TEACHERS' PERCEPTIONS REGARDING THE ROLE OF PRACTICAL WORK IN TEACHING INTEGRATED SCIENCE AT JUNIOR SECONDARY SCHOOLS IN PEMBA DISTRICT

By

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DECLARATION

I, **MIYOBA ROY**, hereby declare that this dissertation represents my own work, and to the best of my knowledge, the work contained in this document has not previously been published for an award of a degree or diploma at this or any other university. All works drawn from other sources have specifically been acknowledged.

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CERTIFICATE OF APPROVAL

This dissertation of **Miyoba Roy** has been approved as partial fulfilment for the award of Master of Education in Sociology of Education by the University of Zambia.

EXAMINERS' SIGNATURES

Examiner 1

Name ………………………..............……....................................

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Examiner 2

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Examiner 3

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DEDICATION

This work is dedicated to my wife Iñutu and our children Luundu, Namatama, Singanga and Libizo.

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I am extremely and forever grateful to God whose mercies endure forever for enabling me to complete this study after toiling for many days.

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ABSTRACT

The purpose of this study was to explore teachers' perceptions regarding the role of practical work in teaching Integrated Science at junior secondary school in Pemba district. The study was guided by the following objectives: to establish teachers' perceptions regarding the role of practical work in teaching of Integrated Science; to determine the extent to which teachers engaged learners into practical work during teaching of Integrated Science; and to identify the challenges of teaching practical work in Integrated Science at junior secondary. This study was carried out in junior secondary schools in Pemba District in Southern Province of Zambia.

The target population of the study was all teachers of Integrated Science in selected junior secondary. The sample consisted of 32 teachers of Integrated Science in selected junior secondary schools. The study followed a qualitative approach using descriptive research design. Purposeful sampling procedure was used to select teachers. Data was analysed thematically. That is data were organized and presented in common themes.

The findings of the study indicated that even after teachers agreed that they conducted practical work in schools; most of them did not conduct it in classrooms. This was evident from a mismatch between their responses and what was obtained from their portfolios. Therefore, the study concluded that teachers had positive perceptions regarding the role of practical work in teaching Integrated Science although their perceptions were not translated it into practical application.

Teachers indicated that teaching of practical work in schools was hampered by: lack large class sizes, work overloads, lack of teaching aids and lack of administrative support.

It is therefore, recommended that: assessment of practical work should be given immediate attention and intensify monitoring it; schools should frequently organise continuous professional development meetings for their teachers to share ideas of new developments in science methodology; and lastly schools should ensure purchasing adequate teaching and learning materials for Integrated Science.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

ACRONYMS

AIEMS – Action to Improve English, Mathematics and Science

ECZ – Examinations Council of Zambia

CDC - Curriculum Development Centre

GRZ – Government Republic of Zambia

MoE - Ministry of Education

UNESCO – United Nations Educational, Scientific and Cultural Organisation

CHAPTER ONE

INTRODUCTION

1.1 Overview

This chapter presents the background of the study, statement of the problem, purpose of the study, objectives, research questions, and the significance of the study. It further looks at the delimitation of the study, theoretical framework and operational definitions.

1.2 Background of the study

Education is one of a nation's important tools for achieving more progress and development in the changeable world. However, due to rapid technological changes and the emerging issues related to students' poor performance in core subjects such as Science, education systems are currently undergoing transformational changes throughout the globe (Dagher and BouJaoude, 2011). They are shifting from a philosophy that focuses on theoretical transmission of information to a more constructivist paradigm of teaching and learning. The constructivist paradigm believes in learning by doing and that learners are thought to be more likely to remember concepts and knowledge created or discovered on their own through use existing knowledge and past experiences to discover facts and relationships. As a result, there has been a number of education reform projects throughout the world which aim at preparing learners to meet the current needs of producing a scientific community that is beneficial to society (Ibid). Therefore, to promote a deep conceptual understanding and development of positive attitudes towards science, there have been great emphases on science education methodologies which promote hands-on learning and teaching.

Zambia's formal education system currently consists of two years of early childhood education, seven years of primary education (grade 1 to 7), two years of junior secondary education (grade 8 to 9), three years of senior secondary education (grade 10 to 12) and two to seven years of tertiary education (Ministry of Education, Science, Vocational Training and Early Education, 2013; GRZ, 2011). The transition from primary to secondary and tertiary levels is determined by national competitive examinations set by Examinations Council of Zambia (ECZ) (Ministry of Education, 1996).

Science is one of the core subjects taught in Zambian schools from grade one to grade twelve as an individual subject. It is taught as Integrated Science from grade one to grade nine, while from grade ten to grade twelve, it is split into three individual components namely; Physics, Chemistry or Biology. The prime goal for teaching science is to help to develop processes of scientific thinking in learners (MoE, 1996).

Science teaching and learning has had a lot of challenges at both primary and secondary school levels in Zambia schools. The challenges ranged from lack of human resource to inadequate school infrastructure. To address these challenges, the Zambian government introduced a lot of deliberate programmes such as Action to improve English, Mathematics and Science (AIEMS); distance and full time programmes in science education at Kwame Nkrumah Teachers' College, Copperbelt Secondary Teachers' Training College, Chalimbana and at the University of Zambia for professional development in the late 1990s. These programmes aimed at equipping teachers with relevant scientific knowledge in both primary and secondary schools. The government also built laboratories in some schools and distributed science kits for most primary and some secondary schools.

Despite all these efforts, various studies conducted still indicated that teaching and learning of practical work in Zambia was still inadequate. A study carried out by Mudenda (2008) showed that learners had problems in conducting practical work during their practical examinations. Furthermore, the Examinations Council of Zambia (2014) acknowledges that the performance at Grade 9 and 12 in the 2013 examinations in Environmental Science and Physical Sciences shows that some candidates had no in-depth understanding of the concepts in the subjects. From sampled scripts, it was concluded that most candidates had challenges related to mastery of the concepts and the interpretation of practical observations.

To this effect, it was observed that there were many factors which challenged the effectiveness with which teachers were able to implement a hands-on curriculum. Some of the factors included learning and teaching materials, administrative support, large class sizes and ongoing professional development. Bybee (1995) argues that to keep reform teaching smooth and on-course, science equipment and materials must be readily available, administrators must be willing to support science teaching reform efforts, assessments must be adjusted to meet the new goals of curricular reform, and ongoing professional development must be provided for the teachers involved.

Despite the known factors that influence teaching and learning of Integrated Science, there is still one key player that has an immediate and overwhelming influence on the day-to-day details of curriculum implementation; the classroom teacher. While certainly constrained by classroom space, available equipment, the assigned curriculum, and administrative guidelines; the teacher is nonetheless relatively free to modify, adapt, improve, experiment and motivate.

The way in which a given curriculum is interpreted, modified and ultimately implemented is not by impulse. Keys and Bryan (2001) firmly attribute such modifications/adaptations to the teacher's own thoughts and opinions, as embodied in their conclusion that "curriculum reforms, however well meaning, are shaped and altered by teachers' beliefs and understandings of the local context". Teachers no matter how good the place may be are affected in their performance by what happens in their surroundings. If for example, the community does not value education, teachers are likely to pay less attention towards teaching simply because they know their efforts are not appreciated. The opposite is true, that is, if the community values education, even teachers strive hard to teach.

Consequently, given the teacher's prominent role in curriculum implementation, classroom teachers are necessarily at the heart of educational reform (Lumpe, Czerniak, and Haney, 1999; Bybee, 1993). The quality and effectiveness of an education system heavily depends on teachers. They are the key persons in determining success in meeting the system's goals. The educational and personal well-being of learners in schools hinges crucially on their competence, commitment and resourcefulness.

Recent research indicates that the nature of teaching has significant influence on both what is taught and how teaching and learning occurs, which in turn influences learning outcomes

(Lingbiao and Watkins, 2001). Teachers’ practical knowledge consists of sets of beliefs and knowledge (Van Driel, Beijaard and Verloop, 2001), which have direct impact on their actual teaching and their interaction with learners. Teachers' perceptions really play a major role in how the subject is taught to learners at each educational level. A perception is a process by which individuals select, organize and interpret stimuli into meaningful and coherent pictures of the world around them (Klazky, 1984). Therefore, individual's perceptions determine the way an individual behaves, reacts to stimuli, interprets and disseminates information.

Ughamadu (2005) argues that success of science will always depend on the quality of teachers and their perceptions regarding science practical work. Teachers are front-line agents of educational innovations and their perceptions towards meeting Integrated Science learning objectives are of great importance. It is therefore, essential to understand teachers’ perceptions and beliefs about the role of practical work in teaching and learning of Integrated Science at junior secondary level. The key role of the teacher is to help learners learn and understand the fundamentals of science efficiently and effectively (Uche and Umoren, 1998).

Even when there is the best educational policy, curriculum designers and huge sums of money spent on education, the ultimate realisation of any set of aims for education depends on the teacher. This is simply because the teacher is responsible for translating policy into action and principle into practice during interactions with learners. It is therefore, important to understand the teacher’s perceptions. It is against this background that this research sought to explore teachers’ perceptions regarding the role of practical work in the teaching of Integrated Science at junior secondary school level in Pemba District of Southern Province of Zambia.

1.3 Statement of the Problem

Science Education in Zambia aims at improving scientific and technological skills of learners. This can be achieved through the teaching and learning of practical work in Integrated Science. At the end of the secondary school cycle, learners are expected to have acquired both the scientific practical work skills and knowledge to help them solve problems that they meet in modern life. Teachers were expected to meet this through teaching practical work to learners.

However, most candidates who failed in Integrated Science failed to exhibit the expected practical skills and the in-depth knowledge required to analyse the experimental results and observation (ECZ, 2014). Up to date, there was no research that focused on teachers' perceptions regarding the role of practical work in teaching Integrated Science at junior secondary. It had not been established whether teachers' perceptions regarding role of practical work in teaching of Integrated Science was positive or not. Teachers' perception of practical work is fundamental to the way they teach it (Anderson, 2002). Hence, this study sought to fill this gap.

1.4 Purpose of the study

The purpose of this study was to explore teachers' perceptions regarding the role of practical work in teaching Integrated Science at junior secondary school in Pemba District.

1.5 Research objectives

1. To determine teachers' perceptions regarding the role of practical work in teaching Integrated Science at junior secondary schools in Pemba District.
2. To determine the extent to which teachers engaged learners in practical work during teaching and learning in Integrated Science at junior secondary schools in Pemba District.

3. To identify the challenges of teaching practical work in Integrated Science at junior secondary school level in Pemba District.

1.6 Research questions

1. What are the teachers' perceptions regarding the role of practical work in teaching Integrated Science?
2. To what extent do teachers engage learners in practical work during the teaching and learning of Integrated Science?
3. What challenges do teachers face regarding the teaching of practical work in Integrated Science?

1.7 Significance of the study

The findings of the study may provide information to the curriculum developers and teacher educators about the importance of teachers' perceptions as they develop innovative programmes. The findings may also help to remind Standard Officers at the Ministry of General Education to make follow-ups to teachers of Integrated Science to ensure that they provide appropriate learning experiences to learners. The study, it is hoped, will also help head teachers and heads of departments about the importance of monitoring work done by subject teachers in their schools.

1.8 Delimitations of the study

This study was confined to teachers of Integrated Science at 18 junior secondary schools in Pemba District of Southern Province. These schools were within reach to the researcher and were the only ones which had received science kits. The schools also had teachers who taught Integrated Science consecutively for a period not less than 2 years.

1.9 Limitations

The main limitation was dearth of literature mainly on practical work in Integrated Science at junior secondary from within Zambia. As a result, much of the literature was borrowed from related natural science and social science subjects mainly at senior secondary school level. In addition, the study was limited to only 32 subject teachers at 18 schools and therefore, the results of the study could not be generalised to represent all teachers of Integrated Science in the whole country.

1.1.0 Theoretical framework

This research was underpinned by the Socio-Cultural theory of learning which was propounded by Lev Semionovich Vygotsky (Vygotsky, 1976). This theory gives priority to the social aspect of consciousness (Bernat, 2008). It also recognises the central role of social relationships and how social relationships affect teachers' thinking as well as their reactions to stimuli in the teaching environment (Cross, 2010). The Socio-cultural theory emphasises that teachers' perceptions should not be seen as an abstract in the classroom but as elements of practical knowledge which control the judgment and behaviour of teachers (Mansour, 2009). This means teachers' experiences serve as lens through which they interpret their behaviour as well as the behaviour of others (Mayer and Marland, 1997). Therefore, it must be realised that knowledge aligns with experience and when experience changes, knowledge also undergo some modification. Since knowledge determines perceptions, then an understanding of teachers' behaviour can lead to an understanding of their underlying perceptions and expectations. Brophy and Good (1997) argue that expectations influence perception and provide teachers with the lens through which they see what they are expecting to see and not to see. The way teacher believe in or perceive practical work, determines how they apply it in classrooms situations. The fundamental Socio-cultural theorists belief is that knowledge must be constructed by the mental activity of the learner and cannot be transmitted (Driver, Asko, Leach, Mortimer, and Scott, 1994; Osborne and Freyberg, 1985). This means learners should acquire knowledge through first-hand experience or getting in contact with sources of knowledge by themselves.

The Socio-cultural theory also presupposes that all new learning is acquired in relation to prior knowledge (Windschitl, 2003). That is there should be links in the knowledge learners acquire from sources such that knowledge prior knowledge should have a link to the latter. Teacher understanding about which pedagogical approaches are likely to help learners to grasp concepts, develop skills or understand about the nature of science is likely to influence how teachers teach and enhance learner learning (Driver *et al.*, 1994; Leach and Scott, 2003). Therefore, teachers should be well vested with the methodology and knowledge of content so that they can easily helps learners to make links between the previous knowledge to the new knowledge.

The Socio-cultural theory of learning provides a basis for understanding how individuals incorporate new knowledge acquired from personal experiences into existing knowledge and then making sense of that knowledge (Ferguson, 2007). It provides a framework for thinking about the ways in which learners engage and make sense of the objects around them (Bodner, Klobuchar, and Geelan, 2001). Socio-constructivists believe about learning from the immediate environment and that learners should have direct interaction with the new knowledge. Solomon (1987) suggested that the social setting makes an essential difference to the learning situation, to how the task is perceived and even to the tools for thought that will be used. However, learning is affected by the reflection on the experiences teachers have, as well as from the reaction of others when ideas are shared. The social constructivist view acknowledges the intra-domain nature of learning with both the social setting and the individual‘s role in the construction of knowledge. In this study, learning is viewed as socially constructed and from this perspective the role of the teacher is highly significant. The methodologies based on social constructivism demand for an interaction between teacher and learner that includes eliciting of prior knowledge, exploration and reflection.

Since the Socio-cultural theory emphasises that teachers' perceptions should not be seen as an abstract in the classroom but as elements of practical knowledge which control the judgment and behaviour of teachers, it would help to determine teachers' perception regarding the role of practical work in teaching Integrated Science. Once perceptions are determined, a lasting solution to current problems of teaching practical work in Integrated Science at junior secondary schools in Pemba District will be solved.

1.1.1 Definitions of key terms

Challenges **:** Problems faced by teachers, inside or outside the class towards the way they conduct practical work in Integrated Science

Hands-on-activities **:** All science practical activities in which learners are actively involved in construction of their scientific ideas using manipulative and scientific skills.

Junior secondary **:** A phase of education in basic and secondary school for Grades 8 and 9

Perceptions **:** Views or opinions held by an individual resulting from experience and external factors acting on the individual.

Practical work **:** Any teaching and learning activity which at some point involves the pupils in observing or manipulating the objects and materials they are studying.

Teacher's portfolio : This refers to schemes of work, lesson plans and records of work.

1.1.2 Summary

This chapter focused on background information on teachers' perception regarding the role of practical work in teaching Integrated Science at Junior secondary. The study started by highlighting the importance of perceptions to a teacher. Perceptions were noted to determine teachers' actions in classrooms. The chapter also looked at the statement of the problem. It was found that poor performance of learners was always attributed to external forces such as learning and teaching materials rather than the teachers. The purpose of the study was to explore teachers' perceptions regarding the role of practical work in teaching Integrated Science. The chapter also looked at the significance of the study. If taken seriously, the study may remind school administrators the importance regular monitoring of teachers in their classrooms and also the importance of supporting teachers in terms of purchasing necessary teaching materials.

CHAPTER TWO
LITERATURE REVIEW

2.1 Overview

This chapter presents a review of literature related to teachers' perceptions of practical work in teaching Integrated Science. The chapter is divided into the following subheadings: meaning of practical work in Integrated Science, importance of practical work in teaching Integrated Science, teacher perceptions in teaching, importance of teacher perceptions regarding teaching practical work and related literature and lastly, the summary of the chapter is given. The sources of the literature were journals and educational text books.

2.2 Meaning of practical work in Integrated Science

There are many definitions and explanations of practical work from literature. According to Tsai (2003), practical work in science is a laboratory-based experience conducted in school while, Millar (2004) defined practical work as an educative activity in which the learner is busy with observation or manipulating an object or any other laboratory materials. On the other hand Stoffels (2005) defines practical work as all those teaching and learning situations which provide learners with opportunities to practice the process of investigation and involve hands-on or mind-on practical learning opportunities where students practice and develop various process skills. Similarly, Lunetta, Hofstein and Clough (2007:394) defined practical work as "learning experiences in which learners interact with materials or with secondary source of data to observe and understand the natural world." The definition by Millar (2004) and Tsai (2003) limit practical work only to activities which take place in the laboratory. It must be noted that science practical work does not only take place in the laboratory but can be performed anywhere as long as there is enough space. Location is not a critical feature in characterising practical work because observation or manipulation of objects can also take place in an out-of-school setting, such as the learner's home or in the field. Therefore, Lunetta *et al.* (2007) and Stoffels (2005) give a more comprehensive description of practical work.

Practical work is considered to be an essential part of science education. There are basically three principle aims of practical work in teaching science (Thompson, 1975) which are:

1. to encourage accurate observation and description,
2. to make phenomena more real through experience, and
3. to promote a logical reasoning method of thought.

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

There are several broad types of practical work in teaching science. Kapenda *et al.,* (2002 and Wellington (1998) identified the following types of practical work; demonstration, structured practical, 'rotating' practical or 'circus' practical, investigation and problem solving.

It is observed that all the above types of practical work, except demonstration, involve learners working in pairs or groups. Investigations and problem solving practicals give students the opportunity for independent and creative working while structured practicals are good for becoming familiar with and practising standard techniques. Circus practicals and demonstrations help reduce the need for equipment. The choice of the type of practical work to use depends on the purpose of the activity as well as on time and resource constraints.

2.3 Importance of practical work in teaching Integrated Science

Braud and Driver (2002) claim that practical work makes learners get excited and yearn to learn more. As learners are doing practical work, much of their senses are involved and this reduces boredom such that learners become eager to learn more and more. Practical work helps to illustrate concepts so that learners can "see" science concepts (Gott and Mashiter, 1991). Illustrations widen the understanding of concepts by learners as they are physically seeing and experiencing what they learn theoretically. During this period, more senses of the learners are involved. When more than two senses are involved, retention of concepts lasts longer because new horizons of understanding or visualizing things, ideas and concepts are opened. In this way, it becomes easier for learners to link the abstract (theoretical ideas) with real life phenomenon.

Millar (2008) argues that practical work can be used as a tool to fulfil the aim of giving freedom to the learner to think and act independently, as in inquiry based laboratory work where the learner is free to be in touch with natural world, create his/her own hypothesis and predict the result. Practical work also helps learners with knowledge of how to find solutions to problems through investigations and analysis of situations. Furthermore, practical work encourages step by step scientific investigations through which learners practice to create hypothesis, collect data, perform experiments, analyse results and make conclusions. Practical work is also used to improve the analytical ability of learners as well as working in groups and practice cooperative work while attaining practical skills (Dillon, 2008). It also enables learners to have hands-on experience to help them make informed decisions.

Good quality practical work engages learners, helps them to develop important skills, helps them to understand the process of scientific investigation and develop the understanding of scientific concepts. Students understand scientific concepts better through a full adoption of practical works in Integrated Science teaching. Woodley (2009) acknowledges that practical work in science supports skills development, experimental learning, independent learning, learning in different ways and the development of personal learning and thinking skills. The concept of practical work extends to include simulated experiences and exercises which involves pencil and paper calculations (Ibid). Lastly, Inomiesa (2010) adds that practical work is carried out to help the learner clarify and extend his/her experience of natural phenomenon. For instance, after learners are provided with theory, they are able to verify that theory by conducting practical work. During practical work, learners manipulate real objects and come up with their own conclusions. This also accords learners an opportunity to practice the correct use of apparatus. Practical work, however, may be done in the laboratory but not strictly at the laboratory.

2.4 Teacher perceptions in teaching

Viewing instructions from the perspectives of those involved in the day-today reality of teaching, knowledge of perceptions adds an important dimension to the understanding of effective teaching. Thus, teachers' perceptions are invaluable in the teaching and learning process. A school may have good classrooms and all the necessary teaching materials, but if teachers' perceptions are not understood, all the materials and classrooms mean nothing. Perceptions are one of the most important factors that need consideration when developing teachers' favourable attitudes towards teaching practical work in Integrated Science.

Maharaj, Brijlall and Molebale (2007) argue that perceptions determine teachers' actions in the classrooms. These actions may include the way teachers plan the work to teach and select the methods to use to teach that work. According to Brooks and Brooks (1999), perceptions and knowledge are continuously shaped by social factors and sociological forces including the influence of ideologies, religion, human interests and group dynamics. Sociological forces are usually controlled by beliefs. Therefore, perceptions provide the basis for teacher beliefs and ultimately their actions (Fenstermacher, 1978). Borko (2004) noted that beliefs have an influence on teachers' perception either directly or indirectly. Therefore, beliefs and perceptions affect each other in one way or the other and together they determine the teacher behaviour. Fives and Buehl (2008:135) argue that:

> In learning contexts, teachers may be guided by their beliefs about teaching knowledge and ability. Such beliefs may lead them to question the value of information presented; make epistemic assumptions about the nature of teaching knowledge; question the validity of knowledge content; and support their views on teaching and the need for teacher education.

Teachers will attach a high priority to practice knowledge and skills that conform to their own beliefs (Opfer *et al.*, 2010). Bandura (1986) acknowledges that beliefs are the best indicators of the decisions people (teachers) make throughout their lives. For instance, when the teacher is planning practical work, he or she will be guided by his or her beliefs about practical work. If he or she believes that practical work really helps learners to understand concepts better than when theory alone is used, the teacher will always strive to conduct practical works when ever chance allows and vice versa.

Clusters of beliefs around a particular situation form attitudes, and attitudes become action agenda that guide decisions and behaviour (Pajares, 1992). The connections among clusters of beliefs create an individual's values that guide one's life and ultimately determine behaviour (Ajzen, 1985). Teachers possess beliefs regarding professional practice which impact their actions. Specifically to science education, Clark and Peterson (1985) claim that teachers and their beliefs may play a major role in science education reform since teachers' beliefs lead to actions and these actions impact on learners.

2.5 Importance of teacher perceptions regarding practical work and related literature

Practical work is one of the most important and recommended methods of teaching science in this modern world. Learning of practical work involves high level use of apparatus to develop scientific skills in learners. Therefore, teaching of practical work in science requires teachers who are well trained, competent and with positive perception and attitudes towards its application. Asikainen and Hirvonen (2010) believe that knowledge of practical work is a part of teachers' deep understanding, which at the same time, belongs to knowledge of the best instructional methods. Shulman (1987) further acknowledges that practical knowledge belongs to the categories of subject matter knowledge and knowledge of representations and strategies. Therefore, it is not only for theoretical teaching, but also for teaching practical activities.

According to Boz and Boz (2008), a teacher needs to possess subject matter knowledge in order to understand the discipline. If a teacher is not knowledgeable and competent, it becomes difficult for him or her to identify difficult concepts and explain them to the learners in class. Sometimes if the teacher is not knowledgeable enough about subject matter, he or ends up omitting some important topics laid down in the syllabus. This may disadvantage the learners who may end up being examined on the topics which they were not taught since mostly teachers have no hand on the final examinations which is always set by external examiners who just follow the syllabus, in case of the Zambian situation. Therefore, subject matter knowledge is a precondition for teachers of science (van Driel et al., 1998; Klafki, 2000).

Woolnough and Allsop (1985) noted that, many teachers of science recognised the importance of practical work and believed that learners should have first-hand practical experience in laboratories in order to acquire skills in handling apparatus, to measure and to illustrate concepts and principles. First hand information gives learners an opportunity to apply the skills which they acquire during practical work lessons in their future scientific endeavours. When learners are involved in practical work, they tend to learn and understand concepts better because as they do so, they use more senses than when the concept is taught theoretically. Hence, learning of concepts this way becomes more effective and enjoyable. Thair and Treagust (1999), believes that learners learn physics content knowledge effectively when they are taught using practical activities, to a level significantly higher than that achieved when taught using group discussion and lectures.

A number of studies also have been carried out to investigate on the importance and value of practical work in various schools throughout the globe. The following were some of the studies. Woodley (2009) carried out a study on teachers' perception of practical work in teaching science in the United Kingdom. The study revealed that teachers considered practical work as an essential part of science teaching and learning and teachers spent large proportion of their science teaching on practical work.

Another study was carried out by Thompson (1975) in England and Wales to investigate on the value of practical work at the upper secondary school level. The aim was to determine the value that teachers placed on laboratory work and to find the constraints that prevented teachers from putting theory into practice. The findings revealed that teachers provided opportunities for students to be involved in a variety of practical work such as standardised exercises, discovery experiments, and taught those aims that they considered important. It further reported that teachers were in agreement with the principle aims of practical work, which are: to encourage accurate observation and description; to make phenomena more real through experience, and to promote a logical reasoning method of thought. The finding further indicated that Biology and Physics teachers placed greater emphasis on the development of critical attitudes. Thompson (1975) also noted that teachers placed more emphasis on practical work as a means of making phenomena more real through experiences.

Thair and Treagust (1999) also carried out a non-empirical study on teacher training reforms in Indonesian secondary science. The study focused on the importance of practical work in physics teaching and learning. The findings were that a significant amount of practical activity was widely accepted to be part secondary science curricula. Educators suggested that learners were to participate in processing information for developing a conceptual understanding of science where practical activities were the only way that provided that opportunity (Woolnough, 1991). It was further noted that students were taught using practical work and they effectively achieved physics content knowledge at a significantly higher level than what was achieved when group discussion and lectures were used (Thair and Treagust, 1999). Learners always get motivated when they are given an opportunity to manipulate apparatus and this enables them to use more senses, hence quicker understanding and longer retention of concepts.

Not only that but also Banu (2011) conducted a study to explore teachers' understanding about the relationship between practical work and developing students' conceptual knowledge of Physics in Bangladesh. The results of the study were that although teachers agreed that they used practical work in teaching Physics in secondary schools, teachers did not offer frequent practical work in teaching the contents of physics. These teachers attributed the failure conduct practical work to lack of sufficient equipment in their schools.

Similarly, Motlhabane (2013) also carried out a study on Physical science teacher's perspectives of the type and nature of practical work in rural schools in South Africa. The findings of the study indicated that teachers doubted the usefulness of practical work in the content comprehension. Most teachers who were interviewed did not show any value for practical work in teaching science. These teachers apportioned much of the blame on lack of apparatus and other contextual factors like overcrowded classrooms. However, teachers were encouraged to change their attitude and to embrace teaching science using practical work at all costs.

Another study on teachers' perceptions of practical work was conducted by Ndeke, Okere and Keraro (2015) in Kenya. The study was investigating Secondary School Biology Teachers' Perceptions of Scientific Creativity. The findings were that a high percentage of the Biology teachers had correct perceptions of general creativity but only a small percentage had the correct perceptions of scientific creativity.

A study carried out by Ramnarain (2014) in South Africa posits that some teachers of science were of the view that science practical work was for making the subject of science enjoyable and development of students' experimental skills. That is teachers did not view practical work as a basis for the development of substantive understanding of concepts in the subject of science. Ramnarain (2014) further elaborated that some science teachers believed that their explanations were better than when they conducted practical work to enhance the comprehension of concepts by learners. This means the focus for these teachers when teaching science was mastery of the subject matter than practical work. As teachers are planning practical work, their beliefs also have a remarkable impact because they determine the final action the teacher takes. Beliefs may be changed with correct knowledge. Therefore, teachers are supposed to knowledgeable enough so that they are not easily influenced by unjustifiable influences.

Similar results were obtained by Nghipandulwa (2011) who carried out a study on secondary school teachers' perceptions of the importance of practical work in biology in Oshana Education Region in Namibia. The results of the study showed that teachers held faulty perceptions of the nature of practical work and their individual definition of practical work contradicted their own perceptions of the nature of practical work. Therefore, the faulty perceptions the teachers had influenced the outcome of practical work.

According to the socio-cultural theory, social relationships affect teachers and learners' thinking as well as their reactions to stimuli in the teaching and learning environment (Cross, 2010). This recognises the central role of social relationships in learning. Therefore, teachers should interact with their learners so as to develop closeness and trust between them.

Although most studies have taken a positive view of the role of practical work in teaching science, some have taken the opposite. In a research article conducted by Millar and Abrahams (2009) about the effectiveness of practical activities in school science, it was stated that although learners liked practical work, they often did not learn from practical tasks the things they were expected to learn. The study observed that a few weeks after carrying out practical tasks, most learners recalled only specific surface details of the tasks and many were unable to remember what they had learned. In another study by Osborne (1998), suggests that practical work plays a very limited role in learning science and that it has little educational value.

Similarly, Hodson (1990) took a critical look at practical work as practised in many schools and stated that the laboratory activities relating to learning scientific concepts, understanding science and acquiring scientific attitudes influenced the learning outcomes. The study claimed that practical work practised in many schools in many countries was ill-conceived, confused, and unproductive, and had not yet been successful in achieving the goals of science education

2. 6 Identified Gaps and Justification

As noted from the different literature reviewed above, it has been observed that that most of the literature was looking at the value practical work in teaching science especially at senior secondary level and none dwelled on teachers' perceptions on the role it played in teaching of science at junior secondary school level. Apart from that, all the literature on teacher perceptions was not from Zambia, but other countries within and outside the continent. Therefore, their findings could not be generalised on the Zambian situation based differences in locality, educational organisation, priority setting and resource constraints. The current study was looking at teachers' perceptions on the role practical work in teaching Integrated Science at junior secondary school level in Zambia, and Pemba district of Southern province in particular. Therefore, there was still a gap in literature more especially on the Zambian scenario. Hence, this study filled this gap.

2.7 Summary

This chapter presented theoretical underpinnings and literature related to this study. It gave an explanation of practical work, teacher perceptions in teaching and related literature on teacher perceptions. The chapter highlighted on the gaps. It was found that much of the literature reviewed looked at the value of practical work in science in foreign countries and at senior secondary level and none looked at teachers' perceptions of the role of practical work in teaching Integrated Science at junior secondary school level in Zambia specifically in Pemba district of Southern province.

CHAPTER THREE
METHODOLOGY

3.1 Overview

This chapter presents the methods and procedures used in carrying out this study. The chapter covers research design, research sites, population, sample size, sampling procedure, research instruments, data collection procedures, pilot study, data analysis, validity and reliability and lastly, ethical considerations.

3.2 Research Design

Huysamen (1993) defined a research design as a preconceived plan according to which data is to be collected and analysed to investigate research hypotheses. In addition, Borg and Gall (1989) define as a research design as all the procedures selected by a researcher for studying a particular set of questions or hypothesis. Being qualitative in approach, this study followed a descriptive research design. Orodho (2003) defined descriptive research design as a method of collecting information by interviewing or administering a questionnaire to a sample of individuals. Descriptive research design provides a picture of a situation as it naturally happens (Burns and Grove, 2003). The design may also be used when collecting information about people's attitudes, opinions, habits or any of the variety of education or social issues (Orodho and Kombo, 2002). In this case therefore, the descriptive research design was used to explore teachers' perceptions regarding the role of practical work in teaching Integrated Science at junior secondary school level in Pemba district in Southern province of Zambia.

3.3 Research sites

The study was conducted in schools within Pemba district. The sites were chosen because learners were not doing well in Integrated Science despite having received science kits. This was evident from the 2014 Southern province provincial grade nine final examination results analysis in Integrated Science which Pemba district was one of the least districts in terms of learner performance. Results further indicated that most learners did not perform well in practical papers. The sites could also be easily reached by the researcher.

3.4 Population of the study

Fraenkel and Wallen (1993) define research population as the group of interest to the researcher, the group to whom the researcher would like to generalise the results of the study. The population of this study consisted of all subject teachers of Integrated Science from sampled schools within Pemba district. Teachers of Integrated Science were chosen for the study because they were trained in science education and had taught at junior secondary for some years. Therefore, these teachers were in a good standing to provide information needed to answer the research questions adequately compared to teachers of science in other grades (Sidhu, 2006).

3.5 Sample size

Fraenkel and Wallen (1993) define a sample as a total number of items to be selected from the universe. The study sample comprised of 32 subject teachers of Integrated Science at junior secondary from 18 different schools within Pemba district. The total number of subject teachers was arrived at by the information saturation point which was reached after 32 teachers were interviewed. There were 4 secondary and 14 primary schools which were sampled for the study. At the time of the study, there were only four secondary schools in Pemba District. The sample of teachers comprised of 6 female and 26 male teachers. The 3 female and 21 male teachers were from primary schools while the other 3 female and 5 male teachers were from secondary schools. The study sample was male dominated because at the time of the study there were only 6 female teachers who taught Integrated Science from the selected schools.

3.6 Sampling procedure

Borg and Gall (1989) define sampling procedure as a method the researcher uses to gather or choose teachers in a sample. This study used purposive sampling procedure to select teachers and schools. Purposive sampling is a technique in which the researcher consciously decides who to include in the sample (Leedey and Ormrod, 2000). Purposive sampling helped the researcher to choose individuals and schools with unique knowledge and experiences not shared by the rest. It further enabled the researcher to target sources which were rich in information that was relevant specifically for the study. In this study, the researcher sampled only teachers who taught Integrated Science at junior secondary and schools which either had a laboratory or a science kit. The researcher also ensured that selected teachers taught Integrated Science for a period of not less than 2 years.

3.7 Research Instruments

Kothari (2004) defines a research instrument as a tool or device chosen by the researcher to collect required information. There were two instruments which were used to collect data in this study. These instruments were semi-structured questionnaires and checklists/observation sheets.

3.7.1 Questionnaires

A questionnaire is a written document comprising of questions soliciting for answers on a particular subject (Bush, 1995). This study used a semi-structured questionnaire. A semi-structured questionnaire is a questionnaire which contains both structured and unstructured questions. It helped the researcher to direct respondents into the main research and also to obtain relevant the responses from their minds.

3.7.2 Observation Checklists

A checklist is a form that is used for quick and easy recording of data or identifying actions or data (Wajnryb, 1992). It is particularly effective at registering the occurrence of incidents, events, tasks or extract data in a more useful manner. Checklists are used to collect data for pattern detection or when converting raw data into more useful information. It can further be used for collection of data on the frequency of an event, problem, defect or other similar measure. The checklist therefore, helped the researcher to examine all the 32 teachers' portfolios (schemes of work, lesson plans and records of work) for evidence of teaching practical work to learners in their schools.

3.8 Data Collection procedures

The researcher sought a letter of authority from the Assistant Dean Post Graduate Studies in the School of Education. After obtaining a letter of authority from the Directorate of Post graduate Studies, the researcher got permission from the District Education Board Secretary (DEBS) Pemba district to conduct the research in the district. Permission was further sought from head teachers, heads of departments or sections and subject teachers to conduct interviews.

Semi-structured questionnaires were administered to teachers of Integrated Science by the researcher with the assistance of the heads of departments. In order to allow for the collection of as much relevant information as possible, the questions in the questionnaire which was administered to teachers were mainly open-ended. The researcher with the help of heads of departments again obtained details of presence of practical work from teachers by going through their portfolios (schemes of work, lesson plans and records of work) and recorded the findings in the Checklist. The two instruments were used side by side to ensure validity and reliability of data obtained from teachers (Kombo and Tromp, 2006).

3.9 Pilot study

A pilot study is a small version of a full scale study which is conducted to assist in determining accuracy, clarity and suitability of research instruments (Borg and Gall 1989). This study is usually conducted on the sample of subjects similar to the groups with which the main study is conducted. It provides an opportunity to establish internal consistency of the questions and to rephrase questions which are found inappropriate in providing the required data (Wilson and McLean, 1994). A pilot study also provides advance warnings of possible failure of the main project, indicate where research protocols might not be followed or whether proposed methods and instruments are inappropriate or too complicated (Patton, 1990).

In this research, a pilot study was used to test whether the instruments were yielding the information that was expected. Piloting of the questionnaire and checklist for this research was conducted at Pemba secondary and Pemba Basic schools in Pemba district of Southern province. A total number of 6 teachers, 2 females and 4 males, were purposefully chosen to be involved in the pilot study. This group of teachers were part of the target population of the study but they were not involved in the main study. The piloting process was completed within a week and the findings were analysed thereafter. Some questions which seemed biased and ambiguous were revised accordingly.

3.10 Validity and reliability

To obtain results which would stand the test of time from a research, researchers need to adhere to issues of validity and reliability of the data collected.

Validity refers to the degree to which a measure truly reflects the phenomenon under study. It is about the closeness of the findings and the situation to show whether the method used in the study provides information appropriate to what it intended to investigate. Chinoy (1981) defines validity as the integrity of conclusions that are generated from the research findings. Validity starts from the stages of formation of themes right to the final stage of reporting. It insists on quality control throughout the stages of knowledge production to enable worthiness for accurate results. To avoid distortion, data obtained should be recorded precisely and analysed accurately. In this study, knowledge of validity helped the researcher by avoiding making inferences and over generalisation beyond the capability of the data. It also helped the researcher to record and analyse data accurately.

Reliability is the extent to which measures produce consistent results. Kant and Khan (1978) state that reliability is the degree of accuracy or agreement between two independently derived sets of scores and the extent to which independent administration of the same instruments yield the same or similar results under comparable conditions. The extent to which a measure provides consistent results depends among others on the factors that influence reliability like test conditions, approaches and sample characteristic. Reliability concerns accuracy, trustworthiness and consistency with focus on whether a study could be repeated and it produces the same results. The findings had to be transcribed well, recorded and presented as meaningful findings. In this study, knowledge reliability helped the researcher by ensuring triangulation in data collection and transcribing the recorded data accurately as meaningful findings.

3.11 Data analysis

Data analysis is the examination of what has been collected from an experiment or survey and making deductions and inferences (Kombo and Tromp, 2006). According to White (2008), data analysis is the climax of the research which involves selecting, categorising, comparing, synthesising and interpreting the information gathered to provide explanation of the single phenomenon of interest. Since the study took a qualitative approach, data were analysed by use of an iterative process which implored use of coding techniques (open and axial coding). In open coding, data were reviewed holistically by reading line by line each individual response, comparing and cross-checking the responses of respondents to the same questions, labelling concepts, and breaking data down into categories that best fitted the research questions. During the axial coding, data from open coding were explored for connections between categories and sub-categories. Some quotations were used from the data to illustrate each important theme identified.

3.12 Ethical consideration

Ethics is a set of standards that guide researchers on how they should interact with the respondents and how the research problems can be conceived and formulated (Chilisa and Preece, 2005). It can also be referred to moral distinction between right and wrong. Research ethics therefore, are set of rules which the researcher must follow in order to conduct a research successfully without injuring the parties involved. Some of the research ethics include: voluntary participation and harmlessness; anonymity and confidentiality; disclosure; and analysis and reporting. The respondent and the researcher, have to abide to certain conditions which protect them in case of any eventuality during or after the research.

Therefore, ethical considerations helped the researcher to recognise and respect the rights, values and decisions made by respondents. They also enabled the researcher to take into consideration all possible and potential ethical issues before and after conducting the research.

3.13 Summary

This chapter presented the methodology that was used in the study. The study followed a qualitative methodology using a descriptive research design. Thirty-two (32) teachers were purposefully sampled to participate in the study. The sample consisted of six (6) females and twenty-six (26) male teachers of Integrated Science. There were 18 schools which were samples, four (4) secondary schools and fourteen (14) primary schools. Instruments for data collection were semi-structured questionnaires and checklists/observation sheets. Qualitative data was analysed thematically. Finally, ethical issues were also taken into consideration.

CHAPTER FOUR

PRESENTATION OF FINDINGS

4.1 Overview

In this chapter, findings of the study were presented according to the research questions. The first part of this chapter gives the findings on teachers' perceptions regarding the role of practical work in teaching Integrated Science and the extent to which practical work was conducted at junior secondary schools level. The second part presents challenges of conducting practical work at junior secondary school level.

4.2 Teachers' perceptions regarding the role of practical work in teaching Integrated Science

All the teachers were able to explain the meaning of practical work. One of the teachers work wrote:

> "*Practical work is a hands on activity in which pupils handle apparatus on their own during experiments to find solutions to a given problems".*

Another teacher wrote:

> *"Practical work is an activity in which pupils are involved testing, observation and making their own conclusion in a classroom".*

All teachers agreed that it was necessary to conduct practical work in integrated science at junior secondary level. Teachers indicated that practical work helped learners to translate theory into practice and also to retain what had been learnt.

Concerning the importance of practical work in teaching Integrated Science, one of the teachers wrote:

> *"Practical work arouses interest in learning and makes learners to feel ownership of the learning process".*

Teachers also indicated that they were aware of different styles of conducting practical work in Integrated Science. Table 1 below shows the common types of teaching practical work teachers used.

Table 1: Types of teaching practical work

Types of practical work	**Frequency (n = 32)**
Demonstration	23
Investigation	4
Structured	2
Rotating or circus	3
Problem solving	0

(Source: Field data, 2016)

The table1 above shows that the majority of teachers (23) preferred using demonstration to other types of teaching practical work while none preferred using problem solving.

Various reasons were cited for each preference and mainly teachers found it to be less involving, cheaper and saves compared to other types listed in table 1 above.

One of the teachers wrote:

> *"I prefer to use demonstration because our school does not have enough apparatus for every pupil to carry out the experiments on their own at once".*

Another teacher wrote:

"I have a lot of other classes to attend to and therefore, demonstration serves me from finishing prepared lessons in time to attend to other classes".

It was noted that none of the teachers preferred using problem solving. Problem solving needs enough time and sometimes more materials and as such it is less used by many teachers.

All teachers were aware that all practical works were supposed to be prepared well in advance before the practical lesson. Teachers cited a number of reasons for preparing practical work well in advance before the time of the lesson. One of the teachers wrote:

"Preparing practical work in advance before the lesson helps the teacher check and ensure that all the apparatus needed are available and working."

Another teacher wrote:

"Preparing practical work in advance enables the teacher to verify whether the experiment is possible and also to know the results in advance".

All teachers agreed that they examined learners in practical work at the end each term and kept record of all practical work they gave to their learners. Teachers further gave reasons for keeping records of practical work for learners. Their responses were as illustrated in table 2 below.

Table 2: Importance of keeping record of practical work given to learners

Reasons for keeping records of practical work given to learners	**Frequency (n = 32)**
To make reference to learners' performance in future	32
To avoid repeating the same work	26
For future improvements in case of a failed practical work	21
Taking note of broken apparatus and accidents in the laboratory	8
Taking note of challenges	13
To help the new teacher in terms of sickness transfer or change of class	27

(Source: Field data, 2016)

Table 2 above shows that all teachers valued record keeping. All the teachers used record keeping as future reference towards learner performance while a few used it to take note of broken apparatus and accidents happening in the laboratory.

Most of the teachers (26) indicated that they were able to conduct practical work without a laboratory in the school. One of the teachers wrote:

> *"Practical work does not need a special place to be conducted, but just enough space. It can even be done in a football pitch".*

Another teacher wrote:

> *"I have been conducting practical work in class with pupils and sometimes outside under a tree. What is important is having necessary apparatus and space".*

A few teachers (6) indicated that it was not possible to conduct practical work without a laboratory in the school. One teacher wrote:

> *"A laboratory is a special place where experiments are conducted and therefore, practical work cannot be separated from this".*

Another teacher wrote:

> *"Safety of pupils is not guaranteed without a laboratory. Some experiments such as reactions of some metals with water to produce hydrogen gas need special facilities such as fume boards to guarantee safety of pupils and therefore, cannot be conducted in open air".*

4.3 The extent to which teachers engaged learners into practical work

All teachers indicated that they involved learners into practical work as much as possible. Majority of the teachers were aware of the number of minutes allocated for practical work per week while a few were not. Table 3 below illustrates teachers' responses on the number of minutes allocated for practical work in integrated Science per week.

Table 3: Maximum time allocated for practical work per week

Number of minutes per week	Frequency (n = 32)
40	1
80	2
160	29

(Source: Field data, 2016)

Table 3 above shows that 29 teachers were aware that practical work was allocated a maximum of 160 minutes per week against the three in which two teachers indicated 80 minutes while one teacher indicated 40 minutes. The majority of teachers were aware of the maximum number of periods allocated for practical work in Integrated Science per week.

Teachers' portfolios (schemes of work, lesson plans and records of work) were collected and thoroughly checked for presence of practical work.

The table below summarises the finding.

Table 4: Practical work in teachers' portfolios

Teachers' portfolios	Teachers with practical work		Teachers without practical work		Total
	Secondary school	Primary school	Secondary school	Primary school	
schemes	4	o	4	24	32
Lesson plan	5	1	3	23	32
Records of work	5	1	3	23	32

(Source: Field data, 2016)

Table 4 above shows that majority of teachers did not record practical work in their portfolios. It was indicated that 5 teachers who recorded practical work in lesson plans and records of work were from secondary schools. It was noted that all the 4 teachers who indicated presence of practical work in schemes of work were also from secondary schools.

4.4 Challenges of conducting practical work in Integrated Science in schools

Teachers indicated that they had a number of challenges towards conducting practical work effectively in their schools. Most of them indicated that they encountered a lot of financial challenges towards purchasing enough learning and teaching materials for practical. Some teachers noted that:

> *"The lack of money for purchasing teaching apparatus is a problem".*

Apart from that, teachers cited shortage of teachers of science in their school and wide syllabus of Integrated Science as some of the challenges which hindered smooth running of practical activities in their schools. One teacher shared:

> *"I do not have enough time to prepare for practical work because I have too many other classes to attend to".*

Another teacher wrote:

> *"The syllabus for integrated science is too wide and therefore, I avoid practical work to cover the syllabus so that pupils pass their examinations".*

Additionally, some teachers described that inconsistent and poor administrative support was one of the factors that hindered successful implementation of practical work in schools. One teacher noted that:

> *"There is poor support for practical work from our school head teacher".*

Finally, several other concerns such as lack of space due to overcrowded classrooms, language barrier and inadequate professional development were noted as primary barriers to successful implementation of practical work in schools.

One teacher wrote:

> *There are too many pupils in my class such that the little equipment the school has cannot cater for everyone. The little we have is just enough for use during demonstrations.*

Another teacher indicated that:

> *Our school cannot organise continuous professional meetings. Whenever there is a science workshop somewhere, same people usually attend and never share when they come back.*

4.4 Summary

This chapter presented the findings of the study in line with the study questions. The first objective was to establish teachers' perceptions regarding the role of practical work in teaching of Integrated Science. The findings indicated that teachers' had positive perception perceptions regarding the role of practical work in teaching of Integrated Science. However, it was found that despite having positive perceptions majority of the teachers did not conduct practical work in classrooms. There was a mismatch between teachers' responses from research questions and from the results obtained from their portfolios. Teachers did not keep record of practical work in their portfolios which would serve as proof of having done the work.

The second research objective was to determine the extent to which teachers involved learners into practical work. The study found that teachers rarely involved learners into practical work despite the Integrated Science curriculum clearly stating so. Teachers claimed that they performed demonstrations in classrooms, but there was no record of the same in their portfolios.

The third objective found out challenges teachers faced during teaching practical work in Integrated Science in their schools. The research found that teachers had the following challenges towards conducting practical work in: inadequate resources and lack of administrative support; language barrier; overcrowded classrooms; inadequate professional development; insufficient instructional time to cover the syllabi content and little time for proper planning of practical work.

CHAPTER FIVE

DISCUSSION OF RESEARCH FINDINGS

5.1 Overview

This chapter discusses the findings of the study in line with the study objectives which were: To determine teachers' perceptions regarding role of practical work in teaching Integrated Science; to determine the extent to which teachers engaged learners into practical work during teaching Integrated Science and; to identify the challenges of teaching practical work in Integrated Science at junior secondary

5.2 Teachers' perceptions regarding the role of practical work in teaching of Integrated Science.

Teachers described practical work as an activity in which pupils are involved testing, observation and making their own conclusion in a classroom. This was in line with the definition provided by Lunetta *et al.* (2007) which described practical work as learning experiences in which learners interacted with materials or with secondary sources of data to observe and understand the natural world. This description showed that teachers had adequate knowledge about practical work. A teacher is supposed be more knowledgeable of the subject matter than the learner so that he or she can explain concepts confidently before the learner. In line with this, Boz and Boz (2008) add that a teacher needs to possess adequate subject matter knowledge in order to understand a discipline. A good understanding about the nature of practical work might help teachers to plan sound practical activities.

All the teachers were aware that learners were supposed to be involved in practical work. This was supported by Ministry of Education (2013) and Black (1993) who asserted that sciences, of which Integrated Science is, were best be learnt through experiments, observations, analysis and generalisation of conclusions. This meant that the more learners practiced, the more proficient they became in conducting practical work, and hence the better understanding of science concepts.

The findings further showed that teachers were aware of the essence of practical work in teaching Integrated Science. Teachers stated that practical work was conducted to cement understanding of concepts by the learners and to arouse learners' interest in learning. The results of the study are consistent with with Gott and Mashitter (1991) who indicated that the purpose of practical work were to illustrate concepts so that learners can "see" science concepts and with Braud and Driver (2002) who argued that practical work made learners get excited and yearned to learn more. Teachers have a prime responsibility to ensure that learners understand the concepts which are being taught. This however, cannot just happen, but teachers should create favourable environments which should motivate learners to learn.

In addition, teachers indicated that they used different types of practical work when teaching Integrated Science which included demonstration, investigation, structured, and rotating or circus. These results are in line with the styles of practical work outlined by Wellington (1998) and Kapenda *et al*. (2002). It is very important that during teaching and learning, teachers use a variety of teaching styles. When a variety of styles of teaching are used, learners are always kept alert and pay much attention to what the teacher is teaching. If same style of practical work is used throughout, learners get bored and lose interest of doing practical work. However, it was observed that most teachers performed more of demonstration than any other style of teaching practical work. This is not different from what Pekmez, Johnson and Gott, (2005) reported that demonstration was the most frequently used type of teaching practical work by teachers. Demonstration does not involve learners physically manipulating materials. It is usually the teachers who conduct those activities on behalf of learners. However, the understanding is that learners who manipulated tools by themselves understood concepts better and gained adequate skills than those who observed others doing something (Dirkes, 1991). Therefore, majority of learners were denied this chance by their teachers.

Teachers on the other hand, indicted that they preferred using demonstration to other types of practical work because they did not have enough learning apparatus in their schools. They believed demonstration saved much of their time in terms of preparation and class control. However, Stoffels (2005) disagrees with this assertion and states that many teachers used demonstrations just for defensive purposes for failure to conduct practical work during teaching and learning. It was further indicated that some practical work could be done by use of simple materials obtained from the local environment such as plastic bottles, stones, strings and many others.

The findings further indicated that most teachers prepared practical work well in advance before the lessons. Teachers indicated they did so to ensure that before the lesson was conducted all necessary materials were available and working correctly. This is in agreement with Nghipandulwa (2011) who argued that teachers should carry out a pre-test of practical work so that they rectify any problem that would prevent successful conducting of a practical lesson in advance. Teachers have the prime responsibility to ensure that facts are taught to learners and therefore, should ensure that all necessary logistics are taken into consideration well in advance.

Pre-test of any practical lesson saves the teacher from embarrassment should the experiment fail to verify theory in front of learners and end up giving excuses.

Furthermore, as regards to the possibility of conducting practical work without a laboratory, teachers showed mixed feelings. Majority of the teachers (26) agreed that it was possible to conduct practical work without a laboratory. These teachers indicated that practical work just needed enough materials and space and could be conducted anywhere even in an open space like a football pitch. These teachers were consistent with Maboyi and Dekkers (2003) who agreed that practical work could be conducted anywhere provided there was enough space and materials to use. It must be noted that teachers of science should be resourceful and innovative.

On the other hand, a few teachers disagreed with the possibility of conducting practical work without a laboratory. These teachers considered the laboratory as an indispensible facility in teaching and learning of Integrated Science. These teachers were in agreement with Tsuma (1997) and Solomon (1994) who pointed out that a science laboratory was an indispensable facility in science education because it provided the best setting for teachers to assist learners in acquiring scientific knowledge and skills. Solomon (1994) further observed that science teaching was best conducted in the laboratory since it belonged there naturally as cooking belonged to the kitchen. Therefore, it was difficult for these teachers to engage learners in practical activities without a laboratory.

However, presence or absence of a laboratory in the school does not overrule the importance of the role of practical work in teaching Integrated Science. Teachers should find what suits their condition best and ensure that practical work takes place during learning and teaching of Integrated Science. Besides, most experiments conducted at junior secondary school level do not involve dangerous experiments which need special attention and can be carried out anywhere.

The study also indicated that teachers agreed that they examined learners in practical work and kept record of all the practical work they conducted. It was also noted that teachers were aware of the importance of keeping record of practical work done by learners. Teachers indicated that keeping record of practical work conducted helped them to make reference of the learner performance whenever there was need. Their understanding of record keeping agreed with Macharia and Wario (1994) who stated that record keeping helped to assess what has been achieved in the past by the pupils and showed the present rate of progress that the pupils were making. Important records which teachers should have in their files include schemes of work, lesson plans, records of work and pupils progress records. It is important to ensure that exercises, quizzes, or tests that given to pupils are also reflected in all these records.

5.3 The extent to which teachers engaged learners into practical work in schools

All teachers agreed that they involved learners in doing practical. Teachers indicated that learners were involved in practical work as much as possible. When learners are frequently involved in doing practical work own their own, they get used to apparatus and solving scientific problems independent of the teachers. Therefore, even during final examinations, learners do not experience unnecessary fever because they already have the experience. This is in line with the Integrated Science syllabus which emphasised that learners were to be involved in practical work as much as possible (MoE, 2013). The Integrated Science curriculum provided more number of hours to practical work than to theory. In a week, practical work was allocated a maximum of

160 minutes while theory is allocated only 80 minutes. The more the learners did practicals the more efficient and competent they became and the greater the retention of practical skills the learner gained.

During practical works, teachers interacted with their learners, and through the interactions, teachers and learners developed positive relationships which were necessary during the teaching process. It must be realised that time for practical work is also time for social exchange. Learners interact with each other and build new relationships which may help them share ideas without reservations. In line with that, the socio-cultural theorists emphasise that the learner must be actively involved in the learning process so that he or she can construct his/her own understanding. This theory also holds that learners with different skills and backgrounds need to collaborate on tasks, such as when they are doing practical work in order to arrive at a shared understanding of the truth in a specific field (Crawford, 1996).

The study findings also indicated that the majority of the teachers (29) were aware that practical work was allocated 160 minutes per week. This was in line with the junior secondary Integrated Science syllabus which clearly indicated the number of minutes which were meant for possible practical work per week in Integrated Science. The Integrated Science syllabus indicated that there were 240 minutes (six periods) which were allocated for Integrated Science per week from which each period was 40 minutes. The 160 minutes which translated into two double periods per week were meant for possible practical work while 80 minutes (two single periods) were meant for theory work (MoE, 2013).

However, the findings also indicated that three teachers were not aware of the possible time allocated for practical work per week. This was an indication that teaching of practical work in some schools was not adequately done due to some teachers who did not know the possible time allocated for conducting practical work. In view of this, it can be clearly stated that teachers without expert knowledge of the time table and time of doing experiments cannot be effective in teaching practical activities.

To verify data provided by teachers in objective one and two, teachers' portfolios which included schemes of work, lesson plans and records of work were thoroughly scrutinised for presence of practical work. The findings revealed that most teachers did not have record of practical work in their portfolios despite having agreed that they kept record of all practical work done in class. These findings concur with a research conducted by Kibirige, Osodo and Mgiba (2014) in South Africa which concluded that teachers, despite being aware of the importance of practical work, did not often keep records of practical work. And yet keeping of any work done by the teachers is vital and a requirement. The findings showed that teachers recorded other works which they taught apart from practical work in their portfolios. This was an indication that majority of the teachers did not conduct practical work in their schools. The implication of this finding is that while most teachers had adequate knowledge of the role of practical work in teaching Integrated Science, most of the learners in schools were not benefiting from it. Most of the learners were graduating from junior secondary schools into senior with little or no idea of basic practical skills in science in general.

It can therefore, be stated that although most teachers had positive perception regarding the role of practical work in teaching Integrated Science, their perceptions were not translated into practical application. Perceptions are very important because they determine how the teacher behaves while conducting practical work. The way a teacher understands things has a strong bearing on how he or she is going to conduct any activity. However, this study has shown that teachers' positive perception of the role of practical work did not translate into positive behaviour regarding the same. Therefore, it can be stated that having positive perceptions alone means nothing if they are not put into practice.

5.4 Challenges of teaching practical work in Integrated Science

To start with, the study established that some teachers did not conduct practical work in schools because of lacked of close supervision. Most of the records, more especially from the primary section had never been checked by supervisors for more than a term. In line with this, Kelly (1999) acknowledges that inspections in schools were rarely conducted, more especially in rural schools. Supervision is good machinery to up-grade teachers into required standards. Some people tend to relax when supervision is inconsistent or lacking so much that they tend to take every situation lightly and even forgetting their core duties. Therefore, teachers also need supervision to work harder no matter their level of experience and devotion. If such supervision lags, teachers backslide rapidly in their performance. Supervisors should also provide teachers with incentives whether verbally or materially, no matter how small. When teachers are appreciated for what they do best, they tend to strive very hard to perform better.

The study has also established that, some teachers did not conducted practical work in schools because of poor training from colleges. Most teacher training colleges usually conduct their lessons in form of lectures. During lectures, students are always on the receiving end and rarely ask questions. These students when they are deployed adopt this method and use it to teach in class. Baird *et al.* (1991) acknowledges that most teachers are influenced by how they were taught and tend to replicate the model. Generally, most teacher training colleges do not emphasise much on methodology but content. At the end of the training usually is bred a teacher who is rich in content but cannot deliver successfully to the learners. The way a teacher is trained has a strong bearing on the way he or she is going to deliver in to learners in schools. Therefore, it must be realised that good content without good methodology means nothing because the good content ends up reaching the learner in disorderly manner. Apart from that, teachers in colleges are trained in the science content that has no relevance in basic and secondary schools. Usually the science content in colleges is too advanced such that when student teachers get deployed in schools, they start learning new content which they could have not understood during their school years. This makes teachers feel lack of confidence about the subject content.

The findings also indicated that most teachers did not have enough time to prepare for practical work. This is in line with Johnson (2009) who contended that lack of sufficient planning and preparation time had long been a contextual mainstay of the teaching profession. Owing to shortage of teachers of science, teachers had many other classes to attend to and this left them with no time to prepare practical work adequately. However, teachers with adequate planning time would be in a better position to provide learners with a productive and interesting Integrated

Science experience, and would also tend to feel more positively about the flow, focus, and effectiveness of their own teaching practices.

In addition, poor conditions of service of teachers contributed towards inadequate time for teachers to prepare practical work. It was observed that most teachers involved themselves into extra works such as offering private tuitions, preparing pamphlets for sale, running their small shops or any other business venture during their free time to realise an extra income at the expense of work preparation. This is in agreement with Mwanza (2010) who argued that teachers' remuneration were inadequate and because of that they spent little time in class rooms while much of their time was spent on secondary employment activities which met their meagre incomes. Therefore, if teachers are to perform their duties diligently, their plight must be addressed first by the responsible authorities. That is, more teacher of science must be trained and also improving on their conditions of service.

The study also established that some teachers did not conduct practical work even when they had positive perceptions about the role of practical work in teaching Integrated Science due to indifferent attitude. As Cheung (2007) argues some teachers of science have low-level attitudes toward laboratory applications, negative perceptions and beliefs of practical work. These teachers show little interest and resistance to curricular innovations. They do not want to change even when the education system demands so. Attitudes determine what each individual will see, hear, think and do. They are rooted in experience and do not become automatic routine conduct. Therefore, teachers may stick to what they think works rather than doing what works.

Apart from indifferent attitudes, it was established that majority of teachers did not have enough resources in schools to conduct practical work. Teachers complained that their schools did not have enough funds to purchase needed equipment for practical work. The non-use of teaching and learning aids made it difficult for teachers to make learners understand concepts and ideas. This finding is similar to that of Manda (2012) which reported that schools in Samfya had insufficient teaching and learning materials. If learning has to be effective, learning and teaching aids should be readily available for teachers to use. However, Chifwa (2015) urged teachers to be resourceful and make use locally available materials from the environment to conduct practical work in schools. Therefore, this study in line with this encourages teachers to use locally available materials as much as possible.

Furthermore, overcrowding in classrooms and was one of the major obstacles towards conducting practical work in schools. In most of the schools where this research was carried out, classes had an average of about 55 learners per class. When learners are too many in a classroom, it is difficult to conduct practical work because usually teaching materials and classroom space are not enough. Besides that, it becomes difficult to control learners in groups. These findings concur with Manda (2012) who acknowledged that over-crowding of classrooms were one of the major obstacle to carry out classroom assessment in schools. Therefore, schools are encouraged to expand classes once in a while to decongest the overcrowded classes.

The findings have also indicated that official language, English, used in schools is a challenge towards learning and teaching of Integrated Science practical work. Teachers noted that most of their learners were not able to communicate fluently in English language and that hindered them from participating fully during discussions. They also observed that apart from just understanding, most of the learners were unable to read and write a sentence in English language. This made it difficult for teachers to teach Science practical work in local language in which much of the science terms could not be translated easily and directly. This is supported by a study conducted by Probyn (2005) in South Africa who indicated that teaching science using the second language had created a barrier in the teaching and learning process. Students understood concepts better when teachers used the students' native language. Chibesakunda (1983) also indicated that when a learner of science is not a native speaker of English language, his learning through it entails very special addition difficulties of cognition and understanding. Most learners are introduced to English language very late. Usually, during the first years of life in school, learners are introduced first into their native language. They get introduced to English mainly at the age of eight when they enter grade two. During the first year in school, grade one learners learn all subjects in their native language. In grade two, oral English is introduced while other subjects are taught in local language. In grade three, English is introduced as a full subject, but other subjects remain being taught in local language. English language is later used as a mode of instruction in all subjects in grade five, which is a bit late. As they reach grade eight and nine learners still have a lot of difficulties in understanding instructions in this new language.

The findings further indicated that Integrated Science syllabus was heavily loaded with contents. As a result of this, teachers did not have enough time to complete the syllabus if they engaged learners in most of the practical work, and as such, most of them preferred demonstration. Therefore, these findings suggest that teachers were not teaching learners to understand the science concepts, but to make them pass their final examinations. These findings are not different from those of Haambokoma *et al.* (2002) who argued that overloaded syllabus does not give adequate time for teachers to engage pupils in practical work such as conducting experiments which require more time to give results. It must be emphasised that curriculum planners rehearse with subject teachers before they consider effecting new curriculum changes.

The findings also showed that most of teachers had inadequate professional development in schools. Teachers stated that there were new developments in terms of tools which were used when teaching science, but they were denied chance to acquaint themselves with these developments through sharing during professional development meetings. Professional development programmes such as workshops and seminars enabled teachers to learn from each other as they interacted. Teachers complained that whenever there was a workshop, same people (heads of departments/sections) travelled to represent their schools but never reported back or shared new knowledge with their colleagues after the workshop or seminar. These assertions are in agreement with Al Shammeri (2013) who argued that most teachers had inadequate professional development in schools. Schools are encouraged to organise such important meeting and also rotate teachers attending such events.

Lastly, it was noted that teachers lacked administrative support towards teaching practical work in Integrated Science in their schools. In many schools, head teachers were reluctant to support purchasing of Integrated Science teaching material. However, some head teachers were able to support other activities such as sports and pay huge night off allowances to teachers even when their science kits had no chemicals for teachers to use. Some school administrations need to set their priorities correctly. This is in line with Berns and Swanson (2000) who indicated that administrative support in science teaching and learning as a core subject is too rare. Lack of administrative support has a great impact on the teacher's perceptions regarding teaching Integrated Science practical work.

5.5 Summary

This chapter presented the discussion of the findings of the study in line with the study questions. The discussion of finding noted that teachers' perceptions regarding the role of practical work were positive although they did not conduct practical work in their schools. This was evident from mismatches between the responses from study questions and the results obtained from teachers' portfolios. From study questions, all teachers agreed that they conducted practical work with learners and kept record. However, the results from teachers' portfolios indicated that majority of teachers did not conduct practical work. Teachers did not even keep record of practical work despite having agreed to have been doing so. Most of the teachers were found unsupervised in the previous three terms. Therefore, having satisfactory perceptions only is not good enough if teachers are not translating those perceptions into practice.

CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.1 Overview

This chapter presents the conclusion and recommendations of the study based on the findings and discussions on teachers' perceptions regarding the role of practical work in teaching of Integrated Science at junior secondary school.

6.2 Conclusion

Findings of teachers' perceptions regarding the role of practical work in teaching Integrated the Science were done using two instruments namely the questionnaire and the observation checklist. Teachers' responses from the study questions indicated that teachers had positive perceptions regarding the role of practical work in Integrated Science. However, the findings from teachers' portfolios indicated that teachers did not conduct practical work in classroom with their learners despite having agreed to have done so. This showed that there was a mismatch between teachers' responses from study questions and the results obtained from their portfolios. Therefore, the study concluded that teachers had positive perception regarding the role of practical work although they did not translate their positive perception into application.

Since the study was underpinned by the Socio-cultural theory of learning, the methodology based on this theory required an interaction between the teacher and learner more especially through hands-on-learning. However, there was little evidence that teachers applied the theory's pedagogical approaches.

Finally, it was also noted that there were still a lot of other barriers which hindered implementation of practical work and forced the teachers toward choosing mainly traditional methods other than practical work. These included among others: huge class sizes, language barrier, lack of modern equipment and work ever loads. These obstacles have put high pressure on teachers and decrease their intrinsic motivation towards conducting practical work.

6.3 Recommendations

Based on the findings and in line with the study objectives, the following recommendations were made:

1. School head teachers, heads of departments and head of sections should intensify monitoring teachers conducting practical work in Integrated Science at junior secondary level in their schools to ensure that standards are maintained.
2. Perhaps with the new Integrated Science curriculum school head teachers should encourage to hold joint Continuous Professional Development to help teachers share and understand the rationale that underpins the new curriculum.
3. School administration should motivate their teachers through providing necessary incentives and purchasing necessary materials such as modern equipment for conducing practical work in Integrated Science in their schools.
4. There is need for the Ministry of Education, Science of General Education to pay attention to quality education through equitable resource allocation.

6.4 Recommendation for further research

1. This study was confined to 32 selected teachers of Integrated Science in schools in Pemba district of Southern Province. To this effect, there is need in future to broaden the scope of the study to involve teachers from other districts in the province.

2. The study should also involve learners, use interview guides and use a mixed approach (both qualitative and quantitative) so that results obtained can be more accurate.
3. The study should also look at the effect of co-curricular activities on the teaching of practical work in Integrated Science in junior secondary schools.
4. The impact of Continuous Professional Development meetings towards teaching practical work in Integrated Science at junior secondary schools.

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APPENDICES

APPENDIX A: SUBJECT TEACHERS' QUESTIONNAIRE

Dear Respondent,

I am a student of the University of Zambia pursuing a Masters of Education in Sociology of Education. I am conducting a research to find out the teachers' perceptions regarding practical work in Integrated Science in Junior Secondary Schools in Pemba district. To this end, I am requesting you to participate in this exercise by responding to questions in this questionnaire.

I wish to assure you that the information you provide to me will be used for academic work only.

SUBJECT TEACHERS' QUESTIONNAIRE **Serial No.: ....**

Section A: Personal details

Instructions

Answer the questions below by filling in spaces provided by writing or ticking.

(i). Sex: M ☐ F ☐

(ii). Age: From 21 - 25 ☐ 26 - 30 ☐ 31- 35 ☐ 36 - 40 ☐ Above 40 ☐ (Tick)

(iii). Highest academic Qualification: Grade 9 ☐ Grade 12 ☐

(iv). (a). Highest professional qualification: Certificate ☐ Diploma ☐ Degree ☐ M. A ☐

(b). Subject of Specialisation ____

(v). How long have you been in service? (Ranges in years)

Less than 1 year ☐ 1 – 5 ☐ 6 – 10 ☐ 11- 15 ☐ 16 – 20 ☐ Above 20 ☐ (Tick)

(vi). How long have you been teaching Integrated Science at junior secondary? (Ranges in years)

Less than 1 year ☐ 1 – 5 ☐ 6 – 10 ☐ 11- 15 ☐ 16 – 20 ☐ Above 20 ☐ (Tick)

(Vii). Which of the following is available at your school?

Laboratory ☐ Science kit ☐ None ☐ (Tick on what is available)

Section B – Teachers' perceptions regarding the role of practical work in teaching of Integrated Science

1. What do you understand by 'practical work' in Integrated Science? [*Write your answer below*]

----

2. Do you involve pupils in practical work? [*Tick (√) correct answer*]

Yes ☐ No ☐ **[If *NO*, go to question 6]**

3. In your opinion, state why it is important to involve pupils into practical work.

----

4. Which style of practical work do you usually use during practical work in class?

Demonstration ☐ Structured ☐ Problem solving ☐

Investigation ☐ Rotating or circus ☐

Reason: ....

5. When do you prepare practical work for your next lesson? [*Tick (√) correct answer*]

After the lesson is taught ☐ When the lesson begins ☐

In good time before the lesson ☐ Not at all ☐

Reasons: ....

....

6. Do you have enough time to prepare for practical work?

Yes ☐ No ☐

Reasons: ....

....

7. Do you examine pupils in practical work at the end of the term? [*Tick (√) correct answer*]

Yes ☐ No ☐

8. Do you add practical work results to the termly or yearly grade to determine whether the pupil has passed or failed in Integrated Science? [*Tick (√) correct answer*]

Yes ☐ No ☐

9. Do you keep record of practical work for your pupils? [*Tick (√) correct answer*]

Yes ☐ No ☐

10. If ***YES*** to question 9 above, why do you keep records of practical work for your pupils?

----

11. Is it possible for you to conduct practical work without a laboratory? [*Tick (√) correct answer*]

Yes ☐ No ☐

Reason:

....

....

Section C: Frequency of conducting practical work in schools

14. How many minutes are you allocated for practical work in Integrated Science per week in your school? 40 Minutes ☐ 80 Minutes ☐ 160 Minutes ☐ None ☐ Any other -------------

15. Are the minutes allocated to you in Q14 above enough for practical work? Yes ☐ No ☐

16. How often do you involve pupils into practical work in a term? [*Tick (√) correct answer*]

Once ☐ As much as possible ☐ Not at all ☐ Any other --------------------------------

17. How often do your supervisors observe you conducting practical work in class in a term?

Once ☐ Twice ☐ Several times ☐ Not at all ☐

Section D: Challenges of conducting practical work in Integrated Science

18. Do you find challenges towards conducting Integrated Science practical work?

Yes ☐ No ☐ [*Tick (√) correct answer*]

19. If ***YES*** to Question 18 above, what challenges do you encounter towards conducting Integrated Science practical work? [*Write your answer below*]

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20. How can challenges of teaching practical work mentioned in **Question 19** above be reduced?

Thank you for your time and co-operation

APPENDIX B: Teachers' portfolios checklist

Respondents	Evidence of practical work in schemes of work	Evidence of practical work in lesson plans	Evidence of practical work in records of work	**Total**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
Total				
Percentage (%)				

Percentage (%) = $\frac{Total available data from teachers' portfolios}{Total number of teachers observed}$ x 100