining information from the whole population (Cohen et al., 2011).

Cohen et al. (2011) go on to say that purposive sampling is often a feature of qualitative research, whereby researchers hand-pick the cases to be included in the study. Researchers typically use purposive sampling in order to access knowledgeable people, those who have in-depth knowledge about particular issues, maybe by virtue of their professional roles, power of access to networks, expertise or experience. Research participants are "hand-picked" as they are known for their "their typicality or possession of the particular characteristics being sought" (Cohen et al., 2011: 156).

In the context of this study, since I intended to obtain in-depth knowledge of how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity, purposive sampling was used to identify participants who are knowledgeable in this aspect. In this study, my research participants were two grade 8 Physical Science teachers and I chose them because one of them had done a research project on how to integrate learners' prior everyday knowledge when teaching the fermentation and distillation processes so she had an understanding of the incorporation of indigenous knowledge systems in the teaching of science. The second teacher is a current Master's student and has been exposed to instruction on how to integrate learners' prior everyday knowledge during her studies at the Rhodes University. Additionally, both teachers have more than five years teaching experience teaching Physical Science in grade 8.

Since the two participants are experienced teachers, their views and experiences are likely to provide considerable insight into the issue under study. However, it is acknowledged that the fact that a teacher is experienced does not necessarily translate into quality teaching. To this end, their pedagogical content knowledge (PCK) (Shulman, 1986) assisted me in understanding the various repertoires being used by these teachers as they provided support to learners and made sense of their prior everyday knowledge when mediating static electricity.

3.5 Data gathering techniques

A qualitative case study is an approach used to dig deep in order to get a full understanding of the phenomenon the researcher is studying. In qualitative research, researchers gather various forms of data and analyze them from various angles to construct a rich and meaningful picture of a complex, multifaceted situation (Leedy & Ormrod, 2010). Data gathering techniques refer to research tools used to gather the information required. Observation, document analysis and interviews are regarded as the most important data gathering tools typically used in a case study (Cohen et al., 2011; Johnson & Christensen, 2004; Leedy & Ormrod, 2010).

In this study I therefore used document analysis, observations and interviews. To help facilitate the data gathering process, the study was conceptualized into two phases. Data gathered in Phase One aimed to answer research sub-questions 1 and 2, whereas data for Phase Two was used to address sub-question 3.

I used three different data gathering techniques to obtain information, namely:

- Documents analysis;
- Observation; and
- Interviews
    - Semi-structured interviews; and
    - Stimulated recall interviews

I used these different data gathering techniques to ensure adequate coverage of the research goal and questions. With the permission of participants, I made two lesson observations per teachers on static electricity. These data gathering techniques are described in detail below.

3.5.1 Document analysis

Document analysis is a social research method, an important research tool in its own right, and an invaluable part of most schemes of triangulation (Cohen et al., 2011). Documentary work involves reading a great deal of written material (it helps to scan the documents onto a computer and use a qualitative analysis package). A document is something that we can read and which relates to some aspect of the social world. Official documents are intended to be read as objective statements of fact but are socially produced and hence subject to bias.

John (2003) points out that document analysis can be performed at a time convenient to the researcher and is an unobtrusive source of information. He further emphasizes that it represents data that are thoughtful. Marten, Kelvin and Desmond (2006) point out that document analysis is in some way easier than doing interviews or participant observation since one does not have to think on one's feet as in an interview, nor engage in the tedious process of transcribing everything.

The documents analyzed in this study included textbooks for grade 8 Physical Science, the Physical Science syllabus and the Namibian Curriculum document. Document analysis helped me to get some insights into what the curriculum says about learners' prior everyday knowledge. I analyzed two main documents that are usually used by teachers in delivering knowledge to learners: a textbook and the subject syllabus description (as part of the curriculum). I focused on what the syllabus says learners need to know about static electricity (that is, what basic concepts learners need to acquire and which competencies have to be addressed).

3.5.2 Observation and field notes

Observation was used to get first-hand information and for triangulation purposes, as discussed in Section 1.5. This method offered me an opportunity to gather 'live' data from natural occurring situations (Cohen et al., 2010).

Cohen et al. (2011: 456) assert that quality observation involves more than just looking: "it is looking and noting systematically people, events, behaviours, setting, artifacts, routines and so on". Leedy and Ormrod (2010:147) state that "observation in a qualitative study is intentionally unstructured and free-flowing", as the observer sees the real action of the teacher in real time.

In this study, I used an observation schedule as a guideline (see Appendix D) and I observed at least two lessons per teacher to find out how they made use of learners' prior everyday knowledge when teaching static electricity. I also took field notes during all the sessions. Informal interviews were conducted after each lesson as well.

3.5.3 Interviews

The research interview has been defined by Cohen et al. (2010:351) as "a two-person conversation initiated by the interviewer for the specific purpose of obtaining research-relevant information". Kvale (1996:76) defines an interview is an interchange of views between two or more people, on a topic of mutual interest aimed at knowledge production or generation. Similarly, Patton (2002:341) maintains that "the purpose of the interview is to allow us to enter into another person's perspectives". These definitions concur in that interviews involve an interviewer and an interviewee.

Cohen et al. (2011:409) point out that "interviews are widely used instruments for data collection". They further state that an interview is a flexible instrument for information collection that enables multi-sensory channels to be used, including of course the verbal. My focus in this study was on semi-structured and stimulated recall interviews, and these are described below.

3.5.3.1 Semi-structured interviews

Johnson and Christensen (2004) state that a semi-structured interview is a type of interview in which the researcher engages participants on a one-on-one basis. Furthermore, qualitative interviews are used to obtain in-depth information about a participant's thoughts, beliefs, knowledge, reasoning, motivation and feelings about the research.

A semi-structured interview is flexible as it allows the researcher to probe and ask follow-up questions during the interview (Cohen et al., 2011). Through semi-structured interviews, therefore, I had hoped to get some insights from the participants regarding how they make use of learners' prior everyday knowledge in order to scaffold learners when teaching static electricity. Moreover, I aimed at discovering the strategies used by teachers in order to improve how they made use of learners' prior everyday knowledge. Interviews were intended to last for approximately 30 minutes, but I found out that there was more than what I wanted to get and they extended beyond the planned duration.

3.5.3.2 Stimulated recall interviews

In this study I also used stimulated recall interviews in order to answer sub-questions one and two. A stimulated recall interview is a technique for investigating how people approach interactions in a number of different situations (Lyle, 2003). In general, the technique involves interviewing individuals and discussing different aspects of the recorded observed interactions. Stimulated recall interviews were essential to my study as they allowed me to probe the participants and obtain information that I did not get at first. At the same time, they served as a validation technique (see Section 3.7).

3.6 Pilot study

A pilot study can be regarded as a small-scale trial run on all the aspects planned for use in the main inquiry (Cohen et al., 2010). Cohen et al. (2010) further argue that a pilot study helps the researcher to fine-tune the data gathering techniques in preparation for the main inquiry.

In this study I piloted my interview questions with two colleagues in the Master's class. The interview questions were piloted with another MEd (science) student during the January contact session. I subsequently piloted my interview questions and observation schedule with a teacher at my school. This was intended to ensure the effectiveness and reliability of the observations and interview questions.

The pilot study thus helped me to acquire a better understanding of what questions are appropriate for an interview and whether they effectively addressed the research topic. It further helped me to answer questions such as: What is important when drawing up interviews for teachers? What aspects need to be considered when planning such research and when observing lessons?

Table 1: Showing the data gathering techniques, methods and purpose for the gathering of data

PHASE ONE: Stage	Methods to be used to gather data	Data to be gathered	Purpose
Stage 1 **DOCUMENT ANALYSIS**	Document analysis of curriculum documents.	What curriculum documents say about learners' prior everyday knowledge?	To get insights about learners' prior everyday knowledge and how to integrate this knowledge in the teaching of static electricity.
	Physical science syllabus	Content to be covered on topic static electricity grade 8	To find out information about the content to be covered on topic static electricity in Grade 8 as well as practical suggestions.
	Physical science textbooks (Go for physical science and new physical science) (Teachers' lesson plans were also mentioned up. Will you not use it as a document? See page 36	Information on the integration of prior knowledge in static electricity.	To investigate how much of the indigenous knowledge do teachers use in the teaching of static electricity as reflected in the schemes of work.
Stage 2 **PILOT**	The researcher piloted the research questions with two colleague who teaches grade 8 Physical Science by interviewing her.	Teacher's perceptions on prior knowledge. The integration of this knowledge do they enable or constrains the teaching of static electricity.	The main reason for piloting my data gathering tools is none than to improve them.
Stage 3 **Interview (semi-structured interview)**	I intended to interview two physical science teachers.	To obtain data on teachers' perception and experiences on the topic of static electricity. How they integrate learners' prior everyday knowledge in the teaching and learning of static electricity.	To get some insights on teachers perception and experiences on the topic static electricity. In addition, to get insights on whether integration of learners' prior everyday knowledge does influence learners' understanding of static electricity.
Stage 4 **Lesson observation**	Observing teachers during lesson preparation were part of the study.	To observe how teachers make use of learners' prior everyday knowledge during the lesson presentation on static electricity.	To get insights on how teachers make use of learners' prior everyday knowledge; When do they use this knowledge; and to find out whether using learners' prior everyday knowledge enhance learning?

3.7 Data analysis

Cohen et al. (2011) state that qualitative data analysis involves organizing, accounting for and explaining the data. Henning, Van Rensburg and Smit (2004) argue that data analysis literally means to break down data into bits and pieces, or break it down by categorizing it. Data analysis is the process of making sense of the data and finding meaning in it, interpreting what has been seen and what has been said (Gay at al., 2006).

Lankshear and Knobel (2004) state that data analysis is informed by the theory that frames the research study: in the context of this study, this means interpretive theory, constructivism and pedagogical content knowledge.

I made use of thematic analysis, in terms of which data were analyzed to provide insights into how learners' prior everyday knowledge was used in the mediation of learning of static electricity. Data were further colour-coded and organized into categories to develop emerging themes (Brand & Glasson, 2004).

Data analysis was therefore an on-going process, utilizing data gathered from the three data gathering techniques in order to extrapolate meaning from the narratives told by the research participants. The labeling or coding process enabled me to retrieve and gather together all the text and other data that associated with some thematic idea, in order to enable them to be examined together and compared.

Inductive analysis was applied in this study, as recommended by Danermark, Ekstrom, Jakobsen and Karlson (2002). This typically consists of identifying similarities in a number of observations or occurrences. Patton (2002) describes inductive analysis as the investigation of data to discover patterns and themes, resulting in a creative synthesis. Through inductive analysis, categories and patterns emerge from the data, rather than being imposed on them prior to the gathering process (Davies, 2007).

During this process of data analyzing and interpretation, I used pedagogical content knowledge as an interpretive approach, in an effort to understand and explain the type of support that teachers gave to their learners in terms of content presentation (mediation), teaching methods used, how the topic is presented in the textbooks, and what enabled or constrained the integration of prior everyday knowledge in the science classroom. I particularly wanted to investigate what challenges the two teachers were faced with (with respect to the integration of indigenous knowledge (IK) of the learners in the teaching of static electricity, and what strategies they implemented to overcome such challenges.

Different colours were used to distinguish the engagement of learners, connectedness between learners' prior everyday knowledge and science in the classroom, teaching strategies used, challenges faced by teachers, measures taken to overcome these challenges, and potential improvements. I experimented with the colour coding after I had gathered data from my pilot study. Merriam (2009:64) posits that "coding is nothing more than assigning some sort of short-hand designation to different aspects of your data for easier retrieval of specific pieces of data".

The analytic techniques described above helped me to understand the data gathered and how to analyze it. In addition, they enabled me to see how teachers helped their learners to move to the same level of understanding, how they built on what learners already knew and what type of pedagogies they used to make learners understand better.

3.8 Validity and trustworthiness

Gray (2004) states that validity ensures that the research instrument measures what it is intended to measure. In this study, I made sure that my data gathering tools were piloted before I began my main study. Cohen et al. (2011:179) assert that "validity is essential to a successful piece of research". If research is invalid then it is worthless. Cohen et al. (2011) state that in qualitative research validity might be addressed through the honesty, depth, richness and scope of the data accumulated, the way the participants were approached, the extent of triangulation, and the disinterestedness or objectivity of the researcher.

To ensure validity, the data gathered should be triangulated by comparing codes across the information sets generated by all the data gathering techniques, before themes are developed. In addition, I also made use of member checking to verify the accuracy of the responses from all the participants. That is, the interview transcripts and summaries of discussions were given back to all research participants in order for them to verify their responses. Cohen et al. (2003:136) argue that "member checking is when the respondent validates, to assess intentionality, to correct factual errors, to offer respondents the opportunity to add information and check the adequacy of analysis". In addition to member checking, I used stimulated recall interviews as proposed by (Lyle, 2003).

3.9 Ethical considerations

Callaham and Hobbs (1981) state that the primary concern of a researcher should be the safety of the research participants. Therefore, privacy and confidentiality issues should be approached with utmost care. Ethical protocol can be referred to as the parameter of ethics within which researchers bind themselves when conducting research.

In this study, I sought permission, in writing, from the Directors of Education (Omusati and Oshana regions), and the Inspectors of Education, Etayi circuit in the Omusati and Oshana regions, for the two schools where I intended to carry out my research (see Appendix A). I also sought permission from the school principals to carry out my research in their schools, and consent from the teachers concerned, via formal letters (see Appendix B). Finally, I also sought permission from parents, in writing, as I was observing their children who were minors (see Appendix B) at the time when this study was conducted. I explained the purpose of the research to the participants and informed them that all the information would be treated confidentially.

I also emphasized that participants were free at any point to withdraw from the study if they so wished (Blanche, Durrheim & Painter, 2006). Hamilton and Whitter (2003) point out that as a researcher, you to get voluntary consent from people you are studying. I explained these ethical issues to everybody at the beginning of every interview and reiterated the point of confidentiality and anonymity before each and every interview session. Denscombe (2007) insists that people should not be forced or coerced into helping or participating in research. To this end, I thus made sure that I did not pressurize anybody to take part in my study.

3.10 Limitations of the study

Being a case study of only two schools in Namibia, the results of this study cannot be generalized. However, the study could provide some insights into how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity. I decided to take a small sample of participants, given the time constraints and the fact that this is a half-thesis case study.

The following methodological challenges were experienced:

School 1

- Two days of research were reduced to one, due to rescheduling by the participant because examinations were approaching. I thus had to observe him for two lessons in the day.

School 2

- I had planned only one day for the observation due to the long distance to be travelled. I managed to observe two lessons and after the first observation, I decided to listen to how the lesson went while waiting for the next observation. I was lucky as I had taken notes during the observation and these were what I used.

3.11 Concluding remarks

In this chapter, I outlined the research design and methodology that informed the study. I also discussed how the data were gathered and analyzed. The chapter provides commentary on issues of validity, ethics, and on the limitations of the study. The chapter is central to the study in that it shows what methods were used for generating data so as to pursue the research goals (as set out in Chapter One), and how analysis of the data was approached. These methods are informed by the literature reviewed in Chapter Two. The chapter elaborated on the presentation and analysis of the data, as reported in subsequent chapters.

In the next chapter I present the data generated from the participants involved in the study.

CHAPTER 4: DATA PRESENTATION

4.1. Introduction

This study sought to find out how grade 8 Physical Science teachers use learners' prior everyday knowledge when teaching static electricity. As highlighted in Chapter One, the study was triggered by my personal 10 years of teaching experience. During all these years I have been grappling with how to incorporate learners' prior knowledge into my Physical Science lessons that would enable me to close the gap between school science and everyday knowledge. My assumption was that teachers were trained with little knowledge on the integration of learners' prior everyday knowledge in the science classrooms. In this chapter I present the data generated using the following methods, namely, document analysis, observation and semi-structured interviews as well as stimulated recall interviews.

This chapter starts off by outlining the teachers' profile information, which I consider crucial to properly contextualize the data. I will then describe how the examples of each situation or each data set were selected. Thereafter, data from each technique are presented as generated from the different data gathering techniques used.

4.2. Participants' profiles

4.2.1 Profiles of teachers

Two participant teachers were involved in this study.

Teacher 1 (T1) at Shamba, teaches Physical Science in grade 8 to 10 and he has been teaching this subject for more than ten years. He is a Master's degree graduate in Science Education from Rhodes University. This teacher has been performing very well in this subject, especially at external examination level of exit Grades, such as Grade 10. The teacher is 45 years and has a teaching experience of more than 20 years

Teacher 2 (T2), at Ndiki, teaches Physical Science grade 8 to 10 and she has been teaching Physical Science for more than eight years. She has a BEd (Hons) degree in Science Education. The teacher is 42 years and has an experience of 19 years.

4.2.2 Learners Profiles

The learners who were observed are grade 8 learners whose average age was 14 years.

4.3. School context

This research was conducted in two schools, namely, Ndiki Junior Secondary School and Shamba Combined School (pseudonyms). Both schools are rural schools, though from different neighbouring regions. At Ndiki Junior Secondary which is only one phase (junior secondary phase) Physical Science is offered as a core subject for all learners from Grade 8 to 10. Shamba Combined school caters for learners from grade 1-10 and Physical Science is offered as a core subject for all learners from Grade 8 to 10.

4.4. Document analysis

4.4.1. The Namibian syllabus for grade 8

The syllabus is the ministerial document which guides educators on teaching and learning. The Physical Science syllabus for Grade 8-10 was developed in order to describe the planned learning outcomes and assessment practices within the science mainstream. The learning and outcomes are designed towards promoting the learners' knowledge of the physical world of which they are part of (MoE, 2006).

The syllabus further states that learning experiences in the Physical Science area are focused upon promoting the teaching and learning for understanding. Learners need to obtain appropriate knowledge and skills which are a pre-requisite for progressive national and economic goals and the improved standard of living for society. Thus, learners need to acquire knowledge and skills which nurture their understanding of the interaction of human beings and the environment

The syllabus indicates the learning objectives and basic competences about static electricity in particular (which is a focus of this study) as follows:

Learning objectives state that learners will:

(1) know the existence of charge (2)understand charge (3)know how to charge objects (4) know how an electroscope works (MoE, 2003).

The basic competences state that learners should be able to: (1) Explain the existence of electrons, protons as introduced in the chemistry section (2) explain the existence of charge by an imbalance of electrons (negative charges) and protons (3) (positive charges), e.g. the separation of charges by rubbing objects against one another) (4) investigate and describe how objects can be charged by friction and explain examples in everyday life (5) investigate and explain how charges on a charged electroscope are able to discharge by flowing to the earth through the process called 'earthing' (MoE, 2003).

The syllabus makes some provision for learners to use examples from everyday life. For example, the fourth basic competence requires learners to explore and describe how objects can be charged by friction and requires them to explain examples in everyday life. It also outlines specific examples of everyday experiences whereby charging takes place by friction. Unfortunately, some examples used in the syllabus do not relate to the local rural environment but rather to an urban environment. This could lead to teachers presenting it to the learners without considering their prior everyday knowledge and experiences of such natural phenomena. Also, examples of static electricity such as pulling off a jersey and pulling a blanket and sheets apart are familiar to the learners but learners in the village might not know what a carpet is as discussed in Section 2.3.1

4.4.2. The textbooks

Two textbooks were analyzed to see how static electricity is approached and how it is presented. The first textbook analyzed was, Go for Physical Science grade 8 (van Niekerk, 2007). The second textbook analyzed was New Physical Science grade 8, Namibia Junior Secondary certificate (Britz & Mutasa, 2007)

Even though both textbooks are in line with the syllabus, the second textbook is used by the learners in most schools in Namibia, while the first one is used mostly by teachers at some schools as a reference. The New Physical Science textbook is commonly used because it is in the government catalogue so it is accessible. This textbook is learner-friendly as the language used in it is simple. It also gives clear and easy explanations and has diagrams that are useful in facilitating learners' understanding (Kasanda, et al., 2003).

These two textbooks were chosen because they are the ones used by the participant teachers.

Textbook 1: Go for Physical Science

Examples on static electricity highlighted in this textbook are as follows: (1) rubbing a TV screen/window with a cloth more and more enables dust particles to be attracted by the screen (2) combing your hair, static electricity causes the hair to stand up (3) getting a shock after walking on a carpet and then touching a metal door handle (4) clothes cling to your body and crackle when you put them on or take them off, and blankets and sheets crackle and cling together when you pull them apart (van Niekerk, 2007)..

This textbook includes the topic of static electricity. Static electricity is described as 'electricity at rest` in this textbook. Based on my analysis of the textbook, the language used is appropriate for the junior secondary level. However, examples used are based more on Western Cultures than African. There are few examples that relate to a rural context (Nanghonga, 2012).

Textbook 2: New Physical Science

Examples on static electricity highlighted in this textbook are as follows: (1) Plastic comb will attract the pieces of paper when the comb has brushed the hair (2)Two charged balloons pushing each other away (Britz & Nevison, 2007)

This textbook includes the topic of static electricity but little information is given on static electricity. It defines static electricity as electricity that does not move. Based on my analysis of the textbook, the language used is appropriate for the junior secondary school which includes grade 8. There are, however, very few examples used in this textbook. Prior everyday knowledge is included in this textbook, for instance, Textbook 1 above.

4.4.3. Learners' books

At the time of gathering the data, learners were busy with the topic of static electricity. There was nothing in their exercise books about static electricity, especially at school Shamba. At Ndiki, at least one activity was given on static electricity. The researcher however, managed to look at the activities done in other topics to see if prior knowledge was included in the assessment. The researcher found that activities and questions were mainly based on learners' prior knowledge, such as 'what are your cultural beliefs on lightning?'

4.5. Lesson observation

Observation was one of the data-collection techniques used in this study. It offered me an opportunity to collect 'live' data occurring in a social situation, which in this case was a classroom (see Section 3.5.2). It enabled me to see how the two participants made use of learners' prior everyday knowledge when teaching static electricity, which was the focus of my study. The purpose of the observation was to generate data to answer research questions 2 and 3: (1) in what ways do grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity? (2) in what ways can grade 8 Physical Science teachers improve their teaching by making use of learners' prior everyday knowledge when teaching static electricity?

During the observations the researcher was able to observe the engagement of learners, connectedness with learning materials, challenges facing teachers, measures taken on dealing with these challenges and ways of improving the use of learners' prior everyday knowledge.

A minimum of two lessons and a maximum of five were supposed to be observed for each teacher. Each lesson lasted about 40 minutes. On one occasion, a double period lesson of about 80 minutes at school 2 was observed for the reason that examinations were about to start and the teacher made an arrangement with a colleague to use his lesson time. The data presented here are from my field notes as well as observed lessons.

4.5.1. Shamba Secondary School

Lessons 1 and 2 (80 min):

The lesson started with the teacher introducing me (the researcher) to the class and reminding the class of the purpose of the visit. He further encouraged learners to be focused as the researcher has nothing to do with them. There was a great enthusiasm among learners as most learners wanted to show me what they were capable of doing.

He started the lesson by reminding learners what they had learnt the previous lesson by asking them what they have been working on. What type of electricity? Learners shouted "*current electricity*". The teacher gave further examples that sometimes when touching your clothes or getting under your blankets at night you hear/see some sparks. What is this? Have you ever experienced this before? Learners responded by saying because the blanket has charges. The teacher further informed learners that they would move to another type of electricity which is static electricity.

Learners were then introduced to the topic of static electricity, and the teacher asked them to define what static meant. The answer was: "*It does not move*". The teacher then consolidated learners' answers that not moving from one place to another. In my opinion, this was a good strategy to incorporate learners' prior everyday knowledge.

When explaining static electricity, the teacher tried to remind learners about how charges are formed by taking them back to the topic of atoms. Throughout the presentation the teacher tried to contextualize it to the level of the learners by asking them to wonder how electricity is relevant. For example, he said *"how does electricity come in here now, into the topic of charges. We just started with an example of touching a blanket. What is happening here?"* This enabled learners to engage in the lesson by sharing what they know from home and previous lessons. The teacher told the class that the blanket produces sparks simply because the blankets have different charges. It gets charged when one rubs the blanket against other blankets and then charges will be separated.

He further integrated learners' prior everyday knowledge by asking the learners to give other examples on static electricity in everyday life. The learners' response was lightning. He continued engaging learners in order to build up knowledge and understanding. He continued to give everyday example when he said: 'when you take a rubbed plastic ruler and bring it close to the tap running water, you will see that the water will bend towards the ruler". No demonstration of this was done

Learners were fully engaged in various stages of the lesson. Learners were given a practical activity to tear pieces of paper and bring a charged plastic ruler close to the paper and observe what happened. He gave another practical activity on an electroscope. Learners were fully involved as they were curious to see how the gold leaf electroscope worked. The main challenge for this teacher was the electroscope because the school had only one instrument which the teacher used to demonstration with.

In conclusion, learners' prior everyday knowledge was considered by the questions that were posed by the teacher throughout the lesson and those that were asked by the learners as well. At the beginning teachers asked questions related to the previous lessons and throughout the lesson teachers kept on asking questions to make connections between home knowledge and school science.

Best practices from lessons 1 and 2

The teacher managed to relate most of his presentations to learners' prior everyday knowledge by making reference to, for example, sparks produced on blankets and how lightning occurs.

He started the lesson by asking learners what they had covered in the previous lesson. The teacher tried to explain how sparks were produced to enable a better conceptual understanding.

Even though this topic requires more demonstrations the teacher did not do any but rather used explanations. It would have been useful if the teacher had given the learners an opportunity to make predictions before doing the practical activities.

4.5.2. Ndiki Combined School

Lesson 1

The teacher started with the actual presentation of the lesson by asking questions related to the previous lesson. She informed the learners that there are two types of electricity, namely, static and current electricity. She started by discussing the static electricity. Static electricity refers to charges acquired when objects such as insulators are rubbed.

Examples in relation to learners' prior everyday knowledge were given. For instance, the teacher incorporated learners' prior everyday knowledge by giving examples on static electricity by referring to the sparks produced when removing a jersey at night and pulling blankets from the bed. She then asked learners to tear small pieces of paper, predict what would happen to the pieces of papers when a rubbed ruler is brought close to them. They carried out the demonstration in class. Pictures were drawn on the board about two balloons with unlike charges for learners to explain what happens.

Learners were fully involved in the lesson since they were asked and responded to questions posed to them and in turn asked questions for clarification. For instance, one learner asked:

"*Can a material have only one charge only?"* The teacher responded that materials always have two charges and when rubbed electrons move from one material to another.

In conclusion, learners' prior everyday knowledge was considered by asking questions throughout the lesson that relate to everyday life. At the beginning the teacher asked questions related to the previous lessons and throughout the lesson asked questions to make connections between home knowledge and school science.

However, the teacher failed to clarify some of the beliefs that were brought by learners to the class due to the fact that she did not know how they related to the scientific knowledge.

Lesson 2

The teacher started the lesson by building on the previous lesson. In other words, she wanted to lead learners from what they knew to what they did not yet know (elicitation of learners' prior everyday knowledge). She engaged in a discussion with learners in order to construct knowledge and understanding. "What are our experiences in everyday that happen because of static electricity?" The teacher gave two examples such as the television screen attracting dust and hair standing on end when combed. She encouraged learners to come up with more examples. Examples given by learners were as follows (freely translated from learners' vernacular into English: (2) *ngele to kumu omakumbafa oya fa taa tema.* (When touching blankets are like burning). (Correct scientific concept blankets producing sparks) (2) n*gele owa kaa tumba koshipundi sho plastic eshi toziko ngaho opena okwiinyenga.* (When you were seated on a plastic chair there will be a sound produced when leaving the chair. (3) *when people hair moved closer to each other you feel shocked*.

The teacher explained that all this happens because of static electricity. For example, she said, *when you are seated on a plastic chair unknowingly your clothes are charging the plastic chair. When leaving you leave it charged that is why the charges will react towards you.*

The teacher further gave another example of static electricity as lightning. She explained the whole scenario of how lightning happens during a storm.

"When there is thunderstorm we experience lightning. Lightning is described as a discharge of large electrical charges through the air and those charges build up on the clouds. When

we see clouds like moving, they are rubbing over each other and there are charges that build on their surfaces so this charges as they becomes many, they will be discharged through the air and then comes to the earth. Therefore, when these charges are being discharged from the clouds to the earth the way they move is called lightning. So lightning is a form of static electricity that happens in the clouds."

The teacher further engaged learners by asking them to share what they know about lightning.

Summary of learners' cultural beliefs and experiences about lightning generated by learners

(1) Okashelu oha ka shelula po ovantu. (Lightning strikes) (2) Oha ka twala aantu pombanda. (Lightning takes people in the sky) (3) Oha ka vakula po omiti. (It strikes trees) (3) Don't run when there is lightning (4) Don't lie on your back (5) Don't stay near cattle (6) Don't eat palm peels (7) Don't stay under the tree, lightning can bury you (8) It does not like cell phones (9) It can direct lost people (10) Don't stay near animals (11) Don't eat palm fruits (12) Does not like people cooking (13) It strikes easily trees that are already struck (14) Don't wear red colour (15) Don't laugh, lightning doesn't like seeing teeth (16) Don't make noise (17) Don't open a television (18) Don't move around (18) Don't stay near twins or else twins should chew a charcoal (20) Does not like underground electricity as charges attract each other.

This activity enabled learners to use the understanding they gained from the two examples given by the teacher about static electricity to generate examples of lightning as given above.

The Lesson continued by asking learners to discuss things that they should do during thunder storm (lightning) and they did this orally

(1) Put a stick (copper strip) on the roof of a hut (2) Put a long wire from the roof to the ground for the charges to move from the wire to the ground (3) Put a car tyre on top of the roof because lightning does not strike rubber materials.

They discussed the things that they should do to protect themselves and their houses.

Best practices observed in the two lessons.

Even though the school does not have enough resources, the teacher improvises by means of drawing pictures and doing some demonstrations.

Some of the best practices that were observed were the use of the sharing information method. This method inspired learners to update their content knowledge. Through sharing of experiences it also enabled the teacher to pick up the scientific experiences and clear up any misconceptions that may occur. Although she cleared up some misconceptions she could not comment on some experiences because they lacked of clarity.

Learners were given the freedom to speak in the language in which they felt comfortable. The code-switching method that was used enabled learners to express themselves clearly about what they already knew from home and the community at large. This was very useful to me and the teacher as it was easy to understand what learners really wanted to say. The use of examples related to learners' prior everyday experiences also came out strongly and helped create a deeper understanding of new concepts.

4.6. Interviews

The interview was conducted with teachers in English. The interview guide consisted of six questions (see Appendix B) and these were held the same day I observed each teacher. Follow-up questions were raised during the interview process. The following are the data from the semi-structured interviews.

What are your views and experiences on the use of learners' prior everyday knowledge during your lessons on static electricity?

Teacher 1 acknowledged that prior everyday knowledge helps learners to make meaning, stimulates learners and brings them into the context, and enables learners to make connections between home and school science. It is a strategy for the learners to grasp scientific knowledge. In addition using prior everyday knowledge is a way of contextualizing science to the learners' level.

The teacher stated that:

"Using prior knowledge of learners is so crucial because whatever you talk or teach learners

will make meaning of whatever you want to say to them. I use prior knowledge as a way to stimulate learners, bring learners into the context of the topic. It is also a strategy to make it easy for learners to grasp scientific knowledge. In addition, that's a way of contextualizing science knowledge into learners' level."

Teacher 2 indicated that learners understand better through making connections of what they already know (prior everyday knowledge) to what they are learning in the classroom.

The teacher stated that:

"The use of prior knowledge is important as it let learners to connect what they already know from their houses, previous lesson or grades to what they are currently learning. In addition, to make learners understand through connections that they make. For instance, when teaching lightning, ask learners what they know about lightning before. From there tell learners that is the same thing that they learn in the classroom and it's just a build on to what they already know".

How and when do you elicit and integrate your learners' prior everyday knowledge during your lessons on static electricity?

Teacher 1 said that he elicits the prior knowledge by probing. He related the scientific concepts to the everyday examples. In addition, he indicated that he asks questions related to the previous topic taught in order to find out what learners already know. He further stated that when a learner comes up with what they know, it creates a very nice platform for him to clear any misconceptions. Furthermore, he stated that elicitation and integration can be done any time in the lesson but mostly at the beginning to get learners' attention and focus their minds on the lesson content.

Teacher 1 stated that:

"Whenever I am teaching I do probing by bringing in a scientific concept to the learners but before interpreting the scientific concept what you have to do you have to bring in everyday examples. For example, static electricity has a lot of everyday examples that I bring to the attention of the learners with an intention to make them understand the topic of static electricity". In addition, regarding the example of lightning, learners have different beliefs on this topic. I ask learners to give their experiences on how lightning happens? And learners

would say: it happens when clouds bump each other and some said it happens when God is pushing his drums for water up in the sky. However, it creates a very nice platform for the teacher to clear the misconceptions. Eliciting prior everyday knowledge can be done throughout the lesson. At the beginning of the lesson you do it to get the attention of the learners and put their mind into the lesson content. And again throughout the lesson you use various everyday examples to clarify different concepts that you are interpreting or teaching in the lesson. In addition, including various beliefs in the community does help. Example that you can integrate in the lesson, is a way of contextualising and bringing it to the learners' level".

Teacher 2 indicated that she asks questions related to the topic and related what is said in the class to the real world. The teacher noted that elicitation and integration can be done throughout the lesson but mainly at the beginning for learners to contextualise and have a clear picture of what is about to be discussed.

Teacher 2 starts her lesson by asking what learners know about the topic. For example, the topic of charges, "I ask them whether they have heard about charges. What type of charges do they know? After telling what they know, then tell them that the same charges they know are the ones that we are talking about in the class".

"For the integration part, I like asking or giving examples like, have you ever noticed a shock when opening a door? If yes tell the learners that are because of charges. Tell them that it come because you have rubbed your body against something that's why the objects are charged. If they tell you an example of a blankets producing sparks tell them it's because of rubbing a blanket against you or against others and cause the blanket to become charged and gives the flame/sparks".

"Elicitation can be done anytime. I mainly do this at the beginning of the lesson in order for the learners to contextualise and give them a clear picture. It will not be good to go on teaching if learners do not have a clear picture of what you are talking about. Eliciting and integration can also be done throughout the lesson but most important at the beginning".

Does the elicitation and integration of learners' prior everyday knowledge help learners to make meaning of static electricity concepts or not?

Both teachers 1 and 2 indicated that it helped learners to understand the content/topic better and when prior knowledge is integrated it helps learners to memorize the knowledge better.

Teacher 1, said:

"It depends on how the teacher is using it. It helps especially to learners with poor background on the topic from the previous grades. When bringing in everyday examples, it will remain in their memories and in one way one can say it help the teacher to make them understand the context".

Teacher 2 pointed out:

"Integrating of prior everyday knowledge really helps learners understand the topic. For example, the part of lightning, you see that sometimes you ask learners to tell what they know about lightning. Learners will tell a lot of examples like, lightning strikes. Take it from there to explain that lightning is a form of charges and it's a huge amount of charges, when they go through something to the earth that's the time it will either kills a person or an animal or destroy plants or what's so ever. Above all I really think it helps facilitating learners understanding".

Is there any other way whereby prior everyday knowledge does not make meaning in relation to science concepts or does it always make meaning?

Teacher 1 argued that prior knowledge will not make meaning if the strategy used is not effective. He gave the following example:

"If you gave a practical example to the learners but that example does not really fit or go in line with what scientific concepts entail, this can mislead the learners and they will remain with that knowledge forever".

Teachers 2 pointed out that it does not make meaning when teachers fail to give a concrete explanation to the learners. For example,

"A teacher cannot really explain or give a concrete explanation as the charges are in the plant and how the discharge through earth happens if the omundali (a plant that Ovambo people believe it prevent people from being struck by lightning) is only at the top of the hut and not touching the ground".

What challenges do you face when eliciting and integrating your learners' prior everyday knowledge when teaching static electricity?

Teachers indicated that there were many challenges in the use of prior everyday knowledge in the teaching of static electricity. One of the challenges is related to language. Both participants indicated that the language barrier among learners is the main challenge (see Appendix B). Teacher 2 also indicated that the lack of clarity on prior everyday knowledge and lack of documentation for prior everyday knowledge are also barriers to the effective integration of prior everyday knowledge in teaching. In addition teacher 1 argued that time is also one of the challenges faced when integrating prior everyday knowledge is to understand what misconceptions are learners having about the subject which the teacher has to teach.

Teacher 1 stated that, there are a lot of challenges, such as:

"Lack of practical materials (most of schools in rural area are not well equipped when it comes to science materials. That's why it requires a teacher to send learners to bring the non-scientific materials in order to design project. However, when it comes to examinations, examiners do not cater for the local examples)"

Does the lack of documentation on indigenous knowledge contribute to these challenges?

Teacher 1 strongly indicated that lack of documentation of knowledge contributed to these challenges because the knowledge gets lost as generations pass on. Teacher 1 answered,

"Definitely because most of the cultures or cultural tribes/communities have different knowledge but sometimes this knowledge just dies with that generation. Once the generation dies then it means it will be rare for you to see the passing on of that knowledge to the next generation and this is as a result of lack of documentation of our prior knowledge".

Teacher 2 indicated that the main challenge is:

Clarification
"Learners have more prior knowledge from their houses but things are not clarified. For instance, during lightning people should not wear red colour. You cannot tell the connection between the red colour and the lightning. It is what learners believe and it is difficult to take

it out of their minds. Therefore, teachers are challenged to clarify beliefs and experiences that learners brought to the class".

Lack of documentation

"Prior everyday knowledge is not documented and it brings problems to teachers when it comes to the integration of this prior knowledge. Elders need to be approached in order to give clarity on some of the prior everyday knowledge".

Language

"Language is a challenge to learners when expressing their prior knowledge in the class. Because of the language problem they express themselves in Oshiwambo and in the process of translation somewhere somehow the meaning gets lost".

How do you deal with these challenges when eliciting and integrating learners' prior everyday knowledge during your lessons on static electricity?

Participants indicated that teachers use various strategies to overcome these challenges depending on the learners' needs. Teacher 1 had this to say:

"You have to use your mind. See what is relevant to your learners and find strategies how you should make your learners understand. Co-teaching with other teachers. If you find out that your learners cannot catch up call in another teacher to re-teach or present the same topic to the learners."

Teacher 2, said:

"Language teachers have to assist learners in order to use the proper scientific words. On the clarification: teachers must make sure they understand what they really want learners to get. Teachers have to make sure they have closed the gap between learners' experiences and what they need to know from the syllabus"

How can the elicitation and integration of learners' prior everyday knowledge on static electricity be improved?

Responses to this question were part of the basis that I used to collaboratively develop model lessons with the participating teachers. The responses were also key for the recommendations presented in Section 6.4 Participants indicated that it is vital to integrate learners' prior everyday knowledge, however, improvement in how to do this is needed. Teacher 1, suggested that:

"Teachers need to be trained on how to elicit learners' prior everyday knowledge. Learners should be encouraged to come up with various projects that can be used in our lessons. Through designing of projects learners are trained to become future scientists and inventors of different scientific knowledge. Curriculum developers should highlight more on the use of prior everyday knowledge, especially with regards to contextualization of scientific concepts. Textbooks authors need to work hand in hand with curriculum developers to ensure that they write what curriculum wants the learners to be taught. The ministry should come up with ways to mobilize the people to ensure that they create a platform where teachers can bring in learners prior everyday knowledge at whatever level of the lesson".

Teacher 2 also suggested that we should try by all means:

"To integrate the learners' prior everyday knowledge and learners have learnt what they required to learn. Teachers should try to close the gap between the classroom and the everyday science. We must clarify all the things that are not understood by learners. Textbook authors should include local examples for learners to see that the science they learn is part of their lives and not only western examples. Authors and curriculum developers need to contextualize knowledge so that learners can see the use and the importance of science in their everyday life. Examiners are doing great because they are always including questions related to local examples like balloons rubbed together."

4.7. The samples selected from each data set (after data presentation)

Samples of data sets presented in this chapter were chosen according to the following categories that are in line with the research questions.

(1)Pedagogies used in the mediation (2) connectedness of learners' prior everyday knowledge with the science learning (3) engagement of learners (4) challenges faced by the teachers (5) measures implemented on challenges (6) ways of improving the elicitation and integration of learners' prior everyday knowledge.

4.8. Concluding remarks

In this chapter I presented data generated at two research sites described in Chapter Three. For my document analysis, I looked at the junior secondary Physical Science syllabus and learners' textbooks. Analysis of such documents revealed that learners' prior knowledge needs to be included in lesson presentations although not many examples are given in textbooks.

In addition, I used observation, which exposed that even if participant teachers had good subject knowledge they have different ways of presenting their lessons. I further made use of interviews, during which teachers indicated some of the challenges they were facing, and they also made suggestions for improvements.

In the following chapter I analyse, interpret and discuss the findings of this study. Analytical themes that formed the basis of discussions are presented in this chapter.

CHAPTER 5: DATA ANALYSIS, INTERPRETATION AND DISCUSSION

5.1. Introduction

In this chapter I analyse, interpret and discuss how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity. The discussion further justifies the findings using the reviewed literature and personal experiences. In discussing the findings, I developed major themes that are associated with the research questions that informed my study.

As a reminder to the reader, the following are the research sub-questions that I sought to answer in this study.

1. What are grade 8 Physical Science teachers' conceptions and experiences on the use of learners' prior knowledge when teaching static electricity?
2. In what ways do grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity?
3. In what ways can grade 8 Physical Science teachers improve making use of learners' prior everyday knowledge when teaching static electricity?

In view of the research questions above, six major themes were drafted for analysis interpretation and discussions as shown in Table 2. These major themes were mainly inductively developed with the anticipation that they would give concise answers to my research questions. These guided my concluding remarks and recommendations regarding how teachers use learners' prior everyday knowledge when teaching static electricity.

In my analysis, I first colour coded my data in order to come up with themes. Thereafter, from the themes I developed major themes in relation the research sub-questions of this research study as described in Chapter Three. In my discussion, I also connected the findings of this study to the literature reviewed Chapter Two.

The major themes that emerged from my analysed data are summarized in the table below.

Table 2: Major themes that are later discussed in detail and research question(s) to which each statement responds

Data source	Theme	Research questions addressed
Document analysis and observation	Consideration of learners' prior everyday knowledge in curriculum documents and textbooks	• What are grade 8 Physical Science teachers' conceptions and experiences of the use of learners' prior knowledge when teaching static electricity?
Document analysis and observation	Teaching pedagogy: strategies used by teachers to mediate learning using learners' prior everyday knowledge.	• In what ways do grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity?
Document analysis, observation	Mobilization of learners' prior everyday knowledge enables or constrains learners' understanding of static electricity.	• What are grade 8 Physical Science teachers' conceptions and experiences of the use of learners' prior knowledge when teaching static electricity? • In what ways do grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity?
Document analysis, observation and semi-structured interview	Challenges faced by teachers when mediating the learning of static electricity and how teachers overcome these challenges.	• In what ways do grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching static electricity?
Document analysis and semi structured interviews	Ways of improving the elicitation and integration of learners' prior everyday knowledge.	• In what ways can grade 8 Physical Science teachers improve making use of learners' prior everyday knowledge when teaching static electricity?

The major themes that arose from the analyzed data were established by considering the sub-questions posed in this study. The following section discusses the major themes that emerged from the analyzed data.

5.2. Analytical Statement 1:

Consideration of learners' prior everyday knowledge on static electricity in curriculum documents and textbooks

The documents reviewed in this study were the Physical Science syllabus for grade 8-10 and the two Physical Science textbooks for grade 8, namely, Go For Physical Science and New Physical Science. These are the textbooks that are in line with the revised curriculum in Namibia. The syllabus outlined that the learning and subsequent outcomes are designed towards promoting the learners' knowledge of the physical world which they are part of (MoE, 2006). Both the syllabus and the two textbooks analyzed indicated the scientific concepts that learners are required to pick up in grade 8.

Some of the examples of static electricity such as pulling off a jersey and pulling a blanket and sheets apart are familiar to the learners but learners in the village do not know what a carpet is. In addition, concepts about lightning such as lightning kills animals, lightning strikes trees and lightning strikes and takes people in the sky are also common known by the learners. But examples about static electricity in everyday life such as rubbing a TV screen/window with a cloth and getting a shock after walking on a carpet might be unfamiliar to them (see Section 4.3.2). Furthermore, among the objectives of what to teach about static electricity, there is no learning objective or basic competence (see Section 4.3.1) which requires teachers to incorporate learners' beliefs and experiences about static electricity. The textbooks also do not contain activities that embrace learners' prior everyday knowledge about natural phenomena, in particular, lightning in the context of this study.

In this study, for example, some of the scientific concepts which learners raised during the lesson presentations were not found in the prescribed learners' textbooks (see Section 4.3.2). This could be due to the fact that the curriculum documents and textbooks are nationally based. This suggests that rural contexts are compromised. For example, cultural beliefs and experiences such as not wearing red clothes and a mother of twins to ululate and so forth are not shown in the curriculum documents and science textbooks. However, this gives the teachers an opportunity to clear up misconceptions connected with these cultural beliefs and experiences. Care should also be taken by the teachers when clearing up misconception not to devalue the community culture but rather to find formulae to unify both home culture and school culture.

5.3. Analytical Statement 2:

Learners' prior everyday knowledge they bring to the classroom

This part of the study engaged learners in their prior everyday knowledge about lightning and silk clothes that glitter at night. Learners in this study showed a rich cultural capital from their homes.

Thus, in this study, learners' ideas were evidence to justify that they do come to science classrooms with some prior everyday knowledge and experiences (Maselwa & Ngcoza, 2003; Maselwa, 2004; Rennie, 2011). They have ideas about natural phenomena and in particular, lightning in the context of this study, which they acquired from their community. Maselwa and Ngcoza's (2003) findings accentuate that the inclusion of learners' prior everyday knowledge and experiences as examples when teaching science has the advantage of drawing learners' attitudes into the learning of science topics. Notwithstanding, Rennie's (2011) recent study revealed that teachers need to be scientifically literate in order to be able to deal with learners' everyday knowledge that they acquire from their communities.

While I concur with Rennie, it is also recognized that for teachers to be able to incorporate learners' prior everyday knowledge in their classrooms, they need to be knowledgeable in their subject content knowledge. These findings resonate with the findings of Kasanda et al. (2003) who noted that teachers need to elicit the indigenous knowledge which learners have before they can impart them with new scientific knowledge. Kasanda et al. further acknowledge that this IK of the learner can be used a baseline upon which new knowledge can be constructed. This attribute is the basis of the constructivist theoretical framework.

5.4. Analytical Statement 3:

Mobilization of learners' prior everyday knowledge about static electricity enables or constrains learners' engagement

Learner engagement

In this study, both teachers introduced their lessons by asking learners about their prior everyday knowledge on static electricity and learners freely responded to the questions. They generated a very long list of what they knew or had heard about lightning.

These findings corroborate with the findings of (Yakubu, 1994; Baloi, 1994; Lubben et al., 1998) who found that the integration of indigenous knowledge with science topics could be an essential tool that can improve the learners' understanding of any concept. On this note, Vygotsky (1962) advises that learners' knowledge needs to be scaffolded for them to rich their ZPD in the understanding of any concept. Hart (2003) asserts that incorporation of everyday knowledge and experiences could be one way to draw learners to execute and unleash their full academic potential. Such ideas resonate with the study findings whereby an opportunity for a meaningful learning environment was created through classroom discussions and learners' group interactions. On this note, McRobbie and and Tobin (1997) encourage that teachers need to be equipped with skills to make sure that each learner in each group participates actively.

5.5 Analytical statement 4

Challenges faced by teachers when mediating the learning of static electricity and how teachers overcome these challenges.

One of the purposes of the study was to elicit the challenges teachers face in the utilization of the learners' IK in the teaching and learning of science. On this attribute several challenges were unveiled. Teachers cited that lack of the technical knowhow humpers their use of the IK of the learners. The major challenge was the cultural diversities of the Namibia community that operate with more than 13 languages making English the medium of instruction the only language that becomes a national language. Cultural beliefs differ from one society to another, and one culture to another, what is believed by the Oshiherero speaking people for instance is not what the Damaras believe in such that a Damara teacher who is teaching the

Oshiwambo speaking people may find it difficult to incorporate the beliefs of the Oshiwambo speaking people. On this attribute, Naukushu (2015) suggests that the Ministry of Education should deploy teachers who speak Damara to their own people and each tribe of teachers should be encouraged to go back and teach in their regions of origin.

The other challenge which was cited was the limited scenarios of IK inclusion in the grade 8 textbooks and which seem to be Western resources developed to benefit the Western people and not written by Namibians for Namibians. On this aspect, Rennie (2011) advises that in a multicultural society it is advisable for each culture to write books that will include their own beliefs and opinions and misconceptions as a people.

5.6 Analytical Statement 5

Pedagogical strategies used in the mediation process

This study revealed that the different teaching methods applied during the lessons (see Section 4.7) included the use of demonstrations, presentations, explanations, questions and use of diagrams as meditational tools to facilitate learning. For the learners to be able to learn they should be taught in such a way that their interest and understanding of scientific concepts is stimulated. These findings coincide with the findings of Oloruntegbe and Ikpe (2011) who argue that if knowledge is transmitted to the learners then they might not be able to apply the knowledge to everyday problems. So, they suggest that teachers should be trained on how to incorporate learners' everyday knowledge in science classroom. Sisivic and Bojovic (2000) also agree with this finding and further advise that the ability of a teacher to incorporate the learners’ IK is an exceptional skill that needs to be developed during teacher training.

The findings from the lesson observations revealed that learners learnt through the scaffolding process. This suggests that the teaching was located in Vygotsky’s (1962) zone of proximal development (ZPD). The zone of proximal development is defined as the difference between the child's ability to solve problems on his own, and his ability to solve them with the support of a more knowledgeable person (Vygotsky, 1978). For example, the two teachers showed learners how to hold the straws and charge them and thereafter they were given an opportunity to work on their own. According to Vygotsky (1978), this exercise gave learners an opportunity to do activities that they could perform on their own and independently.

Building on the Vygotskian theory, Hodson and Hodson (1998) assert that the teacher is at the center of leading learners to a new level of understanding by interacting and talking to them. Chirimbana (2014) claims that teachers should create meditational tools by structuring learning as social interactions to make learning of scientific concepts meaningful. In this study, learners were taught in such a way that they were able to recognize the relevance of science, in particular, lightning in everyday life as a result of carefully scaffolded learning about prior everyday knowledge and experiences about lightning in conjunction with practical activities in static electricity (Nanghonga, 2012).

In other words, the strategies used in this study helped learners to be aware of the science, providing them with multiple experiences of scientific concepts in relation to static electricity which enabled them to see and understand the key ideas in static electricity. As a result, they were able to generate a long list of examples of static electricity in everyday life as well as constructing mind and concept maps independently an attribute Chirimbana (2014) calls a self-efficacy level of scaffolded learning. According to Chirimbana learners who are able to make use of the IK are able to make the necessary connections needed to understand a particular concept and such learners will understand the concept much better than a learner who cannot make this connection.

5.7 Concluding remarks

In this chapter I analyzed, interpreted and discussed the data generated from document analysis, observation and interviews. From the analyzed data sets I came up with four major themes. Through these analytical statements, the data were able to speak for themselves as to how the two participant teachers make use of learners' prior everyday knowledge when teaching static electricity. Lack of documentation of indigenous knowledge and language emerged as being the major stumbling block in the way of integrating prior knowledge in the teaching of static electricity.

In the next chapter, I provide a summary of the findings of the study which culminates in recommendations and areas for future research. I further discusses the limitations of the study and some conclusions.

CHAPTER 6: SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSIONS

6.1. Introduction

This chapter presents a summary of the findings of the study, and describes its limitations. It provides some recommendations that could be implemented within the Namibia Education Curriculum. These recommendations would potentially constitute effective pedagogies teachers could use in making use of learners' prior everyday knowledge when teaching static electricity. Finally, the chapter makes some general recommendations, discusses the limitations of the study and areas for future research.

6.2. Summary of the findings

The study reported on how the selected Physical Science teachers in the Namibian context make use of learners' prior everyday knowledge during the mediation of static electricity. The study was motivated by my personal experience as Physical Science teacher.

The findings of the study have helped to provide insights into the teaching of static electricity and illuminate the potential of the use of everyday materials and activities that arouse learners' interest in science. In addition, this study could be useful to grade 8 Physical Science teachers and others who are grappling with eliciting and integrating learners' prior everyday knowledge in their lessons when teaching science.

The study was constituted as a case study of two schools, one in Ohangwena region and one in Omusati region; it focused on two grade 8 Physical Science teachers. It investigated how these teachers make use of learners' prior everyday knowledge when teaching static electricity. The study used qualitative methods to generate data, specifically document analysis, observation and interviews. Purposive sampling was used to identify the two selected schools. Ethical issues were taken into consideration throughout the study.

It was found that Physical Science teachers involved in the study do not often employ a variety of teaching strategies to make use of learners' prior everyday knowledge when teaching static electricity. It also revealed that the limited use of various teaching strategies by participant teachers results from a lack of familiarity with learners' indigenous knowledge. The study further found that the participant teachers had better understanding of the subject knowledge, but due to inadequate pre-planning and exposure, they made numerous language errors that might lead to misconceptions amongst learners. This in turn would be likely to have an adverse effect on learners’ achievement levels. Enough evidence was also found that participant teachers faced several challenges regarding the lack of documentation of indigenous knowledge and language barriers.

To overcome the challenge of language barriers, Oloorunteb ge and Ikepe (2011) argue that when science is taught to learners in English, special consideration has to be made about the level of vocabulary used to aid them in understanding science, and the science concept itself must be taught in context with the students’ experience or previous knowledge. I agree with this argument because learners learn best when they relate new knowledge with their existing knowledge base. This view resonates well with that of Roschelle (1995) on the importance of interaction between prior knowledge and new experience.

The study findings therefore provided some insightful answers to my research questions. As noted earlier, to a certain extent, teachers tried their best to integrate their learners’ prior knowledge into their lesson even though there was the problem of a lack of adequate information on the particular indigenous knowledge.

6.3. Significance of the study

This study has added to the limited literature on this topic in the context of Namibia. The highlighted recommendations could help teachers, the Department of Education, curriculum developers and other readers to effectively incorporate learners’ prior knowledge.

6.4. Recommendations

The following are some of the critical recommendations associated with the findings of this study. The study recommends that: (1) In this study I established that learners come to the science classroom with their own everyday knowledge and I recommend efforts should be made to incorporate such knowledge where possible. (2) Since science is part of learners' everyday lives, teachers should be encouraged to start their lessons with what learners already know. This is one of the basis of constructivism as a theory of learning. Constructivist believe that learning does not take place in a vacuum but requires prior knowledge which is built trough scaffolding until the learners reach their Zone of Proximal Development (ZPD) as highlighted in Chapter Two. (3) The curriculum documents and textbooks for grade 8 do not contain much content that the learners are familiar with. I therefore, recommend that curriculum documents and textbooks should include learners' everyday knowledge and experiences. (4) This study recommends that when learning and teaching materials (LTSMs) are not available teacher should improvise using local available materials. (5) Teachers also need to have broad knowledge of the learners' everyday experiences in their context. Thus, this study recommends that teachers should be trained in this area so that they can make use of this knowledge and also clear up the misconceptions that might arise during this process. (6) When teaching static electricity, learners' cultural beliefs and everyday experiences should be incorporated into teaching science in conjunction with practical activities or demonstration to enhance acquisition of scientific concepts. (7) Teachers need to find ways of involving community members during teaching and learning so that they can share their everyday knowledge and experiences with the class in order to contextualize knowledge and clear any misconceptions that might be raised from the lesson since the indigenous knowledge is not documented. (8) Teachers should be empowered to teach in English second language in order to help learners to become proficient in the language of learning and teaching. This will help learners to freely express themselves in the class.

6.5. Future research

This study investigated how grade 8 physical science teachers make use of learners’ prior everyday knowledge when teaching static electricity. From the findings of this study I propose the following areas for future research:

1. A similar study could be done involving other schools to investigate how teachers could be assisted to incorporate learners' cultural beliefs and experiences about static electricity in teaching science in different cultures of the Namibian community.
2. Further research is needed to explore the best strategies in integrating learners’ prior everyday knowledge in the teaching and learning of static electricity.
3. Studies could be done focusing on developing model lessons that teachers could use when teaching static electricity.
4. Future research should be conducted with parents in order to give more insight into the documentations of indigenous knowledge and how this could enhance learners’ understanding of scientific concepts.

6.6. Limitations of the study

As a result of the small sample that used a qualitative research design and as such the findings cannot be generalized to other settings. Nevertheless, the study provides some insights into how teachers use learners' prior everyday knowledge, the challenges they face and some relevant recommendations. The use of observations as a data collection tool requires that the first three visits are not recorded so that the participants can attain naturality and behave normally; however in the current study this was not done.

I had intended to analyze the teachers' lesson plans and learners' activities but since one participant transferred to another school it was not possible to do this. Sometimes it was difficult to find time for follow-up interviews as the participants were busy with their daily work and there were long distances involved.

If I were to conduct this study again, I would be very careful with the setting of the interview questions, especially the follow-up questions. During the analysis of my data, I realized that there were gaps in evidence produced, because I did not follow up and/or followed up with the wrong questions. I also experienced problems accessing the Rhodes Library through off campus mode as a result I missed out on critical literature.

Lastly, I came to learn that research is a journey one needs to walk, and to be alert to crucial signboards all the way in order to get to the right endpoint.

6.7. Conclusion

In this chapter, I provided a summary of the research findings. The significance of the study was discussed by giving an overview of the purpose of the study. The overarching findings of this research study are that learners come into classroom with a variety of knowledge about science. Such knowledge should be used as a starting point during teaching and learning.

This thesis finally suggests a need for the capacity development of teachers in order to expand on their content knowledge and pedagogical content knowledge and be able to make use of different teaching styles such as integrating learners' prior everyday knowledge when teaching static electricity. The chapter concludes that further research could focus on best practices to be used when teaching static electricity using learners' prior everyday knowledge.

References

Abell, S. K. (2008). Twenty years later: Does pedagogical content knowledge remain a useful idea? *International Journal of Science Education*, *30*(10), 1405-1416.

Aikenhead, G. S. (2006). Science education for everyday life: Evidence-based practice. *School Science Review*, *76*(277), 47-51.

Ali, M., & Ismail, Z. (2006). Comprehension level of non-technical terms in Science: Areready for science in English. *Jurnal Pendidik dan Pendidikan*, *21*, 73-83.

Azlan, N., & Narasuman, S. (2013). The role of code- switching as a communicative tool in an ESL teacher education classroom. *Sixth International Conference on University Learning and Teaching. Maseru: Lesotho, 12 January 2012.*

Babbie, E., & Mouton, J. (2001). *The practice of social research.* (4th ed.) Cape Town: Oxford University Press.

Babbie, E., & Mouton, J. (2006). *The practice of social research* (4th ed.). Cape Town: Oxford University Press.

Baloi, M. (1994). Ideas about nature: Traditional interpretation of thunder and lightning in physics teaching. In P. Geddes (Ed.), *Explorations in ethnomathematics and ethnoscience in Mozambique* (pp. 62-67). Maputo: ISPM.

Baxter, B., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report, 13*(4), 544-559.

Bernstein, B. (1996). *Pedagogy, symbolic control and identity: Theory, research, critique*. London: Taylor & Francis.

Beyer, B. K. (1991). *Teaching thinking skills: A Handbook for Elementary School Teacher*. Boston: Allyn and Bacon.

Blanche, M. T., Durrrheim, K., & Painter, D. (2006). *Research in practice: Applied methods for the social sciences.* Cape Town: University of Cape Town.

Brand, B. R., & Glasson, G. E. (2004). Crossing cultural boarders into science teaching: Early life experiences, racial and ethnic identities, and beliefs about diversity. *Journal of Research in Science Teaching, 41*(2), 119-142.

Callaham, T. C., & Hobbs, R. (1981). *Research ethics.* Retrieved 20 August, 2011, from http://depts.Washington.edu/bioethx/topics/resrch.html

Chirimbana, M. (2014). *The effect of a PBL approach in the teaching of inverses and compositions of one to one function in a foundation programme.* Lambert Publishing Company: Berlin.

Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education* (6th ed.). London: Routledge.

Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education* (7th ed.). London: Routledge.

Cohen, L., Manion, L., & Morrison, K. (2010). *A guide to teaching practice* (5th ed.). London: Routledge.

Czerniewicz, L., Murray, S., & Probyn, M. (2000). *The role of learning support materials in curriculum 2005.*National Centre for Curriculum Research and Development (NCCRD). Pretoria: Government Printer.

Danermark, B., Ekstrom, M., Jakobsen, L., & Karlson, J. (2002). *Explaining society: Critical realism in social sciences.* London: Routledge.

Davies, B. M. (2007). *Doing a successful research project: Using qualitative or quantitative methods.* New York: Palgrave Macmillan.

Denscombe, M. (2007).*The good research guide for small scale research projects* (3rd ed.). USA: Open University Press.

Delpit, L. (1995). *Other people's children: Cultural conflict in the classroom*. New York: The New Press.

Dlamini, T. (2009). In contextualisation achieving quality teaching? Views from Swazi Primary School teachers. In M. Schafer & C. McNamara (Eds.), *Proceedings of the seventeenth Annual Meeting of the Southern African Association for Research in Mathematics, Science and Technology Education (SAARMASTE).* Rhodes University, South Africa.

Gray, D. E. (2004). *Doing research in the real world.* London: Sage Publications.

Gray, L. R., Mills, G. E., & Airasian, P. (2006). *Educational research: Competencies for analysis and applications* (8th ed.). USA: Pearson Prentice Hall.

Goos, M. (2004). Learning mathematics in a classroom community of inquiry. *Journal for Research in Mathematics Education, 35*(4), 258-291.

Fraser, J. D. C. (2006). Mediation of learning. In M. M. Nieman & R. B. Monyai (Eds.), *The educator as mediator of learning* (pp. 1-2). Pretoria: Van Schaik Publishers.

Hart, J. E. (2003). Teacher professional development to improve the science and literacy achievement of English language learners. *Bilingual Research Journal, 27*(3), 475-501.

Hamilton, L., & Corbett-Whittier, C. (2013). *Using case study in education research.* London: Sage Publications.

Henning, E., Rensburg, V.W., & Smit, B. (2004). *Finding your way in qualitative research: An interpretivist framework.* Pretoria: Van Schaik.

Hodson, D., & Hodson, J. (1998). Science education as enculturation: Some implications for practice. *School Science Review, 80*(290), 17-23.

John, W. C. (2003). *Research design: Qualitative, quantitative and mixed methods approaches* (2nd ed.). Lincoln: Sage Publications.

Johnson, B., & Christensen, L. (2004). *Education research: Qualitative, quantitative and mixed approaches (*2nd ed.). Boston: Pearson.

Kasanda, C., Lubben, F., Gaoseb, N., Kandjeo-Marenga, U., Kapenda, H., & Campbell, B. (2005). The role of everyday contexts in learner-cantered teaching: The practice in Namibia secondary schools. *International Journal of Science Education, 27,* 1805–1823.

Kvale, S. (1996). *Interviews.* London: Sage Publications.

Lankshear, C., & Knobel, M. (2004). *A qualitative research: From design to implementation.* New York: Open University Press.

Leedy, P. D., & Ormrod, J. E. (Eds.). (2010). *Practical research: Planning and design.* Boston: Pearson.

Lemke, J. L. (2001). Articulating communities: Social perspectives on Science education. *Journal of Research in Science Teaching, 38*(3), 296-316.

Lemke, J. L. (1989). *Using language in the classroom.* Australia: Oxford University Press.

Loughran, J., Mulhall, P., & Berry, A. (2004). In search of pedagogical content knowledge in science. *Journal of Research in Science Teaching*, *4*(41), 370-391.

Loughran, J., Mulhall, P., & Berry, A. (2008). Exploring pedagogical content knowledge in science teacher education. *International Journal of Science Education, 30*(10), 1301-1320.

Lubben, F., Campbell, B., & Dlamini, B. (1996). Contextualising science teaching in Swaziland: Some student reactions. *International Journal of Science Education, 18*(3), 311-320.

Lubben, F., Campbell, B., Maphalala, T., & Putsoa, B. (1998). Science curriculum material development through teacher-industrialist partnership: Industrialists` perceptions of their role. *Research in Science & Technology Education, 16*(2), 217-230.

Lyle, J. (2003). Stimulated recall: A report on its use in naturalistic research. *British Educational Research Journal, 29*(6), 861-878.

Marten, T. B., Kelvin, D., & Desmond, P. (2006). *Research in practice applied methods for Social Sciences*. Cape Town: University of Cape Town Press.

Maselwa, M. R., & Ngcoza, K. M. (2003). 'Hands-on', 'minds-on', and 'words-on' practical activities in electrostatics: Towards conceptual understanding. In D. Fisher & T. Marsh (Eds.), *Proceedings of the Third International Conference on Science, Mathematics and Technology Education* (pp. 649-659). Rhodes University, East London Campus, South Africa.

Maselwa, M. R. (2004). *Promoting learners' conceptual understanding of electrostatics through use of practical activities in conjunction with prior knowledge of lightning: A case study*. Unpublished master's thesis, Education Department, Rhodes University, Grahamstown.

Mason, J. (2002). *Qualitative researching* (2nd ed.). London: Sage Publications.

McMillan, J., & Schumacher, S. (2010). *Research in education: Evidence–based inquiry* (6th ed.). Boston: Pearson.

McRobbie, C., & Tobin, K. (1997). A social constructivist perspective on learning environment. *International Journal of Science Education*, *19*(2), 193-208.

Merriam, S. (2009). *Qualitative research: A guide to design and implementation*. San Francisco: Jossey-Bass.

Mertens, D. M. (2005). *Research and evaluation in education and psychology: Integrating diversity with quantitative and psychology* (2nd ed.). Thousand Oaks: Sage Publications.

Ministry of Education. (2009). *The national curriculum for basic education*. Windhoek.

Ministry of Education. 2010a &b). *Revised national curriculum for schools.* Okahandja: NIED.

Moll, I. (2002). Clarifying constructivism in a context of curriculum change. *International Journal of Education, 27*, 6-32.

Mwamwenda, T. S. (1993). Educational psychology: An African perspective. Durban: Butterworths.

Namibia. Ministry of Education and Culture. (1993). *Towards Education for all: A development belief for education, culture and training*. Windhoek: Gamsberg McMillan.

Namibia. Ministry of Education. (2006). *Physical Science Junior Syllabus Grade 8-10*. Okahandja: NIED.

Naukushu, S. T. (2015). The role of teaching Number sense in the Namibian schools. *Namibian Journal of Education.* 3(45) 456-470.

Nanghonga, M. O. (2012). *An investigation on how grade 8 learners make meaning of static electricity through exploring their cultural beliefs and experiences about lightning: A case study*. Unpublished master's thesis, Education Department, Rhodes University, Grahamstown.

Nyambe, K. J. (2008). *Teacher educators' interpretation and practice of learner-centred pedagogy: A case study.* Unpublished doctoral thesis, Rhodes University, Grahamstown.

Oloruntegbe, K. O., & Ikpe, A. (2011). Eco-cultural factors in students' ability to relate science concepts learned at school and experiences at home: Implications for chemistry education. *Journal of Chemical Education, 88*(3), 266-271.

Pabale, M. F. (2006). *Exploring the integration of indigenous beliefs in teaching and learning of school science.* Unpublished master's thesis, University of Limpopo. Retrieved 25 October 2011 from http://hdl.handle.net/10386/137.

Patton, M. (2002). *Qualitative research methods* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Prawat, R. (1993). The value of ideas: Problems versus possibilities in learning. *Educational Researcher, 22*(6), 5-12.

Probyn, M. (2009). 'Smuggling the vernacular into the classroom': Conflicts and tensions in classroom code switching in township/rural schools in South Africa. *International Journal of Bilingual Education and Bilingualism, 12*(2), 123-136.

Rahayu, Kita & Ibnu, (2011),*Education for All: Vestigies to past subjections:* Amambo Press. Acrra

Rennie, J. R. (2011). Blurring the boundary between the classroom and the community: Challenges for teachers' professional knowledge. In D. Corrigan, J. Dillon & F. R. Gunstone (Eds.), *The professional knowledge base of science* (pp. 13-29). New York: Springer.

Roschelle, J. (1995). *Learning in interactive environments: Prior knowledge and new experience*. Retrieved May 15, 2012, from http:www.exploratorium.edu/IFI/resources/museumeducation/priorknowledge.htl

Solomon, J. (1987). Social influences on the construction of pupils' understanding of science. *Studies in Science Education, 14*, 63-82.

Sawyer, R. K. (2006). *The Cambridge handbook of the learning sciences*. New York: Cambridge University Press.

Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1-22.

Sisovic, D., & Bojovic, S. (2000). Approaching the concepts of acids and bases by cooperative learning. *Chemistry Education Research and Practice, 1*(2), 263-275.

Stears, M., Malcolm, C., & Kowlas, L. (2003). Making use of everyday knowledge in the science classroom. *African Journal of Research in SMT Education, 7*, 109-118.

Taylor, N. (2002). Curriculum 2005: Finding a balance between school and everyday knowledge. In N. Taylor & P. Vinjevold (Eds.), *Getting learning right: Report on the President's Initiative Research Project* (pp. 105-130). Braamfontein: Joint Education Trust.

Van Driel, H. J., Verloop N., & de Vos, W. (1998).Developing science teachers' pedagogical content knowledge. *Journal of Research in Science Teaching*, *80*(6), 673-695.

Vygotsky (1962). The constructivist learning Theory. American Journal of Psychology. 7(23) 76-88.

Vygotsky, L S. (1979). Mind in society. In M. Cole, V. John-Steiner, S. Scribner & S. Souberman (Eds.), *The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wood, D. J., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychiatry and Psychology*, *17*(2), 89-100.

Yakubu, J. (1994). Integration of indigenous thought and practice with science and technology: A case study of Ghana. *International Journal of Science Education*, *16*(3), 343-360.

APPENDIX A (1-4): LETTERS TO REGIONAL COUNCILS

Appendix A1

Omusati regional council

Directorate of Education

Private bag 529, outapi, Tel. Fax.

Enq: Ms Iyambo

E-mail: toini.iyambo@yahoo.com

To: Mrs Loide Shatiwa

Acting director of Education

Dear Mrs. Shatiwa

Subject: Request for permission to carry out a research study at Shamba combined school in Omusati region.

I Toini Iyambo, a head of department at Oshuungu combined school, Omusati Region is hereby requesting for permission to conduct a research study at the above indicated schools as from May – June 2014.

I have registered as a part – time student at Rhodes University, Grahamstown (student number 04I6130) as from January last year doing a Master's degree in Science Education. I would be most grateful if you would allow me to conduct my research study at the above mentioned school during the month of May to June 2014. My research topic is "An investigation on how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching the topic of static electricity: A Namibian case study."

The insights generated from this study will be published in a thesis form and will become accessible to grade 8 physical science teachers in order to bring about improved achievements in physical science. Should I get permission, I will observe two lessons presentation, interview the teacher at their free time and share my experience with them.

The school, learners and teachers will be assured of anonymity of information provided and teachers will be allowed to go through the draft thesis to ensure that the details are correct.

Your understanding in this regard will be highly valued.

Yours Sincerely,

T. Iyambo (Ms)

Appendix A2

Ohangwena Regional Council

Directorate of Education

Private bag 2028, Ondangwa, Tel. 264 65 242516 Fax. 264 65 242552

Enq: Ms Iyambo

E-mail: toini.iyambo@yahoo.com

To: Mr

Inspector of Education

Circuit

Dear Sir/Madam

Subject: Request for permission to carry out a research study at Ndiki combined school in Ohangwena region

I Toini Iyambo, a head of department at Oshuungu combined school, Omusati Region is hereby requesting for permission to conduct a research study at the above indicated schools as from May – June 2014.

I have registered as a part – time student at Rhodes University, Grahamstown (student number 04I6130) as from January last year doing a Master's degree in Science Education. I would be most grateful if you would allow me to conduct my research study at the above mentioned school during the month of May to June 2014. My research topic is "An investigation on how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching the topic of static electricity: A Namibian case study."

The insights generated from this study will be published in a thesis form and will become accessible to grade 8 physical science teachers in order to bring about improved achievements in physical science. Should I get permission, I will observe two lessons presentation, interview the teacher at their free time and share my experience with them.

The school, learners and teachers will be assured of anonymity of information provided and teachers will be allowed to go through the draft thesis to ensure that the details are correct.

Your understanding in this regard will be highly valued.

Yours Sincerely,

T. Iyambo (Ms)

Appendix A3

Omusati Regional Council

Directorate of Education

Etayi circuit

Enq: T. Iyambo 10 April 2014

E-mail: toini.iyambo@yahoo.com

To: The Principal

School 1

Dear Mr.

Subject: Request for permission to carry out research study at school 1 combined school

I Toini Iyambo, head of department at Oshuungu combined school, Elim circuit in Omusati region is hereby requesting for permission to conduct a research study at your school as from

I have registered as a part time student at Rhodes University, Grahamstown (student number 04I6130) as from January last year doing a Master's degree in Science Education. I would be most grateful if you would allow me to conduct my research study in your school. I have verbally spoken to Mr. Uushona to be the participant teacher in my research and he indicated his willingness to take part.

My topic of study is to "investigate how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching the topic of static electricity: A Namibian case study."

The insight generated from this study will be published in a thesis form and will become accessible to the curriculum developers, teachers educators and physical science teachers in order to bring improved achievements in physical science. Should I get permission, I will observe and videolize two lessons presentation and interview the teacher observed at their free time and I will share my experience with the teacher and together we will development of model lessons on static electricity grade 8.

I ensure the school, learners and Mr Uushona that everything will be treated confidentially and the participant reserves the rights to withdraw. Mr Uushona will be allowed to go through the draft thesis to ensure that the details are correct and will not use the really name for the school and the teacher.

Your cooperation in this regard will be highly valued.

Yours Sincerely

T. Iyambo (Ms)

Appendix A4

Ohangwena Regional Council

Directorate of Education

Circuit

Enq: T. Iyambo 10 April 2014

E-mail: toini.iyambo@yahoo.com

To: The Principal

School 2

Dear Mr.

Subject: Request for permission to carry out research study at school combined school

I Toini Iyambo, head of department at Oshuungu combined school, Elim circuit in Omusati region is hereby requesting for permission to conduct a research study at your school as from

I have registered as a part time student at Rhodes University, Grahamstown (student number 04I6130) as from January last year doing a Master's degree in Science Education. I would be most grateful if you would allow me to conduct my research study in your school. I have verbally spoken to Mr. Uushona to be the participant teacherin my research and he indicated his willingness to take part.

My topic of study is to "investigate how grade 8 Physical Science teachers make use of learners' prior everyday knowledge when teaching the topic of static electricity: A Namibian case study."

The insight generated from this study will be published in a thesis form and will become accessible to the curriculum developers, teachers educators and physical science teachers in order to bring improved achievements in physical science. Should I get permission, I will observe and videolize two lessons presentation and interview the teacher observed at their free time and I will share my experience with the teacher and together we will development of model lessons on static electricity grade 8.

I ensure the school, learners and Mr Uushona that everything will be treated confidentially and the participant reserves the rights to withdraw. Mr Uushona will be allowed to go through the draft thesis to ensure that the details are correct and will not use the really name for the school and the teacher.

Your cooperation in this regard will be highly valued.

Yours Sincerely

T. Iyambo (Ms)

APPENDIX B: TEACHERS INTERVIEW SCHEDULE

Good afternoon and welcome to the interview. Thanks for your time you devoted on this, please feel free to give your opinion of any kind. I have few questions here, just to start with the first question that reads as:

1. What are your views and experiences on the use of learners' prior everyday knowledge during your lessons on static electricity?

2. How do you elicit and integrate your learners' prior everyday knowledge during your lessons on static electricity?

3. Does the elicitation and integration of learners' prior everyday knowledge help learners to make meaning of static electricity concepts or not?

4. What challenges do you face when eliciting and integrating your learners' prior everyday knowledge when teaching the topic on static electricity?

5. How do you deal with these challenges when eliciting and integrating learners' prior everyday knowledge during your lessons on static electricity?

6. How can the elicitation and integration of learners' prior everyday knowledge on static electricity be improved?

Thank you very much!

APPENDIX C (1-2): INTERVIEW TRANSCRIPTS

Appendix C1

Transcription of interview with (T) (codes used)

Me: interviewer

T: Interviewee

Thank you very much and welcome to this interview. I really appreciate that you accepted to participate in this interview. I have few questions that I want to ask you.

Me: hmm Mr. Uis thanks for giving me your time to just to ask you some few questions. So the questions are so easy and I hope I will get all the necessary information that I will need from you.

T: alright you re more than welcome.

Me: thank you. The first question reads as what are your views and experiences on the use of learners' prior everyday knowledge during your lessons on static electricity.

T: yaa mmm soo yaa with regards to the use of learners prior everyday knowledge, you know in my lessons I have used that one as ways to stimulate learners, to brings learners into the context of the topic. It is also one of the very nice strategies one can use to make it easy for learners to grasp scientific knowledge. That's a way of contextualizing science knowledge into learners' level. [Experience]

Me: mh

T: but actually the using the prior everyday knowledge of learners are so crucial [view] , because whatever you talk or teach learners will make meaning of whatever you want to to to say to them. [Experience] Iyaa

Me: so in other words you want to say they should make meaning by relating to whatever they are doing in their everyday live eee.

T: precisely.

Me: oky

T: which is the way of contextualizing science concepts to the learners' level.

Me: mmhh

T: mmmmm

Q 2

Me: Oky lets just go to the next question. As a teacher for physical science how do you elicit and integrate your learners' prior everyday knowledge during your lessons on static electricity?

T: alright mh you know whenever a teacher is teaching we do the probing, now how do you do this? You bring a concept, a scientific concept to the learners but then before interpreting that scientific concept, what you have to do, you have to bring in everyday examples. I can take an example, when I was teaching this topic of scientific experience. I mean static electricity, that was a lot of everyday example that I bring to the learners but the intention was just to make them understand the topic of aaah static electricity. Take an example of lightning iya soo as I know already that learners are have different believes on this topic of lighting. So that's the one that I have stated with. Give me your experiences how does lightning happen? [Asking questions relating to their believes] Then many learners they gave ideas like it happens when a cloud bumps each other; some come with ideas saying it happens when God is pushing his drums for water up in the sky there.

Me: mhh

T: then it creates a very nice platform for you now to clear their misconceptions. [View]

Me: Oky

T: yaa mm

Me: Oky so you say you you use this prior knowledge just to see what learners know and also to clear the misconceptions. When do you do this? Do you do it during introduction part or throughout the lesson?

T: yaa eee eliciting prior everyday knowledge can be done throughout. At the beginning you can do it for you to get the attention of the learners and put their mind into the lesson content. And then again throughout during the course of the lesson you can use various everyday examples to clarify different concepts that you are interpreting or teaching in the lesson yaa.

[Use of prior everyday knowledge] It's just a way of contextualizing and bringing it to the learners' level [View]

Me: yaaa

T: Because you know some of these concepts they are not aa aa meant to be at the level aaaa I mean to to include various community believes as an example that you can integrate in the lesson. Yaa but as a teacher you have to do your work by bringing it to the learners level.

Me: yaa oky

Me: mhh we move on to the third question, now as a teacher for physical science does the elicitation and integration of learners' prior everyday knowledge help learners to make meaning of static electricity concepts or not?

T: yaa eee it depends on how the teacher is using it but like in my case, I can say it helps aaa because there are some learners who were not having any proper background on that topic from previous grades or yaa. Now if you try to bring it at their lever bring everyday example, things that they used to see at home then in that case it will remain in their memory and in one way one can say it help the teacher to make them understand the context.

Me: Oky

T: yaa

Me: yaa is there may be no other ways whereby maybe prior everyday knowledge doesn't make any meaning on science concepts or does it always make meaning?

T: aaa eee yaa. A lot of aa. Or maybe I can say there might be some other ways or techniques that a teacher can use and that technique might not be effective for example, if you gave a practical examples, an everyday life example to learners but that example that you gave does not really fit or go in line with what scientific concepts entails. And then in that way one can say you might mislead the learners and they will remain with that knowledge forever. Which is, more especially if you did not clarify how the example you are giving is related to the scientific concepts that you want to give to the learners.

Q 4

Me: thank you. The next question. As a teacher what challenges do you face when eliciting and integrating your learners' prior everyday knowledge when teaching the same topic on static electricity? Do you face any challenges?

T: yaa there are a lot of challenges. One of the challenges we have as teachers is language barrier to our learners; ae sometimes you want to present a topic by using a certain example especially if you are not from that particular area where learners are. Now the example that you give sometimes you might find out that learners are not familiar with that example you are giving to them. And it will take you time for you now to explain that topic or that example and then putting it in the context you want learners to understand.

Me: so in other words it takes time.

T: may be another challenge that I can eluted is the lack of practical materials, you know in most of this rural schools, especially where I am teaching we do not have, the schools are not well equipped when it comes to science materials, that's why it require you to send learners and bring the scientific I mean the non-scientific examples like you can give them a project to design. But then again when it comes to examination, people who are going to set most of the pictures or practical's that they are going to give or that are assessed they will not cater these local examples that we are giving therefore, than in that way is a challenging especially, if you do not have the required materials.

Me: ya which is true. Oky aee don't you think that this things that are not documented, our prior knowledge or the indigenous knowledge are not documented don't you think is also bringing some challenges to use.

T: ya definitely, most of the cultures or cultural tribes / communities have various knowledge but sometimes that knowledge just sees with that generation. Once the generation have lapse then it means it will be very rare for you to see the passing on of that knowledge to the next generation and this is as result of lack of documentation of our knowledge. ya you have really raised a very nice and interesting point there.

Q 5

Me: ok you have mentioned some interesting challenges that you face during your teaching. Now as a teacher how do you deal with these challenges?

T: iya emm you know emm. You have to use your mind. You have to see what is relevant to your learners and find ways and techniques how you should eee make your learners understand. Improvisation is always the key. If you are not improvising waiting for the government or for the state to bring you aaee the resources then one can say you are just wasting time. So we have to improve I mean improvising and where necessary we must share resources with the neighboring schools. And sometimes we do co-teaching with some other teachers, I can present a topic and if I found out that my learners they are still not catching up I can still call another teacher of the same subject and then he is going to re-teach or present the same topic. Ya can be from the nearby school.

Me: so on the improvisation of resources, you raised a point on the challenging that eee the examiners setters, examination setters do not really look the local examples. Now when you aare improvising do you take things that are relating to what it supposed to be done in the science or just any other materials?

T: yaa when we improvise we try by all means to come up with project that are relating to what is presented in the syllabus and you have to be very careful when presenting this, because you have to inform the learners that the real examples that you need to master. You can even show them what is in the text textbook or what the syllabus entailing and the you say with this project that you have made now is to make you understand that this is how it is working but not necessarily that is the one that you might come in the examination but it is to make you understand context in absence of what is being asked or what is required. Yaa

Q 6

Me: thank you Mr Uis the last question. Ee how can the elicitation and integration of learners' prior everyday knowledge on static electricity be improved?

T: Yaa eee mmm you know for use to improve this one, I think the very first thing that we need to improve is, we need to come up with some mechanism of training teachers so that they should be able to use and elicit leaners prior everyday knowledge most often in their lessons. And the other thing that we can also do to improve it, is we should encourage learners to always come up with eee different projects that we can be able to use in our lessons ya I mean in our lessons. And through this way we're also training our learners in becoming future scientist and inventors of different aaa aaa scientific knowledge iya eee yaa. Perhaps the curriculum setters they also need to be brought in so that they should highlight more on the use of prior everyday knowledge especially with regards to contextualization of aaa scientific concepts.

Me: eeh what about the authors of textbooks?

T: yaa with regard to the authors they need to work hand in hands with the curriculum setters because sometimes you find textbook of the same subject but what is being presented in those textbook is totally different. So they need to work hand in hand with curriculum setters. And may be the ministry should come up with ways to mobilize these people to ensure that they create a platform where teachers can bring in learners prior everyday knowledge at whatever lever of the lesson.

Me: oky thank you Mr Uis, those were the few few questions that I wanted to pose to you. Thanks for your time. Thanks for the information. I hope they will really help me to write up my my thesis. And in case I got stuck some where I will still come back for you for clarification.

T: ya ya I also thank you for your time and I wish you all the best with your study. You are more than welcome in any part that you got stuck I am always around to help you. You can greet the whole house of science family.

Me: ok I will thank you.

Appendix C2

Me: interviewer

T: interviewee

Thank you very much and welcome to this interview. I really appreciate that you accepted to participate in this interview. I have few questions that I want to ask you.

Me: Mrs. Munyanyo, how are you.

T: Very fine and you.

Me: Thanks for your time, to ask you some few questions and I believe I will get all the necessary information I will need, in order to help me in writing up my thesis. I have six questions for you. What are your views and experiences on the use of learners' prior everyday knowledge during your lessons on static electricity?

T: Ok, the use of learners' prior everyday knowledge is important because it makes learners to connect what they know from their house, previous lessons or grades but in most cases is from previous grades. I us it to connect what they already know to what I am teaching them currently.

Me: So means you only use the prior everyday knowledge to connect the home to school science.

T: Not necessarily house and school but just to connect what the already know [the existing experience] to what they are learning in the class. Just to make that connection and to make learners understand. Because sometimes learners tend to behave like every time they look at things they think that they knew to them. Now in order to help them to get that point that this is just a build on, on what I know you have to refer them back to what they know. For example, when you teach lightning. Ask them what do you know about this? Have you ever heard about this? Or have you ever seen this? And you make that or things clear. That they are the same or closer to each other.

Me: How do you elicit and integrate your learners' prior everyday knowledge during your lessons on static electricity?

T: ok, specifically on static electricity I like asking learners what they know. Especially, the beginning of the lesson. Hm it's now like the whole topic nee, let me start with the beginning of the chapter where we have to talk about charges. So I have to ask learners have you ever heard of the word charges before from grade 7 or 6. And then what types of charges do they know and what happens? Or anything they know about charges. When they tell me what they know about charges that now when I will start and tell them that the same charges they know is the same charges that we are talking about in the class. And for integration I like asking or giving them something for example, have you ever noticed about a shock when you are like opening a door? Have you ever experience any shock when opening a door? When they say yes I will tell them that shock happens because of charges. At least they have to know how the charges are coming up. Then I will then tell them because you have rubbed it or rubbed your body against something that's why the object becomes charged. You feel like shocked. One day I was teaching and learners say something on blankets that oha yi ningi kwafa ta kundi ehandje [producing some sparks]. Then you have to tell them that because you are like rubbing, either the blanket rubbing against other or blanket rubbed against you and becomes charged and gives that flame [sparks].

Me: if I get you well you said you do ask leaners what they know and build on that nee.

T: ya mos you introduce a topic nee, you ask them what do they know about that topic? And if they know something then you build on it. If they don't know you have to pose questions that are eliciting like have you ever experience this? First give them an example because first you want them to remember. Or that thing is connected to this. That is now eliciting. And when they come to that point of remembering that this thing, which we see is because of this. Then I will now build on that or present my topic and I have to bring that one in.

Me: you mention that you mainly use it at the beginning of the lesson?

T: not really at the beginning at the beginning just to make learners to contextualize to give learners a picture. Because you cannot go on teaching if learners do not have a clear picture of what you are talking about. It is very important to start at the beginning but even in the middle [throughout] you can still eliciting it or integrating it. That is very much important that learners got you from the beginning of the lesson.

Me: ok moving to the third question does the elicitation and integration of learners' prior everyday knowledge help learners to make meaning of static electricity concepts or not?

T: ok thank you very much for the question. To me the integration of learners' prior everyday knowledge on this topic it really helps leaners to understand the topic. For example, the part on lightning. When you are teaching lightning, you see sometimes you ask learners to tell what they know about lightning. They will tell you so many examples like when you were observing you heard examples like lightning strikes/ kills or do what? When they tell you ask them why do you think lightning strikes things or what really happens when striking? Yes we use to hear in oshiwambo ohamukala muna omamanya eli medu. [there used to be stones in the ground] those things you will now tell them the lightning strikes because it's in a form of charges and it's a huge amount of charges, when now they go through something because is now discharge that's when they go through something to the earth that's the time it will either kill if it's a person or an animals or destroy it like plants and it can cause fire if it's a house or what's so ever. I think it really helps learners understand.

Me: apart from helping don't you think there are sometimes where it doesn't make meanings?

T: yes there are times and that's the moment when learners do not have a clear picture of what examples given or they cannot make meaning out of them. Let me give you an example of lightning. If you come to the part of lightning sometimes you talk about lightning and when you ask learners maybe learners they don't know that lightning happens because of charges. So, you have to explain it how it happens when the clouds are like charging each other and then ask them what they know about lightning? They will tell you so many examples like when you were observing you heard examples like lightning strikes/ kills or do what what? You will now tell them lightning strikes because of charges because lightning is a form of a discharge, and if it happens to go through you it will kills you because that huge amount of charges that is going through you and then they will get to know oww is true is a form of electricity. Another example in oshiwambo we have this believe a certain type of a plant and they say if you put that plant on top of your hut, it will not be strikes by lightning. Now learners sometimes gets confuse what is really happening? What makes that? You cannot really explain even you yourself as a teacher you don't just have a concrete explanation that it cannot be strikes because that plant is having which charges for example. And we use to tell them things are discharged through the earth and that thing is just on top of the hut it does not touch the ground. So sometimes it's just a point that you re integration but you know ah it's just a matter of knowing.

Me: the fourth question reads as, what challenges do you face when eliciting and integrating your learners' prior everyday knowledge when teaching the topic on static electricity?

T: ok the main challenge is on clarification of things that they know from their houses. [prior everyday knowledge] you ask learners aa like Mrs. They say during lightning we must not wear red clothes you see now even you yourself you are challenged you cannot tell the connection between the red colour and the lightning. And this things they are difficult to like because this I our beliefs. It's difficult to take them out of their minds. So generally there are beliefs or experiences that learners carry to the class and we are challenged to clarify them. That's the problem that's lies there.

Me: ok you mention of clarification of prior everyday knowledge brings into the class from their houses and those are the cultural believes. Don't you think the lack of documentation of cultural believes is the one that creates these challenges?

T: I think documentation is most problematic thing when it comes to the integration of prior everyday knowledge. Coming now to documentation I think we really need to approach the elder ones in order to ask them not only on static electricity but mainly general. Just to keep the information that we have. Make we need to do a certain research, we ask them questions and then we come up with the documentation and now another main problem, some of this things you can see there is a connection between prior knowledge of learners is ,making sense but things are not scientifically proven that's another challenge that we are facing. Learners' things [prior everyday knowledge] are making sense man but things are not scientifically proven and they are not matching with the western science that they learn in books. So, you are telling learners yes that one is right but coming back to the syllabus [the western science] there is a contradiction between the two. That's another challenge that we are facing.

Me: on the side of the language. Do you think is one of the challenges or not.

T: language can be a challenge because when learners are coming to the class they know something and they express themselves in their vernacular so that they can make a meaning. In the process of translating somewhere you are losing a meaning. Just like what I have said learners know or hear that when something is being stricken by lightning there used to be stones at that point where it was stricken, you can just call stones but I don't think scientifically they are called stones. For the lightning that is the action of charges so now charges and stones we need to clarify before we move to the western sides.

Me: ok we move to the next question. You have mentions some challenges you faces in your teaching. How do you deal with these challenges when eliciting and integrating learners' prior everyday knowledge during your lessons on static electricity?

T: ok let me start with the language itself. Like now if learners re trying to translate their believes into the scientific language, I have to assist them and make sure they are using the proper scientifically words.

Me: on the clarification.

T: again as teacher you just have to try and make sure they understand what you really want them to get. And this one I really have to make sure that they understand it not like I have to close that gap between their experiences and what t I want them to know and what the syllabus is requiring them to know. So I have to emphasize that they move from that face to the classroom experiences.

Me: ok we are moving to the end. The last question, how can the elicitation and integration of learners' prior everyday knowledge on static electricity be improved?

T: ok, I think for improvement science teachers we just have to try by all means to include we must not let it go but we have to include learners' prior knowledge and we have to make sure those learners they learn what is required. We just need to close that gap between the classroom and the everyday science. We need to make sure that we clarify all the things that are not understood by the learners or not clear between the science the heard and home with the one they hear in the classroom. But for the prior knowledge we really need to use it. Learners must build on what they know already.

Me: Ok, do you think is only a science teacher or maybe some stakeholders needed to come in in order to improve.

T: I think everybody needs to do something.

Me: maybe not stakeholder. People like authors of textbook and curriculum developers don you think they need to be part of the improvement.

T: I think everybody who took part in education must be responsible for that. Like in the textbook now learners are only seeing things that are oversees. They don't see science in Namibia, they thinks science comes from America that's why when we talk of these things they cannot really see science in them. They don't think that things they do at home is science because what they see in books is just things that are oversees. They think pure science is just in South Africa but even at home there is pure science for them. The authors and curriculum developers we need to contextualize so that learners can see the use and the importance of science in their everyday life.

Me: when integrate this knowledge, do you think setters used to test this knowledge in the examinations.

T: in the case of static electricity sometimes they used balloons and these are things that learners know. But only if a teacher have explained in the class.

Me: thanks Mrs Munyanyo for the information and the time I hope they really answered my research questions and they will help me in writing up my thesis.

APPENDIX D: OBSERVATION SCHEDULE

<table>
<tr><th>What to be observed.</th><th>Comments</th></tr>
<tr><td>
1. Use of leaners prior everyday knowledge
• Introduction
• Throughout the lesson
• Conclusion
2. Use of language
• Clarity of instructions
• Clarity of questions asked
• Teacher - learner interaction
(Learner – learner interaction)
• Clarity of explanations
3. Teaching strategies
• Lecturing (direct instruction)
• Question – answer
• Group discussion
• Use of technology
• Activities # practical work
#investigations
Classwork /
worksheets
• Scaffolding # type of questions
• asked
</td><td></td></tr>
</table>

# Learners **involvement** **#Quality of learners'** **4. Teaching materials used** • **Chalkboard** • **Posters** • **Models** • **Improvisation** • **Worksheets** **5. Content knowledge** **6. Gender sensitivity** **7. General lesson presentation** • **Flow of lesson** • **Stages / sequencing**	

APPENDIX E: TRANSCRIBING THE LESSON PRESENTATION

T: Yaa, today's lesson, we have a visitor, meme Toxy from Oshuungu combined school, she is going to be among us today in our physical science lesson. So be free, she is not here to do anything for you but she is only here together with us in our lesson. Alright iya soo, be the way you are, right, so the topic that we are going to deal with today is the one that has to do with electricity. So the other day we have been working with what? What type of electricity?

LLL: Current

T: Hee oky, one person please! Not in a chorus form.

T: Bertha

L: Current electricity

T: Yes, we have been working with current electricity. So, we have digested that topic for so many days now. Of which I do not want us to go back to it again so the whole week we have talked about electricity. Ya but ae, the very first thing I want to get from you is, there will be sometimes where, like in the evening, you get to your bed, you get to your bed nee, then while you are entering the moment you touch your clothes or may be the blanket something happens, sometimes you hear some sparks, what causes this?

LLL: Murmuring [can't get what they are saying]

T: Uumm, sometimes you touch your clothes and the moment you touch them you feel like you are shocked. Have you ever experienced this? Yee oky what is this now?

LLL: Yes

T: Yes what causes that shock? Mm anyone? Andreas.

L: Because the time you are touching the blanket.

T: Say it loud

L: The blankets are neutral and hands are neutrally charged.

T: So we are talking about charges. Yes thank you very much Andreas. Ya so that is what we are going to concentrate more today. In other words we are going to look at the topic of what?

LLL: Static electricity.

T: Ya [writing on the chalkboard and read it as static electricity] ya since we have already talked about current electricity the other days, can I just have everybody closing their books. Since we have been talking about current electricity the flowing of charges, flowing of what current now, the flowing of what?

LLL: Charges

T: Andreas

L: Charges

T: Of what Gabriel

L: Charges

T: Flowing of what Gabriel

L: Charges

T: Flowing of charges. Now we come to another type of electricity which is static. Can we start with the work static? If something is static what is that? Something is static. What do we mean there? Fares, yes fast, something that is what? Mm, anyone who can assist Fares.

L: Mumming

T: Yes Bertha or Hilma yes.

L: Anything that does not move.

T: Oky static electricity here we are only looking at electricity that is only happening at that point. Which means at rest? At rest, means. Not!

LLL: Not moving

T: Not moving from like one place to another place. Because there is a lot of explanation there. Iya, soo, soo simply we are talking about electricity at what?

LLL: At rest.

T: Electricity at rest, now before we go further in to this one i would like us to go back again in the topic of the building blocks of matter where we have been talking about an atom of which I do not want an explanation of what is an atom because everybody should by this time should now that one nee. Oky I just want us to touch a little bit on the structure of an atom. Structure of an atom. What is an atom made off?

LLL: Learners' murmuring.

T: Eeee the structure of an atom. An atom is made of what? Silas. Is made up of? Different three what? Threes.

L: Electron

T: Oky the electron. Those are three what?

L: Charges

T: Is it charges? Can we say charges?

L: Three particles.

T: Three main particles. Although there are some main, some other main parts. We can start with this one. Aaa which we used to say is a center. That center we call it what?

LLL: The nucleus

T: The nucleus. Now what I want. What do we find in the nucleus? Timotheus. What do we find in the nucleus?

L: Neutrons

T: Very loud. Free and loud nee.

L: Protons

T: Protons and

LLL: Neutrons

T: Protons and neutrons. Oky so those are there particles that we find in the nucleus nee. Oky so the protons are positive and the neutrons are neutral. Let me say we have, that is now our nucleus. It's having how many protons?

LLL: 3

T: 3 and how many neutrons.

LLL: 4

T: N, n is what?

LLL: Neutrons

T; Oky what is the thirdly particle. The third particle is what?

L: Electrons

T: Where do we find the electrons?

L: We find it on the shells.

T: Oky we find it on shells. Oky, normally we present it with an x or aaa.

LLL: Dots

T: Now, what I want us now to come is. Let's look at the charge now. These particles have charges. Which charges are for which particle? What are the charges of which particle? Yes Gerson. You can mention any one.

L: Neutron

T: Yes neutron, for neutron is what? Very loud. Do you hear what he says?

L: Neutral

T: Neutral means?

LLL: Not positive not negative.

T: Oky is just somewhere in between. Not positive and is not.

LLL: Negative

T: Then we have Maria.

L: Proton.

T: Proton nee. The protons. What is the charge of the protons? Eee. Protons.

L: Positive

T: Positive. Eehe. Marian. What charges of this? Electrons.

L: Negative

T: Negative. So negative. That is the way to symbolize it. The other one is

LLL: A plus then a minus.

T: Oky now because we are talking about static electricity. How does electricity comes in here now, into this topic of charges or topic of an atom? Now we just started with an example of touching a what?

LLL: Blanket

T: A blanket nee.

LLL: Yes

T: Touching a blanket and Andreas there told us that there should be some charges happening here. Now who can tell us right the charges we know them already that are positive and negative and what?

L: Neutral

T: And neutral. Now just to go back to that example Andreas, when you touch a blanket can you just repeat it again. What is happening there?

L: It's producing light.

T: Oky is going to produce light called sparks. Now those sparks how do they. Or why is there sparks?

L: Blankets is neutral, the hands are negative and positive charge

T: Oky, blanket is neutral and hands are either positive or negative. Now what does this means? Blanket is neutral; hands are either positive negative or negative charge. What does this means? Who can give us one word for this? Yee one word for this.

L: Unlike charges.

T: Ok hee

L: Unlike charges.

T: We are now talking about a like what?

L: Repel

T: Like charges repel

LLL: Each other

T: Unlike charges in this case this example is unlike charges. Sooo, unlike charges is what? What is happening? Like, unlike what is the difference there? Petrus! Like charge, unlike charge. Like charge are.

LLL: Same

T: That is similar nee. For example you have two objects one is positive the other one is positive. Because they are the same we say they are like charges. Or

L: Negative with a negative

T: Ok negative with a negative objects or nenge a neutral objects and

LLL: And neutral objects

T: Or another neutral. Remember I did not put any sign there nee. This means neutral. Not positive neither negative. Unlike charges are the one that are

LLL: Different

T: We talk about to objects a one and what positive objects?

LLL: Negative objects

T: Let’s go to the action now. What is going to happen if you have a positive charged object with another positively charged object? Let me say you have aaa, what is the very nice example there maybe we have balloons. Two balloons, all this two balloons are charged similar. They are all rubbed, they are all positive. What is going to happen if you bring these together?

LLL: Repel / attract

T: Are they going to attract

LLL: No repel

T: We say they are going to

LLL: Repel

T: In short term we say like terms do what?

LLL: Repel

T: Repel and unlike charges do what?

LLL: Attract

T: Oky, yaa this one is aaa simply like this. Let me give you another example of static electricity in everyday life. Let's think of harder examples on static electricity. Things that are happening because of static, because of charges. We talk of one example of touching your blanket or you clothes. And it produces what?

LLL: Sparks

T: Yes you see sparks simply because of, the blankets have different charges. Give me any other example again in everyday life. But these examples are happening because of.

LLL: Charges

L: Littering

T: What

L: Lighting

T: The lightning nee. Ehe how does lighting happens? Ye Mukanous

L: When someone has red clothes

T: Lightning oluu. Oha tuti oshike [we call it]

L: Olwaadhi [lightning]

T: Ohalu yap o ngini hano? How does lightning happen?

L: If if the clouds attract.

T: When the clouds are attract nee. You can put it in a very nice Josua

L: When the clouds rub against each other.

T: Teacher repeat what the learners says [when the clouds rub against each other]. Rubbing means what?

L: They move against each other.

T: Soo, it means whenever they move against each other they already produce lightning. Can we bring it to the idea of charges?

LLL: Yes

T: Yaa, that one we will do it earlier. I just want to give you more examples of the static electricity before we look at the practical example that we are going to do in the class now. Sometimes you might see is only that we do not have a tap of water close over here. If you open the tap of water. Let's say this is the tap of water [teacher drawing on the chalkboard], then you let the water drip falling down into the container. Then you take any ruler or any plastic object that you have rubbed. Rub is like you move against a cloth or in your hairs [hair]. That one if you bring it closer to the, to this running water which is coming from the tap of water. You are going to see a change in the shape of a what? In the shape of water. And that one is just, the moment you bring a charged object closer to this running water, this water is going to do what? Is going to bend towards what?

LLL: Ruler

T: It's going to bend towards the ruler. Then in that case we say this two object, the water and the charged ruler have different what?

LLL: Charges

T: So is that attractive or repulsion

LLL: Attraction

T: Attraction. Oky let me just give you some of this handouts. Just take one and pass to the back. So there is page one, two, three and four. [Distributing activities paper to the learners]. Ya alright soo, we are going to start with page 1 nee. Page one is more based on the part that we were discussing here. What I want you to do. I want you to be in groups. So what I want you to do, leave page one and move to page two. If you look at that page two there is activity number two. So what I want you to do I want us to follow those simple short instruction I think they are only two. You should have a ruler or a plastic pen at your group there. Try if you can get a piece of paper. Just pieces of paper. Yaa. So what I want you to do are to follow the first instruction. Tear the paper into small pieces of papers and just put the on your table. Yes do you all have those pieces of papers? And the ruler. Take the pen or a ruler, plastic ruler don't do anything to that ruler or that pen? Don't do anything to that ruler or that pen. Put it closer to those pieces of papers. Can you see something happening there?

LLL: No, yes, no

T: What is your observation there?

LLL: Nothing.

T: Nothing happens. I think you have a reason why.

LLL: Yes

T: You should have a reason why?

LLL: Yes

T: Now in your groups you are going to discuss, why? And what is your observation. Why is it happening? Don't write it now. Then go to number 2. The same ruler rub it, either on your clothes or where?

LLL: Hair

T: You can use your hair or your clothes. nado mbindja nga nagshi ndjo. [Even a jersey like that]. Oky if you did it for a number of times, then you can take that ruler where?

LLL: Closer to the pieces of papers.

T: What is happening?

LLL: They attract the pieces of papers.

T: The paper attract jumps onto a what?

LLL: A ruler

T: To the ruler or to the?

LLL: Pen.

T: What is the reason?

LLL: Because the ruler is charged.

T: I think you have seen the difference between the two experiments that we did.

LLL: Yes

T: Now let me ask you a question? Can someone explain very well to us, eee Petrus are we together nee. I want you to stand up. You have seen that we did two short experiments here? You have seen that one nee. The first one we took a what?

L: A ruler

T: A ruler was that ruler rubbed or not rubbed?

L: Not rubbed

T: Then we put it closer to the what?

L: To the pieces of papers.

T: And we say what our observation was? What did we see?

LLL: Nothing happens.

T: Ehe the second time what did we do.

LLL: We rubbed the ruler

T: The ruler was rubbed, when we brought it close to the pieces of papers?

L: Attracts

T: The pieces of papers were attracted to the ruler. Now what I want you to do is? Give use why is there a difference between the first experiment and the second one. Why is it different?

L: The ruler and pieces attract

T: The ruler and pieces of paper are neutral. If we have a neutral object with another neutral object and bring them together, we said what is going to happen?

LL: Attract

T: They are going to do what?

LLL: Repel

T: Nothing no attraction is going to take place. In the second experiment?

L: The ruler attract the paper

T: The ruler attracts the paper. Why?

L: Because the ruler is charged

T: Because the ruler is charged. Are we together nee. How did we charge the ruler?

LLL: by rubbing.

T: when we rub nee. When we rubbing. On the clothes or on the hair. So we were charging it. Now when we charging it, we either make it to be what?

LLL: To be positive or negative.

T: Ok we charged an object either to make it positive or to make it?

LLL: Negative

T: Negative oky. I am going to explain something there. Ok sit down thank you very much. Now when we were talking about the structure of an atom we talked something about three particles.

LL: Proton, neutron and the electron.

T: These three there is one which is always moving from one object to the other object. When we are rubbing, when we are charging. One of these three particles is always moving from one object to another. For example, I have a cloth and a ruler, for me to charge this ruler what should I do?

LLL: You rub

T: I rub it here, now rubbing it means I am going to make this one [ruler] is

LLL: Positive or negative

T: Now in this case, which particle is moving form a cloth to onto the ruler? Is it the protons or the electrons

LLL: Electrons?

T: The electrons nee. Remember were we found the electrons. We find it outside on the shells. The protons are found deep there in the nucleus. The only particle that is move is which on?

LLL: The electrons

T: Now, in this case we have a cloth and what?

LLL: And a ruler, we were rubbing. Let me say this is a ruler and this is a cloth. This are all substances which we can say they are atoms. Now let me say the neutral atom which is presented by a ruler is having 5 protons and five 5 electron. This one is a cloth and the cloth is having, 5 protons and 5 protons {a mistake}. What we are going to do we are going to rub them. When we to rub the ruler with a cloth. One is going to lose electron on to the other.

LLL: Yes

T: Now the one which one is going to lose? Is it a cloth or a ruler?

LLL: A cloth

T: A cloth loses some electron onto the ruler. In this case the ruler is going to gain nee.

LLL: Yes

T: Ruler is going to gain. Let's say it only gain one. Now it's going to have how many protons?

LLL: 5

T: And electron

LLL: 6

T: Now the other one gain. This one loses. Now the protons

LLL: 5

T: Remember protons do not what?

LLL: Do not change

T: And electrons becomes?

LLL: 4

T: Which one is positively charged now here?

LLL: Ruler

T: Bertha. Which one is positively charged?

LLL: The cloth

T: Why?

L: Because it has many protons

T: If it has more negative, we say is negatively

LLL: Charged

T: Ewa we go to page number 3. On page number three there is something that we going to do. But first. You can see this one. You are very unfortunate because we don't have thee many of the in our school. We only have one electroscope or one of this instrument. So this is an instrument. Which is called what?

LLL: Electroscope

T: Ok we call this one a gold leaf electroscope. Why is it a gold leaf? Because it is having this two leaves. You can see them nee.

LLL: Yes

T: Two leaves are gold in colour. Therefore, is called a gold leaf electroscope. And the gold leaf electroscope is an instrument that we can use for what?

LLL: Check the charges

T: Eee, what? Vistorina. We use it for what?

L: Measure the charge

T: To detect small amount of charges. This one how does it work? For you to see it works you look at the

LLL: Gold leaves

T: If you bring anything here at the metal cap. Your observation should be more on the gold leaf. What I am going to do, I will ask this group in the middle. I think all of us we will be able to see. Ya we can just stand. Albertus you are in the middle there. What I will want you to do. You have that ruler; let me say the ruler is neutral. Can you just put the ruler on the pieces of paper to see if it attract. What is the reason for him to do that? He wants to see if it's what?

LLL: If it's charged

T: If it's not picking we say it is. That ruler is what?

LLL: Neutral

T: Neutral now, ok can you put the ruler on the metal cap. While he is putting it there I want each and every one to observe. Just put it closer to the metal cap. Can you see anything there?

LLL: No

T: Ok, perhaps you should also be able to give the reason. Both the metal cap and the what?

LLL: Ruler

T: And the ruler is all

LLL: Neutral

T: We can say they have the same charges. Now what I want you to do I want you to rub several times? Did you see anything?

LLL: Yes

T: You see something neh. What is your observation here?

LLL: Move away

T: The gold leaf

LLL: Repel

T: Repel, its try to move away from the metal cap, metal rod. Why is it happening like that?

LLL: Because the ruler is charged.

T: The ruler is charged. Now when we say the ruler is charged. Let's say this is an electroscope because the ruler was charged on a cloth, what charge was the ruler?

LLL: Positive, negative

T: Positively charged or negatively charged. The ruler now

LLL: Positively

T: The ruler is always gaining ne. plastic are always gaining electrons. So now we say this one is negatively charged because when we were rubbing on the cloth it gain some what?

LLL: Electrons.

T: Some electrons. Now what is going to happen here the charges on the electroscope are going to start moving also? Tu lipamwe nee. [are we together?] They are also going to move. Now how are they going to move? Some of the charges will move to the what?

LLL: To the gold leaf

T: To the gold leaf and the other one will move towards the metal cap so that they should attract the once that are on the ruler. So now which one is going to run to the metal cap?

LLL: Positive

T: The positive are going to run towards the metal cap, where there is negative for the to do what?

LLL: Attract

T: To attract and then because we were talking about like and unlike charges. The negative did not like each other. They do what?

LLL: They repel

T: They move away from each other. Can you rub it again? Bring the ruler closer to the metal cap. What is happening?

LLL: The gold leaf repel

T: The gold leaf is repelling here nee. How do we make this leafs to go back to their original positions?

LLL: By touching the metal cap

T: Tell us something. Pointing a learner

L: By touching the metal cap.

T: Can you touch it? What happens?

LLL: The fall

T: They go back to their original position. Now what does this means? When you touch the gold leaf I mean the metal cap, you are moving the charges, the extra charges that they were here. Taking them where? That's now with the concepts of earthing. When you touching the metal cap the all charges move through your body where to?

LLL: they go to the earth.

T:

They go to the earth that's where they are going to be neutralized. This is one way of neutralizing the what?

LLL: the charge [wrong answer]

T: the electroscope. Yaa so the proper concept is discharges. Discharge is like removing the charges. Nee the answer we say by?

LLL: discharging

T: by earthing. What is earthing?

LLL: taking charges to earth through you [body]. Nee this one can only be done at situation where there are very small amount of charges. In the case of current electricity we say don't touch the electrical wires, because the charges will flow through you. Because you create a path for charges to flow. This charges are so strong therefore, they can kill you. Nee that's why earthing can only be done with this experiments' on situation where there is a small very amount of charges. Now go to page 4 there are some few questions there but let's go to page one because I want us to start answering that worksheet. Page one everybody I would like you to answer all those questions from page 1 up to page 4. The teacher takes the learners through the worksheet. Discuss together and each must write her/his answers on their own answer sheet.

APPENDIX F: TRANSCRIBING THE LESSON PRESENTATION

T: Like charges will, they will

LLL: Repel

T: They will repel each other way. What will happen if I change and bring a negatively charged object to a negatively charged object? What happens to the objects? How are they going to behave? First of all you have to get if, are these two substances carry like charges or are they carrying unlike charges?

LLL: Like charges

T: What happens to the like charges?

LLL: Repel

T: Repel each other nee. Which means if you bring a negatively charged object closer to a negatively objects, those two objects will repel each other. Do you understand?

LLL: Yes

T: What if now I bring negative object to the neutral one? What will happen? Attract or repel?

L: Attract

T: Can you remember a story of a pen and pieces of papers. What happens when you rub your pen? It became charged. Then the papers were just there they were not charged. What happen to the pen when you bring it closer to the pieces of paper?

LLL: It attracts.

T: Which one attracts the other?

LLL: The pen

T: The pen attract the papers

LLL: Yes

T: Which means if you have a charged object and a neutral object (uncharged object) the force that is going to be between the two? Is the force of attraction? [owu na oshinima shimwe sha charging na shimwe inaa shi charging, osinima eshi sha charging oshina oku [the charged material will] attracting eshi inaa shi [the uncharged materials]charging eee] oka ima Kenya twaningeni ngeno eshi e pen and this a the pieces of papers. The pen was charged the papers were uncharged and we have observed that the pen was attracting papers. The papers were moving towards the pen.

Take note:

- Like charges repel each other
- Unlike charges attract
- A charged and an uncharged also attract each other. But the charged one is the one that is attracting the other.

Moving forwards static electricity in everyday life. Here we are going to look at things that happen in our everyday life? Things that we experience in everyday life and they happens as a result of static electricity. Am going to give you two first example and I will ask you to think think and give us many examples. Ok when you rub a television cloth then you observe nice nicely; you observe that the screen is attracting a dust. You see nee when you a rubbing you a charging and that dust will be attracted to that. That happens as a result of static electricity. Another example when you are combing you hair you observe that your hair stands, like standing straight. Why is this happening? This happens because of static electricity. I gave you two example can you now think of any experience that you have as result of static electricity. Foibe is having something to tell us.

L: [Not saying anything]

T: I give you another clue nee. Have you ever experienced this, you just come quickly like this and you touch the handle of the door and sudden you feel like shocked. Have you ever experienced like that?

LLL: Yes

T: Who of you experienced that? What happens? Can you explain to use?

L: Eshi ndaya pomvelo ngaha, eshi ashike ndakumako ngahaondu unda ashike ndafa nda shock ngaha. [When I move close to the door, touching it I feel like shocked]

T: Which part?

L: [Learner showing the edges of the door] the edges of the door.

T: That happens as a result of static electricity. Have you ever experienced a funny sound, to ku fa nande iikutu yoye mondjato to ongele ngo somewhere [when removing clothes from bag or packing them somewhere]?

L: Nomakumbafa. [In blankets]

T: Nge twaningi ngeipi? [When we do what?]

L: Nge twituvikile [covering yourself with a blanket]

T: Ngele twi tuvikile oma kumbafa [covering yourself with a blankets]?

L: Yes afa tatema [as if they're burning / producing sparks].

T: Afa taatema [producing sparks]. Giving out sparks and you can also hear it nee. That one happens because when you are touching blankets you are rubbing them. Therefore the materials are getting charged. That's why, the charges are now reacting. Owu we teko? [Can you see]? What else?

L: Owuwe te nande owuli koshipundi sho plastic wakatuumba, eshi to ndiko ngaha opena okwiinyenga [when you are sitting on a plastic chair there will be a sound when you leave].

T: Tapwiinyenge ngeipi [how is the sound]?

L: Taputi shala kata [making sound like when you squeeze a papaer]. Po ta patema noho [there are some sparks].

T: Do you know that when you are sitting on the chair and make some moving what are you doing?

LLL: Rubbing

T: You are rubbing your clothes against the plastic chair. In the process unknowingly you are charging the plastic chair. When leaving the chair you leave it charged, that's why those charges are reacting towards you. She is also having another example.

L: When two peoples fur or hair moving towards each other. You feel shocked.

T: know in that case, what you think. Which part of our body carries charges?

L: Omalundundi [feathers]

LLL: Laughs {people have no feathers}

T: But you are correct. It's not fur bot hair are the one that are having the charges. I think that one we understand it nee. Ok the last one is lightning. Is one of the examples of things that happens in everyday life and they happens because of charges. Who can tell us? What is lightning?

L: Okashelu [lightning is okashelu in oshiwambo].

T: Okashelu. Do you agree with him?

LLL: Yes

T: Which time of the year or day do we experience lightning?

L: Rain

T: They happen during raining seasons. When they are is a thunderstorm we use to experience lightning. Ok aaah lightning we describe it as a discharge of large electrical charges through the air and those charges are build up on the clouds. So when we are having clouds nee we used to see that those clouds are like moving. When they are moving they are rubbing over each other and there are charges that building on their surfaces so this charges as they are becoming many, they will be discharged. They will be discharged and through the air they come to the earth. When these charges are being discharged from the clouds to the earth the way they move or that movement or the process is called lightning. So lightning [uushelu] happens as a result of static electricity. But this static electricity happens in the clouds. Ok aa I want to know from you, what do you know about lightning?

L: Okashelu [lightning] oh aka shelulapo ovantu [strikes people].

T: Okushelulapo ovantu okuninga ngeipi?

L: Ohaka twala antu pombanda [take people up or in the sky]

T: Ok next person. Everyone has to get a chance.

L: Okashelu ohaka vakulapo omiti. [It strikes trees]

L: Don’t runs when the rain is raining.

L: It strikes people that are lying on their backs.

L: Don’t stay near cattle.

L: Don’t like palm iipeta [palm peels]

L: Does not like people to stay under tree and it can burry people.

L: ‘Lightning does not like cellphone.

L: it can direct lost people.

L: Itcan strike animals therefore don’t stay close to animals.

T: The rest I want you to tell what do we do or should not do during lightning.

L: Don’t eat palm fruits

L: Does not like people cooking

L: It can strike easily tree that where already stricken before.

L: Don’t wear red colour.

L: Don’t open the television and don’t laugh, it does not like seeing teeth.

L: Do not make noise

L: Do not move around

L: Do not stay close to twins. The twin must chew charcoal.

L: Does not like underground current electricity they attract each other.

T: That is very much interesting. Do not stand were those electricity move you will be at risk to be stricken.

T: Do you really believe that if you lie on your back you will be stricken.

LLL: Yes

L: It does not like red things because lungs are also red. If you are one your back you expose the lungs to the lightning and as a result you will be stricken.

T: Ok meme. Why red colour and no other colour? What is the difference?

L: Red has more charges. If wearing a red colour nyota it to prevent lightning.

T: I think there is a logic in that because if you nyata you are rubbing.

L: You are removing out charges.

T: Ok what do we do at homes that prevent lightning?

L: Put a stick on the roof of the hut.

L: Put long wire from the roof to the ground for the lightning to move from the wire to the ground.

T: How do we call this wire?

L: Spike

L: Put a car tire on top of the roof because lightning does not strike rubber materials.

T: The next lesson we will look if there are some logic in these believes. Homework, page 146, answers question number 3 A-E in your exercise book. Due date is tomorrow. That’s the end of the lesson have a nice day.